1.3.1 Institution integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into the curriculum

Sr. No	INDEX
01	List of courses related to Gender, Human Values, Environment, Sustainability and Professional Ethics
02	Events organized under Gender, Human Values, Environment and Sustainability and Professional Ethics

Sant Gadge Baba Amravati University Scheme:

Four Year Degree Course in Bachelor of Engineering Branch: ELECTRONICS & TELECOMMUNICATION ENGINEERING
Semester Pattern (Choice Based Credit Grade System)

SEMESTER : THIRD																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	3ETC01	Engineering Mathematics-III	4	--	--	4	4	3	80	20	100	40	--	--	--	--
02	3ETC02	Electronic Devices & Circuits	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	3ETC03	Digital System Design	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	3ETC04	Electromagnetic Waves	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	3ETC05	Object Oriented Programming (ES)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Science (Mandatory Course)	2	--	--	2	0	--	--	--	--	--	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	3ETC06	Electronic Devices and Circuits Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	3ETC07	Digital System Design	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	3ETC08	Object Oriented Programming Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	3ETC09	Electronic Workshop	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	18	0	8	26	20	--	--	--	500	--	--	--	200	--
														Total	700	

Note: **The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester.

University Syllabus

SYLLABUS PRESCRIBED FOR FOUR YEAR DEGREE COURSE IN B.E

SEMESTER-III

Subject (Th): 3ETC1 - ENGINEERING MATHEMATICS-III

Course Requisite: 1. (IA1) Engineering Mathematics-I 2. (IB1) Engineering Mathematics-II
Course Objectives: . To deal with linear differential equations. 2. Understand Laplace transforms . 3. Introduction to geometry of curves, two and three-dimensional regions and calculus of vector valued functions. 4. To equip students with necessary knowledge and skills to enable them to handle mathematical operations of complex analysis . 5. . Understand the computational details behind certain numerical methods and their convergence. 6. To deal with system of differential and difference equations in the study of electrical/electronic and systems.
Course Outcomes: After successfully completing the course, the students will be able to 1 . Demonstrate the knowledge of differential equations to solve engineering problems of analog systems. 2 . Apply Laplace transform to solve differential equations. 3. Apply knowledge of vector calculus. 4. Comprehend knowledge of complex analysis in terms of complex variables, harmonic functions and conformal mapping. 5. Apply numerical methods to obtain approximate solutions to mathematical problems. 6. Identify and solve certain forms of partial difference equations as applied to discrete systems.

	Subject: ENGINEERING MATHEMATICS-III	**L**
Unit-1	**Ordinary Differential Equations**: - Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations.	07
Unit-2	**Laplace transforms**: definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Solution of linear differential equations using Laplace transform.	07
Unit-3	**Vector Calculus**: - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion formulae (without proof), irrotational and solenoidal vector fields. Fourier transforms: Fourier sine and Fourier cosine transforms and integrals .	07

Unit-4	**Complex Analysis**: - Functions of complex variables, Analytic function, CauchyReimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method. Conformal Mappings: Translation, Rotation, Magnification, Inversion and Bilinear Transformation, expansion of function in Taylor's and Laurent's series.	07
Unit-5	**Numerical Methods**: Solution of Nonlinear and Polynomial Equations : False Position, Newton Raphson Method. Solution of Linear Systems Equations: Gauss Elimination method, Gauss Seidel Iterative Method, Relaxation method Solution of Differential Equations: Euler's method, Runge-Kutta method, Picards method.	07
Unit-6	**a) Difference Equatio**n:- solution of difference equations of first order, solution of difference equations of higher order with constant coefficient. (**b) Partial differential equation of first order of following form**- (i) f (p, q) = 0; (ii) f (p, q, z)=0; (iii) f(x, p) = g (y, q); (iv) Pp + Qq =R (Lagrange's Form); (v) Z=px+qy+f(p, q) (Clairaut form)	07
	Total	**49**

Text Books:

1. Elements of Applied Mathematics by P. N. Wartikar and J. N. Wartikar. Poona Vidhyarthi Publisher
2. Higher Engineering Mathematics by B.S.Grewal. Khanna Publishers
3. Introduction to method of Numerical Analysis- S. S. Shastry, Second Edition, PHI Pvt. Ltd.,New Delhi.

References:

1. A Mathematical Companion for Science and Engineering Students – Brettenbach, Oxford University Press, 2008
2. Advancing Engg. Mathematics, E.K.Kreyzig, John Wiley
3. Numerical Method for Mathematics Science and Engineering, John H. Mathew, PHI 4. Numerical Methods -

Principles, Analysis & Algorithms Pal, Oxford.

Subject (Th): Subject (TH): 3ETC02 - Electronic Devices & circuits

Course Requisite: 1. Engineering Physics
Course Objectives: 1. To understand detail analysis of Electronic devices. 2. To understand use of electronic devices for various applications in Electronic circuits. 3. To analyze various electronic circuits.
Course Outcomes: After successfully completing the course, the students will be able to 1. Comprehend the knowledge of diode and its applications in rectifier and regulator circuits. 2. Understand basics of BJT, JFET, MOSFET, UJT and their operational parameters. 3. Understand feedback concept, topologies and their applications. 4. Implement and analyze various electronic circuits.

	Subject: Electronic Devices & circuits	L
Unit-1	**Unit-1 PN junction diode:** Formation of p-n junction, biasing the diode, current equation and V-I characteristics of diode, static and dynamic resistance, Analysis of Half Wave Rectifier (HWR), Full Wave Rectifier (FWR), introduction to filters C, L,LC and CLC filters, working of diode as a Switch, Zener diode and its application as voltage regulator.	06
Unit-2	**Unit-2 Waveshaping:** Analysis of RC low pass, and high pass filters for Sinusoidal, Step, Pulse, Square signal, analysis of clipping and clamping circuits using diodes.	06
Unit-3	**Unit-3 Bipolar Junction Transistors:** Operation of PNP and NPN transistor, CB, CE and CC configurations with characteristics and parameters, transistor as a switch, Transistor switching times, dc load line, transistor biasing methods, bias stability, Introduction to voltage divider biased CE amplifiers using h-parameter model.	06
Unit-4	**Unit-4 Feedback amplifiers:** Feedback concept, effects of negative feedback, basic feedback topologies Sinusoidal oscillators: Barkhausen's criteria, Hartley, Colpitts, RC Phase shift, Wein bridge and crystal oscillators.	06
Unit-5	**Unit-5 Multistage Amplifiers:** Need of multistage, direct coupled amplifier, RC coupled amplifier, transformer coupled amplifier, emitter follower, Darlington emitter follower, bootstrapping principle (analysis not expected).	06
Unit-6	**Unit-6 JFET:** Theory, construction and characteristics: parameters (μ, gm & rd) MOSFET: Theory, construction and characteristics of enhancement & depletion type MOSFET. UJT: Theory, construction and characteristics; UJT as relaxation oscillator	06
	Total	**36**

Text Books:

1. David Bell: Electronic Devices and Circuits, Oxford University Press, 2010.
2. Milliman and Halkias: Integrated Electronics, Tata McGraw Hill, New Delhi.

References:

1. Robert L.Boylestad, "Electronic Devices and Circuit theory", Publ. Pearson Education.
2. Floyd, "Electron Devices" Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.

Subject (Th): 3ETC03 - Digital System Design

Course Requisite:
1. Engineering Physics

Course Objectives:
1. To study basic concepts of Boolean algebra, number systems and codes.
2. To study techniques of minimization of Boolean expression.
3. To study the formal procedures for the analysis and design of combinational circuits.
4. To study the formal procedures for the analysis and design of sequential circuits.
5. To learn digital logic families, Programmable logic Devices.
6. To learn the semiconductor memories and mapping.

Course Outcomes:
After successfully completing the course, the students will be able to:
1. Use Boolean algebra to solve logic functions, minimization techniques, number systems and its conversion, arithmetic functions.
2. Identify, analyze and design combinational and sequential circuits.
3. Understand digital logic families and their characteristics.
4. Use the knowledge of semiconductor memories and mapping of memories, programmable logic devices in digital design.

	Subject: DIGITAL SYSTEM DESIGN	**L**
Unit-1	**Unit-1 Number systems and codes:-** Number system and their conversions, BCD codes, Octal codes, Hexadecimal codes, Excess-3 code, Gray Code, Arithmetic Operations using 1’s complement and 2’s complement Introduction, Basic Digital Circuits: AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR.	06
Unit-2	**Unit-2 Logic gates, Boolean Algebra and Minimization Techniques:-** Boolean Algebra, Demorgans Theorem, Simplifications using Boolean Algebra , SOP and POS form, K-map representation and minimization of logical functions upto 4 variables, don’t care conditions, Quine McCluskey method.	06
Unit-3	**Unit-3 Combinational logic design using 74XX/54XX MSI chip:-** Adders, Subtractors, 4-bit parallel adder, look ahead carry BCD adder, MUX, DEMUX, Decoders, Encoders, Code Converters, Comparators, Parity Generator/Checker, BCD to 7 segment decoder, combinational logic design using ROM, PLA, PAL.	06
Unit-4	**Unit-4 Flip-flops, Registers and Counters:-** S-R, J-K, Master slave J-K, D-type, T-type. Shift Registers: Mode of operations of shift registers, Universal Shift Register.Counters: Asynchronous and Synchronous counter, up/down counter, MOD-N counter, Ring counter, Johnson counter, Frequency Division Counter.	06
Unit-5	**Unit-5 Logic families and Memories:-** TTL NAND gate, specification noise margin, propagation delay, fan-in, fan-out, tri-state TTL, ECL, CMOS. Semiconductor Memories: - RAM, ROM, EPROM, EEPROM, SRAM, DRAM	06
Unit-6	**Unit-6Analysis of Clocked Sequential Networks:-**Moore and Mealy Machine, State table, State Assignment, State Reduction, State Transition diagram, Sequence Generator, Sequence Detector.	06
	Total	**36**

Text Books:
1. M.Morris Mano and M.D.Ciletti, “Digital Design”, Pearson Education.
2. R P Jain, “Modern Digital Electronics”, TMH.

References:

1. Wakerly, “Digital Design: Principles and Practices”, 3rdedition, Pearson Education, 2004.
2. Charles H. Roth, “Fundamentals of Logic Design”, 4th Edition, Jaico Publication
3. Lee S.C, “Digital Circuits and Logic Design”, PHI

4. Richard S. Sandige, “Modern Digital Design”, McGraw-Hill Series in Electrical Engineering.

Subject (Th):3ETC04 - Electromagnetic Waves

Course Prerequisites: 1. Engineering Mathematics-I 2. Engineering Mathematics-II 3. Engineering Mathematics-III
Course Objectives: The objectives of the course are, 1. To introduce basic mathematical concept of coordinate system and vector integrals. 2. To impart knowledge of the basic concepts of electric fields. 3. To impart knowledge of the basic concepts of magnetic fields. 4. To understand the Maxwell's Equations for Electric & Magnetic Field, Boundary conditions and their interpretation. 5. To introduce concept of propagation of electromagnetic waves in free space, conductors and dielectrics. 6. To understand, analyze and evaluate the radiation of electromagnetic wave from theoretical and practical antennas.
Course Outcomes: At the end of this course students will demonstrate the ability to 1. Understand the coordinate systems and vector integrals. 2. Evaluate Electric Field Intensity for different charge distributions. 3. Evaluate Magnetic Field Intensity due to current carrying conductors. 4. Understand scientifically about Maxwell's equations & Boundary conditions. 5. Characterize uniform plane wave & can calculate reflection and transmission coefficient of waves at media interface. 6. Understand principle of radiation and radiation characteristics of theoretical & practical antennas.

	Subject: - Electromagnetic Waves	**L**
Unit-1	**Introduction to Vector analysis:** Coordinate systems, Basics of Vectors: Vector products, Projection of vectors, Gradient, Divergence & Curl, Vector integrals, Divergence Theorem & Stokes Theorem.	06
Unit-2	Electrostatics: Introduction to Coulomb's law &Electric Field Intensity (without numericals), Evaluation of Electric Field Intensity due to point charge, line charge & surface charge distribution. Introduction to Electric Flux, Electric Flux Density, Electrostatic potential, Potential gradient &Electric dipole (without numericals).	06
Unit-3	**Magnetostatics:** Introduction to Biot Savart's law, Ampere's circuital law, Magnetic Field Intensity (without numericals), Evaluation of Magnetic Field intensity due to infinite, finite & circular current carrying conductors. Introduction to Magnetic Flux, Magnetic Flux Density, Magnetic dipole.	06
Unit-4	**Maxwell Equations & Boundary Conditions:** Derivation of Maxwell's Equations for Electric & Magnetic Field (without numericals). Boundary condition at dielectric-dielectric interface, dielectric-conductor interface &Boundary conditions for magnetic materials interface.	06
Unit-5	**Electromagnetic Wave Propagation:** Uniform plane wave, Propagation of wave, Formulation of wave equation in free space, dielectric &conducting medium, Skin depth, Poynting Theorem, Reflection and refraction of electromagnetic waves with normal incidence at dielectric interface.	06
Unit-6	**Radiation:** Scalar & Vector magnetic potential, Retarded Potential, Radiation of Electromagnetic wave from the Hertzian Dipole ,Quarter wave Monopole and Half-wave Dipole antennas.	06
	Total	36

Text Books:

. William H.Hayt,Jr and John A.Buck., "Engineering Electromagnetics", Tata McGraw-Hill Publishing Ltd.

2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
Reference Books: 1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005 2. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997. 4. David Cheng, Electromagnetics, Prentice Hall Course

Subject (Th): 3ETC05: Object Oriented Programming

Course Requisite:

1. Computer Programming

Course Objectives:

1. To learn object-oriented concepts and build simple applications using C++ and Java.
2. To understand the basic concepts and techniques which form the object-oriented programming paradigm

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Justify the basic concepts of object-oriented programming such as data types, functions, classes, objects, constructors, inheritance, overloading etc.
2. Design, implement, test, and debug simple programs in C++.
3. Describe how the class mechanism supports encapsulation and information hiding.
4. To know the concept of operator overloading
5. Understand inheritance in C++
6. Design and test the implementation of Java programming concepts

	Subject: OBJECT ORIENTED PROGRAMMING	**L**
Unit-1	Principles of object-oriented Programming: OOP'S paradigm, basic concept of OOP'S, benefits of OOP'S, Four pillars of OOP, structure of C++ programming, basic data types.	06
Unit-2	User defined data type, derived data type, Abstract data types in C++, operators and control statement, Functions in C++: Functions, Function over loading, Friend Functions and virtual functions.	06
Unit-3	Classes and objects in C++: Types of classes and its use, concept of object and its implementation, constructor and destructors	06
Unit-4	Operator and their definition, overloading unary and binary operator, rules for overloading operators, overloading binary operators using friends and string manipulation	06
Unit-5	Inheritance in C++: Extending classes: Multilevel Inheritance, Multiple inheritances, Hierarchical inheritance, Hybrid inheritance, Virtual base classes and Abstract classes.	06
Unit-6	Introduction to Java programming, features of JAVA, JVM, Variables, Primitive data types, Identifiers, Basics of classes, objects, creating objects and methods in JAVA	06
	Total	**36**

Text Books:

1. E Balagurusamy, "Object Oriented Programming Using C++ and JAVA", Tata McGraw-Hill.
2. E Balagurusamy, "Object Oriented Programming Using C++" ,Tata McGraw-Hill.

References:

1. Bjarne Stroustrup, "C++ Programming Language", Pearson Education.
2. H.M.Dietel and P.J.Dietel, "Java How to Program" Pearson Education/PHI, Sixth Edition.
3. Robert Lafore, "Object-Oriented Programming in C++ ", Pearson Education India, (4th Edition).
4. Herbert Schildt , "Java : The Complete Reference" Tata McGraw-Hill (7th Edition).
5. Yeshwant Kanetkar "Let us C++", BPB Publications.
6. Dr. N.B. Vekateswarlu, Dr. E.V. Prasad, "Learn Object Oriented Programming Using Java: An UML Based", S. Chand Publication.

Subject (Pr): 3ETC06 Electronic Devices & circuits Lab

Course Requisite:
1. Engineering Physics 2. 3ETC02 Electronic Devices and Circuits
Course Objectives: . 1. To verify characteristics of various semiconductor devices. 2. To determine and verify various performance parameters of electronic devices and circuits. 3. To provide basic experimental exposure about operation and applications of electronic devices.
Course Outcomes: 1. Acquiring basics of parameters and operation of various semiconductor devices. 2. Implementation of basic circuits using electronic devices. 3. Verification and analysis of performance of electronic circuits.

	Experiment List
Expt-1	To verify V-I characteristics of p-n junction diode and obtain static and dynamic resistance values.
Expt -2	To calculate efficiency and ripple factor of Half wave, Full wave and Bridge wave rectifier.
Expt -3	To study different types of filter circuits and calculate its ripple factor for C-filter.
Expt -4	To study Zener diode as a voltage regulator.
Expt -5	To observe the response of RC Low pass circuit for a square wave input for different time Constant i) RC >>T ii) RC = T iii) RC <<T.
Expt -6	To observe the response of RC High pass circuit for a square wave input for different time Constants i) RC>>T ii) RC = T iii) RC<<T.
Expt -7	To obtain output characteristics of the clipping circuits for different reference voltages and to verify the responses.
Expt -8	To study and observe the performance of various clamper circuit.
Expt -9	To verify characteristics of CE mode of BJT and compute its parameters such as gain(β),input and output Impedance.
Expt-10	To compare calculate and observe frequency response of oscillations of 3 stage RC phase shift oscillator.
Expt-11	To compare calculate and observe frequency response of oscillations of RC Wein Bridge oscillator.
Expt-12	To plot frequency response of RC coupled amplifier and determine its bandwidth.
Expt-13	To plot frequency response of Transformer coupled amplifier and determine its Bandwidth.
Expt-14	To sketch the drain and transfer characteristics of n-channel JFET and determine ac drain resistance, trans-conductance and amplification factor
Expt-15	To sketch V-I characteristics of UJT and determine Intrinsic stand-off ratio
Expt-16	To analyze the response of Rectifier, Amplifier, Oscillator, using simulation software.

* Minimum 10 experiments based on/relevant to the above list.

Subject (Pr): 3ETC07 Digital System Design Lab

Course Requisite:
1. Engineering Physics lab

Course Objectives:
1. To impart the concepts of digital electronics.
2. To provide students basic experimental experiences in the operation of various digital logic Families.
3. To learn the operation of various logic gates and their implementation using digital IC's.
4. To learn the realization of various combinational and sequential circuits.
5. To learn Semiconductor memories and mapping.

Course Outcomes:
After successfully completion of the lab course the students will be able to:
1. Apply practically the concepts of digital electronics.
2. Explain the operation and characteristics of various digital logic families.
3. Understand the operation of various logic gates and their implementation using digital IC's.
4. Design and implement various combinational logic circuits.
5. Design and implement various sequential logic circuits.
6. Design and mapping of various types of memories.

	Experiment List
Expt-1	To study and verify the operation of various digital logic families.
Expt -2	To study and verify the operation of logic gates.
Expt -3	Design and implementation of Adders and Subtractors using logic gates.
Expt -4	Design and implementation of code converters using logic gates.
Expt -5	Design and implementation of multiplexer using logic gates and IC.
Expt -6	Design and implementation of demultiplexer using logic gates and IC.
Expt -7	Design and implementation of code converters using logic gates.
Expt -8	Design and implementation of Magnitude Comparator using logic gates and IC.
Expt -9	Design and implementation of odd/even parity checker /generator using IC.
Expt -10	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.
Expt -11	Construction and verification of ripple counters.
Expt -12	Design and implementation of 3-bit synchronous up/down counter

* Minimum 08 experiments should be conducted out of above enlisted.

Subject (Pr): 3ETC08 Object Oriented Programming Lab

Course Requisite: 1. Computer Programming 2. 3ETC05 Object Oriented Programming
Course Objectives: 1. Design, implement, test, and debug simple programs in an object-oriented programming language. 2. Design and test the implementation of C++ programming concepts. 3. Design and test the implementation of java programming concepts.
Course Outcomes: After successfully completing the course, the students will be able to 1. Justify the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism. 2. Design, implement, test, and debug simple programs in an object-oriented programming language. 3. Describe how the class mechanism supports encapsulation and information hiding. 4. Design and test the implementation of C++ and java programming concepts.

	Experiment List
Expt-1	Write a C++ program to swap two variables a) Using third variable b) Without using third variable.
Expt -2	Write a program in C++ to print the area and perimeter of a rectangle.
Expt -3	Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
Expt -4	Develop programs to implement the concepts of classes and object, accessing members: e.g. a. Design an EMPLOYEE class to contain Data members: Employee_Number, Employee_Name, Basic_Salary, All_Allowances, IT, Net_Salary. Member functions: to read the data of an employee, to calculate Net_Salary and to print the values of all the data members.
Expt -5	Write a program in C++ to implement parameterized constructor and copy constructor.
Expt -6	Write a C++ program to implement function overloading.
Expt -7	Write a program in C++ illustrating the use of virtual functions in a class.
Expt -8	Write a C++ program to overload unary operator for inverting the value of data variable using member function.
Expt -9	Write a program in C++ to demonstrate multiple inheritances.
Expt -10	Write a program in C++ to demonstrate multilevel inheritance.
Expt -11	Write a program in C++ to implement virtual base class.
Expt -12	Write a java program to Calculate Circle Area.
Expt -13	Write a program in Java that reads a number in meters, converts it to feet, and displays the result.

* Minimum 08 experiments should be conducted out of above enlisted.

Subject (Pr): 3ETC09 Electronic Workshop Lab

Course Objectives: 1. The main objective of this lab is to motivate the student to familiarized with basic component of electronics and testing equipment. 2. To get the knowledge of mechanical component like relay cables and connectors. 3. To familiarized with the basics of Senors and transducer. 4. To get the comprehension of various electronic component testing using testing equipments. 5. To aware the students with hands-on experience with a variety of practical circuits designing software tool. 6. To initiate the student with basic knowledge of design of PCB,hardware implementation. Prerequisite :It requires basic knowledge of electronic Engg & electrical components such as resistor, inductor & capacitor
Course Outcomes: After completion of course 1. Student are habituated with basic component of electronics. 2. Student are comfortable with the knowledge of mechanical component. 3. They are familiarized with the basics of Senors and transducer. 4. Predict and experimentally verify the output voltage characteristics of various series and parallel diode circuits. 5. Students are used to with the basic designing and simmulation tools. 6. Student will able to apply basic knowledge of component to design and hardware implementation. 7. Student receives good training and confidence to handled with the measuring equipments,component , software tool, designing aspect and hardware implementation in electronics.

	Experiment List
Expt-1	1. To revised and familiar with the basics of Multimeter and CRO ,Digital Storage Oscilloscope [DSO],Function Generator.
Expt -2	To examine And distinguish Various Types Of A. Fixed & Variable Resistors. B. Fixed & Variable Capacitors.
Expt -3	To Analyze and learn different types of Switches and Relays.
Expt -4	To examine and learn The Different Types of Cables and Connectors.
Expt -5	To revised and familiar with different types of transformers (Step up, Step Down, LVDT, small package) and Inductor.
Expt -6	To study different types of diodes and Opto-Devices: LED, Photo Diode used in various application.
Expt -7	To scrutinize and learn different types of sensors like Temp Senor, Pressure sensors, Light Detecting sensor, Sound sensor, smoke sensor.
Expt -8	Testing of Diode and Transistor and various sensors Using Multimeter and CRO.
Expt -9	To Simulate A. Zener diode using Multisim. B. Plot the output waveform of Full Wave rectifier using Multisim.
Expt -10	Preparation of Layout, artwork Of Various Circuit for PCB Designing along with different types of soldering and Desoldering technique.
Expt -11	To study and explore the use of Sprectum Analyzer
Expt -12	To study and explore the use of Sprectum Analyzer

Text Books:
1. Maduri Joshi, “ Electronic Component and Material” 3rd Edition Shroff Publication. 2. David A. Bell- Electronic Instrumentation and Measurements, Third Edition, Oxford Higher Education . 3. David Bell’ “ Electronic Devices and Circuits” Oxford University Press, 2010
References: 1. Bosshart, “ Printed Circuit Board” TMH 2. Boylestad R,“Electronic Devices and Circuits” Prentice Hall of India Pvt. Ltd. New Delhi 3..K.A.Bakshi, A.V.Bakshi, U.A.Bakshi-“Electronic measurement systems” Technical Publications 01-Jan-2008 3. Bosshart, “ Printed Circuit Board” TMH

(Mini-Project: Preparation of PCB for given circuit along with component mounting, soldering and hardware testing.)

SEMESTER : FOURTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	4ETC01	Analog and Digital Communication	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	4ETC02	Analog Circuits	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	4ETC03	Network Theory	4	--	--	4	4	3	80	20	100	40	--	--	--	--
04	4ETC04	Signals and Systems	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	4ETC05	Values and Ethics (HS)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
06	4ES06	**Environmental Science (Mandatory Course)	2	--	--	2	2	3	80	20	100	40	-	-	-	-
PRACTICALS / DRAWING / DESIGN																
07	4ETC06	Analog and Digital Communication Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	4ETC07	Analog Circuits Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	4ETC08	Network Theory Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
10	4ETC09	Signals & Systems Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	**18**	**0**	**8**	**26**	**22**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**	

Note: **The Examination of Mandatory Subject Environmental Science shall be conducted in IV Semester.

Subject (Th): 4ETC01 - Analog and Digital Communication

Course Objectives:

1. To understand different modulation and demodulation techniques in analog and Digital communication.
2. To interpret the performance of analog communications systems in presence of noise
3. To study various pulse modulation and demodulation techniques used in transmission of analog signal.
4. To understand the concept of sampling and quantization in digital transmission system.
5. To study basic building blocks of digital communication system.
6. To learn information theory and theoretical bounds on the data rates of digital communication.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand the necessity of modulation and identify the various components of analog and Digital communication systems.
2. Compare and contrast the strengths and weaknesses of various communication systems.
3. Apply the concepts of Probability theory in communication systems.
4. Analyze the performance of various pulse modulation scheme
5. Understand basic building blocks of digital communication system and formatting of digital signal.
6. Understand concepts of information theory and analyze information transmission over communication channel

	Subject: - Analog and Digital Communication	L
Unit-1	**AM Transmitters and Receivers:** Modulation, need of modulation, AM Modulation (Mathematical expression and related numerical), Principles of DSB-FC, DSBSC, SSB-SC modulation and their comparison, Details of DSB-FC Transmitter. Superheterodyne receiver: Detail block diagram, Need and types of AGC, Receiver Characteristics: Selectivity, Sensitivity & Fidelity.	06
Unit-2	**FM Transmitters and Receivers:** FM Modulation, Circuit & Analysis for direct FM generation using FET. Circuit & analysis of Indirect FM generation, Narrow Band and Wide Band FM, their comparison, Pre-emphasis and Deemphasis.FM Receiver block diagram including Limiter. FM Discriminator: Introduction to Single Slope and Balanced slope detector, Foster Seeley and Ratio detectors. Comparison of performance of AM & FM systems.	06
Unit-3	**Random Processes and Noise:** Introduction, Random vectors obtained from random processes, Stationary, Mean, Correlation & Covariance function, Properties of autocorrelation function, Properties of Power spectral density Types of Noise, Gaussian and white noise characteristics. Noise in FM Reception: FM threshold effect.	06
Unit-4	**Pulse Modulation:** Band limited & time limited signals, Narrowband signals and systems, Sampling Theorem in time domain, Nyquist criteria, ISI, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect. Analog modulation techniques: PAM, PWM & PPM. Digital representation of Analog signal, PCM Generation and Reconstruction: Quantization and its types, Companding, Quantization Noise, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation.	06
Unit-5	**Introduction to Digital Communication System:** Functional Blocks of Digital Communication System, Line Coding: Need for Line coding, Properties of Line Coding, Types of Line Coding and its comparison, Scrambler and Unscrambler. Information Theory: Measure of Information, Entropy and Information Rate Introduction of Binary Symmetric Channel.	06

Unit-6	BPSK, BFSK, ASK and DPSK generation and reception, QPSK and MSK Transmitter and Receiver, Probability of Error (only theoretical concepts) of ASK, BPSK and BFSK systems, Comparison of Digital modulation systems. Equalization: Need and types of equalization, Clock and Carrier Synchronization.	06
	Total	**36**

Text Books:

1. Kennedy G. “Electronic Communication System” Tata Mc-Graw Hill Co., New Delhi (Third Ed).
2. Taub and Schilling D.L., “Principles of Communication Systems”, Mc-Graw Hill Co., New Delhi (Second Ed.).
3. Shanmugam K.S., “Digital & Analog Communication Systems”, John Wiley & Sons, NewYork, 1996.
4. Lathi B. P., “Modern Digital and Communication Systems”, Holt Rinchart and Winston Inc.,New York, 1993.
5. Simon Haykin, “Digital Communication”, John Wiley and Sons,Pvt. Ltd., Singapore.

References:

1. Proakis J. K., “Digital Communication”, Mc-Graw Hill Book Co., London (Second Edition).
2. Glover and Grant, “Digital Communication”, Prentice Hall Publication
3. Collins Dennis, Collins John, “Electronic Communications” PHI.
4. Wayne Tomasi, “Electronic Communication Systems” Pearson Education, (Fifth Edition).
5. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
6. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.

Subject (Th): 4ETC02 - Analog Circuits

Course Requisite:

1. (3ETC02) Electronic Devices and Circuits

Course Objectives:

1. To understand the basics and internal structure of Op-Amp.
2. To analyze and design linear and non-linear applications of Op-Amp.
3. To understand and design concepts of voltage regulators.
4. To study and synthesize the waveform generators using IC 555 and IC 565.
5. To demonstrate applications of Op-Amp in temperature monitoring.

Course Outcomes:

After successfully completing the course, the students will be able to

1. Perform evaluation of the switching behavior of semiconductor devices.
2. Comprehend the knowledge of basic concepts and performance parameters of Op-Amp.
3. Use Op-Amp for implementation of linear and non-linear applications.
4. Comprehend the knowledge of PLL, its applications and data converters.

	Subject -Analog Circuits	**L**
Unit-1	Operational amplifier Operational amplifier Block diagram of Op-Amp, differential amplifier configurations using BJT, constant current source, level shifting, transfer characteristics, frequency response, study of ICuA741, Op-Amp parameters	06
Unit-2	Linear applications of Op-Amp:Linear applications of Op-Amp: Inverting and non inverting amplifiers scaling amplifiers, summing amplifiers, differential amplifier, integrator and differentiator, sinusoidal RC oscillators: RC-phase shift, Wein bridge oscillator using IC 741.	06
Unit-3	Non Linear Applications of Op-Amp:Non Linear Applications of Op-Amp: comparator, zero-crossing detector, window detectors, Schmitt trigger, astable multivibrator as square and triangular wave generator, Monostable Multivibrator	06
Unit-4	Design of Voltage regulators using IC 723 and LM 317, instrumentation amplifier, bridge amplifier, temperature Controller/indicator using RTD	06
Unit-5	Introduction to IC 555, IC 555 based design of Astable, Monostable multivibrator and their applications, A to D converters: Successive approximation & Dual Scope, D to A converters: Weighted Register & R-2R Ladder.	06
Unit-6	PLL: Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC LM 565 and its applications as AM detector, FM detector, Design of Butterworth first and second order low pass, high pass, all pass filter, design of notch filter.	06
	Total	**36**

Text Books:

1. R.A. Gayakwad, “OP-AMP and Linear Integrated Circuits”, Prentice Hall/ Pearson Education Publications.
2. K R Botkar “Integrated Circuits” Khanna Publications.
3. Sergio Franco, “Design with Linear Integrated Circuits & Op-Amps”,TMH Publications.

References:

1. Gray and Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley Intl. Publication.
2. Paul Horowitz, W. Hill, “The art of Electronics”, Cambridge Publications.

SUBJECT (TH: 4ETC03 - Network Theory

Course Requisite: 1. Electrical Engineering. 2. Engineering Mathematics.
Course Objectives: 1. To understand fundamental concepts of Node and Mesh analysis for linear circuits. 2. To study Network Theorems for circuit analysis. 3. To study Graph Theory for network analysis. 4. To apply Laplace Transform Technique for analysis of linear circuits. 5. To study Two Port Network parameters. 6. To study Network Functions.
Course Outcomes: After successfully completing the course, the students will be able to: 1. Analyze electrical circuits using Mesh and Node analysis. 2. Apply suitable Network Theorem to analyze electrical circuits. 3. Draw oriented Graph of the network to determine their currents and voltages. 4. To implement the concept of Laplace Transform for electrical circuit analysis. 5. To apply Two-Port network theory for electrical network analysis. 6. To evaluate different Network Functions.

	Subject: Network Theory	**L**
Unit-1	**Node and Mesh analysis:** Circuit components, assumptions for circuit analysis, Sources of electrical energy, Source transformation, Kirchoff's laws, Node and Mesh analysis, Matrix approach of network containing voltage and current sources and reactances, Network equations for RLC networks.	08
Unit-2	**Network Theorems:** Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem as applied to AC circuits.	08
Unit-3	**Graph theory and network equations:** Graph of a network, Trees, cotrees and loops, Incidence matrix, Tie set and Cut set of a network, Analysis of a network using Tie set and Cut set matrix, Network equilibrium equations (without magnetic coupling), Duality.	08
Unit-4	**Network Analysis using Laplace Transform:** Overview of Laplace transforms, singularity functions, waveform synthesis, analysis of RC, RL and RLC networks with and without initial conditions. Initial and Final value theorems.	08
Unit-5	**Two port networks:** Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interconnection of two port networks.	08
Unit-6	**Network functions:** Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function, Application of network analysis in deriving functions, Time domain behaviour from pole-zero plot, driving point and transfer impedance functions of LC networks.	08
	Total	**48**

Text Books:

1. D. Roy Choudhary, "Networks and Systems", New Age International.

References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall,3rd Edition.
2. Sudhakar A., Shyammohan S. P. “Circuits and Network” ; Tata McGraw-Hill New Delhi, 1994
3. W. H. Hayt, J. E. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis", 7th Edition, Tata McGraw-Hill education private Limited, New Delhi.
4. Abhijit Chakrabarti, “Circuit theory, Analysis and Synthesis”,Dhanpat Rai and Co. Publications.

SUBJECT (TH): 4ETC04 – Signals and Systems.

Course Requisite:

1.Engineering Mathematics-III

Course Objectives:

1. Understand the fundamental characteristics of signals and systems.
2. Understand signals and systems in terms of both the time and transform domains.
3. Develop the mathematical skills to solve problems involving convolution and sampling.

Course Outcomes:

After successfully completing the course, students will be able to

1. Understand the continuous time signals and systems mathematically and their classification along with the mathematical operations that can be performed on them.
2. Understand the spectral characteristics of continuous-time periodic signals using Fourier series.
3. Analyze the spectral characteristics of continuous-time periodic signals and systems using Fourier Transform.
4. Apply the Laplace transform for analysis of continuous-time systems.
5. Understand the Discrete Time signals and systems mathematically and understand their classification along with the mathematical operations that can be performed on them.
6. Analyze the spectral characteristics of Discrete Time signals and systems using Discrete Time Fourier Transform.

	Subject: – Signals and Systems.	L
Unit-1	Continuous time signals and systems: Signal Classification, Energy and Power Signal, Signal Operations, Signal models, Even and Odd functions, convolution, System Classification	06
Unit-2	Continuous-Time Signal Analysis -The Fourier Series: Periodic Signal Representation by Trigonometric Fourier Series, Existence and Convergence of Fourier Series, Gibbs Phenomenon, Exponential Fourier Series, Magnitude and phase plots of Fourier coefficients.	06
Unit-3	Continuous-Time Signal Analysis-The Fourier Transform: Aperiodic Signal Representation by Fourier Integral, Properties of Fourier Transform, Signal Transmission Through LTIC Systems, Signal energy, Inverse Fourier Transform, plotting Fourier Spectrum.	06
Unit-4	Continuous-Time System Analysis Using Laplace Transform: Laplace Transform, Region of convergence, Inverse Laplace transforms Application of Laplace transform for determination of solution of differential equation and System realization up to second order, Frequency response of LTIC system.	06
Unit-5	Time-Domain Analysis of Discrete-Time Signals & Systems: Sampling theorem, Signal Operations, Classification of Discrete-Time Systems, Discrete-Time System Equations, System response to Internal condition, Unit Impulse Response, System response to External Input, Classical Solution of Linear Difference Equations.	06
Unit-6	Fourier Analysis of Discrete-Time Signals: Discrete-Time Fourier Series (DTFS), Aperiodic Signal Representation by Fourier Integral, Properties of DTFT, Relationship between DTFT & CTFT.	06
	Total	**36**

Text Books: 1. Lathi B. P., “Principles of Linear Systems and Signals” Second Edition (International Version) Oxford University Press. 2. Alan V. Oppenheim & Alan S. Willsky with S. Hamid Nawab, “Signals & Systems” PHI Publication, Second Edition.
Reference Books: Ambardar A., “Analog And Digital Signal Processing”, Thomson Learning-2005. 2. Simon Haykin, Barry Van Veen, “Signals & Systems”, IInd Edition, Wiley Pub. 3. Michael J. Roberts, “Signals and Systems Analysis Using Transform Methods and MATLAB”, Mc Hill Publication.

SUBJECT (TH): 4ETC05 – Values & Ethics (HS)

Course Objectives: .To create an awareness on Engineering Ethics and Human Values. 2. To understand social responsibility of an engineer. 3. To appreciate ethical dilemma while discharging duties in professional life.
Course Outcomes: 1. Understand the significance of value inputs in a classroom and start applying them in their life and profession 2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc. 3. Understand the role of a human being in ensuring harmony in society and nature. 4. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

	Subject: Values & Ethics (HS)	**L**
Unit-1	Introduction to Value EducationValue Education, Definition, Concept and Need for Value Education, The Content and Process of Value Education, Basic Guidelines for Value Education, Self exploration as a means of Value Education, Happiness and Prosperity as parts of Value Education.	06
Unit-2	Harmony in the Human Being Human Being is more than just the Body, Harmony of the Self ('I') with the Body, Understanding Myself as Co-existence of the Self and the Body, Understanding Needs of the Self and the needs of the Body, Understanding the activities in the Self and the activities in the Body.	06
Unit-3	Harmony in the Family and Society and Harmony in the Nature Family as a basic unit of Human Interaction and Values in Relationships, The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love, Comprehensive Human Goal: The Five Dimensions of Human Endeavour. Harmony in Nature: The Four Orders in Nature, The Holistic Perception of Harmony in Existence.	06
Unit-4	Social Ethics The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct, Holistic Alternative and Universal Order, Universal Human Order and Ethical Conduct, Human Rights violation and Social Disparities.	06
Unit-5	Professional Ethics Value based Life and Profession, Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics – The Current Scenario, Vision for Holistic Technologies.	06
Unit-6	Production Systems and Management Models - Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.	06
	Total	**36**

Text Books:
A.N.Tripaty, Human Values, New Age Intemational Publishers, 2003 2. Bajpai.B.L.,Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted, 2004 3. Bertrand Russell, Human Society in Ethics and Politics
References: 1. Corliss Lamon! Philosophy of Humanism 2. Gaur.R.R., Sangal.R, Bagaria.G.P., A Foundation Course in Value EducatiorL Excel Books, 2009 3. Gaur.R.R., Sangal.R, Bagaria.G.P., Teacher's Manual, Excel Books, 2009 4. I.C.Sharma, Ethical Philosophy of L:rdia, Nagin & Co., Julundhar 8. Mortimer.J.Adler, What Man has Made of Man. 5. R.Subramanian, Professional Ethics, Oxford University Press 6. Text Book for Intermediate Ethics and Human Values, Board of lntermediate Education & Telugu Academy, Hyderabad 11. William LiJIy, Introduction to Ethics, Allied Publishers.

Subject (Pr): 4ETC06 - Analog and Digital Communication Lab

Course Requisite:

1. 4ETC01 Analog and Digital Communication.

Course Objectives:

1. To demonstrate the performance of different modulation and demodulation techniques on the basis of various performance parameters.
2. To verify the performance of different analog communication systems
3. To understand various Pulse communication systems for transmission of analog signals.
4. To enable the students to understand different line coding used for representation of digital waveforms.
5. To understand operation of Scrambler and Unscrambler.
6. To understand Bandpass Modulation and Demodulation techniques.

Course Outcomes:

1. Understand the concepts of modulation and demodulation in communication system.
2. Analyze performance characteristics of AM/FM receiver
3. Describe various line codes used for representation of digital waveforms.
4. Demonstrate different working blocks of digital communication system.
5. Analyze the performance of digital communication system.
6. Apply various MATLAB functions for digital Communication Systems.

	Experiment List
Expt-1	To explore the operation of AM Transmitter and Receiver in the communication system
Expt -2	To explore the operation of FM Transmitter and Receiver
Expt -3	To explore the generation of SSB-SC by using different methods
Expt -4	To study the generation of DSB-SC Signal
Expt -5	To observe the AM & FM frequency spectrum on spectrum analyzer.
Expt -6	To interpret the effect of Pre-emphasis and De-emphasis.
Expt -7	To verify the operation of PWM, PAM and Demodulation.
Expt -8	To verify the operation of Pulse Code Modulation (PCM) and Demodulation.
Expt -9	To explore Time Division Multiplexing (TDM) Technique as a application of PAM.
Expt -10	To implement various line coding schemes in MATLAB/SCILAB and observe their spectrum.
Expt-11	To analyze and compare performance of 1) Phase Shift Keying (PSK). 2) Differential Phase Shift Keying (DPSK). 3) Quadrature Phase Shift Keying (QPSK
Expt-12	Implementation of Scrambler and Unscrambler.
Expt-13	To implement Shanon-Fano / Huffman coding using MATLAB.
Expt-14	To verify the output of Delta Modulation and Demodulation process.

* Minimum 08 experiments should be conducted out of above enlisted.

Subject (Pr): 4ETC07 - Analog Circuits Lab

Course Requisite: (3ET3) Electronic Devices and Circuits. 2. (4ETC02) Analog Circuits
Course Objectives: To verify operation of various wave shaping circuits. 2. To demonstrate linear and non-linear applications of Op-Amp. 3. To analyze multivibrator circuits using BJT and Op-Amp. 4. To understand functions and characteristics of PLL.
Course Outcomes: After successfully completing the course, the students will be able to: 1. Implement wave shaping circuits using passive components, diode and BJT and perform their analysis. 2. Demonstrate linear and non-linear applications of Op-Amp. 3. Implement PLL in certain applications.

Expt. No.	**Experiment List**
Expt-1	To verify Op-Amp IC 741 as an inverting and non- inverting amplifier with a specific gain value.
Expt -2	To demonstrate integrator and differentiator circuit using Op-Amp IC 741.
Expt -3	To verify RC- phase shift oscillator using Op-Amp IC 741.
Expt -4	To verify Op-Amp IC 741 as a Schmitt trigger and calculate the hysteresis voltage.
Expt -5	To verify operation of Astable multivibrator using Op-Amp IC 741.
Expt -6	To plot frequency response of first order Butterworth LPF for a specific pass-band gain and cut-off frequency.
Expt -7	To verify characteristics of PLL.
Expt -8	Application of PLL as AM detector/FM detector/frequency translator (Any one application)
Expt -9	Design transistorized series voltage regulator
Expt -10	Design a low voltage variable regulator to 7 V using IC 723.
Expt -11	Design of summing amplifier using IC 741.
Expt -12	Design of Schmitt trigger.
Expt -13	Design of integrator and differentiator.
Expt -14	Design of sinusoidal RC phase shift oscillator.
Expt -15	Design and setup a Wien-bridge oscillator.
Expt -16	Design the square and triangular wave generator using IC 741.
Expt -17	Design a Butterworth high pass filter with specifications.

* Minimum 08 experiments should be conducted out of above enlisted.

Subject (Pr): 4ETC08 - Network Theory Lab

Course Objectives:

To apply knowledge of Mesh and Node analysis for a given network.

2. To learn various network theorems and apply them to solve networks.
3. To apply knowledge of Two Port network and Network Functions to analyze given network.

Course Outcomes:

After successfully completion of the lab course the students will be able to:

1. To apply knowledge of Mesh and Node analysis for a given network.
2. To apply various network theorems to solve networks.
3. To apply knowledge of Two Port network and Network Functions to analyze given network.

Expt. No.	Experiment List
Expt-1	To verify Node Analysis for electric circuit.
Expt -2	To verify Mesh Analysis for electric circuit.
Expt -3	To verify Superposition theorem for a given network.
Expt -4	To verify Thevenin's theorem for a given network.
Expt -5	To verify Norton's theorem for a given network.
Expt -6	To verify Reciprocity theorem for a given network.
Expt -7	To verify Maximum Power Transfer theorem for a given network.
Expt -8	To determine and verify open circuit (Z) Impedance parameters of a given Two Port network.
Expt -9	To determine and verify short circuit (Y) Admittance parameters of a given Two Port network.
Expt -10	To determine and verify Transmission (ABCD) parameters of a given Two Port network.
Expt -11	To determine and verify Hybrid (h) parameters of a given Two Port network.
Expt -12	To find the driving point Impedance for a given network.
Expt -13	To find the Voltage Transfer Ratio for a given network.
Expt -14	To study RLC series circuit using any simulation Tool.
Expt -15	To study RLC parallel circuit using any simulation Tool.

* Minimum 08 experiments should be conducted out of above enlisted.

Subject (Pr): 4ETC09 Signals & Systems Lab

Course Requisite: 1. 4ETC04 Signals & Systems.
Course Objectives: To use software to visualize analysis of Signals and System. 2. To manipulate the time signals and identify the type of given system.
Course Outcomes: . After successful completion of this course, students will be able to 2. Generate different plots and explore results to draw valid conclusions and inferences in Signal Processing. 3. Enable on how to approach for requirement of signal processing and system design using simulation tools. 4. Familiarize with the concepts of sampling.

	Experiment List
Expt-1	Study of Signal Processing Functions used in MATLAB/SCILAB.
Expt -2	Program to generate standard continuous Time Signals.
Expt -3	Program to generate standard discrete Time Signals.
Expt -4	Program to perform basic operations on Signals.
Expt -5	Program to find Even And Odd parts of a signal.
Expt -6	Program to check Periodicity of signals.
Expt -7	Program to find the Energy and Power of a Signal.
Expt -8	Program to identify a given system as linear/ non-linear, time variance/ invariance property of a given system.
Expt -9	Program to demonstrate the time domain sampling of band limited signals (Nyquist theorem).
Expt -10	Program to find Fourier transform of given signal.
Expt-11	Implement system equation using Simulink/Xcos to find output of system for different input signals.
Expt -12	Find unit step response of system described by transfer function using Simulink/Xcos.

* Minimum 08 experiments should be conducted out of above enlisted.

Sant Gadge Baba Amravati University Scheme:

SEMESTER : FIFTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks Int.	Max. Marks Ext.	Total	Min. Passing Marks
THEORY																
01	5ETC01	Microcontroller	4	--	--	4	4	3	80	20	100	40	--	--	--	--
02	5ETC02	Control System	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	5ETC03	Digital Signal Processing	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	5ETC04	Professional Elective –I (PE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	5ETC05	Open Elective – I (OE-I)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	5ETC06	Microcontroller Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	5ETC07	Digital Signal Processing Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	5ETC08	Power Electronics Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	5ETC09	Electronic lab based on Instrumentation	--	--	2	2	1	--	--	--	--	--	25	25	50	25
		Total	16	0	8	24	20	--	--	--	500	--	--	--	200	--
														Total		700
	5ETC04: PE (I) : (i) Power Electronics (ii) Fiber Optic Communication (iii) Speech and Audio Processing															
	5ETC05: OE (I) : (i) Sensors and Transducers (ii) Data Structure (iii) Introduction to Java															

A student will be eligible to get Under Graduate degree with Honors or additional Minor Engineering, if he/she completes an additional 20 credits relevant to the UG program.
The detail of which is as follows:

Course Name	Semester	Credit
MOOCs Course-I	V	04
MOOCs Course-II	VI	04
MOOCs Course-III	VII	04
MOOCs Course-IV	VIII	04
Internship	V to VIII Sem	02
Industrial Visit	V to VIII Sem	02
	Total	20

Note: The student needs to submit

1. MOOCs Course passing certificate of each semester
2. Completion & Evaluation Certificate of Internship
3. Industrial Visit certificate.

Note: Only One MOOCs course per semester shall be considered.

Subject (Th): 5ETC01: MICROCONTROLLER –

Course Requisites: 3ETC03: Digital System Design
Course Objectives: .1. To study fundamentals of microprocessor systems 2. To deal with interfacing of different peripheral devices with Microprocessor 3. To study fundamentals of microcontroller systems with Assembly Language Programming 4. To understand microcontroller C Language Programming concepts. 5. To know the importance of different peripheral devices and their interfacing to microcontrollers 6. To get familiar with RISC Architecture
Course Outcomes: Upon successful completion of this course, the student will be able to: 1. Attain the knowledge of Microprocessor 8085 2. Understand the Interfacing of various peripheral devices with Microprocessor 8085 3. Attain the knowledge of Microcontroller 8051 4. Understand assembly language & C Programming for Microcontrollers 5. Understand the Interfacing of various peripheral devices with Microcontroller 8051 6. Gain knowledge of advance Microcontrollers

	Subject: MICROCONTROLLER	**L**
Unit-1	**Introduction to Microprocessor 8085:** Pin Diagram and Architecture, Addressing Modes, Instruction Set, Stack & Subroutine, Interrupt system, Data transfer schemes	08
Unit-2	**I/O Interfacing of 8085:** Address space partitioning schemes, Architecture and interfacing of: PPI 8255, PIT 8254, USART 8251	08
Unit-3	**Introduction to Microcontroller 8051** :Architecture, Signal description, Memory organization, Interrupt structure, Timers and its modes, Addressing Modes, Instruction set, Assembly Language Programming, Serial communication modes	09
Unit-4	**8051 Programming in C :** Data types, IO programming, Logic operations, Data conversion programs, Accessing code ROM space, Data serialization	08
Unit-5	**Interfacing and Programming using C with 8051:** LED, LCD display, Keyboard, Stepper Motor, DC motor, Relays, ADC 0808, DAC 0809	08
Unit-6	**Introduction to RISC Processors:** RISC Features, Difference between CISC and RISC, 32 bit ARM7 Philips NXP LPC2148 Microcontroller : Architecture, Registers, Pipeline	07
	Total	**36**

Text Books: 1. Gaonkar R.S: "Microprocessor Architecture Programming and Applications with the 8085", Penram International Pub. 2. M. A. Mazidi, J. G. Mazidi and R. D. McKinley : "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Education (2nd Ed.) 3. Furber: "ARM System on Chip Architecure", 2ndEdition,Person India

References:

Subject (Th): 5ETC01: MICROCONTROLLER –

1. K. J. Ayala : “The 8051 Microcontroller”, Penram Int. Pubs., 1996
2. Phillips NXP LPC 2148 User Mannual.
3. Data Sheet Manual by INTEL

Subject (Th): 5ETC02: CONTROL SYSTEM

Course Requisite: 1. (IA1) Engineering Mathematics-I 2. (IB1) Engineering Mathematics-II 3. (4ETC3) Signals and Systems
Course Objectives: 1. To understand the fundamental concepts of Control systems and mathematical modeling of the physical systems. 2. To analyze time response of the LTI system. 3. To analyze LTI system using frequency response. 4. To develop and analyze State Variables of the system
Course Outcomes: Upon successful completion of this course, the student will be able to: 1. Understand mathematical models of electrical, mechanical and electromechanical systems. 2. Determine transfer functions from block diagrams and signal flow graph. 3. Evaluate transient response and steady state response parameters. 4. Analyze stability of the LTI system using Routh criterion and root locus 5. Analyze stability of the LTI system using bode plot and Nyquist criterion 6. Create the state model and Evaluate response of the system using state variable method.

	Subject: CONTROL SYSTEM	**L**
Unit-1	**Basics of Control system** Types of control systems Classification of control system, Mathematical modeling of Physical Systems, Electrical Analogous Systems, Force -voltage analogy, force- Current analogy.	05
Unit-2	**Control system Representation** Block diagram reduction technique, rules for block diagram reduction. Analysis of multiple input multiple output systems, properties of signal flow graphs, Mason's gain formula basic control actions.	06
Unit-3	**Time Response Analysis:** Standard test signals, Time response of first order and second order system, impulse response function, Transient domain specifications, Steady state analysis: steady state error and error constants, dynamic error coefficients	06
Unit-4	**Stability of Control System:** Concept of stability, necessary conditions for stability, Routh stability criterion. Root locus Techniques: Introduction, Construction of root locus, construction rules, Stability analysis of systems using root locus, Effect of addition of open loop zeros & poles.	07
Unit-5	**Frequency- Domain analysis:** Introduction, correlation between time and frequency response, Bode plot: general procedure for construction, Gain margin and phase margin, Stability analysis of systems using Bode plots. Polar plots, Nyquist stability criterion.	06
Unit-6	**State Variable Analysis:** Space model representation of LTI systems using physical, phase and canonical variables, Relationship between state variable model and transfer function, state transition matrix and its computation, Solution of state equations. Controllability and Observability.	06
	Total	**36**

Text Books: 1. Nagrath I. J. and M. Gopal, "Control Systems Engineering", 5th Ed.New Age International. 2. K. Ogata: Modern Control Engineering, Fourth Edition (PHI)

References

Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, 11th Ed., Pearson Education.
2. M. Gopal, “Control System – Principles and Design”, Tata McGraw Hill, 4th Edition, 2012.
3. Norman S. Nise, “Control System Engineering”, 5th Edition, Wiley.
4. Bhattarcharya: Control System Engineering, 2nd Edition (Pearson Education).
5. Benjamin C. Kuo , Automatic Control System “JOHN WILEY & SONS, INC.9th Edition

Subject (Th): 5ETC03: DIGITAL SIGNAL PROCESSING

Course Requisite: 1. 3ETC01 Engineering Mathematics-III 2. 4ETC04 Signals and Systems
Course Objectives: 1. Learn discrete signal and system fundamentals. 2. Learn the discrete-time signals in the frequency domain, using Z-transform and DFT. 3. Understand the implementation of the DFT in terms of the FFT 4. Learn the basic forms and design of FIR and IIR filters. 5. Learn the application filter bank in multirate DSP. 6. Become aware of some applications of digital signal processing.
Course Outcomes: Upon successful completion of this course, the student will be able to: 1. Manipulate the discrete time signals and identify the type system. 2. Compute the Z-transform of a sequence, identify its region of convergence , and compute the inverse Z-transform. 3. Evaluate the Fourier transform of a signal. 4. Design FIR and IIR filters. 5. Understand the concepts of Multirate Digital Signal Processing and need of Filter banks. 6. Understand the application of Digital Signal Processing

	Subject: : DIGITAL SIGNAL PROCESSING	L
Unit-1	**Introduction to Discrete Time Signals[DTS]:** Discrete Time Signal, representations of DTS, Basic Signal Operations, Linear Convolution by using Analytical and Graphical Method.	06
Unit-2	**Z-Transform:** Definition and Properties of Z-Transform, Concept of Region of Convergence[ROC], Inverse Z-transform using long division method, PFE method and residue method.	06
Unit-3	**Discrete and Fast Fourier Transform:** Definition and Properties of DFT, IDFT. Circular convolution of sequences using DFT and IDFT. Fast Fourier Transforms(FFT), Radix-2 decimation in time and decimation in frequency FFT. [Numerical based on DIT-FFT & DIF-FFT]	06
Unit-4	**Finite Impulse Response (FIR) filters:** Design techniques for FIR filter by windowing method: Rectangular window. Realization of basic structure FIR system : Direct form and Cascade.	05
Unit-5	**Infinite Impulse Response (IIR) filters:** IIR Filter Design by Mapping of S-plane to Z-plane: impulse invariance method, bilinear transformation method. Realization of basic structure IIR system: Direct form-I, Direct Form-II, Cascade & Parallel.	06
Unit-6	**Multirate Digital Signal Processing:** Sampling, Sampling rate conversion, multilevel filter bank. Overview and architecture of DSP processor TMS320C54XX.Applications of DSP (Only Block Diagram): Speech Signal, RADAR & SONAR.	07
	Total	**36**

Subject (Th): 5ETC03: DIGITAL SIGNAL PROCESSING

Text Books: 1. Nagoorkani,“DigitalSignalProcessing”,TataMcGraw-HillEducation,SecondEdition. 2. S.Salivahanan,A.Vallavaraj,“DigitalSignalProcessing”,TataMcGraw-HillEducation,2001.
References: 1. Oppenheim & Schafer, “Discrete time Processing”, PHI. 2. Proakis & Manolakis D.G.,“Digital Signal Processing”,PHI. 3. MitraS.K.,“Digital Signal Processing”,TMH. 4. RomanKuc,“Digital Signal Processing”,MGH. 5. IfeacherE.C.,JervisB.W.,“DigitalSignalProcessing”,AddisonWesley. 6. P.P.Vaidyanathan,“DSP and Multirate Systems”, PHI.

Subject (Th): 5ETC04 Professional Elective - I (PE-I):
(ii) 5ETC04 Professional Elective - I (PE-I): (i) POWER ELECTRONICS

Course Requisite: 1. 1B3Basic Electrical Engineering. 2. 3ETC02 Electronic Devices and Circuits.
Course Objectives: 1. To introduce power electronics devices; SCR, TRIAC, IGBT, MOSFET and to learn their characteristics. 2. To develop the ability to analyze the dynamics in power electronic converters/drives systems. 3. To study AC-DC converters and effect of freewheeling diode. 4. To study AC-AC, DC-AC, DC-DC converters. 5. To build and test circuits using power devices such as SCR 6. To study applications of power converters in DC drives.
Course Outcomes: Upon successful completion of this course, the student will be able to: 1. Analyze the characteristics of various power electronics devices . 2. Understand SCR firing circuits, commutation techniques. 3. Analyze and design controlled rectifiers and dual converters 4. Analyze and design DC to DC, AC to AC converters and DC to AC inverters, 5. Design and develop power electronic circuits for various applications. 6. Know various applications of power converters in DC drives.

	Subject: : POWER ELECTRONICS	**L**
Unit-1	SCR -construction, characteristics, two transistor analogy for turning ON-OFF a SCR, different methods of turning ON of a SCR, turn OFF mechanism, Thyristor firing circuit using UJT, Protection of SCR (snubber circuit)	06
Unit-2	Triac, Diac-construction, characteristics. power transistor, power MOSFET, IGBT – their construction & characteristics, Introduction to GTO, Classification of circuit for forced commutation.	06
Unit-3	Principle of phase control, single phase half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of freewheeling diode, single phase dual converters.	06
Unit-4	Series inverter, improved series inverter, parallel inverter, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorized bridge inverter.	06
Unit-5	Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper circuit, Jones chopper, step-up chopper, step up/down chopper and AC chopper.	06
Unit-6	Basic principle of cyclo-converter, single phase to single phase cyclo-converter. Speed control of DC series motors speed control of DC shunt motor using phase controlled rectifiers UPS, fan speed regulator	06
	Total	**36**

1. M.D.Singh, K.B. Khanchandani, “Power Electronics”, Tata McGraw-Hill.
2. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.

References:

1. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
2. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
3. V.R.Moorthi, “Power Electronics”, Oxford University Press.
4. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
5. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International
6. Publishers. SCR manual from GE, USA.

5ETC04 Professional Elective - I (PE-I): (ii) FIBER OPTICS COMMUNICATION

Course Pre-Requisite: 1. 3ETC04 Electromagnetic Waves 2. 4ETC01 Analog and Digital Communication
Course Objectives: 1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures 2. To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors 3. To learn the various optical source materials, LED structures, quantum efficiency, Laser diode 4. To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration 5. To learn the fiber optical network components, variety of networking aspects, operational principles WDM. 6. To learn and understand the applications.
Course Outcomes: . Upon successful completion of this course, the student will be able to: 1. Understand the principles fiber-optic communication, the components and Losses and dispersion in fiber. 2. Understand the properties of the optical fibers and optical components in sources. 3. Understand operation of lasers, LEDs, and detectors in fiber 4. Analyze system performance of optical communication systems in networks 5. Understand the block diagram of FOC System with Power budgeting parameters. 6. To apply the knowledge of fiber optical components, links, and systems.

	Subject: FIBER OPTICS COMMUNICATION	**L**
Unit-1	**Optical Fiber Communication System:** Basic optical laws and definitions, Optical fiber modes andconfigurations, N.A. Attenuation: Units, absorption, scattering losses radioactive losses, core and cladding losses.Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index.Material dispersion, wave guide dispersion, intermodal dispersion. [Numerical based on N.A. and mode calculations]	06
Unit-2	**Optical Sources:** Light Emitting Diodes: Structure, Light source materials. Laser Diodes: Structure, threshold conditions, Modulations of laser diodes. Light source linearity, reliability considerations.	06
Unit-3	**Optical Detectors:** Principles of photodiodes, Photo detector noise, Detector response time, Avalanche multiplication noise, Temperature effect on avalanche gain.	06

Unit-4	**Optical switches** Coupled mode analysis of directional couplers, electro-optic-switches. Optical amplifiers - EDFA, Raman amplifier	06
Unit-5	WDM and DWDM systems. Principles of WDM networks. Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solution based communication.	06
Unit-6	Block Diagram of fiber optic communication, selection of optical fiber types for short haul, long haul and high speed data links, optical power and dispersion budget calculations of fiber optic communication link, Repeaters, optical fiber amplifiers, optical fiber transmitter and optical fiber receiver design considerations. [Numerical are not expected]	06
	Total	**36**

Text Books:

G. Keiser, "Optical Fibre Communication", McGraw Hill International.

References:

1. Seniors J. M., "Optical Fibre Communication and Applications", Prentice Hall of India Pvt. Ltd., New Delhi

5ETC04 Professional Elective - I (PE-I): (iii) SPEECH AND AUDIO PROCESSING

Course Pre-Requisite:

1. 3ETC01 Engineering Mathematics-III
2. 4ETC04 Signals and Systems
3. 4ETC01 Analog and Digital Communication

Course Objectives:

1. To be able to relate human physiology and anatomy with signal processing paradigms.

2. To acquire the knowledge of speech generation and speech recognition models.

3. To understand methods/techniques used in speech signal estimation & detection.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Illustrate how the speech production is modeled
2. Summarize the techniques involved in collecting the features from the speech signal in time and frequency domain.
3. Summarize the various speech coding techniques.
4. Understand the process Speech Synthesis.
5. Apply techniques/methods used for speech enhancement.
6. Apply techniques/methods used for speech recognition.

	Subject: SPEECH AND AUDIO PROCESSING	**L**
Unit-1	**Speech Production and Acoustic Phonetics:** Process of speech production, Articulatory phonetics, Acoustic Phonetics, Acoustic theory of speech production, Co- articulation, Prosody, Digital models of speech signals, Brief applications of speech & audio processing	06
Unit-2	**Speech Analysis:** Time and frequency domain methods for analysis of speech: Methods for extracting energy ,average magnitude, zero crossing rate, silence discrimination using ZCR and energy, short time Fourier analysis, Formant extraction, Pitch extraction, Cepstral analysis.	06
Unit-3	**Coding of Speech Signals:** Introduction, Quantization, Speech redundancies, Time domain waveform coding, Linear predictive coding: Linear Delta Modulation ,Adaptive Delta Modulation, Adaptive Differential Pulse Code Modulation	06
Unit-4	**Speech Synthesis:** Principles of speech synthesis, Articulatory synthesis, Formant synthesis and LPC synthesis.	06
Unit-5	**Speech Enhancement:** Introduction, Nature of interfering sounds, speech enhancement techniques: spectral subtraction and filtering, harmonic filtering, Spectral subtraction, Adaptive noise cancellation	06
Unit-6	**Speech Recognition:** Introduction, Baye’s rule, Segmental feature extraction, MFCC, DTW, HMM approaches for speech recognition	06
	Total	**36**

Text Books: 1. “Speech Communications: Human & Machine”, Douglas O'Shaughnessy, Universities Press. 2. “Digital Processing of Speech Signals”, Rabiner and Schafer, Prentice Hall, 1978.
References: 1. “Discrete-Time Speech Signal Processing: Principles and Practice”, Thomas F. Quatieri,Publisher: Prentice Hall. 2. “Speech and Audio Signal Processing: Processing and Perception of Speech and Music”,Nelson Morgan and Ben Gold, John Wiley & Sons. 3. “Speech Analysis Synthesis and Perception”, J. L. Flanagan, Second edition, Springer-Verlag(1972). 4. “Speech and Audio Signal Processing”, Gold & Morgan, 1999, Wiley and Sons.

5ETC05 Open Elective - I (OE-I): (i) SENSORS AND TRANSDUCERS

Course Pre-Requisite: 1. 1B3 Basic Electrical Engineering. 2. 3ETC02 Electronic Devices and Circuits.
Course Objectives: 1. To provide a basic knowledge about Sensors and transducers. 2. To learn about the various sensor and transducer for measurement of physical quantities.
Course Outcomes: Upon successful completion of this course, the student will be able to: 1. Understand the basic aspect of transducers and sensors 2. Gain knowledge of statistical characteristic and Errors of system. 3. Realize the fundamental concept about temperature and Velocity measurement 4. Acquire knowledge of measurement of displacement and Humidity. 5. Familiarize the basic information about measurement of Pressure, Flow, Level 6. Aware about the basics of Strain gauge and smart sensors

	Subject: SENSORS AND TRANSDUCERS	**L**
Unit-1	**Sensor & Transducers:** Definition, Types & selection of sensors, Need of sensor, Difference between Sensors & Transducers, Classification of Transducer, Selection criteria. Introduction to Generalized Instrumentation system with example.	06
Unit-2	**Characteristic, parameters and Errors** Characteristics of instruments – static characteristics, Statistical Parameters with numericals. Error and its Types: Gross error, Systematic Error, Random Error with remedies.	06
Unit-3	**Temperature Measurement:** Introduction to Thermistor, RTD, Thermocouple and LM 335,Total Radiation Pyrometer **Velocity Measurement:** Velocity measurement system by encoder, Magnetic Pickup and Photo detector (Linear and Angular Measurement)	06
Unit-4	**Humidity Measurement:** Resistive, Capacitive, Piezoelectric, and Infrared **Measurement of Pressure:** Primary pressure sensors - elastic elements like bourdon tube and diaphragm Electrical/Secondary Pressure Transducers: Capacitive, piezoelectric and its material, Low Pressure (Vacuum): Pirani gauge.	06
Unit-5	**Measurement of Flow:** Hot wire anemometer **Measurement of Level:** Resistive method, Ultrasonic level detector **Strain Measurement:** Introduction, types of strain gauge, gauge factor calculation, materials for strain gauge, resistance strain gauge bridges, temperature compensationand applications of strain gauges.	06
	Introduction to smart sensors: Objective, block diagram, advantages and disadvantages.	06

Unit-6		
	Total	**36**

Text Books:

1. Sawney A K and Puneet Sawney, “A Course in mechanical measurements and instrumentation and control”,

12th edition, DhanpatRai and Co, new delhi,2013.

2. Electronics instrumentation" by H. S. Kalsi [TMH]

References:

1. David A. Bell, Electronic Instrumentation and Measurements, Third Edition, Oxford Higher Education
2. D.Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi, 1999.
3. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.
4. Ernest O.Doebelin, Measurement systems Application and Design, International Student Edition, IV Edition,
McGraw Hill Book Company, 1998.

5ETC05 Open Elective - I (OE-I): (ii) Basic Electronic Devices and Circuits

Course Pre-Requisite:

1. Engineering Physics

Course Objectives:

1. To study construction and working of different types of Resistors and Capacitors
2. To study construction and working of different types of Fuse, Cable and connectors
3. To Understand the PCB layout and its manufacturing
4. To understand detail analysis of Electronic devices.
5.

Course Outcomes:

After successfully completing the course, the students will be able to

1. Understand the working and construction of Resistors and capacitors
2. Comprehend the types of fuses, connectors and cables
3. Learn the PCB layout and its manufacturing
4. Comprehend the knowledge of diode and its characteristics
5. Understand basics of different special semiconductor devices
6. Understand the basics of BJT with characteristics of different modes

	Subject: Basic Electronic Devices and Circuits	**L**
Unit-1	Construction, selection and failures of Resistors: Fixed type, Variable Type, Network and Chip type, Capacitors: fixed and variable Type	06
Unit-2	Switches & Relays: Types, Construction and Testing of Fuses, Cables, Connectors: Types, Construction	06
Unit-3	Basics of Electronic Component layout, PCB material, Properties and specifications, Basic manufacturing process of single layered PCB, Soldering and De-soldering Techniques	06
Unit-4	P-N Junction diode theory, V-I Characteristics, Static and dynamic resistance, Zener diode: characteristics, Avalanche & Zener breakdown, Testing of diode using Ohmmeter and CRO	06
Unit-5	Theory, Construction, Characteristics and application of Tunnel diode, Varactor diode, Shottkey diode, Opto-Devices: LED & Photo Diode	06
Unit-6	Theory of PNP and NPN Transistor, Transistor Configurations, Their Characteristics and current Components. Transistor as an amplifier, Testing of Transistor using Ohmmeter and CRO	06
	Total	**36**

Text Books:

1. Maduri Joshi, “ Electronic Component and Material” 3rd Edition, Shroff Publication
2. Millman H Halkies, “ Integrated Electronics” TMH Co. New Delhi

References:

1. Bosshart, “ Printed Circuit Board” TMH
2. David Bell’ “ Electronic Devices and Circuits” Oxford University Press, 2010

Subject (Pr): 5ETC06- MICROCONTROLLER- LAB

Course Requisite: 3ETC03: Digital System Design
Course Objectives: . To study fundamentals of microprocessor systems 2. To deal with interfacing of different peripheral devices with Microprocessor 3. To study fundamentals of microcontroller systems with Assembly Language Programming 4. To understand microcontroller C Language Programming concepts. 5. To know the importance of different peripheral devices and their interfacing to microcontrollers 6. To get familiar with RISC Architecture
Course Outcomes: Upon successful completion of this course, the student will be able to: 1. Attain the knowledge of Microprocessor 8085 2. Understand the Interfacing of various peripheral devices with Microprocessor 8085 3. Attain the knowledge of Microcontroller 8051 4. Understand assembly language & C Programming for Microcontrollers 5. Understand the Interfacing of various peripheral devices with Microcontroller 8051 6. Gain knowledge of advance Microcontrollers

	Experiment List
Expt- 01	Draw and Explain Block diagram and Pin diagram of 8085 Microprocessor.
Expt- 02	To perform Addition of two 8 bit number using 8085
Expt -03	To perform Subtraction of two 8 bit number using 8085
Expt -04	LDR interfacing with 8051 microcontroller.
Expt -05	Interfacing of IR sensor with 8051 microcontroller
Expt -06	LCD interfacing with 8051 microcontroller.
Expt -07	Interfacing of DHT11 sensor with 8051 microcontroller.
Expt -08	7-segment display interfacing with 8051 microcontroller.
Expt -09	Interfacing of Servo motor with AVR microcontroller.
Expt-10	Interfacing of DC motor with AVR microcontroller.

Subject (Pr): 5ETC07- DIGITAL SIGNAL PROCESSING LAB

Course Requisite:

1. 4ETC04 : Signals & Systems.
2. 4ETC09 : Signals & Systems Lab
3. 5ETC03 : Digital Signal Processing.

Course Objectives:

1. To use software basic concepts of digital signal processing.
2. To Generate and demonstrate the basic discrete time signals.
3. To visualize discrete time signals in frequency domain using Fourier Transform.
4. To identify the stability of discrete time system using z-transform.
5. Learn the basic design procedure of FIR filters.
6. To Verify basic properties of multi rate systems.
7. To become aware of DSP processor TMS320C54XX.

Course Outcomes:

After successful completion of this course the student will be able to

1. Generate different plots and explore results to draw valid conclusions and inferences in DSP.
2. Sketch the magnitude and phase response of DFT, Inverse DFT and FFT of discrete time signals.
3. Calculate linear and circular convolution of discrete sequences.
4. Model FIR filter using window techniques
5. Familiarize with the concepts of Multirate Digital Signal Processing.
6. Understand the architecture of digital filter and DSP processor.

	Experiment List- DIGITAL SIGNAL PROCESSING LAB
Expt- 01	**Study of Signal Processing Function used in MATLAB.** 1. To study basics of MATLAB. 2. To study the basic commands used in MATLAB for signal processing.
Expt- 02	**Generate basic discrete signals: unit impulse, unit step sequence, unit ramp sequence, real exponential signal, sinusoidal signal** 1. To acquire the knowledge of basic discrete signals used in DSP. 2. To generate & plot basic discrete signal in MATLAB.
Expt -03	**Find the Linear Convolution and Circular convolution of sequence** 1. To evaluate the response of the system for given input.
Expt -04	**Calculate of DFT and IDFT of a given discrete time sequences.** 1. To find out the Discrete Fourier Transform and its inverse of discrete time signal. 2. To demonstrate the frequency domain representation of signal.
Expt -05	**Determine the stability, Pole Zero plot of given transfer function.** 1. To demonstrate pole zero plot of given transfer function. 2. To identify the stability using complex Z-plane.
Expt -06	**FIR filter design using rectangular window** 1. To design the FIR filter for given specifications.
Expt -07	**Multirate Digital Signal Processing,** 1. To demonstrate upsampling and downsampling of a given signal. 2. To demonstrate interpolation and decimation of a given signal.
Expt -08	**To study TMS 320C54xx DSP Processor** 1. To overview the architectural details of DSP Processor 2. To learn the basics of signal processing operation using hardware.

Subject (Pr): 5ETC08- POWER ELECTRONICS LAB

Course Requisite: 1. (1B4) Electrical Engineering. 2. (3ET3) Electronic Devices and Circuits. 3. (5ET2) Power Electronics & Drives.
Course Objectives: The course aims to: 1. To understand the characteristics of power electronic devices like SCR, TRIAC, MOSFET. 2. To verify the effect of firing angle in phase-controlled converters. 3. To understand the turn off mechanism of SCR. 4. To examine the basic working principle of DC and AC Motors. 5. To understand speed control techniques of DC and AC motors.
Course Outcomes: Upon successful completion of this course, students will be able to: 1. Analyze the characteristics of various power electronics devices. 2. Understand SCR firing circuits, commutation techniques. 3. Design and develop power electronic circuits for various applications. 4. Illustrate the operation of various DC and AC motors. 5. Use different speed control techniques for DC and AC motors. 6. Understand the operation of various DC and AC motors.

	Experiment List
Expt- 01	To verify the characteristics of SCR. Obj: 1. To plot V-I characteristics of SCR. 2. To measure Latching and Holding current of SCR.
Expt- 02	To verify the characteristics of DIAC/TRIAC. Obj: 1. To plot V-I characteristics of DIAC/TRIAC when MT1 is +ve w.r.t. MT2. 2. To plot V-I characteristics of DIAC/TRIAC when MT1 is -ve w.r.t. MT2.
Expt -03	To verify the characteristics of Power MOSFET. Obj: 1. To plot V-I characteristics of Power MOSFET
Expt -04	To verify the effect of firing angle on output voltage in single phase half wave/ Full wave-controlled rectifier Obj: - 1. To study basic working of single-phase half wave/ Full wave controlled rectifier 2. To study the effect of firing angle on output voltage
Expt -05	To verify the working of SCR Commutation Obj: - 1. To examine class A, class B, class C, class D and class E commutation of SCR 2. To draw the waveforms at different points for commutation circuit
Expt -06	To verify the working of basic /improved series inverter Obj: - 1. To examine the basic working principle of series inverter 2. To examine the basic working principle of improved series inverter
Expt -07	To verify the working of parallel inverter Obj: - 1. To examine the basic working principle of parallel inverter 2. To analyze working of parallel inverter with class C commutation
Expt -08	To verify the basic working principle of Jones chopper Obj: - 1. To examine the basic working principle of Jones chopper 2. To observe & plot waveforms at different points
Expt -09	To verify the speed control of D.C. shunt motor. Obj: - 1. To examine the basic method of speed controlling of D.C. motor.

	2. To observe and plot the speed vs. current characteristics.
Expt-10	To perform load test on D.C. series motor. Obj: - 1. To examine the basic working principle of D.C. series motor. 2. To observe and plot the various characteristics of D.C. Series motor.
Expt-11	To use TRIAC in the speed control of universal motor. Obj: 1. To observe and plot speed Vs. voltage characteristics of universal motor.
Expt-12	To perform load test on 3 phase Induction Motor. Obj: - 1. To study the basic working of 3 phase Induction Motor. 2. To examine various characteristics of 3 phase Induction Motor.

* Minimum 10 experiments based on/relevant to the above list.

Subject (Pr): 5ETC09: ELECTRONIC LAB BASED ON INSTRUMENTATION

Course Outcomes:
At the end of this course student will demonstrate the ability to
1. Learn about various Sensors
2. Examine the measurement of various physical quantities using transducers
3. be aware of statistical data analysis of different transducers
4. Understand computerized data acquisition

	Experiment List
Expt- 01	Temperature measurement using temperature sensor.
Expt- 02	Measurement of linear displacement using LVDT.
Expt -03	Study of instrumentation amplifier
Expt -04	Measurement of force using strain gauge
Expt -05	Measurement of Pressure using Piezo-electric Transducer.
Expt -06	To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric).
Expt -07	Displacement measurement by Capacitive Transducer
Expt -08	Temperature measurement by thermistor.
Expt -09	Liquid level measurement using level transducers.
Expt-10	Displacement measurement by resistive Transducer.
Expt-11	Comparative study of temperature measurement using: RTD, Thermistor and Thermocouple.
Expt-12	Study of Smart Sensors and Data Acquisition Systems

*** Minimum 08 experiments should be conducted out of above enlisted.**

SEMESTER : SIXTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	6ETC01	Communication Network	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	6ETC02	Computer Architecture	4	--	--	4	4	3	80	20	100	40	--	--	--	--
03	6ETC03	Professional Elective -II (PE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	6ETC04	Open Elective - II (OE-II)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	6ETC05	Economics for Engineers (HS)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	6ETC06	Communication Network Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	6ETC07	Electronic Circuit Design Lab (Hardware + Software)	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	6ETC08	Python Programming Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	6ETC09	Mini Project	--	--	2	2	1	--	--	--	--	--	50	--	50	25
		Total	**16**	**0**	**8**	**24**	**20**	--	--	--	**500**	--	--	--	**200**	--
														Total	**700**	

6ETC03: PE (II) : (i) CMOS Design (ii) Satellite Communication (iii) Adaptive Signal Processing

6ETC04: OE (II) : (i) Introduction to Python Programming (ii) Data Base Management System (iii) Renewable Energy Sources (Solar & Electric Vehicles)

Subject (Th): 6ETC01 COMMUNICATION NETWORK

Course Objectives:

1. To understand the general principles of network design and compare the different network
Topologies.
2. To understand the general principles of switching and various routing algorithms.
3. To acquire the knowledge of functions and protocols of OSI and TCP/IP models.
4. To understand Application layer Protocols.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Identify different types of network devices and their functions within a network.
2. Understand the basic functions of data logical link control and media access control and protocol used in this layers.
3. Distinguish between the layers of the OSI and TCP/IP model.
4. Analyze, specify and design routing strategies for an IP based networking infrastructure
5. Understand the concept of reliable and unreliable transfer protocol of data and how TCP and UDP implement these concepts.
6. Understand various Application layer Protocols.

	Subject: COMMUNICATION NETWORK	**L**
	Data Communication Network: A brief history of Internet, Protocols and Standards, Standard Organizations, Need for Protocol Architecture, OSI Reference Model, Overview of TCP/IP architecture, Addresses in TCP/IP.	
Unit-1	**Types of Network:** LAN, MAN, WAN. Network connecting Devices: Hubs, Repeater, Bridges, Switches, Routers, Gateways. Network Topology: Mesh, Bus, Tree, Ring, Star.	08
Unit-2	**Data Link Control Protocols:** Need for Flow control, Stop and Wait Flow Control, Sliding Window Flow Control, Stop and wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Transmission efficiency of ARQ protocols.	06
Unit-3	**Multiple Access Control Protocols:** Random Access Techniques: ALOHA, Slotted ALOHA, Contention Techniques: CSMA, CSMA/ CD (IEEE 802.3), CSMA/CA.Controlled Access Techniques: Polling, Token Passing. Medium Access Control Protocols: Token Bus (IEEE 802.4), Token Ring (IEEE 802.5).	06
Unit-4	**Network layer:** TCP IP Reference Model, IPv4-Classful and Classless Addressing, Virtual circuit and Datagram networks, Router, Routing algorithms, Dijkstra's Algorithm (Problems expected), Bellman Ford Algorithm (Problems expected). Traffic Control: Leaky bucket algorithm, Token bucket algorithm	05
Unit-5	**Transport layer:** Connectionless transport - UDP, Connection-oriented transport – TCP, Remote Procedure Call. Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.	05
Unit-6	**Application Layer:** Domain Name Space (DNS), TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP.	06
	Total	**36**

Subject (Th): 6ETC01 COMMUNICATION NETWORK

Text Books:

1. B. Forouzan, “Data Communications and Networking”, 4th Edition, McGraw-Hill.
2. Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks”, 5th Edition, Pearson Education, Inc.
3. William Stallings, “Data and Computer Communication”, 8th Edition, Pearson Education, Inc.

References:

1. James F. Kuross, Keith W. Ross, “Computer Networking A Top-Down Approach Featuring the Internet”,
Third Edition, Addison Wesley, 2004.
2. Nader F. Mir, “Computer and Communication Networks”, Pearson Education,2007.
3. Comer, “Computer Networks and Internets with Internet Applications”, Fourth Edition, Pearson Education,
2003.

Text

6ETC02 _ COMPUTER ARCHITECTURE

Course Requisite: 3ETC03 Digital System Design 2. 5ETC01 Microcontroller
Course Objectives: 1. To familiarize the basic concepts and structure of computers 2. To understand different types of instruction formats and concepts of arithmetic operations 3. To learn the concepts of microinstruction, its sequencing and execution. 4. To learn different types of memories and understand memory organization 5. To learn how I/O devices are organised and accessed. 6. To understand the concept of parallel processing and multi-processor architecture.
Course Outcomes: Upon successful completion of this course, the student will be able to: 1. Learn how computers work 2. Analyse the performance of computers 3. Perform floating point arithmetic operations and design ALU as per the requirement 4. Know how computers are designed & built 5. Understand and design different types of memory systems 6. Understand issues affecting recent processors

	Subject: COMPUTER ARCHITECTURE	**L**
Unit-1	**Basic Structure of Computers:** Hardware & software Functional units, Basic operational concepts, Bus structures, addressing methods and Machine program sequencing: Memory locations, Addresses, Instruction and Instruction sequencing, Addressing modes, Basic I/O operations.	08
Unit-2	**Processing Unit:** Processor organization, information representation, number formats, Instruction sets and its implementation. Arithmetic operation, ALU design, Floating point arithmetic, IEEE 754 floating point formats.	06
Unit-3	**Control Unit:** Micro operation, control of processor Hardwired implementation, micro program control: Concepts, microinstructions sequencing and execution, application of microprogramming.	06
Unit-4	**Memory Unit :**Concept of virtual memory, Memory hierarchies, Main memory allocation, Replacement policies, segments and pages, file organization, High speed memory, inter-board memories, Cache memories, Associative memories.	05
Unit-5	**I/O Organization :** Accessing I/O devices, Interrupts, Enabling and disabling interrupts, handling multiple devices, DMA, I/O Hardware, Standard I/O interfaces.	05
Unit-6	**Parallel Processing:** Basic concepts, types of parallel processors. Pipeline processor: Pipeline types, design, structures, Multiprocessors: Types, performance, parallel programming, Multiprocessor Architecture, interconnect network	06
	Total	**36**

Text Books:

1. Hayes J.P, “Computer Architecture and Organization”, PHI, Second edition
2. A.S.Tanenbum, “Structured Computer Organization”, PHI, Third edition
3. M.M.Mano, “Computer System Architecture”, Edition

References:

1. V.Carl Hammacher, “Computer Organisation”, Fifth Edition
2. Y.Chu, "Computer Organization and Microprogramming”, II, Englewood Chiffs, N.J., Prentice Hall Edition
3. C.W.Gear, “Computer Organization and Programming”, McGraw Hill, N.V. Edition

Subject (Th): 6ETC03 PROFESSIONAL ELECTIVE - II (PE-II): (I) CMOS DESIGNCOMMUNICATION

Course Requisite:

1. 3ETC02 - Electronic Devices & Circuits.
2. 3ETC03 - Digital System Design

Course Objectives:

1. To study CMOS transistor theory and performance parameters.
2. To study layout design rules for size & power optimization.
3. To understand the concept of combinational CMOS circuit design.
4. To implement the concept of sequential circuit in CMOS design.
5. To learn the dynamic CMOS logic circuit

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. To understand the concept of CMOS circuit.
2. To draw Layout, Stick diagrams of CMOS Circuits.
3. To analyses the CMOS circuit performance parameter
4. To implement combinational CMOS circuit design using CMOS logic families.
5. To design sequential CMOS circuit.
6. To design the CMOS circuit using dynamic CMOS logic

	Subject: CMOS Design	**L**
Unit-1	**BCMOS Device Fundamentals:** Moore's Law, MOS structure capacitance, Channel capacitance, Junction capacitance,Review of MOS transistor models, Non-ideal behaviour of the MOS Transistor. Transistor as a switch, CMOS Inverter and its Characteristics.	08
Unit-2	**VLSI Circuit Design Processes:** VLSI Design Flow, CMOS Process enhancements –Interconnect, Circuit Elements, CMOS Lambda-based Design Rules, Stick Diagrams, Physical layout of simple CMOS Logic Gates, RC Parasitic, CMOS Fabrication [P-well process, N-well process].	06
Unit-3	**CMOS Performance Parameter:** Introduction to Delays in CMOS,RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout.	06
Unit-4	**Combinational Circuit Design:** CMOS logic families, CMOS logic gates design, Complex CMOS circuit, Transmission gate, Pass transistor logic.	05
Unit-5	**Sequential Circuit Design:** Design of latches and Flip-flops, Static Read - Write Memory (SRAM) Circuits (6T), Dynamic Read-Write Memory (DRAM) Circuits (3T).	05
Unit-6	**CMOS Clocking Styles:** CMOS Clocking Styles, Clocks Skew, Clock distribution techniques, Clock Jitter. Dynamic Logic Circuit: Dynamic Pass transistor logic, Dynamic CMOS logic, Domino logic, NORA logic.	06
	Total	**36**

Text Books:

1. S. M. Kang and Y. Leblebici, “CMOS Digital Integrated Circuits: Analysis and Design”, 3rd Edition, MH, 2002.

2. Neil H. Weste, D. Harris, “Principles of CMOS VLSI design A Circuit & System Perspective” 4th Edition, Pearson (Addison-Wesley), 2011.

3. Wayne Wolfe, “Modern VLSI Design: IP based Approach”, 4th Edition, PHI.

4. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, “Digital Integrated Circuits: A Design Perspective”, 2nd Edition, Pearson

References:

1. S.K. Ghandhi, “VLSI Fabrication Principles”, John Wiley Inc., New York, 1994 (2nd Edition).
2. Plummer, Deal, Griffin, “Silicon VLSI Technology: Fundamentals, Practice &Modeling” PH, 2001.
3. S.M. Sze (Ed), “VLSI Technology”, McGraw Hill.
4. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.

Subject (Th): 6ETC03 PROFESSIONAL ELECTIVE - II (PE-II): (II) SATELLITE COMMUNICATION

Course Requisite: 1. 3ETC04 Electromagnetic Waves 2. 4ETC01 Analog and Digital Communication
Course Objectives: 1. To understand the frequency bands used in satellite communication 2. Toknowthebasicsoforbitalmechanism,thetypesof satelliteorbitsandorbitalaspectsof Satellitecommunication. 3. To understand the various typical phenomenon in satellitecommunication. 4. To understand different satellite channel parameters. 5. To understand the working of different satellitesubsystems 6. To understand the various services ofsatellite.
Course Outcomes: Upon successful completion of this course, the student will be able to: At the end of this course students will demonstrate the ability to 1. Visualizethearchitectureof satellitesystems as ameansof highspeed,highrange communicationsystem. 2. Statevariousaspectsrelatedtosatellitesystemssuchas orbitalequations,sub-systemsin asatellite 3. Solvenumerical problemsrelatedtoorbitalmotionanddesignoflinkbudgetforthe given parametersandconditions. 4. Learnadvancedtechniquesandregulatoryaspectsofsatellitecommunication 5. Understand role of satellite in variousapplications 6. Understand VSAT and GPS

	Subject: Satellite Communication	L
Unit-1	**Introduction to Satellite Communication:** Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication, satellite types – LEO, MEO, GEO, HEO.	06
Unit-2	**Orbital Mechanics:** Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity, look angle determination of a satellite, concepts of Solar day and Sidereal day. Geo stationary and non-Geo- stationary orbits.	06
Unit-3	**Typical Phenomena in Satellite Communication :**Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift, space launch vehicles.	06
Unit-4	**Satellite Channels:** Electromagnetic field propagation, Atmospheric losses, Receiver noise, Carrier to Noise ratio, Satellite system link model: Uplink, Downlink, Cross link, Transponder, Satellite system parameters, Satellite link analysis, Frequency reuse and depolarization.	06
Unit-5	**Satellite sub-systems:** Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power subsystems etc. Satellite link budget.	06

Unit-6	**Very Small Aperture Satellite (VSAT):** Overview of VSAT system, Network architecture, Access control protocols, Signal format, Modulation coding and interference issues, VSAT antennas, Transmitter and Receiver, Link analysis for VSAT network. **Satellite Navigation and Global Positioning System (GPS):** Radio and Satellite navigation, Position, Location in GPS, GPS receivers and codes, GPS navigation message and signal levels, Timing accuracy, GPS receiver operation, Differential GPS.	06
	Total	**36**

Text Books:

. Timothy Pratt Charles W.Bostian, Jeremy E.Allnutt: Satellite Communications: Wiley India. 2nd Edition, 2002

2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill,2009

References:

Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2009

Subject (Th): 6ETC03 PROFESSIONAL ELECTIVE - II (PE-II Adaptive Signal Processing

Course Requisite:

1. 3ETC01 Engineering Mathematics-III
2. 4ETC04 Signals and Systems
3. 5ETC03 Digital Signal Processing

Course Objectives:

1. To introduce with adaptive signal processing and adaptive systems.
2. To be acquainted with desired response,mean square error performance and Wiener Filters.
3. To make familiar with gradient search algorithms and functions.
4. To Understand LMS algorithms and its performance analysis.
5. To Understand Linear LeastSquare Estimation and RLS algorithms
6. To study the applications of adaptive signal processing

Course Outcomes:

Upon successful completion of this course, the student will be able to: At the end of this course students will demonstrate the ability to :

1. Comprehend adaptive system and functions
2. Evaluate the performance of various methods for designing adaptive filters through estimation of different parameters.
3. Understand the concepts of gradient and mean square error performance in adaptive systems
4. Analyse convergence and stability issues associated with adaptive filter design and come up with optimum solutions.
5. Apply an adaptive filter algorithm that recursively finds the coefficients that minimize a weighted linear least squares cost function.
6. Implement applications of adaptive signal processing.

	Subject (Th): Adaptive Signal Processing	**L**
Unit-1	**Adaptive Systems:** AdaptiveSystems: Definition and characteristics,General Properties, Applications and examples of an adaptive system. Review of probability, random variables and random processes.	06
Unit-2	**Wiener Filters:** Input signal and weight vectors, desired response and error, Mean Square Error (MSE), Principleof Orthogonally, FIR Wiener Filters, Wiener Hopfequation.	06
Unit-3	**Steepest Descent Algorithms:** Searching the performance surface – Methods & Ideas of Gradient Search methods Gradient Searching Algorithm & its Solution – Stability & Rate of convergence – Learning Curves Gradient Search by Newton’s Method, Method of Steepest Descent, Comparison of Learning Curves.	06
Unit-4	**Least Mean Square (LMS) Algorithms:** Derivation of LMS algorithm, Convergence, Stability and performance analysis of LMS Algorithm, Normalized Least-Mean-Square Algorithm.	06
Unit-5	**Recursive Least Square Algorithms:** Linear LeastSquare Estimation Problem, Introduction to RecursiveLeast-Squares Adaptive filters, Matrix Inversion Lemma, RLS Algorithm.	06

Unit-6	**Applications of Adaptive filtering:** System identification, Adaptive Equalization, noise cancellation, linear prediction, Echo Cancellation, Lattice Filters.	06
	Total	**36**

Text Books:

1. "Adaptive Filter Theory", Simon Haykin, 3rd Ed, Prentice HallInc, 2002.
2. Bernard Widrow & Samuel. D. Stearns, "Adaptive Signal Processing", Pearson Edu, 2001.

References:

1. "Adaptive Filtering Primer with MATLAB", Alexander D.Poulanikas & Zayed M Ramadan, Taylor &Francis Series, CRS Press.
2. "Adaptive Signal Processing", Bernard Widrow, Prentice-HallSignal Processing Series.
3. ."Real Time Digital Signal Processing: Implementation and Applications", Sen M. Kuo, Bob H. Lee and Wenshun Tian,2nd Ed, John Wiley & Sons, 2006.
4. "Adaptive Digital Filters", Maurice G Bellanger, 2nd Edition,
5. "Adaptive Nonlinear System Identification", Marcel DekkarInc. T Ogunfummi, Springer

6ETCO4 Open Elective - II (OE-II): (i) Electronic Communication Systems

Course Requisite:

Course Objectives:

After completing this course the students should be able to:

1. Understand the basics of Electronic Communication System.
2. Understand the AM transmitter working.
3. Understand the working of AM and receiver and its parameters.
4. Understand FM transmitter working.
5. Understand of FM and receiver and its parameters.
6. Understand the pulse modulation techniques.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Demonstrate the basics of Electronic Communication systems.
2. Use the working of AM transmitter.
3. Demonstrate the working of AM receiver.
4. Able to understand working of FM transmitter.
5. Demonstrate the working of FM receiver.
6. Understand the various pulse modulation techniques.

	Subject (Th):) Electronic Communication Systems	**L**
Unit-1	Introduction to Electronic Communication System: Introduction Basic block diagram of Communication System, Modulation, Need for Modulation, Noise: Internal and external Noise. (No numericals expected)	
Unit-2	Introduction to AM Transmitter: Amplitude Modulation Theory, Frequency Spectrum of AM, Representation of AM, Mathematical Expression of AM wave (only derivation, No numerical expected). Definitions of Modulation Index, SNR.	
Unit-3	Introduction to AM Receiver: TRF Radio Receiver, Block diagram of Superheterodyne radio Receiver, Comparison. Definitions of Selectivity, Sensitivity and Fidelity	
Unit-4	Introduction to FM Transmitter: Frequency Modulation Theory, Frequency Spectrum of FM, Wideband and Narrowband FM. Advantages of FM over AM.	
Unit-5	Introduction to FM Receiver: Block Diagram of FM Receiver, Comparison with AM Receiver. Stereo FM multiplex reception.	
Unit-6	Pulse Modulation Techniques: Introduction to pulse Modulation Techniques, PAM, PWM and PPM. Comparison	
	Total	

Text Books:

1. Electronic Communication Systems, George Kennedy and Bernard Davis, Fourth Edition. Tata McGraw Hill Publishing Company Ltd.
2. Analog and Digital Communication Engineering, J. S. Chitode, Technical Publications.

References:

1. Communication Systems, 3rd Edition, Simon Haykin, John Wiley & Sons.
2. Telecommunications Principles Circuits Systems and Experiments, S. Ramabhadran, Khanna Publishers, Sixth Edition, 1997.

6ETCO4 Open Elective - II (OE-II): (ii) Wireless Communication

Course Objectives: 1. To understand basics of Cellular System. 2. To study the fundamentals of cellular radio system, capacity & Coverage improvement techniques. 3. To understand mobile radio propagation mechanism and Multiple access techniques. 4. To understand operation of GSM in detail. 5. To study the CDMA techniques in. 6. To understand the WiFi and Bluetooth technology.
Course Outcomes: Upon successful completion of this course, the student will be able to: 1. Illustrate the evolution of cellular mobile system and understand cellular concepts. 2. Use fundamentals of cellular radio system. 3. Understand propagation mechanism in mobile radio system. 4. Demonstrate concepts of various 2nd and 3rd generation cellular systems and wireless data communication networks.

	Subject: Wireless Communication	**L**
Unit-1	**Introduction to Wireless Communication:** Evolution of Mobile Communication, Basic Cell Fundamentals, Introduction to Cellular Telephone Systems: 1G, 2G, 3G, 4G and 5G, Comparison of these systems.	
Unit-2	**Basic Cellular Concept:** Frequency Reuse, Hand off Strategies, Types of Hand off, Cell improvement techniques : Cell Sectoring, Cell Splitting, Repeaters.	
Unit-3	**Basic Radio Propagation and Multiple Access Techniques:** Basic propagation techniques : Reflection, Diffraction and Scattering, Comparison. Introduction to fading (numericals and types not expected). Introduction to FDMA, TDMA and CDMA , Comparison.	
Unit-4	**Introduction to GSM** Basic GSM architecture block diagram, GSM Channels, Frame Structure, GSM handoffs such as NCHO, MAHO.	
Unit-5	**Introduction to CDMA Digital Cellular Standard:** Basic Architecture block diagram of CDMA System, Comparison of CDMA and GSM. Introduction to WCDMA.	
Unit-6	**Bluetooth and WiFi :** Introduction to Bluetooth, Overall architecture, Advantages and Applications. Introduction to Wi-Fi, Advantages and Disadvantages.	
	Total	

Text Books:

1. Theodore S. Rappaport, “Wireless Communications: Principles & Practice”, Second edn., Pearson Edn. (2002).
2. K. Pahlavan and P. Krishnamurthy, “Principles of Wireless Networks”, Pearson Educn. Asia Publication (2002).
3. T. L. Singal, “Wireless Communication”. McGraw Hill Education.

References:

1. A. F. Molisch, “Wireless Communications”, Second Edition, Wiley Publication.
2. K. Shammugham, “Digital and Analog Communication

6ETC05: ENGINEERING ECONOMICS

Course Pre-Requisite:

1. 3ETC03 Digital System Design
2. 5ETC01 Microcontroller

Course Objectives:

1. To familiarize the basic concepts and structure of Engineering Economics
2. To understand different principles of Engineering Economics
3. To learn the concepts Production and cost associated with it
4. To learn different types of cash flow
5. To learn depreciation analysis
6. To understand the concept of Banking system in India

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Learn basics of Engineering Economics
2. Understand and compute the production cost
3. Study different cash flow methods
4. to evaluate Engineering alternatives
5. Understand depreciation analysis
6. Understand Indian Banking System

	Subject: ENGINEERING ECONOMICS	**L**
Unit-1	Definition and Scope of Engineering Economics , Subject Matter of Economics, Principles of Engineering Economics, Micro-economics Vs Macro-economics , Utility Analysis, Laws of diminishing utility analysis, derivation of demand curve and law of Demand, Elasticity of demand	06
Unit-2	Theory of Production: Theory, Importance, Isoquants and its properties, Marginal rate of Technical substitution, Law of variable proportions, Returns to Scale, Cost of Production and Cost of Curves, The law of supply, Price determination	06
Unit-3	Time value of Money, Techniques for adjusting time value of money, Uniform Gradient series factor, annuity, annuity due, calculation of deferred annuity , Types and components of cash flow, cash flow diagrams, principles of equivalence, Uses, significance and limitation of Cash flow statement	06
Unit-4	Evaluation of Engineering alternatives, Present worth method, Future worth Method, Equivalent annual worth comparison , Rate of return method, Project evaluation and Cost benefit analysis	06
Unit-5	Depreciation Analysis, Causes of depreciation, Depreciable property, depreciation methods, Digit method, Break even analysis, determination of breakeven point, Breakeven point in terms of quantity, sales and as percentage of capacity, Break even chart, Breakeven analysis assumptions, Managerial uses, Limitations	06
Unit-6	Commercial Banking, Functions of Commercial Banks , Role of Commercial banks in developing economy, sound baking system for under-developed countries, types of banks, balance sheet of a bank, New developments in banking system.	06

		Total	**36**

Text Books:

. Engineering Economics and Costing, Second Edition, PHI, 2010 by Sasmita Mishra

References:

1. Engineering Economic Analysis, Volume 2, By Donald G. Newnan, Ted Eschenbach, Jerome P. Lavelle ·
2004
2. ENGINEERING ECONOMICS, PHI Learning, By R. PANNEERSELVAM · 2013

SUBJECT (PR): 6ETC06 COMMUNICATION NETWORK LAB

Course Requisite:
Course Objectives: To understand the general principles of network design and compare the different network Topologies. 2. To understand the general principles of switching and various routing algorithms. 3. To acquire the knowledge of functions and protocols of OSI and TCP/IP models. 4. To understand Application layer Protocols.
Course Outcomes: Upon successful completion of this course, the student will be able to: 1. Identify different types of network devices and their functions within a network. 2. Understand the basic functions of data logical link control and media access control and protocol used in this layers. 3. Distinguish between the layers of the OSI and TCP/IP model. 4. Analyze, specify and design routing strategies for an IP based networking infrastructure 5. Understand the concept of reliable and unreliable transfer protocol of data and how TCP and UDP implement these concepts. 6. Understand various Application layer Protocols

	Experiment List
Expt-1	Implement the cross-wired cable and straight through cable using crimping tool.
Expt -2	.Study of different network devices (Repeater, Hub, Switch, Router, Gateways, Bridges).
Expt -3	Format and Partition the hard disk of personal computer (PC).
Expt -4	Check network interface card and install network driver.
Expt -5	Building networks topologies with Cisco Packet Tracer.
Expt -6	To implement a network using Cisco Packet Tracer.
Expt -7	Building a VLAN Configuration Cisco Packet Tracer.
Expt -8	Write a program showing the connection of 2 nodes and 4 router such that the extremes nodes act as client and server

Subject (Pr): 6ETC07- ELECTRONIC CIRCUIT DESIGN LAB

Course Requisite:

1. 3ETC02 - Electronic Devices & Circuits.
2. 3ETC03 - Digital System Design

Course Objectives:

1. To study CMOS transistor theory and performance parameters.
2. To study layout design rules for size & power optimization.
3. To learn CMOS process technology.
4. To learn techniques of chip design using programmable devices.

Course Outcomes:

1. Express the Layout of simple MOS circuit using Lambda based design rules.
2. Apply the Lambda based design rules for subsystem design
3. Differentiate various FPGA architectures.
4. Design an application using Verilog HDL.
5. Concepts of modeling a digital system using Hardware Description Language

	Experiment List
Expt- 01	Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of CMOS Inverter on silicon using appropriate ASIC design tool.
Expt- 02	Layout, physical verification, placement & route for design, static timing analysis of two input NAND and NOR logic gates on silicon using appropriate ASIC design tool.
Expt -03	Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of D Flip-flop on silicon using appropriate ASIC design tool.
Expt -04	Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of f=(A.B+C.D) on silicon using appropriate ASIC design tool.
Expt -05	To write Verilog code for BCD Counter and simulate with test bench.
Expt -06	To write Verilog code for 2-to-4 decoder and simulate with test bench, synthesis, implement on PLD.
Expt -07	To write Verilog code for 8-to-1 Multiplexer and simulate with test bench, synthesis, implement on PLD.
Expt -08	To write Verilog code for D flip-flop with reset and simulate with test bench, synthesis, mplement on PLD.
Expt -09	Verilog code for 4 Bit Full Adder in Module instantiation simulate with test bench, synthesis,implement on PLD.
Expt -10	To write Verilog code for sequence detector-1111 and simulate with test bench, synthesis, implement on PLD.

Minimum 08 experiments based on/relevant to the above list.

Subject (Pr): 6ETC08 Python Programming Lab

Course Requisite:

Course Requisite:

(3ETC05) Object Oriented Programming

Course Objectives:

1. Describe the core syntax and semantics of Python programming language.
2. Discover the need for working with the strings functions.
3. Illustrate the process of structuring the data using Lists, Tuples, Sets and Dictionary.
4. Indicate the use of regular expressions and built-in functions.

Course Outcomes:

Upon successful completion of this lab, the student will be able to:

1. Interpret the fundamental Python syntax and semantics
2. be fluent in the use of Python control flow statements
4. Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, tuples and sets.
5. Identify the commonly used Function and Method involving in python.
6. To learn and use operators

	Experiment List
Expt-1	Write a program to demonstrate different number data types in python..
Expt -2	Write a program to perform different arithmetic operations on numbers in python.
Expt -3	Write a program to perform different Logical operations on numbers in python.
Expt -4	Write a program to create, concatenate and print a string.
Expt -5	Write a python script to print the current date in following format “Sun May 29 02:26:23 IST 2017”
Expt -6	Write a python program to create lists in python. A) Create a list and perform the following methods 1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear()
Expt -7	Write a program to demonstrate working with tuples in python
Expt -8	Write a program to demonstrate working with dictionaries in python. Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len()
Expt -9	Write a python program to find largest of three numbers.
Expt -10	Write a python program to print a number is even/odd using if-else condition.

*** Minimum 08 experiments should be conducted out of above enlisted.**

6ETC09: MINI PROJECT

Course Objectives:
1. To acquaint with the process of identifying the needs and converting it into the problem. 2. To familiarize the process of solving the problem in a group. 3. To acquaint with the process of applying engineering fundamentals to attempt solutions to the problems. 4. To inculcate the process of self-learning and research.
Course Outcomes: Upon completion of this course, students will demonstrate the ability to : 1. Identify problems based on societal /research needs. 2. Apply Knowledge and skill to solve societal problems in a group. 3. Develop interpersonal skills to work as member of a group or leader. 4. Analyze the impact of solutions in societal and environmental context for sustainable development. 5. Excel in written and oral communication. 6. Demonstrate project management principles during project work.

Guidelines for Mini Project

· Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
· Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department.
· Students shall submit implementation plan, which will cover weekly activity of mini project.
· A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record comments.
· Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on selflearning.
· Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
· Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
· The solution to be validated with proper justification and report to be compiled in standard format.
· With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out by all the groups of the students.

Guidelines for Assessment of Mini Project:
Term Work:

· The review/ progress monitoring committee shall be constituted by head of departments of each institute.
The progress of mini project to be evaluated on continuous basis, minimum two reviews in the semester.
· In continuous assessment focus shall also be on each individual student, assessment based on individual's
contribution in group activity, their understanding and response to questions.
· Distribution of Term work marks for both semesters shall be as below;
·
Marks awarded by guide/supervisor based on log book: **10**
Marks awarded by review committee: **10**
Quality of Project report: **5**

Guidelines for Assessment of Mini Project Practical/Oral Examination:

· Report should be prepared as per the guidelines issued by the College.

· Mini Project shall be assessed through a presentation and demonstration of working model by the student
project group to a panel of Internal and External Examiners

· Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Assessment criteria of Mini Project

Mini Project shall be assessed based on following criteria;

1. Quality of survey/ need identification
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness
6. Societal impact
7. Full functioning of working model as per stated requirements
8. Contribution of an individual's as member or leader
9. Clarity in written and oral communication

Note:

An orientation program of 15 hours duration / MOOC to be offered to the students during

(a) Vth semester : Indian Constitution

(b) VIth semester : Indian Traditional Knowledge

Sant Gadge Baba Amravati University Scheme:

SEMESTER : SEVENTH																
Sr. No.	Subject Code	Subject	TEACHING SCHEME					EXAMINATION SCHEME								
			HOURS / WEEK			Total HOURS/WEEK	CREDITS	THEORY					PRACTICAL			
			Lecture	Tutorial	P/D			Duration Of Paper (Hr.)	Max. Marks Theory Paper	Internal Marks	Total	Min. Passing Marks	Max. Marks		Total	Min. Passing Marks
													Int.	Ext.		
THEORY																
01	7ETC01	Microwave Theory and Techniques	3	--	--	3	3	3	80	20	100	40	--	--	--	--
02	7ETC02	Digital Image and Video Processing	3	--	--	3	3	3	80	20	100	40	--	--	--	--
03	7ETC03	Project Management and Entrepreneurship	3	--	--	3	3	3	80	20	100	40	--	--	--	--
04	7ETC04	Professional Elective - III (PE-III)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
05	7ETC05	Prof. Elective- IV (PE-IV)	3	--	--	3	3	3	80	20	100	40	--	--	--	--
PRACTICALS / DRAWING / DESIGN																
06	7ETC06	Microwave Theory and Techniques Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
07	7ETC07	Digital Image and Video Processing Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
08	7ETC08	Project Management and Entrepreneurship Lab	--	--	2	2	1	--	--	--	--	--	25	25	50	25
09	7ETC09	** Project Stage I (Seminar)	--	--	8	8	4	--	--	--	--	--	100	--	100	50
		Total	15	0	14	29	22	--	--	--	500	--	--	--	250	--
														Total	750	

7ETC04: PE(III) : (i) High Speed Electronics (ii) Mobile Communication and Networks (iii) Mixed Signal Design

7ETC05: PE(IV) : (i) Introduction to MEMS (ii)Error Correcting Codes(iii) Antenna and Propagation

Note: ** Seminar based on Final year Major Project

Chapter 4

University Syllabus

SYLLABUS PRESCRIBED FOR FOUR YEAR DEGREE COURSE IN B.E

SEMESTER-VII

Subject: 7ETC01: CRYPTOGRAPHY AND NETWORK SECURITY

Prerequisites: 1. 1. 4ETC04 : Signals and Systems 2. 2. 5ETC03 : Digital Signal Processing 3. 3. 6ETC01: Communication Network
Objectives: 1. Explain the objectives of information security 2. Explain the importance and application of each of confidentiality, integrity, authentication and availability 3. Understand various cryptographic algorithms. 4. Understand the basic categories of threats to computers and networks 5. Describe public-key cryptosystem. 6. Describe the enhancements made to IPv4 by IPSec
Outcome: Upon successful completion of this course, the student will be able to: 1. Understand basic cryptographic algorithms 2. Attain the knowledge of message and web authentication and security issues. 3. Identify information system requirements 4. Understand the current legal issues towards information security 5. Discuss the fundamental ideas of public-key cryptography 6. Understand Intrusions and intrusion detection.

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	Subject: CRYPTOGRAPHY AND NETWORK SECURITY	**L**
UNIT-I	**Security** Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.	**06**
UNIT-II	**Symmetric key Ciphers:** Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.	**06**
UNIT-III	Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie- Hellman Key Exchange, Knapsack Algorithm.	**06**
UNIT- IV	**Cryptographic Hash Functions:** Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure	**06**
UNIT- V	**Transport-level Security:** Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Wireless Network	**06**

	Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security.	
UNIT-VI	**E-Mail** Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability**.**	**06**

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition.
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

REFERENCE BOOKS :

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH .
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning 6. Network Security and Cryptography: Bernard
Menezes, CENGAGE Learning.

Subject: 7ETC02: DIGITAL IMAGE AND VIDEO PROCESSING

Prerequisites: 1. Signals and Systems. (4ETC04) 2. Digital Signal Processing (5ETC03)
Objectives: After taking this course student will be capable to learn and apply: 1. Fundamentals of digital image processing 2. Digital image filtering techniques in spatial and frequency domain. 3. Knowledge of image transform and enhancement techniques in digital image processing 4. Various image compression techniques used in digital image processing. 5. Fundamentals of Video Processing and segmentation.
Outcome: **After successful** completion of the course the student will be able to: 1. Comprehend fundamentals of digital image processing. 2. Understand & apply knowledge of spatial domain and frequency domain filtering to digital images. 3. Analysis of image segmentation and morphological techniques. 4. Understand image degradation model and its restoration; analyze various image compression techniques based on redundancy features. 5. Understand the Fundamentals of digital video processing. 6. Comprehend motion estimation and video processing applications.

	Subject: DIGITAL IMAGE AND VIDEO PROCESSING	**L**
UNIT-I	Digital Image Fundamentals: Elements of visual perception, image as a 2-D signal, image sensing and acquisition, image sampling and quantization, image formats, image types, basic relationships between pixels neighborhood, adjacency, connectivity, distance measures.	**06**
UNIT-II	Image Enhancements and Filtering in Spatial and Frequency domain: Gray level transformations, histogram equalization and specifications, spatial domain smoothing filters – linear and order-statistics, spatial-domain sharpening filters: first and second derivative, two-dimensional DFT and its inverse, frequency domain filters low-pass and high-pass.	**06**
UNIT-III	Image Segmentation and Image morphological techniques: Detection of discontinuities, Thresholding : local and global, region-based segmentation, edge and boundary detection techniques using laplace, guassian and high pass filtering, Basic morphological image processing concepts, Basic concepts of erosion and dilation, The Hit-or-Miss Transformation.	**06**
UNIT- IV	Image restoration and Compression techniques.: Image degradation and restoration technique (Wiener filtering), Image Compression Redundancy–inter-pixel, psycho-visual and coding, entropy, Loss less compression (Huffman and Lempel-Ziv), Lossy compression- predictive and transform coding; Still image compression standards – JPEG and JPEG-2000.	**06**
UNIT- V	**Fundamentals of Video Processing :**Time-Varying Image Formation model, fundamentals of Three-Dimensional Motion Model, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals in spatial domain**,** formats of video signals**.**	**06**
UNIT-VI	Applications of digital video processing: Motion estimation using pixel based, block matching and mesh based, Application of motion estimation in video coding, Fundamentals of Temporal segmentation, Video object detection and tracking.	**06**

TEXT BOOKS: 1. Gonzaleze and Woods ,"Digital Image Processing ", 3rd edition , Pearson 2. S. Jayaraman, S. Esakkirajan, T. Veerakumar,"Digital Image Processing ", 2nd edition, McGraw Hill publication 3. M. Tekalp ,"Digital video Processing", Prentice Hall International 4. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication ", 1st edition , PHI
REFERENCE BOOKS: *1.* Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004 2. Arthur R. Weeks, "Fundamentals of Electronic Image Processing", Wiley–Blackwell 3. Wiliam Pratt," Digital Image Processing: PIKS Inside, Fourth Edition", A Wiley-Interscience Publication

Subject: 7ETC03 PROJECT MANAGEMENT & ENTREPRENEURSHIP

Prerequisites: 6ETC05 Economics for Engineers:
Objectives: 1. To make them understand the concepts of Project Management for planning to execution of projects. 2. To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation. 3. To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting. 4. Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.
Outcome: Upon successful completion of this course, the student will be able to: 1. Understand basic concept of Project management 2. Attain the knowledge of cost estimation & working capital 3. Prepare Cost Sheets, balance sheets and Cash Flow statements 4. Understand the Entrepreneurial competencies & traits 5. Discuss the Management skills for Entrepreneurs 6. Understand Social Entrepreneurship

	Subject: PROJECT MANAGEMENT & ENTREPRENEURSHIP	**L**
UNIT-I	Project Management: Project management: meaning, scope & importance, role of project manager; project lifecycle Project appraisal: Preparation of a real time project feasibility report containing Technical appraisal,; Environmental appraisal, Market appraisal (including market survey for forecasting future demand and sales) and Managerial appraisal.	**06**
UNIT-II	Project Financing: Project cost estimation & working capital requirements, sources of funds, capital budgeting, Risk & uncertainty in project evaluation.	**06**
UNIT-III	Project Report and Finance: preparation of projected financial statements viz. Projected balance sheet, projected income statement, projected funds & cash flow statements, Preparation of detailed project report, Project finance.	**06**
UNIT- IV	Entrepreneurship: Entrepreneurship: need, scope Entrepreneurial competencies & traits, Factors affecting entrepreneurial development,Entrepreneurial motivation (Mc Clellend's Achievement motivationtheory), conceptual model of entrepreneurship, Entrepreneur vs.Entrepreneur; Classification of entrepreneurs; Entrepreneurial Development Programmes.	**06**
UNIT- V	**Entrepreneurial Idea and Innovation:** Introduction to Innovation, Entrepreneurial Idea Generation and Identifying Business Opportunities,Management skills for Entrepreneurs and managing for Value Creation,Creating and Sustaining Enterprising Model & Organizational Effectiveness.	**06**
UNIT-VI	**Social Entrepreneurship:** Social Sector Perspectives and Social Entrepreneurship, Social Entrepreneurship Opportunities and Successful Models, Social Innovations and Sustainability, Marketing Management for Social Ventures, Risk Management in Social Enterprises, Legal Framework for Social Ventures.	**06**

TEXT BOOKS: 1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row 2. Business, Entrepreneurship and Management: Rao, V.S.P.; Vikas
REFERENCE BOOKS: 1. Entrepreneurship: Roy Rajeev; OUP. 2. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.;McMillan 3. Project Management for Engineering, Business and Technology: Nicholas, J.M., andSteyn, PHI

Subject: 7ETC04 PROFESSIONAL ELECTIVE - III (PE-III)
(i) HIGH SPEED ELECTRONICS

Prerequisites: 4ETC02 Analog Circuits
Objectives: 1. Basic concepts of the active and passive devices. 2. Basics of non-ideal interconnect issues. 3. The PCB making design concepts.
Outcome: At the end of the course, students will demonstrate the ability to: 1. Explain significance and the areas of application of high-speed electronics circuits. 2. Analyze effect of noise in high speed application 3. Summarize the properties of various components used in high speed electronics 4. Design the various type of RF amplifier for high speed application 5. Explain the operation of the Mixer, Oscillator and PLL transceiver 6. Design the various types of PCB using CAD tool

	Subject: HIGH SPEED ELECTRONICS	**L**
UNIT-I	Transmission line theory (basics): The Importance of Interconnect Design, Transmission Line Structures, Wave Propagation, Transmission Line Parameters, Transmission Line Reflections, Termination Schemes to Eliminate Reflections, Multiple Reflections, Crosstalk, Crosstalk Estimation, Crosstalk Termination Schemes.	
UNIT-II	Basics of Non ideal Interconnect Issues, Transmission Line Losses, Concentric-Ring Skin-Effect Model, Serpentine Traces. Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Inter modulation, Cross-modulation, Dynamic range.	
UNIT-III	Buffer Modeling, Types of Models, CMOS Output Buffer, Digital Timing Analysis, Common-Clock Timing, Source Synchronous Timing, Clock Repeaters, Zero-Delay Clock Repeaters, Clock Jitter.	
UNIT- IV	Devices: Passive and active, Lumped passive devices (models), Active (models, low vs. high frequency).	
UNIT- V	RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations.	
UNIT-VI	Printed Circuit Board: Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design Challenges.	

TEXT BOOKS:- 1. Stephen H. Hall, Garrett W. Hall, James A. McCall “High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices”, August 2000, Wiley-IEEE Press 2. Thomas H. Lee, “The Design of CMOS Radio-Frequency Integrated Circuits”, Cambridge University Press, 2004, ISBN 0521835399. 3. Behzad Razavi, “RF Microelectronics”, Prentice-Hall 1998, ISBN 0-13-887571-5.
REFERNCE BOOKS:- 1. Guillermo Gonzalez, “Microwave Transistor Amplifiers”, 2nd Edition, Prentice Hall. 2. Kai Chang, “RF and Microwave Wireless systems”, Wiley. 3. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011. 4. Chris Schroeder , “PCB Design Using AutoCAD” 1st Edition, 1997.

Subject: 7ETC04 PROFESSIONAL ELECTIVE - III (PE-III)
(ii) MOBILE COMMUNICATION AND NETWORKS

Prerequisites: 4ETC01 Analog and Digital Communication.
Objectives: 1. To know the evolution of Mobile communication and cell concept to improve capacity of the system. 2. To know the role of equalization in Mobile communication and to study different types of Equalizers and Diversity techniques. 3. To understand the concepts of orthogonal frequency division multiplexing.
Outcome: After completing the course, the students will be able to: 1. Explain basic concept of Cellular systems and standards 2. Demonstrate knowledge of Signal propagation model 3. Compare different multiple access techniques in mobile communication. 4. Summarise the concept of rake receiver 5. Demonstrate advance knowledge of MIMO 6. Compare different Mobile Communication Systems and standards

	Subject: MOBILE COMMUNICATION AND NETWORKS	**L**
UNIT-I	Cellular concepts: Evolution of Mobile Radio Communication Systems, 1G, 2G, 2.5G, and 3G Wireless Cellular Networks and Standards, Cell structure, frequency reuse, cell splitting and sectoring, Channel assignment, concept of handoff, Interference (both Adjacent Channel and Co-Channel), capacity, power control mechanisms.	**07**
UNIT-II	Signal propagation-Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Small Scale Fading and Multipath Propagation, Types of Small- Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread.	**07**
UNIT-III	Multiple access schemes-Multiple access techniques in wireless communication: FDMA TDMA, CDMA, SDMA and Hybrid, Introduction of OFDM techniques.	**05**
UNIT- IV	Receiver Structure- Diversity receivers- selection and MRC receivers, RAKE receiver, Equalization: Linear and Adaptive, Algorithms for adaptive equalization, space, polarization, frequency diversity, Interleaving.	**05**
UNIT- V	MIMO Channels: Physical modelling, MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff.	**06**
UNIT-VI	Mobile Systems - GSM, GPRS, CDMA 2000 and WCDMA, LTE, Introduction to Cognitive Radio, Introduction to 5G.	**06**

TEXT BOOKS:- 1. T.S.Rappaport, “Wireless Communications Principles and Practice”, 2nd edition, PHI, 2002. 2. William C.Y.Lee, “Mobile Cellular Telecommunications Analog and Digital Systems”, 2nd edition, TMH, 1995. Asha Mehrotra, “A GSM system Engineering” Artech House Publishers Bosten, London,1997 3. V.K.Garg, J.E.Wilkes, “Principle and Application of GSM”, Pearson Education, 5th edition, 2008. 4. V.K.Garg, “IS-95 CDMA & CDMA 2000”, Pearson Education, 4th edition, 2009.
REFERNCE BOOKS:- 1. D. Tse and P. Viswanath, Fundamentals of Wireless Communication, Cambridge Univ. Press, 2005. 2. A. Goldsmith, Wireless Communications, Cambridge Univ. Press, 2005. 3. A. Kumar, D. Manjunath, and J. Kuri, Wireless Networking, Morgan Kaufmann, 2008.

Subject: 7ETC04 PROFESSIONAL ELECTIVE - III (PE-III)
(iii) MIXED SIGNAL DESIGN

Prerequisites:

4ETC02 Analog Circuits.

Objectives:

The student will understand the concepts of :

1. CMOS Process flow, basic MOSFET and op-amp circuits,
2. Switched capacitors Circuits
3. Phase lock loops
4. Data Converter fundamentals.
5. Nyquist Rate A/D Converters and applications
6. The Oversampling Converters and Continuous-Time Filters

Outcome:

After successfully completing the course, the students will be able to:

1. Expand knowledge of the CMOS Process, and op-amp design
2. Devise appropriate switch capacitor circuits
3. Analyze phase lock loop circuits
4. Use desired data converters in various applications.
5. Explain Various types of A/D Converters
6. Understand D/A converters.

	Subject: MIXED SIGNAL DESIGN	**L**
UNIT-I	Submicron CMOS: Overview and Models, CMOS process flow, Capacitors and Resistors. Digital circuit design: The MOSFET Switch, Delay Elements, An Adder. Analog Circuit Design: Biasing, Basic Op-Amp Design.	**07**
UNIT-II	Switched Capacitor Circuits: Introduction to Switched Capacitor circuits basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, switched capacitor integrators, first order filters, Switch sharing.	**07**
UNIT-III	Phased Lock Loop (PLL): Basic PLL topology, Design and Analysis of various PLL blocks, Basic charge pump PLL, Non-ideal effects in PLLs, Design of FM detector circuit.	**05**
UNIT- IV	Data Converter Fundamentals: DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Hybrid converters.	**05**
UNIT- V	Nyquist Rate A/D Converters: Successive approximation converters, Flash converter, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time interleaved converters.	**06**
UNIT-VI	Oversampling Converters: Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibit quantizers, Delta sigma D/A.	**06**

TEXT BOOKS:- 1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, Tata McGraw Hill, 2nd Edition. 2. Analog Integrated Circuit Design- David A. Johns,Ken Martin, Wiley Student Edition.
REFERNCE BOOKS:- 1. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Interscience, 2009. 2. CMOS Analog Circuit Design –Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

Subject: 7ETC05 PROFESSIONAL ELECTIVE - IV (PE-IV)
(i) INTRODUCTION TO MEMS

Prerequisites: 3ETC02 - Electronic Devices & Circuits
Objectives: The learners will- 1. Understand Scope, importance and application of MEMS 2. Distinguish materials for MEMS devices 3. Examine fundamental laws governing MEMS devices 4. Summarize MEMS design process. 5. Recommend MEMS sensors and actuators 6. Devise MEMS Applications.
Outcome: After successfully completing the course, the students will be able to: 1. Demonstrate skills to select appropriate material for MEMS devices 2. Understand fabrication process of MEMS 3. Select appropriate sensor and actuator in a given application.

	Subject: INTRODUCTION TO MEMS	**L**
UNIT-I	**Introduction:** Historical background**,** classification, intrinsic characteristics of MEMS, miniaturization issues, microelectronic integration, precision parallel fabrication, scaling effects, future trends.	**06**
UNIT-II	**MEMS Materials:** Overview, Physical Properties, Materials: Piezoelectric, Electrostrictive, Magnetostrictive, Magneto-electric; Fluids: Magnetorheological and Electrorheological Fluids.	**06**
UNIT-III	**Mechanics of solids in MEMS/NEMS:** Stress, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.	**06**
UNIT- IV	**Review of Basic MEMS fabrication modules:** Oxidation, deposition techniques, lithography (LIGA), Etching, Surface Micromachining, sacrificial layer processes, bulk micromachining, isotropic and anisotropic etching.	**06**
UNIT- V	**MEMS Sensors and Actuation:** Sensors and actuators consideration, Electrostatic Sensors, Micro Grippers, Micro Motors, Thermal Resistors, Thermal Bimorph , Piezoresistive Sensors, Pressure and flow Sensors.	**06**
UNIT-VI	**Applications of MEMS :** Electronics, automotive and medical; automotive airbag sensor, medical pressure sensor, blood Pressure Sensors, microphone, Bio-MEMS, acceleration sensing, gyros.	**06**

TEXT BOOKS:- 1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, “Micro and Smart Systems”, Wiley India, 2012. 2. 2. S. E.Lyshevski, “Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering” (Vol. 8). CRC press, (2005). 3. S. D. Senturia, “Microsystem Design”, Kluwer Academic Publishers, 2001.
REFERNCE BOOKS:- 1. Tai-Ran Hsu, “MEMS and Microsystems Design and Manufacture”, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2002. 2. Chang Liu, “Foundations Of MEMS”, Pearson Education Inc., 2012. 3. Mark Madou, “Fundamentals of Microfabrication”, CRC Press, New York, 1997.

Subject: 7ETC05 PROFESSIONAL ELECTIVE - IV (PE-IV)
(ii) ERROR CORRECTING CODES

Prerequisites: 4ETC01 Analog and Digital Communication
Objectives: After completing this course the students should be able to: 1. Understand Block Codes and Maximum Likelihood Decoding. 2. Understand Decoding Tables, Hamming Weight and Distance and Error Correction vs Detection. 3. Understand Generator Matrix, Parity-Check Matrix and Error-Correcting Capability of a Linear Code 4. Understand Binary Cyclic Codes, encoding with (n-k)-Stage Shift Register and Syndrome Calculations and Error Detection. 5. Understand Error Trapping Decoding for Cyclic Codes. 6. Understand BCH Codes and the encoding and decoding techniques.
Outcome: At the end of the course, students will demonstrate the ability to: 1. Understand the error sources 2. Understand error control coding applied in digital communication 3. Able to transmit and store reliable data and detect errors in data through coding 4. Able to understand the designing of various codes like block codes, cyclic codes, convolution codes, turbo codes and space codes.

	Subject:	**L**
UNIT-I	Error Control Coding: Introduction to Error Control Coding, Types of Errors, Methods of Controlling Errors, Linear Block Codes: Matrix Description of Linear Block codes, Hamming Distance, Hamming Weight, Minimum Hamming Distance, Hamming Codes.	**06**
UNIT-II	Linear block codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Encoder for Linear Block code, Syndrome Decoding, Syndrome Decoder for (n, k) Linear Block Code, Error Detection and Correction capability of Linear Block Codes (Derivation expected).	**07**
UNIT-III	Cyclic Codes: Properties of Cyclic Codes, Systematic and Non-Systematic generator Matrix, Parity Check Matrices for Cyclic Codes, Encoders for Cyclic Codes, Syndrome Decoding for Cyclic Codes. Introduction to Convolution Codes: Time Domain Approach and Transform domain approach for convolution code generation, Code Tree and Code Trellis for Convolution code.	**06**
UNIT- IV	Cyclic Codes. BCH codes; Reed-Solomon codes, MDS codes, Spectral properties of cyclic codes. ; Cyclic codes - Syndrome calculation, Encoder and decoder – CRC.	**06**
UNIT- V	Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm.	**05**
UNIT-VI	A fast Berlekamp - Massey algorithm. Convolution codes; Wozencraft's sequential Decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm.	**06**

TEXT BOOKS:-
1. F.J. McWilliams and N.J.A. Slone, The theory of error correcting codes, 1977. 2. R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.
REFERNCE BOOKS:-
1. Digital Communications-Fundamental and Application - Bernard Sklar, PE 2. Digital Communications- John G. Proakis, 5th ed., 2008, TMH.

Subject: 7ETC05 PROFESSIONAL ELECTIVE - IV (PE-IV)
(iii) ANTENNA AND PROPAGATION

Prerequisites: 3ETC04: Electromagnetic Waves.
Objectives: The student will learn and understand - 1. Basic terminology and concepts of Antennas. 2. Concept of radiation mechanism of various antennas and antenna array. 3. Principle of aperture antennas. 4. Concept of Broadband & Micro strip antennas. 5. Smart antenna environments & implementation. 6. Mechanism and models for radio-wave propagation
Outcome: At the end of the course, students will demonstrate the ability to: 1. Describe the basic concepts and applications of Antenna systems. 2. Determine the radiation pattern and directivity of antenna arrays. 3. Describe the concept of Huygens Principle & Babinet's Principle. 4. Understated the properties of broadband antennas and micro strip antennas. 5. Describe the basic principles of smart antenna systems. 6. Understand different ways of propagation of radio waves.

	Subject:	**L**
UNIT-I	**Antenna Fundamental:** Concept of radiation, Radiation pattern, near-and far-fields, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation.	**06**
UNIT-II	**Antenna Arrays:** Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, small circular loop, Antenna array, Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays.	**06**
UNIT-III	**Aperture Antennas:** Huygens' Principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, designconcepts, parabolic reflector and Cassegrain antennas.	**06**
UNIT- IV	**Broadband & Micro strip Antennas:** Broadband Antennas: Broadband concept, Log-periodic and Yagi-Uda antennas, frequency independent antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, Introduction of rectangular and circular patch antennas.	**06**
UNIT- V	**Smart Antennas**: Smart Antennas: Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.	**06**
UNIT-VI	**Wave Propagation:** Modes of Propagation: Ground, Sky & Space Wave Propagations, Structure of Atmosphere, Fading, ionospheric absorptions, Multi-hop propagation and Super refraction.	**06**

TEXT BOOKS:- 1. C. A. Balanis, "Antenna Theory and Design", 3rd Ed., John Wiley &Sons, 2005. 2. Harish A. R., Antenna and wave propagation, Oxford University Press. Tri T. Ha, “Digital 3. Satellite Communications”, Tata McGraw-Hill,2009 J.D.Kraus,”Antennas,McGraw-Hill,1988 4. R.S.Elliot, “Antenna Theory and Design”, IEEE Press, John Wiley, 2005, 5. K.D.Prasad, “Antennas and Radiating Systems”, Satyaprakasa
REFERNCE BOOKS:- 1. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985. 2. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw hill, 1984. 3. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980. 4. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005. 5. R.E. Crompton, Adaptive Antennas, John Wiley.

7ETC06- CRYPTOGRAPHY AND NETWORK SECURITY LAB

Course Requisite:

1. 4ETC04 : Signals and Systems
2. 5ETC03 : Digital Signal Processing
3. 6ETC01: Communication Network

Course Objectives:

1. To use software to visualize the real time packet sniffing.
2. To understand the principles of encryption algorithms.
3. To convert plain text into cipher text using substitution and transposition techniques.
4. To become familiar with Symmetric and Asymmetric key Ciphers though programming.
5. To introduce network tools for data storage, secure data transmission, creating digital signatures and to perform audit on an access points.

Course Outcomes:

After successful completion of this course the student will be able to

1. Demonstrate intrusion detection system using network security tool.
2. Utilize the different open source tools for network security and analysis
3. Apply the cryptographic algorithms for data communication.
4. Compare the performance of various security algorithms
5. Apply the Digital signature for secure data transmission

PRACTICALS:

	Experiment List
1	To create a Cipher Encryption and Decryption Algorithm RC4 using CrypTool.
2	To test different filter commands and study I/O Graphs used in Wireshark.
3	To implement the simple substitution technique named Caesar cipher in C.
4	To implement the simple substitution technique Vigenere cipher named in C.
5	To write a C program to implement the rail fence transposition technique.
6	Develop a C program to perform XOR operation.
7	Implement C program to generate key for 10 bits user defined data using simplified DES.
8	To implement the Diffie-Hellman Key Exchange algorithm using C language.
9	Implement RSA algorithm for encryption and decryption in C.
10	To Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG) .
11	Working With KF Sensor Tool For Creating And Monitoring Honeypot.
12	To perform wireless audit on an access point or a router and decrypt WEP and WPA. (Net Stumbler).

*** Minimum 08 experiments should be conducted out of above enlisted.**

7ETC07- DIGITAL IMAGE AND VIDEO PROCESSING – LAB.
PRACTICALS:

Prerequisites:

1. 4ETC04 : Signals & Systems.
2. 4ETC09 : Signals & Systems lab.
3. 5ETC03 : Digital Signal Processing.
4. 5ETC07 : Digital Signal Processing Lab

Objectives:

1. To use software approach to develop a foundation of fundamental DIP concepts.
2. To learn the image enhancement operations using histogram technique.
3. To apply Fourier, transform for image processing.
4. To perform morphological image processing operation
5. To understand the image segmentation techniques.
6. To study the basic concepts of edge detection techniques
7. To study the basic digital video processing and its related techniques.

Outcome:

After successful completion of this course the student will be able to

1. Perform basic operation viz resizing and rotating on given image
2. Apply the image enhancement operation in the spatial domain.
3. Implement fourier transform on image using software approach.
4. Analyze different image morphological operation such as dilation, erosion, opening & closing.
5. Interpret image global and local image thresholding operation and its results.
6. Differentiate between the advantages and disadvantages of different edge detection techniques
7. Familiarize with the concepts of digital video processing.

	Experiment List
1	To develop a code for resizing and rotating an image
2	To develop a code for Histogram equalization.
3	To develop a code for calculating DFT of an image.
4	Implement salt and pepper noise removal using a simple median filter
5	To implement global and local thresholding for segmentation of image
6	To develop a code for edge detection using derivative filter mask with Prewitt, Sobel & Canny operators.
7	To demonstrate image morphological operation using Dilation and Erosion operation
8	To perform the basics operations of digital video processing.

(Note: Minimum 8 experiments based on syllabus)

7ETC08- PROJECT MANAGEMENT & ENTREPRENEURSHIP – LAB.

Course requisite:

1. **6ETC05 Economics for Engineers:**

Course Objectives:

1. To make them understand the concepts of Project Management for planning to execution of projects.
2. To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3. To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting.
4. Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian Context

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand basic concept of Project management
2. Attain the knowledge of cost estimation & working capital
3. Prepare Cost Sheets, balance sheets and Cash Flow statements
4. Understand the Entrepreneurial competencies & traits
5. Discuss the Management skills for Entrepreneurs
6. Understand Social Entrepreneurship

PRACTICALS:

1	Assessing Entrepreneur potential.
2	Assessment of problem-solving ability.
3	Case study on business idea.
4	To prepare of a real time project feasibility report containing technical appraisal.
5	To prepare of a real time project feasibility report containing Environmental appraisal.
6	To prepare of a real time project feasibility report containing Market appraisal including market survey for forecasting future demand & sales.
7	To prepare project cost estimation for any project.
8	To prepare projected financial statement for Case Study.
9	To study environmental motivation (McClelland's Achievement motivation theory)
10	To prepare social entrepreneurship opportunities and successful models.
11	Guest talk on entrepreneurship opportunities
12	Site visit

(Note: Minimum 8 experiments based on syllabus)

Project Management and Entrepreneurship Lab Guidelines

Project Management and Entrepreneurship Lab -Lab is a project-based action learning course, in which teams of students are matched to startups to work on problems of strategic importance to the venture. Lab goals include

• Gaining experience with fast-paced, massively scalable companies
• Applying academic knowledge to the problems faced by entrepreneurial firms in a context of uncertainty, extreme time pressure and decision making based on limited information
• Learning quickly about a new industry, technology, market
• Strengthening your ability to analyze technical feasibility, to identify early-adopters and the right target market, and define a path to commercialization, ultimately delivering real value to the startup

Lab Setup:

- The groups of the students shall be formed
- Group should not include more than 4 students
- Students should select a company / Industry and visit regularly to understand the working of the company
- The principles and strategies learnt during the Course : Project Management and Entrepreneurship should be related to the working of the company / industry
- Report and attendance for every visit should be signed and stamped by the competent authority of that industry
- Detail report of working culture with reference to Project Management and Entrepreneurship should be prepared
- Seminar containing presentation on the report should be delivered by the students at the end of the course

Evaluation:

- The lab manual will contain the regular visit report and attendance for every visit signed and stamped by the competent authority of the industry. Detail project report containing all the details of the company should be submitted and presented by the group at the end of the semester.
- The marks shall be awarded to the student on the basis of knowledge acquired during the visits, attendance and the final presentation followed by Viva-voce.

7ETC09- PROJECT STAGE-I (SEMINAR)

- Seminar based on Final Year Major Project should be conducted with submission of Seminar Report as part of 7ETC09- Project Stage-I (Seminar)

SYLLABUS PRESCRIBED FOR FOUR YEAR DEGREE COURSE IN B.E

SEMESTER-VIII

8ETC01: EMBEDDED SYSTEMS

Prerequisites:

1. (3ETC03) Digital System Design
2. (3ETC05) Object Oriented Programming
3. (5ETC01) Microcontroller

Objectives:

1. To study the concept of Embedded Systems
2. To understand core of the Embedded System
3. To study architecture and inbuilt peripherals of AVR Microcontroller
4. To know microcontroller C Language Programming concepts.
5. To recognize the importance task scheduling in real time embedded systems.
6. To get acquainted with architecture & design of an Embedded System.

Outcome:

After successfully completing the course, the students will be able to,

1. Recognize the concept of Embedded Systems
2. Summarize the quality attributes of Embedded System
3. Articulate the architecture and inbuilt peripherals of AVR Microcontroller
4. Evaluate the programming of AVR Microcontroller in C
5. Compare task, process & threads in Real Time Embedded System
6. Assess validation and debugging of Embedded System

	Subject: EMBEDDED SYSTEMS	**L**
UNIT-I	Introduction to Embedded systems: History of Embedded system, Embedded systems vs. General computing systems, Classification of Embedded systems, Major application areas of Embedded systems, Purpose of Embedded systems.	**06**
UNIT-II	Building blocks of Embedded systems: Core of the Embedded system, Memory Devices, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System components, Characteristics of Embedded systems, Quality attributes of Embedded System.	**06**
UNIT-III	Introduction to AVR Microcontroller: AVR microcontroller, History, Features and AVR family and its inbuilt Peripherals, Architecture of ATMega 32: signal description, registers of AVR, Data Memory, data formats.	**06**
UNIT- IV	AVR Application and Programming in C: Data types, I/O programming, I2C, Timer Structure, Watch dog timer, UART, Interrupt Structure, Analog to Digital convertors.	**06**
UNIT- V	RTOS based Embedded System Design: Operating System basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Processes and Scheduling.	**06**
UNIT-VI	Embedded System Architecture: Architecture Styles, implementation Aspects, validation & debugging of embedded systems, hardware – software co-design in an embedded system.	**06**

TEXT BOOKS:

1. Introduction to Embedded System, Shibu K. V.,McGraw Hill Education
2. Embedded Real-time Systems Programming, S.V. Iyer & Pankaj Gupta, McGraw Hill Education
3. “AVR Microcontroller and Embedded systems using assembly and C”, Muhammad Ali Mazidi, Sarmad Naimi and Sephers Naimi, Pearson Education, Inc. publishing as Prentice Hall 2013.

REFERENCE BOOKS:

1. “Embedded Systems”, Rajkamal, 2nd Edition, Tata McGraw Hill
2. “Scheduling in Real Time Systems”, Cottet, Delacroix & Mammeri, John Wiley & Sons.

8ETC2: MICROWAVE THEORY AND TECHNIQUES

Prerequisites: (3ETC04) Electromagnetic Waves
Objectives: To learn: 1. Basic concepts of Microwave active and passive devices. 2. Operations of Semiconductor Microwave Devices. 3. Transmission characteristic of microwave through waveguide and parallel microstrip line. 4. Operations of Microwave resonators 5. S-parameters for characterization of microwave devices 6. Measurement of microwave parameters.
Outcome: At the end of the course students will be able to: 1. Understand operations of microwave active and passive devices. 2. Understand operations of Semiconductor Microwave Devices. 3. Describe characteristics of microwave propagation through waveguide and parallel microstrip line 4. Understand Operations of Microwave resonators. 5. Use S-parameters for characterization of microwave devices. 6. Measure various parameters of microwave system.

	Subject: MICROWAVE THEORY AND TECHNIQUES	**L**
UNIT-I	Introduction to Microwaves: History of Microwaves, Microwave Frequency bands; Applications of Microwaves, Microwave Tubes: Limitation of Conventional devices at high frequency, Construction & working principle with supportive expressions of Two cavity, Reflex klystron, Cylindrical Cavity Magnetron & TWT.	
UNIT-II	**Semiconductor Microwave Devices**: Construction & working of Gunn Diodes, IMPATT diodes, TRAPAT diodes & Parametric amplifiers and MASERs.	
UNIT-III	**Waveguide system and Microstrip line**: Waveguides: Introduction, TE & TM Modes of propagation through rectangular wave guide & circular waveguide, Microstrip line: Introduction, characteristic impedance & losses in parallel microstrip line.	
UNIT- IV	Microwave Resonator: Transmission line resonators, Cavity resonators: rectangular and circular cavities, resonant frequency, and quality factor of resonators.	
UNIT- V	**Passive Microwave Devices**: Scattering matrix formulation for E-plane tee, H-plane tee , Magic Tee, Directional Coupler, Principle of Faraday’s rotation, Isolator, Gyrator & Circulator.	
UNIT-VI	Microwave Measurements: Frequency Measurements, Power Measurements, Attenuation Measurements, VSWR Measurements, Impedance Measurements, Noise at microwave frequency and measurement of noise figure.	

TEXT BOOKS :

1. Liao, Samuel Y., “Microwave Devices & Circuits”, Tata Mc-Graw Hill Co. Ltd., New Delhi. 2
2. David M Pozar, “Microwave Engineering” Wiely 3 rd Edition.
3. Collin, Robert E., “Foundations for Microwave Engineering”, Mc- Graw Hill, New York.

REFERENCE BOOKS:

1. Kennedy G., “Electronics Communication Systems”, Tata Mc-Graw Hill Book Co.,New Delhi..
2. K.C. Gupta, “Microwave Engineering”, New Age.
3. Reich, Scolnik, Ordung, Krangs, “Microwave Principles”, PHI.
4. M.L. Sisodiya and G.S. Raghuwanshi, “Microwave Circuits and Passive devices”, John Wiley & Sons Ltd.
5. Mathew M. Radmanesh, “RF and Microwave Electronics – Illustrated”, Prentice Hall.

8ETC03 PROFESSIONAL ELECTIVE V (PE-V)
(i) NANO ELECTRONICS

Prerequisites: - 3ETC02: Electronics Devices and Circuits.
Objectives: 1. The course intends to give students a broad understanding of fundamentals, fabrication technologies and applications of nano scale structures. 2. Students will also be trained for literature study and critique, oral presentation, problem formulation, solution development, and formal writing. 3. To introduce the students to nano-electronics, nano-devices, spintronics and molecular electronics. To identify quantum mechanics behind nano-electronics. 4. To describe the principle and the operation of nano-electronic devices. 5. To explain the principle and application of spintronic devices. 6. To identify quantum mechanics behind nano-electronics.
Outcome: After successfully completing the course, the students will be able to: 1. Understand various aspects of nano-technology and the processes involved in making nano components and material. 2. Leverage advantages of the nano-materials and appropriate use in solving practical problems. 3. Understand various aspects of nano-technology and the processes involved in making nano components and material. 4. Leverage advantages of the nano-materials and appropriate use in solving practical problems. 5. Students will understand the divers electronic device fabrication. 6. Students will have in-depth technical knowledge in one or more areas of specialization.

	Subject: NANO ELECTRONICS	**L**
UNIT-I	Introduction: Recent past, the present and its challenges, Future, Overview of basic Nano electronics. Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig Penny Model. Brillouin Zones.	
UNIT-II	Nano electronics & Nano computer architectures: Introduction to Nano computers, Nano computer Architecture, Quantum DOT cellular Automata (QCA), QCA circuits, Single electron circuits, molecular circuits, Logic switches, Interface engineering, Properties (Self-organization, Size-dependent) – Limitations.	
UNIT-III	Nano electronic Architectures: Nanofabrication, Nano patterning of Metallic/Semiconducting nanostructures (ebeam/ X-ray, Optical lithography, STM/AFM- SEM & Soft-lithography) – Nano phase materials – Self assembled Inorganic/Organic layers.	
UNIT- IV	Spintronics: Introduction, Overview, History & Background, Generation of Spin Polarization Theories of spin Injection, spin relaxation and spide phasing, Spintronic devices and applications, spin filters, spin diodes, spin transistors.	
UNIT- V	Memory Devices and Sensors: Memory devices and sensors, Nano Ferroelectric random access memory, Fe-RAM circuit design, ferroelectric thin film properties and integration, calorimetric –sensors, semiconductor sensor array.	

UNIT-VI	Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.)	

TEXT BOOKS :

1. Stephen D. Sentaria, Microsystem Design, Kluwer Academic Press
2. Marc Madou, Fundamentals of microfabrication & Nanofabrication.
3. T. Fukada & W.Mens, Micro Mechanical system Principle & Technology, Elsevier, 1998.
4. Julian W.Gardnes, Vijay K. Varda, Micro sensors MEMS & Smart Devices, 2001.
5. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
6. K.E. Drexler, Nanosystems, Wiley, 1992.

REFERENCE BOOKS :

1. Nano Terchnology and Nano Electronics – Materials, devices and measurement Techniques by WR Fahrner – Springe
2. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology by T.Pradeep; Tata Mc.Graw Hill.
3. Spin Electronics by M. Ziese and M.J. Thornton
4. Nanoelectronics and Nanosystems – From Transistor to Molecular and Quantum Devices by Karl Goser, Peter Glosekotter, Jan Dienstuhl
5. Silicon Nanoelectronics by Shunri Odo and David Feny, CRC Press, Taylor & Franicd Group
6. Nanotubes and nanowires by C.N.R. Rao and A. Govindaraj, RSC Publishing
7. Quantum-Based Electronic Devices and Systems by M. Dutta and M.A. Stroscio, World Scientific. 8. James R Sheats and Bruce w.Smith, "Microlithography Science and Technology", Marcel Dekker Inc., New York, 1998.
8. J.P. Hirth and G.M.Pound "Evaporation: Nucleation and Growth Kinetics" Pergamon Press, Oxford, 1963.

8ETC03 PROFESSIONAL ELECTIVE V (PE-V)
(ii) WIRELESS SENSOR NETWORKS

Prerequisites: 7ETC04: Mobile Communication and Networks.
Objectives: 1. Basic concepts of Wireless Sensor Networks 2. Architecture details of WSN 3. Case study of the WSN.
Outcome: After successfully completing the course, the students will be able to: 1. Understand the basis of Sensors with its applications 2. To learn the architecture and placement strategies of Sensors 3. To analyze routing and congestion algorithms 4. To design, develop , and carry out performance analysis of sensors on specific applications 5. To explore and implement solutions to real world problems using sensor devices, enumerating its principles of working 6. To understand the working through the case study on WSN.

	Subject: WIRELESS SENSOR NETWORKS	**L**
UNIT-I	Introduction to wireless sensor Networks – Advantages of ad-hoc/sensor networks, Unique constraints and challenges- Applications Platforms for WSN: Sensor node hardware: mica2, micaZ, telosB, cricket, Imote2, tmote, btnode . Sensor node software introduction (Operating System): tiny0S, MANTIS, Contiki, and Ret0S.	
UNIT-II	Single-Node Architecture. WSN coverage and placement: Coverage problems in WSN – Type of coverage – OGDC coverage Algorithm- Placement Problem.	
UNIT-III	Topology management in wireless sensor Networks-: Different classification of topology management Algorithmstopology discovery-sleep cycle management. Medium access control in wireless networks.	
UNIT- IV	Routing in sensor networks: Data centric- position based routing- data aggregation- Clustered based routing Algorithms.	
UNIT- V	Congestion and flow control: Source of congestion- congestion control scenarios- Protocols for congestion and flow control in sensor networks: ESRT-CODA-PSFQ-RCRT-RMST-Fusion.	
UNIT-VI	Hard ware design of sensor Networks : Characteristics – Design challenges-Design of Architecture- Functional components- Energy supply- operating system. Application: Home Control, Highway Monitoring, Environmental Engineering Applications.	

TEXT BOOKS: 1. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, 2005. 2. Zhao and L. Guibas, “Wireless Sensor Networks”, Morgan Kaufmann, San Francisco, 2004 3. C. S. Raghavendra, K.M.Shivalingam and T.Znati, “Wireless Sensor Networks”, Springer, New York, 2004
REFERENCE BOOKS: **1.** Anna Hac, “Wireless Sensor Network Designs”, John Wiley & Sons, 2004. 2. Kazem Sohraby, Daniel Minoli and Taieb Znati, “Wireless Sensor Networks: Technology, Protocols, and Applications”, Wiley Inter Science, 2007.

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8ETC03 PROFESSIONAL ELECTIVE V (PE-V)
(iii) WAVELETS

Prerequisites: 1. (5ETC03) Digital Signal Processing 2. (7ETC02) Digital Image and Video Processing
Objectives: After taking this course student will be capable to: 1. Introduce with basic concepts of Wavelets. 2. Understand the wavelet transform for continuous and discrete time signals 3. Study the basic concepts of multi resolution analysis. 4. Study filter bank algorithm in details. 5. Study the application of wavelet transform for data compression. 6. Learn the application of Wavelet transform in different fields.
Outcome: After successfully completing the course, the students will be able to: 1. Comprehend the fundamentals of wavelets. 2. Explain the concepts, theory, and algorithms related with wavelet transform. 3. Understand the modern signal processing tools using signal spaces, bases, operators etc. 4. Analyse wavelets, filter banks, and multiresolution techniques. 5. Understand data compression techniques using wavelets. 6. Comprehend projects ideas based on wavelet transform.

	Subject: WAVELETS	**L**
UNIT-I	**Introduction to Time Frequency Analysis:** Vector Spaces, Properties, Dot Product, Dimension, Orthogonality and Orthonormality, Relationship Between Vectors and Signals, Signal Spaces, Signal representation using basis and frames, Brief introduction to Fourier transform and short time Fourier transform, Time frequency analysis	
UNIT-II	**Continuous Wavelet transform:** Continuous Time Wavelets, definition of CWT, Construction of continuous wavelets: Spline, orthonormal, bi-orthonormal, Inverse continuous wavelet transform, Redundancy of CWT, zoom property of the continuous wavelet transform, Filtering in continuous wavelet transform domain	
UNIT-III	**Discrete Wavelet Transform and Filter Bank Algorithms: I**ntroduction to Discrete Wavelet Transform, Decimation and Interpolation, Convolution Followed by Decimation, Interpolation Followed by Convolution, Signal Representation in the Approximation Subspace, Wavelet Decomposition Algorithm, Reconstruction Algorithm	
UNIT- IV	**Multi-resolution Analysis:** Introduction, Formal definition of MRA, Construction of general orthonormal MRA, A Wavelets basis for MRA, Digital Filtering Interpretations, Examples of orthogonal basis generating wavelets, interpreting orthonormal MRAs for discrete time signal.	
UNIT- V	**Wavelet Transform and Data Compression:** Introduction, transform Coding, DTWT for Image Compression, Image compression using DTWT and run length coding, Embedded Tree Image Coding, Audio Compression, Audio Masking, standard specifying sub band implementation, wavelet-based audio coding, video coding using multi-resolution techniques.	
UNIT-VI	**Applications of Wavelet transform:** Introduction, Wavelet Denoising, speckle Removal, Edge Detection or Object Isolation, Image Fusion, Object detection by wavelet transform of projections	

TEXT BOOKS: 1. Raghuveer Rao and Ajit S. Bopardikar, Wavelet transforms: Introduction to Theory and applications, Pearson Education Asia, 2000. 2. J. C. Goswami & A. K. Chan, Fundamentals of Wavelets: Theory, Algorithms, and Applications, 2nd edition, Wiley, 2011 3. S. Mallat, A Wavelet Tour of Signal Processing, 2nd edition, Academic Press, 1999.
REFERENCE BOOKS: 1. Y.T. Chan, Wavelet Basics, Kluwer Publishers, Boston. 2. J. S. Walker, A premier on Wavelets and their scientific applications, CRC press, 2002. 3. Gerald Kaiser, A Friendly Guide to Wavelets, Birkhauser, New York, 1995. 4. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey, 1993. 5. A.N. Akansu and R.A. Haddad, Multiresolution signal Decomposition: Transforms, Subbands and Wavelets, Academic Press, Oranld, Florida, 1992. 6. B. Boashash, Time-Frequency signal analysis, In S. Haykin, (editor), Advanced Spectral Analysis, pages 418-- 517. Prentice Hall, New Jersey, 1991.

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8ETC03 PROFESSIONAL ELECTIVE V (PE-V)
(iv) BIO-MEDICAL ELECTRONICS

Prerequisites: 1. (3ETC02) Electronic Devices and Circuits 2. (5ETC01) Microcontroller 3. (7ETC02) Digital Image and Video Processing
Objectives: 1. Understanding role of engineers in medical field 2. Studying various electrical signals generated in human body. 3. To study various transducers, electrodes, recorders and problems for recording biomedical signals. 4. Study different medical imaging systems. 5. Introduction to patient care & safety 6. Introduction of various therapeutic life saving instruments.
Outcome: After successfully completing the course, the students will be able to: 1. Understand fundamentals of Medical Instrumentation, Biomedical Signals and Electrode. 2. Identify and classify various Biomedical Transducers. 3. Illustrate the significance of human signals and recording techniques 4. Familiarize with Modern medical imaging systems. 5. Conceptualize requirements and importance of Patient Care and Monitoring and Safety. 6. Describe the function and necessity of Physiological and electrotherapy equipments.

	Subject: BIO-MEDICAL ELECTRONICS	**L**
UNIT-I	**Introduction:** Sources of bioelectric potentials, Different bioelectric signals like ECG, EMG and EEG, Bio potential Electrode theory, Basic electrode, Electrodes for EEG, ECG, EMG, Biochemical electrodes. Skin contact Theory, motion artifacts, Nernst Equation.	**06**
UNIT-II	**Biomedical transducers:** Classification of Transducers-Pressure, force, acceleration, flow, respiration sensor, Smart sensors, pulse sensor, temperature, potential, dissolved ions and gases.	**06**
UNIT-III	**Biomedical Recorders and Measurement:** Biomedical recorders for EEG, ECG, EMG, Measurement of Blood Pressure: Direct method, Indirect methods- The Rheographic method, Ultrasonic Doppler shift method, Blood flow meter - Square wave electromagnetic, Measurement of Heart rate, Measurement of pulse rate.	**06**
UNIT- IV	**Medical Imaging System:** Instrumentation for diagnostics X-rays, X- rays basics properties, X-ray machine, Special imaging techniques: Computerized Axial Tomography (CAT), Ultrasonic imaging system: Physics of Ultrasound, Biological effect of ultrasound. Ultrasonics: A-scan, M-scan, B-scan	**06**
UNIT- V	**Patient Care and Monitoring and Safety:** System concepts, Bedside patient monitors, central monitors, Intensive care monitoring. Biotelemetry: Single channel and Multichannel bio-telemetry, PATIENT SAFETY: Electric shock hazards, leakage current. Types of Leakage current, measurement of leakage current, methods of reducing leakage current, precautions to minimize electric shock hazards.	**06**
UNIT-VI	**Therapeutic Equipments & Ventilators:**	**06**

	Need of Physiological and electrotherapy equipments. Cardiac pacemakers, Cardiac Defibrillators, Nerve and Muscle stimulators. Diathermy Machines: Short wave, Microwave, Ultrasonic. Ventilators: Mechanics of respiration, Artificial Ventilators, Microprocessor controlled Ventilators.	

TEXT BOOKS:

1. Khandpur R.S. "Handbook of Biomedical Instrumentation", Tata Mc-Graw Hill, New Delhi.
2. Cromwell L. & Wiebell. F. J., "Biomedical Instrumentation", PHI Publications.

REFERENCE BOOKS:

1. Webstar J.G., "Medical Instrumentation", Third ed. John Wiely & Sons.
2. Carr & Brown, "Introduction to Biomedical Equipment Technology", Prentice Hall.

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8ETC04 PROFESSIONAL ELECTIVE VI (PE-VI)
(i) 5G-6G MOBILE COMMUNICATIONS

Prerequisites: 7ET04: Mobile Communication and Networks
Objectives: 1. To Understand latest trends in wireless technologies, a path towards 5G and 6G system. 2. To study network architecture, components, features and benefits of 5G system. 3. To understand various radio waveforms and channel model for 5G. 4. To understand different networking techniques in 5G system. 5. To study introduction of 6G system.
Outcome: Upon successful completion of this course, the student will be able to: 1. Illustrate the evolution of mobile communication leading to the introduction of 5G. 2. Explain the key innovations in radio and network. 3. Elaborate the standardization process and timeline for 5G 4. Identify the spectrum requirements. 5. Discuss key issues and challenges in 5G deployment. 6. Understand the concept of 6G

	Subject: 5G-6G MOBILE COMMUNICATIONS	**L**
UNIT-I	**INTRODUCTION TO 5G**: Historical trend and evolution of LTE technology to beyond 4G – Key building blocks of 5G – 5G use cases and System Concepts – The 5G Architecture – IoT: relation to 5G.	**06**
UNIT-II	**RF FRONT END FOR 5G:** Millimeter Wave Communications: Hardware technologies for mmW systems – Architecture and Mobility – Massive MIMO: Resource allocation and Fundamentals of baseband and RF implementations in massive MIMO – Beam forming.	**06**
UNIT-III	**5G WAVEFORMS AND CHANNEL MODELS**: 5G Radio Access Technologies: Radio Access for V2X Communication - Radio access for massive machine-type communication - 5G wireless propagation channel models: Modelling requirements and scenarios.	**06**
UNIT- IV	**NETWORKING IN 5G:** Coordinated multi-point transmission in 5G: Joint Transmission CoMP enablers - Distributed cooperative transmission - Relaying and network coding in 5G: Multi-flow wireless backhauling - Buffer aided relaying.	**06**
UNIT- V	**APPLICATIONS of 5G:** Machine-type communications: Fundamental techniques for MTC - Massive MTC - Ultra-reliable low-latency MTC - Deviceto- device (D2D) communications - Multi-hop D2D communications - Multi-operator D2D communication – Simulation methodology: Evaluation methodology – Calibration	**06**
UNIT-VI	**INTRODUCTION TO 6G**: Key building blocks of 6G – 6G use cases and System Concepts – The 6G Architecture.	**06**

TEXT BOOKS: . 1. Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, - 5G Mobile Communications, Springer, 2017. 2. Afif Osseiran, Jose F. Monserrat and Patrick Marsch, - 5G Mobile and Wireless Communications Technology, Cambridge University Press, 2016.
REFERENCE BOOKS: Jonathan Rodriguez, - Fundamentals of 5G mobile networks, John Wiley & Sons, Ltd, 2015.

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8ETC04 PROFESSIONAL ELECTIVE VI (PE-VI)
(ii) INFORMATION THEORY AND CODING

Prerequisites: 1. 3ETC03: Digital System Design 2. 4ETC01: Analog and Digital Communication
Objectives: Students undergoing this course are expected to: 1. Understand the basics of information theory and coding theories. 2. Introduce the concept of amount of information, entropy, channel capacity, error-detection and error-correction codes, block coding, convolution coding. 3. Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them. 4. Describe the real life applications based on the fundamental theory. 5. Calculate entropy, channel capacity, bit error rate, code rate, and steady-state probability and so on. 6. To get exposed to information and entropy, compression technique, audio & video
Outcome: After successfully completing the course, the students will be able to: 1. Understand the concept of information and entropy 2. Understand Shannon's theorem for coding 3. Calculation of channel capacity 4. Discuss the various capacity reduction based coding techniques for text, audio and speech type of data 5. Compare various capacity reduction based coding techniques for image and video type of data. 6. Implement various error control techniques for Convolution codes

	Subject: INFORMATION THEORY AND CODING	**L**
UNIT-I	Basics of information theory, Entropy, Information rate, classification of codes, entropy for discrete ensembles; Source coding theorem, Shannon-Fano coding, Huffman coding.	**06**
UNIT-II	Extended Huffman coding – Joint and conditional entropies, Mutual information – Discrete memoryless channels – BSC, BEC – Channel capacity, Shannon limit Shannon's noiseless Coding theorem; Encoding of discrete sources.	**06**
UNIT-III	Markov sources; Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.	**06**
UNIT- IV	Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 – Speech: Channel Vocoder, Linear Predictive Coding.	**06**
UNIT- V	Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG Video Compression: Principles-I, B, P frames, Motion estimation, Motion compensation, MPEG standard.	**06**
UNIT-VI	Techniques of coding and decoding; Huffman codes and uniquely detectable codes; Cyclic codes, convolutional arithmetic codes.	**06**

TEXT BOOKS:
1. N. Abramson, Information and Coding, McGraw Hill, 1963. 2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
REFERENCE BOOKS: 1. R.B. Ash, Information Theory, Prentice Hall, 1970. 2. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983. 3. Ranjan Bose, Information Theory, Coding and Cryptography, Publication,2005

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8ETC04 PROFESSIONAL ELECTIVE VI (PE-VI)
(iii) SCIENTIFIC COMPUTING

Prerequisites: 3ETC01: Engineering Mathematics-III
Objectives: To enable the student to understand : 1. the basics of scientific computing 2. variety of tools and techniques to transform into computer model 3. Use of Matlab and python in scientific computing.
Outcome: After successfully completing the course, the students will be able to: 1. View scientific computing as the point of intersection between computer science, numerical mathematics, and modeling. 2. introduce to numerical mathematics and prepares them for the scientific computing part. 3. Learn to solve Nonlinear equations useful for computer models 4. Learn to solve Numerical differentiation useful for computer models 5. Learn to use MATLAB 6. Learn to use python for the applications in scientific computing

	Subject: SCIENTIFIC COMPUTING	**L**
UNIT-I	Introduction to scientific computing, applications involving scientific computing, Tools and languages to solve complex scientific problems.	**06**
UNIT-II	Systems of Linear Algebraic equations: Introduction, Gauss Elimination Method, LU decomposition, Symmetric and banned coefficient Matrices, Pivoting, Matrix Inversion, Iterative Methods, Other methods.	**06**
UNIT-III	Solving Nonlinear Equations. The Bisection Method for Root-Finding.,Convergence Criteria and Efficiency, Scripts and Function Files , The False Position Method, The Newton—Raphson Method for Root-Finding , Fixed Point Iteration.	**06**
UNIT- IV	Numerical Differentiation: Finite Difference approximations; Numerical Integration; Initial Value Problems; Two- Point Boundary Value Problems; Symmetric Matrix Eigen value problems; Introduction to Optimization.	**06**
UNIT- V	Basics of MATLAB. Defining and Using Scalar Variables, Saving and Reloading the Workspace, Defining and Using Arrays, Operations on Vectors and Matrices, more on Plotting Functions of One Variable, Loops and Logical Operators, Working with indices and arrays, Number representation.	**06**
UNIT-VI	Scientific computation using python - Statistical data analysis, image processing, web development and hardware interfacing using Python.	**06**

TEXT BOOKS: 1. Hans Petter Langtangen, A Primer on Scientific Programming with Python (Link) 2. Claus Fuhrer, Jan Erik Solem, Olivier Verdier, Scientific Computing with Python 3 Packt Publishing Limited 3. Martin C. Brown, Python: The Complete Reference, McGraw Hill Education 4. Hemant Kumar Mehta, Mastering Python Scientific Computing, Packt Publishing Limited
REFERENCE BOOKS: 1. By Dan Stanescu Long Lee ,"A Gentle Introduction to Scientific Computing ", First edition Chapman and Hall/CRC 2. Jaan Kiusalaas, "Numerical Methods in Engineering with Python", Cambridge University Press, 2005.

8ETC05- EMBEDDED SYSTEMS LAB
PRACTICALS:

- Minimum Eight Experiments based on syllabus of 8ETC01: Embedded Systems must be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

8ETC06- MICROWAVE THEORY AND TECHNIQUES –LAB.
PRACTICALS:

(Note: Minimum 8 experiments uniformly distributed based on the syllabus)

Name of Subject (Pr): 8ETC06- Microwave Theory and Techniques Lab

- Minimum Eight Experiments based on syllabus of 7ETC01: Microwave Theory and Techniques must be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

8ETC07- PROJECT STAGE-II

Course Objectives: Students will be required to:

1. Perform a literature search to review current knowledge and developments in the chosen technical area;

2. Undertake detailed technical work in the chosen area using one or more of:

o theoretical studies o computer simulations o hardware construction;

3. Produce progress reports or maintain a professional journal to establish work completed, and to schedule additional work within the time frame specified for the project;

4. Deliver a seminar on the general area of work being undertaken and specific contributions to that field;

5. Prepare a formal report describing the work undertaken and results obtained so far; and

6. Present the work in a forum involving poster presentations and demonstrations of operational hardware and software.

Course Outcomes: On successful completion of the course students will be able to:

1. Demonstrate a sound technical knowledge of their selected project topic.

2. Undertake problem identification, formulation and solution.

3. Design engineering solutions to complex problems utilising a systems approach.

4. Conduct an engineering project.

5. Communicate with engineers and the community at large in written an oral forms.

6. Demonstrate the knowledge, skills and attitudes

Vision Buldhana Educational & Welfare Society's

PANKAJ LADDHAD INSTITUTE OF TECHNOLOGY & MANAGEMENT STUDIES, YELGAON, BULDHANA

(Recognized by AICTE, New Delhi & affiliated to SantGadge Baba Amravati University)

Accredited by NAAC

Department of Electrical (E&P) Engineering

Syllabus (3rd Semester to 8th Semester)

Semester 3rd

3EE 01/ 3 EP01 /3EX01 ENGINEERING MATHEMATICS – III

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and partial differential equations, applied to electrical engineering systems.
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
4. Apply Z Transform to solve of various Linear Difference equations with constant coefficients.
5. Apply the knowledge of vector calculus to solve physical problems.
6. Demonstrate the basic concepts of probability and statistics.

SECTION-A

UNIT-I:

Ordinary Differential Equations: - Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. Applications to electrical circuits. (7)

UNIT-II:

Laplace Transforms: definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Laplace transform of Periodic Function, Impulse Function, Unit Step Function. Solution of linear differential equation using Laplace transform. (7)

UNIT-III:

a) Partial differential equation of first order and first degree of following type-

(i) f (p, q) = 0; (ii) f (p, q, z)=0; (iii) f (p, q, x, y) = 0; (iv) Pp + Qq =R (Lagrange's Form);

(v) Clairaut form Z = px + qy + f(p, q) **b)** Fourier transforms- Definition, standard forms, inverse

Fourier transform Fourier sine and Fourier cosine transforms and integrals. (7)

SECTION-B

UNIT-IV:

a) Difference Equation:- solution of difference equations of first order, solution of difference equations of higher order with constant coefficient.

b) Z-transform: Definition, standard forms, Z-transform of impulse function, Unit step functions, Properties of Z- transforms (Linearity, shifting, multiplication by k, change of scale), initial and final values, inverse Ztransforms (by direct division and partial fraction), Solution of difference equation by Z-transforms. (7)

UNIT-V:

Vector Calculus: - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion formulae (without proof), Irrotational and Solenoidal vector fields, Line Integral, Stokes and Divergence Theorem. (7)

UNIT-VI:

Statistics & Probability: Axioms, conditional probability, Bay's theorem, mathematical expectations, probability distributions: Binomial, Poisson and Normal. (7)

Books Recommended:

1. Elements of Applied Mathematics by P. N. Wartikar and J. N. Wartikar
2. Advancing Engineering Mathematics by E. K. Kreyzig.
3. Advance Engineering Mathematics by B. S. Grewal
4. Integral Transforms by Goyal & Gupta.
5. Statistical Methods by S.G. Gupta

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3EE02/3 EP02/3EX02 ELECTRICAL CIRCUIT ANALYSIS

Course Outcomes:

After completing this course studentwill be able to:

1. Analyze electric and magnetic circuits using basic circuital laws
2. Analyze the circuit using Network simplification theorems.
3. Solve circuit problems using concepts of electric network topology.
4. Evaluate transient response of different circuits using Laplace transform
5. Evaluate two-port network parameters and network functions

Unit I:

a] Terminal Element Relationships: V-I relationship for Dependent &Independent , Voltage and Current Sources., Source Transformations. Source Functions: unit impulse, unit step, unit ramp and interrelationship, sinusoidal input, generalized exponential input.

Magnetic Circuits: concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, Analysis of series and parallel magnetic circuits. b] Basic Nodal and mesh Analysis: Introduction, Nodal analysis, super node analysis, mesh analysis, super mesh analysis.

Unit II:

Network Theorems: Superposition theorem, Thevenin'stheorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorem

Unit III :

Graph Theory and Network Equation:-Graph of a network, Trees and loops, Tie-set and cut set matrix of a network, Network equilibrium equations, duality-network transformation.

Unit IV:

a] **Transformation of a Circuit into s-domain:** LaplaceTransformed equivalent of inductance, capacitance and mutual inductance, Impedance and admittance in the transform domain, Node Analysis and Mesh Analysis of the transformed circuit. Complete Solution ofLinear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-for step Inputs. Natural Response, Transient Response, Determination of initial conditions.

Unit V :

Two Port Networks: Two port networks: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interrelationship between parameters, Interconnection of two port networks , Input impedance in terms of two port network parameters, Output impedance, Image impedance.

Unit VI :

Network functions: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function. Applications of network analysis in driving network functions, positive real functions, driving point and transfer impedance function.

Text Book: Network Analysis, M.E. Van Valkenburg, PHI, 2005.

Reference Books:

1. Circuits & Networks – Analysis, Design & Synthesis by M.S.Sukhija, T.K.Nagasarkar, OxfordUniversity Press, 2010.

2. Circuit and Network Analysis, SudhakarShyammohan, Tata Mc Graw Hill, 2005.

3. Network Analysis, P. Ramesh babu, SciTech Publications, Chennai, 2009

3EE03/3 EP03/3EX03 ELECTRICAL MACHINE - I

Course Outcomes:

After Completing this course, students will be able to:

1. Explain the construction and working of DC Machines.
2. Illustrate the different Characteristics, types, their applications and parallel Operation of D.C. Generators.
3. Demonstrate the various characteristics, starting, speed control and braking operation on DC motors
4. Analyze the performance of DC machines by conducting the various tests on it.
5. Determine the parameters of equivalent circuits, performance parameters of single phase transformer and
merits & demerits of autotransformer
6. Explain the construction, working, different connections, applications and testing of three phase transformer.

D.C. Machines: Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap,wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.

Unit II :

D.C. Generators: Types, Characteristics and Applications of D. C. Generators, Parallel Operation of D.C.Generators, Introduction to testing of D. C. Generators as per Indian standard.

Unit III :

D.C. Motors: Types, Characteristics & Modified Characteristics, Applications of D.C. Motors. Starting, Electric Braking, Speed Control of DC Motors. Losses, efficiency and testing of DC Motors.

Unit IV :

Single phase Transformer: Working Operation, EMF Equation, and separation of core losses in to its component. Equivalent Circuit, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on transformer as per Indian standard. Single phase Autotransformer: - construction, working, merits, demerits and its application.

Unit V :

Three Phase Transformer: Construction, Working, Types, connections, vector group connections, open delta Connection, OC, SC, Heat run test, load test, magnetic balance, vector group test on three phase transformer.

Unit VI :

Three Phase Transformer: Three-winding transformer, On load & Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Waveforms of no load current & inrush current phenomenon.

Reference Books:

1) C. Dawes: Electrical Engineering, Vol.I: Direct current (IV Edition), (McGraw Hill Book Company)

2) H. Cotton: Advance Electrical Technology, (Wheeler publication)

3) Indian Standard Guide for testing DC Machine. IS: 9320-1979, (Indian Standards Institution, New Delhi.)

4) Indian Standard Specification for safety transformer. IS: 1416-1972, (Indian Standards Institution, New Delhi.)

3EE04/3 EP04 – ENERGY RESOURCES AND GENERATION

Course Outcomes:

A student, on completion of this course, will be able to:

1. Explain the operation of Thermal, Hydro, Nuclear and Diesel power plants.
2. Summarize solar energy conversion, solar radiation measuring instruments, wind energy conversion and
their applications.
3. Outline the principle and operation of fuel cells, ocean & tidal energy conversion, and other nonconventional
energy resources.
4. Determine the various factorsand curves related to electrical load & generating plant.

Unit I:

Conventional and non conventional energy sources, Indian Energy Scenario.

Thermal and hydro power plant: Layout of Thermal power plant, Selection of site, working of various parts: Economizer, air preheater, condenser, cooling tower, ash &coal handling plant, advantages & disadvantages Layout of Hydro power plant, classification of hydro power plant according to available head, nature of load, functions of different components and their working, mini and micro hydro-electric power generation, advantages & disadvantages.

Unit II :

Nuclear and Diesel power plant: nuclear fission and fusion, Layout of Nuclear power plant, Selection of site, Functions of different components of nuclear plant, types of nuclear reactors , advantages & disadvantages of different nuclear reactors, nuclear waste disposal., safety measures.

Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages.

Unit III :

Solar Energy and its measurement: Solar cell, array & module, Solar constants, solar radiation at earth's surface, Solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface, principle of solar energy conversion in to heat, types of solar collectors, energy balance equation and collector efficiency.

Unit IV:

a]Fuel cells: Chemistry applied to fuel cells, principle and operation ,classification and types of fuel cells, performance characteristics of fuel cells, classification of fuel cell system. b]Wind energy :Basic principle of wind energy conversion, wind data and energy estimation, selection of site ,basic components of wind energy conversion system ,classification of WEC systems ,generating system, applications of wind energy.

Unit V :

Ocean, Tidal & Other non-conventional energy resources: Ocean energy resources, ocean energy routes, ocean thermal energy conversion, basic principle of tidal power, components of tidal power plants, operation methods of utilization of tidal energy, estimation of power and energy in single and double basin tidal system,. Operating principles of energy from biomass, energy from biogas, geothermal energy, MHD power generation, energy from urban and rural waste.

Unit VI :

Load-Generation factors: connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, load curve, chronological load curve, load duration curve, energy load curve, energy duration curve, load survey, base load and peak load station.

Text Book: Generation of electrical energy by B.R.Gupta, Eurasia Publishing House, New Delhi.

Reference Books:

1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Solar energy by S.P.Sukhatme Tata McGraw Hill Publication
3. Principles of Power System by V.K.Mehta, S.Chand publication.
4. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication

3EE05/3 EP05ELECTRONIC DEVICES AND CIRCUITS

Course Outcomes:

After successfully completing the course, the students will be able to :

1. Demonstrate the knowledge of semiconductor physics and PN Junction Diode
2. Analyze the rectifier and regulator circuits.
3. Analyze the operational parameters of BJT
4. Analyze various multistage amplifier circuits
5. Demonstrate the knowledge of JFET, MOSFET, UJT and their operational parameters

UNIT-I:

P-N Junction diode theory, Energy bands in intrinsic and extrinsic silicon, carrier transport, diffusion current , drift current, mobility and resistivity, generation and recombination of carriers, PN junction diode , zener diode, zener diode as voltage regulator, Numericals based on voltage regulator (line and load regulation, Numericals based on resistivity, conductivity, mass action law)

UNIT-II:

Half wave, full wave center tapped full wave and bridge rectifier. Filters-C, LC and their analysis, clipping and clamping, Numericals based on clipping and clamping

UNIT-III:

Theory and Analysis of Bipolar Junction transistor, 'H' Parameter, methods of biasing, their needs, 'Q' and stability factors, compensation techniques.

UNIT-IV

Study of typical transistor amplifier circuits i) Emitter follower, ii) Darlington emitter follower. iii) Bootstrap emitter follower, iv) RC coupled amplifier, v) Transformer coupled amplifier, vi) Cascaded amplifier, vii) Direct coupled amplifier, viii) Cascade stage.

UNIT-V :

FETs (JFET & MOSFET): Types, Characteristics and parameters (u, gm &Rds), Applications of FET amplifiers, UJT: Characteristics, working, UJT as relaxation oscillator.

UNIT-VI :

Theory, construction and applications of Schottky diode, Tunnel diode, Varactor diode, Selenium diode, LED, Photo diode, PIN diode, photo-transistor.

Text Book: Millman's Electronic Devices & Circuits by J.Millman, C.Halkias, Satyabrata Jit TMH 3rd ed, 2nd reprint 2011.

Reference Books:

1. Electronic Devices and Circuits 5/e – David Bell Oxford University Press
2. Microelectronic Circuits 5/3 – Sedranad Smith Oxford University Press
3. Boylestad R. and "Electronics Devices & Circuits", Prentice Hall of India Private Limited, New Delhi (Fifth
Edition), 1993..

3EE06/3 EP06/3EX06 ELECTRICAL CIRCUIT ANALYSIS LAB

Minimum eight experiments based on the syllabus content of 3EP02 Electrical Circuit Analysis. The intensive list of experiment is given below.

1. Verification of output response of series R-C circuit for step input
2. Study of dot convention and determination of

A) Mutual inductance

B) Coupling coefficient of b transformer

3. Verification of Mesh and Node analysis.

4. Verification of Superposition theorem.
5. Verification of Thevenin's theorem.
6. Verification of Maximum Power Transfer theorem.
7. Verification of reciprocity theorem.
8. Study of Milliman's theorem& verification.
9. Verification of Norton's theorem.
10. Determination of ABCD parametersT-network &Π-network.
11. Study of Tie set and Cut set schedule for a given network.
12. MATLAB simulation for o/p verification of any theorem.
13. Determination of Z and Y parameter.
14. Determination of hybrid parameter.

3EE07/3 EP07/3EX07 ELECTRICAL MACHINES - I LAB.

Minimum eight experiments based on the syllabus content of 3EP03Electrical Machines – I.
The indicative list of experiments is given below.

1. Plot the OCC of DC generator and find its critical resistance and critical speed.
2. To study the build-up of DC shunt generator, calculate critical resistance at different speeds.
3. Plot/Compare: External, Internal Characteristics of DC Shunt/series/compound generator.
4. Calculate the efficiency and voltage regulation of DC generator by the direct load test.
5. Speed Control of DC Shunt motor by armature control & Field Control method.
6. Perform the direct load test on DC series/shunt/compound motor to plot its performance characteristics, and determine its efficiency and speed regulation.
7. Conduct the Swinburn's test on DC machine to estimate its performance at any desired load condition.
8. Conduct the Hopkinson's test on DC Machine to analyze its performance.
9. Perform Electric Braking Operation on DC shunt Motor.
10. Conduct the Polarity test and Ratio test on transformer
11. Calculate the Equivalent circuit parameters of single-phase transformer by performing OC & SC test on it and determine its efficiency and voltage regulation
12. Perform the direct load test on single phase/three phase transformer and determine its efficiency and voltage regulation.
13. Conduct back to back test (Sumpner's test)on two single phase transformers and determine the temperature rise.
14. Conduct the magnetic balance test on three phase transformer.
15. Conduct the vector group test on three phase transformer.
16. Conversion of three phase to two phase supply system using Scott Connection
17. Capture the waveform of inrush current of single phase/three phase transformer using DSO.

Reference:

S.G.Tarnekar, P.K.Kharbanda, S.B.Bodkhe, S.D.Naik and D.J.Dahigaonkar"Laboratory Courses in Electrical Engineering", S. Chand & Co. New Delhi, 2013.

3EE08/3 EP08/3EX08 ELECTRONIC DEVICES & CIRCUITS LAB

Minimum eight experiments based on the syllabus content of 3EP05Electronic Devices & Circuits. The intensive list
of experiment is given below.

1. To study and verify V-I characteristics of semiconductor diode
2. To study and verify V-I characteristics of Zener diode.
3. To verify the performance of half wave rectifier circuit with and without filter.
4. To verify the performance of full wave bridge rectifier circuit and determination of load regulation.
5. To verify the performance of Zener voltage regulator.
6. To verify characteristics of bipolar junction transistor
7. To study and perform C-E amplifier gain with variation of load resistance.
8. To study and verify the characteristics of FET
9. To study UJT as a relaxation oscillator
10. To study phase shift oscillator & determine frequency of oscillation
11. To study characteristics of MOSFT
12. To study clipper circuits using diodes
13. To study clamper circuits using diodes
14. To study and verify operation of cascade amplifiers

3EE09/3 EP09/3EX09 ELECTRICAL TECHNOLOGY - LAB

Perform minimum Eight practicals / demonstration from the following list and prepare the report as a term work for this laboratory.

1. Introduction to standard symbols used in wiring diagrams
2. Introduction to different wiring accessories.
3. Demonstration of different types of wirings eg. Domestic wiring, commercial wiring, Industrial wiring.
4. Connection of Staircase wiring, Godown wiring, fluorescent lamp. Ceiling fan, air cooler etc
5. Domestic wiring diagrams
6. Connections of switch board, MCB and energy meter
7. Testing and electrical Maintenance of domestic appliances like lamps, electric iron, heater, geyser, air cooler, fan, microwave-oven, induction heater, etc.
8. Insulation resistance and earth resistance measurement
9. Conduct the load survey for domestic/commercial /Industrial consumers
10. Illumination system Design (selection of type and number of lamps required for any location)
11. Calculation of Energy bill for LT & HT consumers.

12. Safety precautions while working with electrical system
13. Demonstration of first aid treatment after getting electric shock.
14. Study of various components of solar power plant.
15. Design calculation of small capacity roof top solar power plant

SEMESTER – IV

4EE01/4EP01/4EX01 ELECTROMAGNETIC FIELDS

Course outcomes :

At the end of the course the student should be able to:

1. Demonstrate the basic mathematical concepts related to electromagnetic vector fields.
2. Apply the principles of electrostatics to the solutions of problems relating to electric field and electric
potential, boundary conditions and electric energy density.
3. Apply the principles of magneto statics to the solutions of problems relating to magnetic field.
4. Apply Maxwell's equation in different forms (differential and integral) to diverse engineering problems.

Unit I :

Review of Vector Analysis: Cartesian, cylindrical and spherical co-ordinate systems, vector algebra and vector calculus. Line integral and multiple integrals. Gauss theorem.

Unit II :

Electrostatics: Coulomb's law, electric field, Gauss flux theorem in integral and differential form. Electrostatics potential, Poison and Laplace equations.

Unit III :

Electrostatics fields in dielectrics: electric dipole, polarization. P and D vectors, boundary conditions. Capacitance and electrical energy.

Unit IV :

Magnetic fields: Biot-Savart law, Ampere's law in integral and differential form. Continuity equation, time of relaxation. Vector and Scalar magnetic potential, electric current, J vector..

Unit V

Magnetic fields in materials: magnetic dipole equivalent volume and plane section curve. H vector, magnetization vector M, boundary conditions between magnetic materials, inductance, Electromagnetic Energy.

Unit VI :

Maxwell equations and wave equations: Displacement current, time varying fields and Maxwell's equations, plane uniform magnetic waves. Depth of penetration Poynting vector

Text Book: "Engineering Electromagnetics", by Hayt W.H. Tata Mc-Graw Hill publication

Reference Books:

1. Electromagnetic fields by TVS Arun Murthy S Chand & Co
2. Principles and applications of Electromagnetic fields by Plansycollin , Mc-Graw Hill Books Co.
3. Foundations of electromagnetic theory by John Reitz, Addison Wesley Pub Co.
4. Basic electromagnetic field by Herbert Neelf, Harber International education
5. Introduction to electromagnetic, Derucy and Johnson, Mc-Graw Hill Books Co.

4EE02/4EP02/4EX02 ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Course Outcomes:

A student completing this course, should be able to:

1. Classify the various measuring instruments like PMMC, MI, Electrodynamometer, and Induction type instruments for measurement of current, voltage, power, and energy.
2. Demonstrate the construction & working of Instrument Transformers and special purpose meters.
3. Analyze various methods for measurement of resistance, inductance, and capacitance using AC/DC bridges.
4. Explain the working of various Digital measuring instruments.
5. Explain the generalized Instrumentation system & working of different transducers.

Unit-I: Analog Instruments - Classification of measuring instrument, Different torques in measuring instrument, Analog Ammeter, Voltmeter, Electrodynamic type Construction, ,theory of operation, torque equation, errors, merits and demerits of each type

Unit II : Wattmeter and Energy meter-Construction, theory of operation, torque equation, errors, merits and demerits of each type. Analysis of three phase balanced load:- Blondell’s theorem, Measurement of active and reactive power in single phase and three phase circuits.

Unit III : Instrument transformers- C.T.and P.T., Importance, theory and construction, phasor diagram, causes of errors, testing, and applications. Special Instruments- Frequency meter, Power factor meter, Phase sequence indicator, Synchroscope and Stroboscope.

Unit IV: Measurement of circuit parameters- Different methods of measurement of low, medium, high value of resistance, sensitivity and accuracy of different methods. AC and DC bridges, Wheat -stone, Kelvin, Maxwell ,Wein , Hay , De-Sauty ,Schering , Owen , Anderson’s bridge.

Unit V:

Digital methods of measurements, Introduction to A/D, D/A techniques , F/V and V/F conversion techniques , Digital voltmeter (DVM), ammeter, wattmeter, multi-meter and Electronic energy meter, Sources of error, Inherent error in digital meters.

Unit VI:

Generalized Instrumentation system- characteristics of measurement and Instrumentation system. Transducers: Definition, classification, Specification, selection, loading effect, Displacement, velocity transducers, Force and torque transducers, Resistive, inductive, Capacitive, strain gauge transducers, Piezoelectric, current and voltage transducers. Elastic-members (Bellows, Bourdon tube, Diaphragm)

Text Book: A.K. Sawhney, 'Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai& Co (P) L

Reference Books:

1. E.W.Golding&F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler& Co.
2. Albert D. Helfrick& William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques',
Prentice Hall of India, .
3. Joseph. J. Carr, 'Elements of Electronic Instrumentation & Measurements', III edition, Pearson Education.
4. Bouwens, A.J., "Digital Instrumentation", McGraw Hill.

4EP03 CONTROL SYSTEMS

Course Outcomes:

After completing this course, student will be able to:

1. Demonstrate the fundamental concepts of automatic Control and mathematical modeling of the Systems.
2. Determine the transfer function of control system components.
3. Analyze the time response of various systems and performance of controllers.
4. Evaluate the stability of linear systems using various methods.

Unit I : Introduction to automatic control

Open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs. Effect of feedback on sensitivity to parameter variation and reduction of the noise.

Unit II : Control System Components

Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, synchros, potentiometers, tacho-generators, encoders, their functional analysis and operating characteristics and their application.

Unit III: Time response analysis:

Time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series. Approximate methods for higher order system, proportional, derivative and integral control.

Unit IV: Stability

Stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability. Root Locus: construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Unit V: Frequency response methods

Frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems. Estimation of approximate transfer functions from the frequency response.

Unit VI: Stability analysis from frequency response : Gain margin and Phase margin; Stability analysis from Bode plots. Nyquist criterion, Nyquist plots and stability analysis.

Books Recommended:

Text Book: Nagrath I.J., Gopal M.: Control System Engineering, Wiley Eastern.

Reference Books:

1. Control Engineering, D.Ganesh Rao, k. Chennavenkatesh, 2010, PEARSON
2. Ogata K.: Modern Control Systems, Prentice Hall of India.
3. Control Systems by K.R.Varmah TMH edition 2010
4. Linear Control Systems, Ashfaq Hussain, Haroon Ashfaq, Dhanpat Rai & co.

4EP04 NUMERICAL METHODS & OPTIMIZATION TECHNIQUES

Course Outcome:

After completing this course students will be able to

1. Solve linear and Simultaneous Equations with the help of Numerical Methods.
2. Apply various Numerical methods to fit the curve.
3. Solve Numerical differentiation, integration, and Differential Equations.
4. Solve linear, non linear and dynamic optimization problem by various methods.
5. Determine the optimum scheduling by using CPM and PERT.

Unit I:

(a)Absolute, relative and percentage errors and analysis, Solution of Algebraic and Transcendental equations: Bisection Method, False Position method, Newton Raphson methods, Successive approximation method

(b) **Solution of Simultaneous Algebraic Equations**: matrix inverse method, Gauss elimination method,Iterative method-Jacobi’s Method, Gauss Seidel Method; Eigen values of a matrix.

Unit II:

(a) Curve fitting by Least Square Method, Correlations and Regression.

(b) Newton’s forward and backward interpolation method, Newton’s Divided Difference Method, Lagrange’s Interpolation method, Interpolation with Cubic Splines.

Unit III:

Numerical differentiation by Taylor series method, Maximum and minimum values, Numerical Integration by rapezoidal, Simpsons one third and three eight rules, Numerical solution to differential equations by Taylor Series, Euler’s method, RungeKutta second and fourth order methods

Unit IV:

Basics of Optimization Techniques, Linear programming - standard form, definitions and theorems, graphical method, simplex method, two phase simplex method, balanced and unbalanced transportation problems.

Unit V:

Non linear programming: unimodal function, Fibonancci search method and golden section method, Steepest descent method, conjugate gradient method, unconstraint optimization, direct search method.

Unit VI:

Dynamic programming: multistage decision processes, principle of optimality, sub optimization, calculus and tabular method of solution, conversion of final value problem into initial value problem.

CPM and PERT: introduction, Network representation of project, critical path, Probability of completion of project, optimum scheduling by CPM, crashing of project.

Books Recommended:

Text Books:

1. Introductory Methods of Numerical Analysis; S. S. Sastry (PHI)
2. Engineering Optimization – Theory & Practice; S. S. Rao (New Age International Pvt. Ltd.)

Reference Books:

1. Mathematical Statistics by J. N. Kapoor, Tata McGraw Hill Pub. Co. Ltd
2. Numerical Methods in Engineering and Science; B. S. Grewal (Khanna Publishers)
3. PERT and CPM- Principles & Application; L. S. Srinath (Affiliated East-West press pvt. Ltd)
4. Optimization for Engineering Design - Algorithms and Examples byKalyan Moy Deb, PHI Pub.

4EE04/ 4EP05 /4EX04 ANALOG AND DIGITAL CIRCUITS

Course Outcomes:

After completing the course, students will be able to

1. Explain the principles of operational amplifiers, parameters of op-amp
2. Illustrate the linear and nonlinear applications of op-amp
3. Demonstrate the knowledge of Voltage regulator and Timer ICs
4. Describe the working of Logic families andtheir applications.
5. Demonstrate the knowledge of combinational and sequential circuits and its application

Unit I:

Introduction to IC's: Operation amplifier; Block schematic internal circuits, Level shifting, overload protection, study of IC 741 op-amp, Measurement of op-amp parameter.

Unit II:

Linear and Non-linear Application of Op-amp: Inverting and non inverting amplifiers, voltage follower, integrator, differentiator differential amplifier, op amp as adder subtractor, op amp as a log and antilog amplifier

Sinusoidal RC-phase shift and Wein bridge oscillators, clipping, clamping and comparator circuits using op-amps.

Unit III:

Other linear IC's : Block schematic of regulator IC 723, and its applications, study of 78XX, 79XX and its applications, SMPS, Block schematic of timer IC 555 and its applications as a timer, a stable, mono stable, bistable multivibrator and other applications, Operation of phase lock loop system and IC 565 PLL, its application.

Unit IV: Basic Logic Circuits : Logic gate characteristics, NMOS inverter, propagation delay, NMOS logic gate, CMOS inverter, CMOS logic gates, BJT inverter, TTL, NAND gate, TTL output, state TTL logic families, ECL circuits, composition logic families.

Unit V:

Combinational Digital Circuits: Standard gate assemblies, Binary adder, Arithmetic functions, Digital comparator,Parity check generator, Decoder / demultiplexer, Data selector / multiplexer, Encoder

Unit VI:

Sequential Circuits and Systems: Bistable Latch, Flip-Flop clocked SR,J-K, T, D type shift Registers, counter. Design using filp-flops, Ripple and synchronous types, application of counters

Books Recommended:-

Text Book: Millman, Microelectronics, 2nd Ed., McGraw Hill.

Reference Books:

1. Gayakwad, Op-Amp & LLG, 2nd Ed.
2. Malvino& Leach, Digital Principles & Applications, 4th Ed., McGraw Hill.
3. K.B.Botkar, Integrated Electronics (Khanna Publishers.)

4EE07/ 4EP06 /4EX06 ELECTRICAL MEASUREMENTS & INSTRUMENTATION- LAB

Minimum eight experiments based on the syllabus content of 4EP02 Electrical Measurements & Instrumentation.

The intensive list of experiment is given below.

1. Measurements of Low resistance by using Kelvin double Bridge.
2. Measurements of Medium resistance by Ammeter Voltmeter method/Wheatstone Bridge
3. Measurement of High resistance by Loss of Charge method.
4. Measurement of Insulation resistance by using Megger
5. Measurement of unknown Inductance using Maxwell Bridge/Hay Bridge/Anderson Bridge
6. Measurement of Unknown Capacitance by Desauty Bridge/Schering Bridge
7. Measurement of frequency using Wien Bridge
8. Extension of range of ammeter using shunt/CT.
9. Extension of range of voltmeter using multiplier/PT.
10. Calibration of Wattmeter by Phantom loading

11. Calibration of energy meter to detect the error in it.
12. Measurement of active & reactive power measurement in 1 phase / 3 phase circuit.
13. Measurement of rotational speed using stroboscope
14. Conversion of non electrical quantity into its equivalent electrical quantity using proper transducer.
15. Compare the accuracy, preciseness, sensitivity of Analog & Digital Measuring Instruments

4EP07 CONTROL SYSTEM LAB

Minimum eight experiments based on the syllabus content of 4EP03Control System. The intensive list of experiment is given below.

1. Study of Potentiometer
2. Study of A.C. Synchro and its characteristics
3. Determination of Transfer Function of D.C. Generator
4. Determination Of Transfer Function of D.C.Servomotor and Its Characteristics
5. Performance Characteristics of a D.C. Motor Angular Position Control System
6. Determination Of Frequency Response of Given R-C Network
7. Determination Of Transfer Function of A.C. Tacho-Generator
8. Experimental Study Of The Operating Characteristics of a Small Stepper Motor and Its Controller
9. Study Closed Loop PI Controller System and Its Time Response to Different Input.
10. Experimental Study of Position Control of DC Motor using Ardiuno
11. Experimental Study of Time Domain Analysis of Second Order Control System
12. Study AC Position Control System

4EE09/ 4EP08 /4EX08 ANALOG AND DIGITAL CIRCUIT LAB

Minimum eight experiments based on the syllabus content of 4EP05Analog & Digital Circuit. The intensive list of experiment is given below.

1. To Plot Frequency Response Of Non-Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth & Maximum Gain
2. To Plot Frequency Response Of Inverting Mode Of Op-Amp Using IC741 and Determine the Bandwidth &
Maximum Gain
3. To Perform Op-Amp as Differentiator Using IC741 .
4. Design The Circuit for Supplying 5V,25mA As A Low Voltage Regulator Using IC 723
5. Verification Of Truth Table Of Various Logic Gates Using ICs
6. To Study and Verify The Operation Of SR and MS ,JK Flip Flop
7. To Verify The Operation Of Multiplexer Using IC74153.
8. To Design And Verify Function Of Decade Counterusing IC 7490
9. To Verify The Truth Table Of 4 Bit Comparator
10. To Perform Op-Amp As Integrator Using IC741

11. A stable Multi-vibrator Using IC 555timer

12. To Study And Verify The Operation Of Half-Adder And Full-Adder

4EE10/ 4EP09 /4EX09 ELECTRONIC TECHNOLOGY LAB

Perform Minimum Eight experiments / demonstration based on the following contentand prepare the report as a term work for this laboratory.

 Study of electronic Components: Identification of components, name, types, symbol, size, rating and application.

 Handling Electronic Components: Finding values and testing (using DMM), test working condition, fault detection.

 Working with breadboards: understanding the breadboards for component mounting, working with small circuits on breadboard

Soldering: Soldering skill tips- use of proper soldering Iron, Metal, Flux**,** Cleaning, Tinning etc., mounting components on zero PCB, testing of small circuits mounted on zero PCB. De-soldering of components

 PCB Layout and design: Understanding different PCBs, Working on PCB Layout (Software), PCB etching, drilling on PCB, Mounting components on PCB, Working with small circuits on PCB and their testing

 Electronic circuit Simulation: Familiarizing with the simulation software, simulation and result validation of simple circuit with software.

SYLLABUS BE SEM. V ELECTRICAL ENGG. (ELECTRONICS & POWER)

5EP01 POWER SYSTEM- I

Course Outcomes:

After completing this course, the students will be able to:

1. Determine the parameters of transmission lines.
2. Evaluate the performance of transmission line
3. Describe transmission lines voltage control and power factor improvement methods.
4. Explain representation of power system, Ferranti effect and corona phenomenon.
5. Demonstrate various Insulators , its string efficiency & underground cables.

Syllabus:

Unit I: Transmission line parameters: calculation of resistance, inductance and capacitance of single phase andthree phase transmission lines, skin effect and proximity effect, transposition, G.M.D. & G.M.R. methods, double circuit lines, bundled conductors, effect of earth on inductance and capacitance, interference with communication lines.

Unit II: Electrical characteristics of transmission line: V-I characteristics of short, medium and long lines, A, B, C, D constants, nominal T and equivalent π representations

Unit III: Voltage control and power factor improvement: methods of voltage control and power factor improvement, use of static VAR generators and synchronous condenser, automatic voltage control. Receiving end and Sending end power circle diagrams.

Unit IV: Representation of power systems: single line diagrams, per unit system and one-line impedance and reactance diagrams. Ferranti effect, corona phenomenon, Introduction to Travelling waves.

Unit V: Insulators: materials used, types, comparison of pin type and suspension type insulators, voltage distribution and string efficiency, methods of increasing string efficiency, grading rings and arcing horns. Introduction to insulator testing, line supports for LV, HV, EHV and UHV.

Unit VI: Underground cables: material used for conductor & insulation, different types of cables and their construction, parameters of underground cable, grading of cable, losses, break down and rating, selection of cables.

Text Books:

1. Modern Power System Analysis by D. P. Kothari, I. J. Nagrath TMH Publishing

2. Elements of power system analysis by William D. Stevenson, Jr, McGraw-Hill International edition

Reference Books:

1. Power System Engineering by D. P. Kothari, I. J. Nagrath TMH company ltd., New Delhi
2. Narain G. Hingorani and Lazlo Gyugyi "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems.
3. Principles of power system by V. K. Mehta, S. Chand & company ltd., New Delhi.
4. Electrical Power Systems by C. L. Wadhwa, New Age International Publishers, New Delhi
5. Electrical Power Systems by Ashfaq Husain, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
6. Electrical Power system design by M. V. Deshpande, TATA McGraw-Hill Publishing Company Limited, New Delhi.

5 EP02 MICROPROCESSORS & MICROCONTROLLER

Course Outcomes:

After completing the course the students will be able to

1. Recite Fundamentals and Architecture of Microprocessor 8085, Microcontroller 8051
2. Interpret Assembly Language Programming of Microprocessor 8085, Microcontroller 8051
3. Illustrate interfacing with Microprocessor 8085, Microcontroller 8051
4. Apply knowledge of Microprocessor 8085 for measurement of Electrical quantities
5. Discusss Fundamentals and Architecture of Microprocessor 8086
6. Explain Fundamentals and Architecture of Microprocessor 8051

Unit I: 8085-architecture and Pin Diagram, Microprocessor Operations (Initiated, Internal and External) BUS
organization and register structure, instruction set of 8085, addressing modes, Machine Cycles & Bus Timings

Unit II: Assembly Language Programming of 8085, counters and time delays, stack and subroutines, Memory mapped I/O and I/O mapped I/O, address decoding techniques. Interrupt system of 8085 (software and hardware interrupts), Data transfer schemes, serial data transfer through SOD and SID line.

Unit III: Programmable Interfacing devices: Internal architecture, programming and interfacing of Programmable Peripheral Interface PPI (8255), Programmable Interrupt Controller PIC (8259), and Universal Synchronous Asynchronous Receiver Transmitter USART (8251) and Programmable Interval Timer PIT (8253)

Unit IV: Introduction to microcontroller: 8051 pin configuration and architecture, 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory.

Unit V: Instruction set of 8051.Addressing modes. Various groups of instructions: data transfer. Arithmetic-logical
group. Interrupt, timer counter related instructions. Interfacing of 8051with external memories. Programming 8051 with interfacing examples.

Unit VI: 8085 Microprocessors / 8051 Microcontroller Applications: hardware & software developments: signal conditioning & data acquisition system components. Measurement of Pulse width and Magnitude using 8085. Measurement of fundamental quantities -voltage, current, frequency, speed using 8051 Microcontroller.

Text Book: Microprocessor Architecture, Programming, and Applications with the 8085, Romesh Gaonkar PHI Publication - 2006

Reference Books:

1. An Introduction to Microcomputers Volume 1 Basic Concepts, Adam Osborne Osborne-McGraw Hill, Berkely California, 1980

2. Introduction to Microprocessor L. Gibson, Prentice-Hall, 2003

3. Advance Microprocessor and Peripherals, K. M. Bhurchandi & A. K. Ray, 2nd Edition, Tata McGraw Hill, 2006.

4. Microprocessor 8086 ,Sunil Mathur PHI 2010

5. The 8051 Family of Microcontrollers Richard Barnett Prentice-Hall, Inc -2000

6. The 8051 Microcontroller and Embedded Systems: Using Assembly and C,M A Mazidi,J.GMazidi and Mckinlay, 2nd Edition, Pearson.

5EP03 ELECTRICAL MACHINES – II

Course Outcomes:

After completing this course students will be able to

1. Describe the construction, working operation & performance characteristics of three phase Induction Motor
2. Analyze the starting, braking and speed control of three phase induction motors by various methods.
3. Describe the construction, working operation & performance characteristics of single-phaseInduction Motor
4. Demonstrate the construction, working operation & performance characteristics of synchronous machine.
5. Explain the construction & working of special motors like Universal, Reluctance, PMSM & BLDC Motor

Unit I: Three phase induction motor – I:

Construction, Types (squirrel cage and slip-ring), Rotating Magnetic Fields, principles of operation, Working, Torque Slip Characteristics, Starting and Maximum Torque. Effect of parameter variation on torque slip characteristics (variation of rotor and stator resistances, stator voltage, frequency).Equivalent circuit. Phasor Diagram, Performance evaluation by direct & indirect testing, circle diagram.

Unit II: Three phase induction motor – II :

Starters for squirrel cage &slip-ring type IM, Methods of speed control, electric braking, High Torque IM, single phasing, cogging and crawling, Generator operation Self-excitation, Doubly-Fed Induction Machines.

Unit III: Single phase Induction Motor : Double revolving field theory, Constructional features, equivalent circuit, working, Split-phase starting methods and applications of single-phase Induction motors.

Unit IV: Synchronous Generator:

Constructional details, working principle, operation, armature reaction, circuit model, determinations of parameters of the circuit model and phasor diagram, methods of determining the regulations and efficiency, Parallel operation of alternators - synchronization and load division.

Unit V: Synchronous Motor:

Construction, principle of operation, working, starting methods, torque equation - V-curve, Inverted V curve & power angle characteristics, hunting & damping, applications. Transient, sub transient & steady state reactance of synchronous machines.

Unit VI: Special Motors:

Construction, working principle, operation, characteristics and applications of Universal motor, Reluctance Motor, Permanent Magnet Synchronous Motor & BLDC Motor.

Text Books:

1. D.P.Kothari & I.J. Nagrath, "Electrical Machines"- 5thEdition, TMH Publication.
2. S. Langsdorf, "Alternating Current Machines", McGraw Hill Publication

Reference Books:

1. Stephen D. Umans, "Fitzgerald and Kingsley's Electric Machinery", 7th Edition, McGraw Hill Publication,
2020.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. C L Dawes, "A Course in Electrical Engineering (Volume -2)", McGraw Hill Publication.

5EP04 Professional Elective-I SIGNALS AND SYSTEMS

Course Outcomes :

After completing this course student will be able to

1. Demonstrate knowledge of continuous-time and discrete-time signals and systems.
2. Analyze the continuous-time systems using continuous Time Fourier transform.
3. Explain the concept of sampling, Sampling Theorem, aliasing and the Nyquist rate.
4. Analyze DT systems & their realization using Z-transforms.
5. Analyze the discrete time systems using DTFT and DFT

Unit I: Introduction to Signals and Systems: Classification of Signals Classification of Systems, Systems Modeling Some Ideal Signals, Energy and Power Signals Frequency Response, Discrimination of Continuous-Time Signals Topological Models, Analysis of Continuous-Time Systems Properties of Elementary Signals Linear Convolution Integral, Response of Continuous-Time Systems

Unit II: Fourier Transform Properties of Fourier Transform, Tables of Fourier Transform Pairs Fourier Transform of Periodic Signals, Ideal Low-Pass Filter Frequency-Domain Analysis of Systems Fourier analysis of Sampled Signals

Unit III: Analysis of LTI Discrete-Time Systems: Time Domain and Frequency Domain, Properties of Discrete- Time Sequences Linear Convolution, Discrete-Time System Response.

Unit IV: Sampling: Representation of continuous time signals by its samples, reconstruction of a signal from its samples, aliasing, discrete time processing of continuous time signals, sampling of discrete time signals

Unit V: Z- Transform: Z- transform, the region of convergence for the z-transform, Inverse z-transform, properties of Z transform, analysis and characterization of LTI systems using z transforms, System function algebra and block diagram representations, the unilateral z –transform.

Unit VI: Discrete Fourier Transform and Fast Fourier Transform Representation of Discrete-Time aperiodic signals and the Discrete-Time Fourier Transform; Fourier Transform for Periodic

Signals; Properties of the Discrete-Time Fourier Transform; Discrete-Time LTI Systems and Discrete-Time Fourier Transform. Fast Fourier Transform (FFT)

Text Books:

1. Alan Oppenheim &Alan Willsky ,"Signals and Systems" Prentice Hall India Learning Private Limited; 2nd edition
2. P. Ramesh Babu R. Ananda Natarajan "Signals and Systems**."** Scitech Publications

Reference Books:

1. Fred Taylor,Principles of Signals and Systems "Tata McGraw-Hill, 1998, New Delhi
2. Nagrath, Sharan, Ranjan Rakesh and Kumar Sukhbinder" Signals and Systems" Tata McGraw-Hill, 1998, New Delhi.
3. S Haykin and B Van Veen, "Signals and Systems "John wiley & sons

5EP04 Professional Elective - I

2. NETWORK ANALYSIS AND SYNTHESIS

Course Outcomes :

After completing this course student will be able to

1. Analyze the transient response of series and parallel A.C. circuits
2. Demonstrate the properties of network functions.
3. Demonstrate the properties of positive Real Functions
4. Synthesize driving point functions of RL, RC and RLC
5. Synthesize two port network functions
6. Design passive filters to meet desired specifications

Unit I: Transient Analysis:

Transient response of RC, RL and RLC circuit to various excitation signals such as step, ramp, impulse and sinusoidal signals. Network solution with Laplace transformation, initial and final value theorem and convolution integral.

Unit II: **Network Functions:**

Network Functionsfor one port & two-port networks, poles and zeroes of network functions. Restrictions on poles and zeroes locations for driving point functions and transfer functions. Time domain behavior of electrical network from the pole- zeroes plot.

Unit III: Positive Real function: Driving point function, Brune's positive real function, properties of positive real function, testing of driving point function. An application of Maximum Modulus Theorem, properties of Hurwitz polynomial, computation of residue, even and odd functions

Unit IV: Synthesis of One Port Networks

Properties of LC, RC and RL driving point functions and their synthesis in canonical (Foster and Cauer) forms. Synthesis of RLC driving point functions which can be synthesized by partial fraction or continued fractions

Unit V: **Synthesis of Transfer Functions**

Properties of transfer functions, Zeros of Transmissions (ZOTs), synthesis of Y21 and Z21 with 1ohm termination. Synthesis of transfer functions using constant resistance single and double terminated lattice and bridge T networks. Synthesis of open circuit transfer function

Unit VI: Filter fundamentals

Classification of filters, Analysis of prototype filter section, Analysis of a prototype Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop Filter, M-Derived Filter, Low Pass Filter with RC and RL Circuits, High Pass Filter with RC and RL Circuits, Low Pass Filter with RLC Circuit. Introduction of Different Types of Active Filters

Text Books :

1. Van Valkenberg, “Network Analysis”,, Prentice Hall of India (PHI)
2. Sudhakar and Shyammohan,“Circuits and Networks: Analysis and Synthesis ,McGraw-Hill Education

Reference Books:

1. Van Valkenburg “Introduction to Network Synthesis”, Prentice Hall of India (PHI)
2. Kelkar, Pandit, “Linear Network Theory”, Pratibha Publication.
3. Franklin Kuo, “Network Analysis and Synthesis”, Wiley international.
4. A.Chakrabarti, “Circuit Theory” Dhanpat Rai & Co.
5. C.L Wadhwa, “Network Analysis and Synthesis” New Age International Publishers, 2007.

5EP04 Professional Elective – I

3. ELECTRONIC COMMUNICATION THEORY

Course Outcomes:

After successfully completing the course, the students will be able to

1. Explain various types of signal & elements of communication system.
2. Analyze the signal using Fourier Transform
3. Apply Amplitude modulation & Frequency modulation on the communication signal
4. Compare Pulse communication & Digital communication
5. Describe microwave communication system.

Unit I: Introduction to Electronics Communication Systems:

Signals: Analog & digital, Deterministic & Non-deterministic, Periodic & non periodic,Elements of Communication Systems, Transmitter, Receiver, Need for Modulation, bandwidth requirements, Noise, External, internal noise, noise calculation, noise figure.

Unit II: Signal Analysis:

Fourier Series, Exponential Fourier Series, Fourier Transform, Properties of Fourier Transform, Dirac Delta Function, Fourier Transform of Periodic functions, Fundamental of Power Spectral Density & Energy Spectral Density.

Unit III: Amplitude Modulation:

Amplitude Modulation Theory, Generation of Amplitude Modulation, Single Side band Communication, suppression of carrier, suppression of unwanted sideband, AM receiver.

Unit IV: Frequency Modulation:

Theory of Frequency Modulation, characteristics of FM, Generation of FM, pre-emphasis, De-emphasis, wide &Narrowband FM Transmission, FM receiver.

Unit V: A. Pulse Communication:

Information Theory, Classification of pulse modulation, Sampling process, pulse amplitude modulation, PWM and PPM modulation pulse code modulation.

B. Digital Communication:

Fundamentals of data communication systems, data sets and interconnection requirements.

Unit VI: Microwave communication system

Analog microwave communication: LOS, OTH microwave system Satellite communication: Satellite orbits, frequencies, attitude, transmission path.

Text Book: Electronic Communication System by Kennedy, Davis, TMH

Reference Books:

1. Electronics Communication by K.Shoenbcle PHI, India.
2. Electronics Communication techniques, Paul Young, Willey Eastern Pub.
3. Principle of C.E TMIL Taub Schilling.
4. Electronics Communication - Robert Shrader McGraw Hill.

5FEEP05 Open Elective – I

1. ELECTRICAL DRIVES

Course Outcomes:

After completing this course, Students will be able to:

1. Explain the basic Concept of electrical drives
2. Describe Power Electronics devices & their Applications
3. Demonstrate various starting, braking and speed control methods of D.C. Motors
4. Demonstrate various starting, braking and speed control methods of three phase Induction Motor.

5. Describe the construction, working principle and applications of single phase Induction Motor& special motors.

Unit I: Concept of electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Types of duties: continuous, intermittent and short time. Selection of an electric drive for particular applications.

Unit II: Theory, principle, Characteristics of Power Transistor, SCR, Power MOSFET and IGBT. Introduction to single phase & three phase fully controlled bridge convertors.

Unit III: D.C. Motors: Types, characteristics, Torque equation, Starting and braking, Speed controland Applications.

Unit IV: Three phase Induction Motors: Types, construction, principle of working, characteristics and applications. Starting and braking. Speed control methods: Thyristorized stator voltage control of three phase induction motor.

Unit V: Single phase Induction Motors: Double revolving field theory, Cross field theory,types, construction, principle of working, starting methods and applications.

Unit VI: Special Motors: Construction, Principle of working, and applications of D.C. servo motors, stepper motors, Brushless D.C. motors and Universal motor.

Text Books :

1. S.K.Pillai : A First Course on Electrical Drives by New Age International Publishing Co. Ltd
2. I.J.Nagrath & D.P.Kothari : Electric Machines by Tata Mc Graw Hill Publishing Co Ltd

Reference Books :

1. VedamSubrahmanyam: Electric Drives : Concepts & Applications by Tata Mc Graw Hill Publishing Co Ltd.
2. Ion Boldea, Nasar. S A : Electric Drives by CRC Press India
3. Ashfaq Husain: Electric Machines by Dhanpat Rai & Co. Ltd
4. M.D.Singh &K.B.Khanchandani : Power Electronics by Tata Mc Graw Hill Publishing Co Ltd
5. V.K.Mehta: Principles of Electronics by S.Chand and Co Ltd ,New Delhi

5FEEP05 Open Elective-I:

2. POWER SUPPLY SYSTEM

Course Outcomes:

After completing this course student will be able to

· Describe the Structure of Power system

· Explain construction and working of various generation plants

· Describe layout and working of Substations

· Compare various power distribution system

· Explain Electrical wiring required for various Installations

Unit I: Structure of Power System :

Generation, transmission and distribution. Power generating stations – different types. Steam power stations: Main parts and working, Water tube boiler, Fire tube boiler and their characteristics. Main flow circuits of steam power station. Power station auxiliaries,

Unit II: Gas-turbine power stations:

Main parts, plant layout and Bryton cycle operation. Combined cycle generation & Cogeneration. Nuclear power stations- Layout of nuclear power station, types of power reactors, main parts and control of reactors, nuclear waste disposal, radioactivity and hazards.

Unit III: Hydro-electric stations:

Site selection, constituents and schematic arrangement of hydroelectric stations, principles of working, types of turbines, Layout and working of Pumped storage plant.

Unit IV: Substation:

Classification of substations, Major equipment, Selection & location of site for substation, Main Electrical connections, Symbols for various apparatus & circuit elements in substation, 66/11kV and 11kV/400V substation Key diagram, Busbar layouts. Auxillary supply, substation earthing

Unit V: Power distribution system:

Primary and secondary distribution, types of conductors in Distribution system. Connection Scheme: radial, parallel, ring main, comparison of distribution systems

Unit VI: Electrical wiring and installation:

Domestic, commercial and industrial wiring, main, sub-main and sub-circuit wiring.Types and need of Earthing.Fuse and disconnecting devices. Electrical Safety precautions.

Text Books :

1] Principles of Power System, by V K Metha and RohitMetha, S Chand Publication

2] Generation of Electrical Energy, by B R Gupta, S Chand Publication

Reference Books :

1] A Course in Power System J B Gupta, S Chand Publication

2] Elements of Electrical Power Station Design, by M. V. Deshpande, Wheeler publications

3] Electrical Installation Estimating & Costing by J. B. Gupta

4] Transmission & Distribution by H. Cotton.

5FEEP05 Open Elective – I

3. POWER PLANT ENGINEERING

Course Outcomes: -

1) Describe different Sources of Energy Generation

2) Explain the Working and layout of steam power plant & hydro power plant.

3) Discuss the working principle and basic component of Nuclear, Diesel & gas power plant

4) Illustrate various terms related to power plant economics & tariff.

Unit-I: Introduction:

Energy resources and their availability, types of power plants, selection of the plants, Introduction to basic thermodynamic cycles used in power plants, Conventional and non-conventional energy sources, Indian Energy Scenario.

Unit-II: Hydro Electric Power Plant:

Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, Layout of Hydro power plant, operation of different components of hydro-electric power plant , classification of hydro Electric power plant, Pump Storage Plant, site selection, advantages & disadvantages

Unit-III: Steam Power Plants:

Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, Layout of Thermal power plant , Site selection, coal storage, coal handling systems, ash handling systems, working of various parts: Economizer, air preheater, condenser, cooling tower, Electrostatic Precipitator, advantages & disadvantages

Unit-IV: Nuclear Power Plants:

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium-Uranium reactor (CANDU) fast breeder reactor, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

Unit-V: Diesel & Gas power plant:

Layout of Diesel power plant, functions of different components of diesel plant, advantages & disadvantages, Principle of Operation of Gas Turbine Plants, Open cycle gas turbine plant, closed cycle gas power plant, Combined gas and steam cycle.

Unit-VI: Power Plant Economics:

Load curve, energy load curve, energy duration curve, connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor, types of loads, operating cost, annual plant cost, Generation cost, Depreciation, Objectives of Tariff, Types of Tariff.

Text Books:

1. Generation of electrical energy by B.R.Gupta, Eurasia Publishing House, New Delhi.
2. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications.

Reference Books:

1. Non conventional energy resources. By G.D.Rai, Khanna Publishers New Delhi
2. Principles of Power System by V.K.Mehta, S.Chand publication.
3. Conventional energy technology by S.B.Pandya, Tata McGraw Hill Publication.
4. Power Plant Engineeirng. P. K. Nag.

5EP06 POWER SYSTEM – I LAB

Student should perform minimum eight practicals based on the syllabus

List of Experiments:

1. To study the performance of a transmission line using a nominal T model.
2. To study the performance of a transmission line using a nominal π model.
3. To calculate A,B,C,D parameters for a transmission line by using nominal T model
4. To calculate A,B,C,D parameters for a transmission line by using nominal π model.
5. To study skin effect, proximity effect and Ferranti effect in transmission line.
6. To study Corona phenomenon and corona loss and its control in transmission line.
7. To study conversion of single line diagram to impedance diagram and reactance diagram for a typical power system.
8. To draw the circle diagram for a typical power system.
9. Study of a tap changing transformer (ON load and OFF load tap changing).

10. Study of static VAR generator and synchronous condenser.

11. To study different types of insulators used in power system & their comparison.

12. To conduct a dry and wet test on a pin type insulator.

13. To conduct a flashover test on an insulator.

14. To study a horn gap.

15. To study different types of power cables.

16. To study testing of cables.

17. To draw different Tower structures

Note: Above experiments may be conducted by using models, simulation, numerical, drawing sheets or experimentation.

5EP07 MICROPROCESSOR & MICROCONTROLLER- LAB

List of Experiments:

Student should perform minimum eight practicals based on the syllabus

1. Write an Assembly Language Program for the Addition of two 8-bit/16-bit numbers
2. Writean Assembly Language Program for the Subtraction of two 8-bit numbers
3. Write a Program for Finding the larger and smaller one among the two 8- bit numbers
4. Write a Program for Finding the largest/smallest number in array of 8-bit numbers
5. Write a Program for Masking and setting of nibbles
6. Write a Program for Block data transfer in same and reverse order
7. Write a Program for Sorting of even and odd numbers from an array of 8-bit numbers
8. Write a Program for Multiplication of two 8-bit numbers
9. Write a Program for Square wave generation using 8255 PPI
10. Write a Program for Stepper motor control using 8255 PPI
11. Write a Program for Interfacing ADC with 8085/8051using 8255 PPI
12. Write a Program for Interfacing DAC with 8085/8051 using 8255 PPI
13. Write a Program for Lamp load control using 8255 PPI
14. Write a Program for measurement of DC Voltage /Current using ADC, 8255 PPI
15. Study of Architectural Differences: Microprocessor 8085, and Microcontroller 8051

5EP08 ELECTRICAL MACHINES-II LAB

Student should perform minimum eight practicals based on the syllabus**.**

List of Experiments:

1. Perform the load test on three phase IM & plot its performance characteristics.
2. Perform the No load test on three phase IM to separate out its no load losses.
3. Estimate the performance parameters of three phase IM from its circle diagram.
4. Plot the equivalent circuit of three phase Induction motor.
5. Study of different types of starters used for three phase IM

6. Speed control of three phase squirrel cage Induction motor by various methods like stator voltage control method, frequency control method, changing number of poles.
7. Speed control of three phase Induction motor.
8. Perform the electric braking of three phase Induction motor.
9. Perform the load test on single phase IM & plot its performance characteristics.
10. Load test on three phase alternator to determine its performance parameters.
11. Synchronize the three-phase alternator with infinite bus-bar
12. Perform the OC & SC test on synchronous generator to estimate its regulation by EMF & MMF methods
13. Estimate the regulation of three phase alternator using ZPF method.
14. Perform the load test on three phase Synchronous motor.
15. Plot the V & inverted V curves of synchronous motor.

5EP09 INFORMATION & COMMUNICATION TECHNOLOGY - LAB

Student needs to complete minimum eight assignments based on the following:

Word Processing with MS-Word:

· Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
· Working with tables, figures, images.
· Mail merge. Working with Charts, Equations, symbols.

Working with workbooks /work sheets.

· Data Entry techniques & Defining data set as a Table.
· Setting, Previewing, and Printing under MS-Excel.
· Performing Calculations, using Excel Formulas, Functions and Charts.
· Sorting/ Filtering data in excel sheet.

Working with MS Power Point.

· Presentation Basics. Adding more components to the slides, Printing the slides.
· Formatting Presentations, backgrounds and layout. Applying Themes. Using Slide Master.
· Working with Graphics, Images and Clips.
· Working with Multimedia. Inserting Sound and Narration.
· Delivering Presentations. Animating Objects. Adding Action effects.
· Live Presentation. Using Custom Shows.
· Saving/Protecting the Presentation.

Working with Latex:

· Basic operations- Editing and Formatting text, paragraphs and pages, printing the documents.
· Working with tables, figure & images.

Web Page Development:

· Introduction to HTML, CSS, JAVA Coding.
· Development of Web page

Semester VI

6EP01 POWER ELECTRONICS

Course Outcomes:

After completing this course student will be able to

1. Explain the concepts and techniques used in power electronics
2. Apply the knowledge of series and parallel connection of SCRs in power control applications
3. Analyze various single phase and three phase power converter circuits
4. Analyze the single phase and three phase Inverter circuits
5. Explain the operation of DC/DC and AC/AC converter circuits
6. Demonstrate the applications of power electronic circuits.

Unit I: SCR, Triac, Diac – Construction and Applications, two Transistor Analogy of SCR, SCR turn ON mechanism, different methods for turning ON SCR, turn OFF mechanism, Thyristor firing circuits, introduction tomPower MOSFET and IGBT their construction and characteristics.

Unit II: Series-Parallel operation of SCRs, firing circuits for series and parallel operations, static and dynamic equalizing circuit, equalization of current in parallel connected SCRs ,string efficiency, de-rating factors, protections of SCRs against di/dt, dv/dt, over-voltage and over-current protection, Gate protections, Electro Magnetic Interference(EMI) and Shielding.

Unit III: Principle of phase control, half wavecontrolled rectifier, half controlled bridge and fully controlled bridge rectifier for R, RL and RLE load, derivation for output voltage and current, effect of freewheeling diode, effect of source inductance. Three phase half controlled bridge and fully controlled bridge rectifier.

Unit IV: Classification of circuit for forced commutation, series inverter, improved series inverter, parallel inverter, single phase PWM inverters, principle of operation of three phase bridge inverter in 1200 and 1800mode,single phase transistorized bridge inverter.

Unit V: Basic principle of Chopper, Time ratio control and current limit controlled technique, Voltage commutated Chopper circuit, Jones Chopper, Step up Chopper, Step down Chopper and AC Chopper.

Unit VI: Basic principle of cycloconverter, single phase to single phase cycloconverter, Introduction, principle of operation of single-phase voltage controllers for R and R-L load Speed control of DC series motor using chopper, Speed control of DC shunt motor using phase controlled rectifier.

Speed control of three phase Induction motor by stator voltage control method, V/f control.

Text Books:

1. M.D. Singh & K.B. Khanchandani, “Power Electronics “Tata Mc-Graw Hill, New Delhi
2. Rashid Muhammad, H., “Power Electronics: Circuits, Devices and Applications”, 2nd Edition. Prentice- Hall, 1998

Reference Books:

1. Mohan Ned, Undeland Tore, M. and Robbins William, P., “Power Electronics: Converter, Applications and Design”, John Wiley & Sons, 1994.

2. LandevCyrill, W., “Power Electronics”, McGraw Hills, London, 1981.

3. Dewan, S.B. and Satrughan A., “Power Semiconductor Circuits”, John Wiley & Sons,

4. Dubey, G.K., Doradlla, S.R., “Thyristerised Power Controllers”, Wiley Eastern, 1987.

6EP02 ELECTRICAL ENERGY DISTRIBUTION & UTILISATION

Course Outcomes:

After completing this course, Students will be able to:

1. Demonstrate the knowledge of distribution substation
2. Compare different power distribution systems
3. Describe elements of distribution Automation system
4. Select proper electrical drive for industrial applications
5. Explain the workingof electric traction system
6. Describe an illumination system & electric heating

Unit I: Substation: Selection & location of site, classification, major equipment ,graphical symbols for various apparatus & circuit elements ,key diagram for 33/11kV substation along with selection & specification of substation equipment, types of bus-bar arrangements, substation earthing. Introduction to Gas Insulated Substation (GIS).

Unit II: Power distribution system -I: Primary and secondary distribution, types of conductors in Distribution system, comparison of distribution systems radial, parallel and ring main, economics of feeder design.

Unit III: Power distribution system - II: Methods for reduction of line losses in distribution system. Introduction to High Voltage Distribution System (HVDS). Distribution Automation: Need for distribution automation, feeder automation, and communication requirements for Distribution automation, Remote terminal unit (RTU). Introduction to SCADA systems.

Unit IV: Electrical Drives: Concept, types, selection criterion for electrical drive. Types of duties, rating calculations for these duties. Heating and cooling. Industrial applications: Textile mill, Cement mill, Sugar mill.

Unit V: Traction System: Requirement, speed- time curves. General features, types, Quadrantal diagram of speed torque characteristics of traction motors. Control of traction motors: Series-Parallel control. Different accessories for track electrification –overhead wires, conductor rail system, current collector-pantograph

Unit VI: Illumination : Street lighting**:** Principle, illumination level, mounting height of lamps, spacing, types of lamps. Flood lighting: Flood lighting calculations, waste light factor, Depreciation factor, Utilization factor. LED: Working principle, advantages & applications.

b) **Electric Heating**:Resistance& Induction heating & its applications.

Text Books:

1. S.K.Pillai, “A First Course on Electrical Drives”, New Age International Publication
2. J.B.Gupta, “A Course in Power System”, S.Chand Publication

Reference Books:

1. M.V.Deshpande, “Electrical Power System Design”, TMH Publishing Company Ltd
2. S.Sivanagaraju&S.Satyanarayana, “Electric Power Transmission & Distribution” Pearson Publication
3. P. S. Satnam&P.V.Gupta, “Substation design & Equipment” Dhanpat Rai Publication.
4. J.Upadhyay&S.N.Mahendra : Electric Traction by Allied Publishers Ltd
5. J.B.Gupta :Utilization of Electric Power & Electric Traction by S.K.Kataria& Sons, New Delhi.
6. H.Pratap :Art & Science of Utilization of Electrical Energy by Dhanpat Rai & Company Ltd.
7. H Pratap, “Modern Electric Traction” Dhanpat Rai & Sons Ltd
8. Dr.M.K.Khedkar&Dr.G.M.Dhole : A Textbook of Electrical Power Distribution Automation by University Science Press
9. S.L.Uppal: Electrical Wiring, Estimating and Costing by Khanna Publishers.

6EP03 COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Course Outcomes:

After completing this course, student will be able to

1. Explain the Basics of Computer aided machine design & material selection.
2. Derive the design parameters of single & three phase transformer core.
3. Calculate the winding& cooling system parameters of the transformer
4. Develop the armature winding diagram for three phase Induction Motor
5. Determine the stator core dimensions of three phase Induction motor
6. Design the squirrel cage & wound type rotor for three phase Induction motor

Unit I: Introduction :

Review of transformer & Induction motor constructional features, Major considerations in electrical machine design, optimization, electrical engineering materials: Conducting, Insulating & Magnetic Materials,Limitations of traditional design, need for CAD, analysis, synthesis and hybrid methods of CAD, Introduction to FEM based machine design.

Unit II: Transformer Design –I:

Transformer Core Design - Material selection, type of construction, Specific magnetic & electric loadings, output equation, core and yoke cross sections, window dimensions, overall core dimensions calculations, core loss estimation from design data. Optimum core design for Minimum cost, Minimum losses, Minimum weight & Minimum volume.

Unit III:Transformer Design – II:

Transformer Winding - types, and design calculation, Layout, no-load current calculation, primary and secondary winding resistance and leakage reactance from design data, mechanical forces – types

& causes.Estimation of efficiency & regulation from design data. Cooling methods for a transformer, design of transformer tank. Calculation of cooling tubes.

Unit IV: AC winding Design :

Concentrated & distributed winding, Integral slot & fractional slot winding, Full pitch & short pitch windings, Single layer& double layer winding, distribution factor, coil pitch factor and winding factor, EMF equation, Development of winding diagrams.

Unit V: Induction motor stator design:

Specific electric and magnetic loadings selection, output equation, main dimensions (D&L) calculation, stator slotnumbers, shape and dimensions, stator teeth dimension, stator core dimensions.Air gap length calculation.

Unit VI: Induction motor rotor design:

Squirrel cage rotor design –selecting number of rotor slots, design of rotor bars & slots, design of end rings.

Wound type rotor design - rotor winding design, rotor slots design, and rotor core design. Bearings, shaft design.estimation of no-load current, stator and rotor winding resistances from design data, dispersion coefficient & its effect on performance of IM.

Text Books:

1. A. K. Sawhney, "A Course in Electrical Machine Design" Dhanpat Rai & Co Ltd, 2016
2. R.K.Agrawal, "Principles of Electrical Machine Design", S.K.Kataria and Sons, Delhi

Reference Books:

1. M.G.Say,"The Performance and Design of Alternating Current Machines", C.B.S. Pub., Delhi.
2. K.G.Upadhyay,"Design of Electrical Machines", New Age international Publishers,1st Edition 2008
3. S.K.Sen,"Principles of Electrical Machine Design with Computer Programs", Oxford and I.B.H. Company Pvt. Ltd., New Delhi
4. IndrajitDasgupta, "Design of Transformers", TMH 1st Edition 2002
5. Indian Standards for Transformer & Three phase IM design from BIS websites

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6EP04 Professional Elective - II

1. ADVANCED CONTROL SYSTEMS

Course Outcome

After completing this course students will be able to

1. Design compensator using time domain and frequency domain specifications
2. Represent system using state space model
3. Analyze controllability and observability for systems and design full state feedback controller.
4. Analyze digital systems using Z Transform
5. Develop the describing function for the nonlinearity to assess the stability of the system.

6. Analyzethe Nonlinear system using Phase plane Analysis

Unit I: Compensation Techniques:

Introduction, preliminary consideration of classical design. Lead compensator, Lag Compensator, Lead-Lag compensator, Feedback compensation in frequency domain.

Unit II: State Space Technique I:

State, state space and state variables ,SISO /MIMO linear systems state Variable models- differential equations, transfer functions, block diagrams And state diagrams. Transfer function decomposition – Phase variable Forms,canonical forms and Jordan canonical forms, STM computation, L.T, Canonical transformation, and Cayley Hamilton theorem. Time Response –SISO systems.

Unit III: State Space Technique II:

Concept-controllability and observability , SISO/ MIMO linear Systems Gilbert's method and Kalman's test; SISO controllable Systems design –state feedback.

Unit IV: Sampled Data Control Systems:

Representation, Z transform, Sampler and hold, ZOH, Open loop and closed loop SDCS,

Z transfer Function, difference equation, solution, Pulse transfer function, Stability Analysis, S and Z domain relationship, Jury's test, and bilinear Transformation. Root locus method.

Unit V: Non-Linear System Analysis I:

Non linear system behaviour, types and characteristics, Describing function Stability analysis limit cycles, Limitation of Describing function.

Unit VI: **Non-Linear System Analysis II**:

Linearization, Singular points, Classification and nature, Phase plane method, non linear system analysis, Phase trajectories, construction –analytical and graphical method by isoclines, stability analysis, limit cycles, limitations – phase plane method.

Text Books:

1. Nagrath and Gopal, "Control system Engineering" Wiley Eastern Ltd , New Delhi
2. K.Ogata," Modern Control Theory "Prentice Hall Of India Pvt Ltd , New Delhi.

Reference Books:

1. Naresh Sinha. "Control system Engineering" Wiley Eastern Pvt. Ltd., New Delhi.
2. B.C. Kuo. "Automatic Control system" Prentice Hall Of India Pvt Ltd Delhi
3. D Roy Choudhury, "Modern Control Engineering"Publisher: PHI Learning.

6EP04 Professional Elective – II:

2. PROCESS CONTROL SYSTEMS

Course Outcomes:

After Completing this course student will be able to

1. Explain the various Electronic Instruments for measurement of electrical parameters.
2. Analyse the different signals
3. Demonstrate the signal counting, recording and working of digital readout devices.

4. Demonstrate the Various techniques of A/D and D/A conversions.
5. Apply various signal processing tools as per requirement
6. Develop ladder diagrams &programmes for PLC

Unit I : Electronics Instruments for Measurement of Electrical Parameters Advantages of Electronic Instruments, Electronic Voltmeters Electronic Multi-meter, differential volt meter, Digital voltmeter, Q meter, vector impedance meter, vector voltmeter.

Unit II: Signal Generation and Analysis Signal generators, Function generators. Wave analyzer Harmonic Distortion Analysers, Spectrum Analysis.

Unit III: Signal Counting and Recording Decade counting Assembly, Binary counter, Decimal counter, Decade counter with digital display, universal counter, Digital readout devices, storage type CRO, Servo type X-Y recorder.

Unit IV: Signal conditioning and Conversions. Frequency characteristics of various types of signals, active filters bandpass, low pass and high pass filters using opAmps. Various techniques of A/D and D/A conversions. Modulation and demodulation PCM techniques, phase locked loop.

Unit V: Signal Processing Pulse times, triggered delayed sweeps, discrete pulse delay circuits, pulse sequencing, analog multiplexers and de-multiplexers, digital multiplexing sample and hold circuits, serial and parallel digital data conversion. Signal transmission, Analog and digital telemetry techniques, MODEM and UART, keyboard and character generators, tape recorder,

Unit VI : Introduction to Processor and Processor based Techniques. Introduction to PLC, PLC architecture, programming; ladder diagram and examples, micro controller based instrumentation

Text Books:

1. H.S. Kalsi – Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.
2. Cooper, Helfrick – Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India. New Delhi.

Reference Books: -

1. B.R. Gupta-Electronics and Instrumentation – Wheeler Publishing.
2. Rangan, Sharma & Mani – "Instrumentation – devices & Systems." Tata Mc-Graw Hill Publishing Company, New Delhi.
3. R.P. Jain-Digital Electronics, Tata Mc-Graw Hill Publishing Company, New Delhi.
4. Microprocessors and Digital Systems, by:D.V.Hall,TMH Publishing Company, New Delhi.
5. Shoen Beck- Electronic Communication, Prentice Hall of India. Pvt. Ltd. New Delhi.
6. B. Ram- fundamental of Microprocessors, Dhanpat Rai & Sons, New Delhi.
7. A.K. Sawhney – A Course in Electrical & Electronics Instrumentation, Dhanpat Rai & Sons, New Delhi

6EP04 Professional Elective – II

3. INDUSTRIAL ELECTRICAL SYSTEM

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the electrical wiring systems for residential, commercial and industrial consumers.
2. representing the systems with standard symbols and drawings, SLD.
3. Understand various components of industrial electrical systems.
4. Analyze and select the proper size of various electrical system components

Unit I: Electrical System Components :

LT system wiring components, selection of cables, wires, switches, distribution box, meteringsystem, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse currentcharacteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator,Relays, MPCB, Electric shock and Electrical safety practices

Unit II: Residential and Commercial Electrical Systems:

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Unit III: Illumination Systems:

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Unit IV: Industrial Electrical Systems – I:

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC,MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Unit V: Industrial Electrical Systems – II:

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing theDG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit VI: Industrial Electrical System Automation:

Study of basic PLC, Role of in automation, advantages of process automation, PLC basedcontrol system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text Book: S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & Costing”, Khanna publishers, 2008.

Reference Books:

1. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.

2. S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co.,

3. Web site for IS Standards.

4. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.

6FEEP05 Open Elective – II

(1) ENERGY AUDIT AND MANAGEMENT

Course Outcomes:

After completing this course student will be able to:

1. Discuss energy scenario and its management.
2. Conduct the energy audit of different systems.
3. Determine the economics of energy conservation
4. Discuss various energy Conservation methods & their case studies
5. Explain fundamentals of Harmonics.

Unit I : Energy Scenario & Management:

Indian energy scenario, Energy needs of growing economy, Energy pricing in India Energy sector reforms, various forms of energy, Primary and secondary energy, commercial and non-commercial energy, Global primary energy reserves, Energy and environment, Necessity of conserving energy, Energy strategy for the future, Electrical energy management, Concept of supply side management and demand side management, Methods of implementing Demand side management and advantages to consumer, utility and society.

Unit II: Energy Audit:

Definition, Need of energy audit, Preliminary and detailed energy audit. Procedure for carrying out energy audit Instruments used for energy audit, Data Analysis-Energy— production relationship, specific energy consumption, Sankey diagram, CUSUM Technique, Bench marking energy performance, Recommendations for energy conservation, Action plan, Executive Summary.

Unit III: Economics of energy conservation:

Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, internal rate of return method, Profitability index for benefit cost ratio

Unit IV: Energy Conservation:

Energy conservation in motive power, Illumination, Heating & cooling systems, Pumping systems, thermal power stations and Transmission & Distribution Sector. Cogeneration &Waste heat recovery systems.

Unit V: Energy Audit Case Studies:

Energy Intensive Industries, Commercial, Industrial, Municipal and Agriculture Sector, IT industries, Hospitals

Unit VI: Fundamentals of Harmonics:

Harmonic distortion, voltage versus current distortion, Power systems quantities under non sinusoidal conditionsactive reactive and apparent power, displacement and true power factor, harmonic phase sequences, triplen harmonics, harmonic indices- Total harmonic distortion (THD), Total demand distortion (TDD) , Harmonic sources
from commercial and industrial load.

Text Book: Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, Book-2, Book-3, Book-4 (available online BEE website)

Reference Books:

1. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.
2. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)
3. Energy Conservation and Audit ByThumman, Fairmont Press
4. Energy Audit and Conservation TERI

6FEEP05 Open Elective – II

(2) ELECTRICAL ESTIMATING & COSTING

Course Outcomes:

After completion of the course students will be able to

1. Understand methods of installation and estimation of service connection
2. Decide type of wiring, its estimation and costing for residential building
3. Carry out electrification of commercial complex, factory unit installations
4. Design & estimate for feeders & distributors
5. Understand contract, tendering and work execution process.

Unit I: Electrical Installation:

Classification of Electrical Installation, General requirement of Electrical Installation. Important definitions related to Installation. Service Connection: Concept of service connection, Types of service connection & their features. Methods of Installation of service connection. Estimation of service connection.

Unit II : Residential Building Electrification :

Procedures for designing the circuits and deciding the number of circuits. Selection of type of wiring and rating of wires & cables. Earthing of Residential Installation. Estimate and cost Preparation of Residential Installation.

Unit III: Electrification of commercial Installation:

Concept of commercial Installation. Differentiate between electrification of Residential and commercial Installation Deciding the size of cables, busbar and busbar chambers. Earthing of the electrical Installation Selection of type wire, wiring system.Preparation of detailed estimate and costing of commercial Installation.

Unit IV: Electrification of factory unit Installation:

Concept of Industrial load. concept of Motor wiring circuit.Important guidelines about power wiring and Motor wiring.Selection and rating of wire, cable size. Sequence to be followed to prepare estimate. Preparations of detaile estimate and costing of small factory unit/ workshop.

Unit V: Design & estimate for feeders &distributors:

Different schemes for feeders & distributors, estimates for different feeders & distributors, Distribution transformer, Deciding Size & location, Estimate for outdoor & indoor type distribution substation.

Unit VI: Contracts, Tenders and Execution:

Tender and tender notices. Procedure for submission and opening tenders. Comparative statements, criteria for selecting contractors, General conditions in order form. Principles of Execution of works administrative approval, technical sanctions. Billing of executed work.

Text & Reference Books:

1. Electrical Design; Estimating and costing by K.B. Raina, S.K.Bhattacharya New Age International (p) Limited, New Delhi.
2. Electrical Estimating and costing by Surjit Singh Dhanpat Rai and company, New Delhi
3. Electrical Estimating and costing by N. Alagappan S. Ekambaram, Tata Mc Graw Hill Publication New Delhi

6FEEP05 Open Elective - II

3. ELECTRICAL MATERIALS

Course outcomes:

After completing this course students will be able to

1. understand importance of electrical engineering materials
2. understand how electric conduction takes place in conductors
3. understand importance of semiconductors and magnetic materials in electrical engineering.
4. understand importance of dielectric materials in electrical engineering.
5. Identify the need of special materials in electrical engineering

Unit-I Introduction to Electrical Engineering Materials:

Importance of materials, Classification of electrical materials, Scope of electrical materials, Requirement of Engineering materials.Types of engineering materials, Levels of material structure.

Unit-II Conducting Materials:

Review of metallic conduction on the basis of free electron theory. variation of conductivity with temperature and composition, materials for electric resistors- General Electric properties; material for brushes of electrical machines, lamp filaments,fuses and solder.

Unit-III Semiconductors:

Semiconductors: Mechanism of conduction in semiconductors, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Unit-IV Magnetic Materials:

Classification of magnetic materials- origin of permanent magnetic dipoles, magneto materials used in electrical machines, instruments and relays. Magnetic Circuit terminology, Relation between relative permeability and magnetic susceptibility. Classification of
magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Antiferromagnetic. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss.

Unit-V Dielectrics & Insulating Materials:

Dielectrics, Factors influencing dielectric strength. Capacitor materials. Insulating materials, Insulating Materials: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators(transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.

Unit-VI Materials for Special Applications:

Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts.

Text & Reference Books:

1. Electrical Engineering Materials by Dekker A.J (PHI)
2. Electrical Engineering Materials by S.P.Seth (Dhanpatrai and Sons)
3. An Introduction to Electrical Engineering Materials by Dr. C. S Indulkar & Dr. S. Thiruvelgadam (S Chand
Publication)

6EP06 POWER ELECTRONICS LAB

Perform minimum eight experiments:

List of Experiments:

1. To verify the V-I characteristics of SCR
2. To verify forward and reverse characteristics of DIAC
3. To verify forward and reverse characteristics of TRIAC
4. To study UJT as relaxation oscillator
5. AC voltage control using triac - diac combination
6. To verify the operation of half and full controlled converter
7. To verify the operation of SCR commutation circuits
8. To design & simulate dc-dc buck converter
9. To design & simulate dc-dc boost converter
10. Construct and test the dc chopper control circuit using thyristor
11. Study of PWM based step down dc chopper using MOSFET/IGBT
12. To verify the operation of Single phase single pulse / sinusoidal PWM inverter using MOSFET/IGBT
13. To verify the operation of Single phase parallel inverter using MOSFET/IGBT

14. To verify the operation of Single phase to single phase cycloconverter

15. To verify the operation of Single phase dual converter With R - RL loads

16. To verify the operation of Single phase ac voltage controller

6EP07 ELECTRICAL ENERGY DISTRIBUTION & UTILIZATION LAB

Perform minimum eight experiments

List of Experiments:

1) Study of Distribution substation equipments.
2) Study of various types of busbar arrangements.
3) Study of Power distribution system.
4) Study of Distribution Automation system.
5) Prepare a report on visit to distribution substation.
6) Simulation of various types of Electrical Distribution System (Radial, Parallel, Ring main)
7) Development of single line diagram of of 33/11 kV substation in AutoCAD Electrical
8) Determination of Efficiency by Performing Load Test on Three-Phase Induction Motor.
9) Determination of Efficiency by Performing Load Test on DC Shunt Motor.
10) Electric Braking of DC.Shunt Motor.
11) Electric Braking of Three-Phase Induction Motor.
12) Speed Control of Three-Phase Slip-Ring Induction Motor.
13) Determination of Efficiency by Performing Load Test on Single-Phase Induction Motor.
14) Study of Electric Heating.
15) Design Scheme of Illumination System.
16) Study of Electric Traction System .

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6EP08 COMPUTER AIDED ELECTRICAL MACHINE DESIGN LAB

Develop Minimum Eight Computer Programme:

List of Computer Programme:

1. Develop a computer programme for core design of a single-phase core type transformer
2. Develop a computer programme for core design of a single-phase shell type transformer
3. Develop a computer programme for core design of a three-phase core type transformer
4. Develop a computer programme for optimum core design of a three-phase core type transformer for minimum cost or maximum efficiency.
5. Develop a computer programme for Estimation of Iron losses in a three-phase core type transformer.
6. Develop a computer programme for windings design of a single-phase transformer
7. Develop a computer programme for windings design of a three-phase transformer
8. Develop a computer programme for calculating the No load current of a single-phase transformer.
9. Develop a computer programme for calculating the No load current of a three-phase transformer.

10. Develop a computer programme for tank design and calculating the number of cooling tubes required for three phase core type transformer.

11. Develop a computer programme to calculate Main dimensions (D & L) of a three phase Induction motor.

12. Develop a computer programme for stator core design of three phase induction motor.

13. Develop a computer programme for squirrel cage rotor design of three phase induction motor.

14. Develop a computer programme for wound type rotor design of three phase induction motor.

15. Develop a computer programme for estimating magnetizing current of a squirrel cage type three phase induction motor.

6EP09 COMPUTER TECHNOLOGY- LAB

Student needs to complete minimum eight assignments based on the following:

· Computer Network: Basic hardware and terminology in networks, Classifications, The Internet, The Intranet and Extranet.

· Installation of operating systems, application software in Personnel Computer or laptop.

· Develop the simulation models for various tasks in electrical engineering using simulation software.

· Develop the computer programme for various tasks in electrical engineering using software.

· Study of PLCs used for Industrial automation & develop the ladder diagram for given task in automation using PLC.

· Basics of IoT, IoT based Monitoring & Controlling of various Electrical Equipments.

Syllabus of VII & VIII Semester B.E Electrical (Electronics & Power) (C.B.C.S.)

SEVENTH SEMESTER

7EP01 POWER SYSTEM-II

Course Outcomes:

After successful completion of this course, student will be able to:

1. Explain the basic Concept of Fault Analysis in Electrical systems.
2. Analyze the different types of symmetrical and Unsymmetrical Faults in Electric Power System.
3. Explain the concept of Power System Stability and synchronous machine parameter determination.
4. Analyze the steady state stability of system.
5. Assess transient state stability of two machine system.

Unit I: Basic Concepts: Symmetrical components Definition and choice, Alpha operator, transformation matrices, sequence components, power invariance, line and phase sequence quantities relations, three phase delta/star transformer bank- sequence voltages and currents relationship; power system elements – sequence impedance and sequence networks; Various three phase transformer connections – zero sequence rules;

Unit II: Symmetrical Fault Analysis: Symmetrical Fault Analysis Transmission line transients, three phase symmetrical short circuit at alternator terminals, Power system fault calculations, short circuit MVA, Current limiting reactors, ring system and tie bar system, Circuit breaker rating calculation.

Unit III: Unsymmetrical Fault Analysis: Unsymmetrical Fault Analysis L-G, L-L-G and L-L faults at unloaded generator terminals, Equivalent sequence network diagram, Fault impedance, Unsymmetrical faults through impedance, Power system faults loaded and unloaded conditions.

Unit IV: Fundamentals of Stability: Meaning of stability, Steady state, Transient and Dynamic stability limits; Three Phase Synchronous Machine-circuit representation, voltage equation and Park's Transformation; Reactance and Time Constants determination.

Unit V: Steady State Stability: Steady state stability limit-short transmission line, two machines system, Clarke's diagrams for system with and without loss, Conservative criterion, Synchronizing coefficients and Multi machine system. Short circuit ratio and automatic voltage regulator effects.

Unit VI: Transient State Stability: Transient state stability and equal area criterion, Swing equation and its pointby- point solution, Critical clearing angle and time. Type of faults, Grounding and high-speed re-closing effects, Stability improvement methods, and role of Digital Computers in stability studies

BOOKS RECOMMENDED:

Text Books:

1. D. P. Kothari, I. J. Nagrath, "Power System Engineering", TMH 3rd edition, 26th April 2019.

2. E W Kimbark, "Power System Stability", Vol.1 and 3, Dover Publications Inc., NewYork.

3. Prabha Kundur, "Power System Stability & Control", TMH, 11th reprint 2011.

Reference Books:

1. L.P. Singh, "Computer Aided Power System Operation and Dynamics", Wiley Eastern Ltd. New Delhi.

2. J.Nagrath and D.P.Kothari, "Modern Power System Analysis", Tata Mc-Graw Hill Publishing Company, New Delhi.

3. N. V. Ramana, "Power System Analysis", PEARSON education, 2010.

4. Arthur R. Bergen, Vijay Vittal, "Power System Analysis", 2nd Edition, 2009, PEARSON Education.

7EP02 DIGITAL SIGNAL PROCESSING

Course Outcomes: After successful completion of this course, students will be able to:

1. Analyze the discrete time signals in time domain.
2. Analyze the discrete time systems using DTFT and DFT.
3. Apply the concept of Band pass sampling.
4. Design the structures of different types of digital filters.
5. Analyze the frequency response of various digital filters.
6. Apply the knowledge of multi-rate signal processing.

Unit I: Introduction to DSP, Frequency domain description of signals &systems, Discrete time sequences systems, Linearity unit sample response, Convolution, Time invariant system, Stability criteria for discrete time systems, Solutions of linear difference equations.

Unit II: Fourier Transform**:** Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, DFT and its properties, Circular convolution, Linear convolution from DFT, FFT, decimation in time and frequency algorithm.

Unit III: Sampling of Band pass signals, Representation of Band pass signals, sampling of Band pass signals, discrete time processing of continuous time signal; Analog to digital conversion-sample and hold, quantization and coding, analysis of quantization errors, oversampling of A/D converter; Digital to Analog conversion sample and hold, first order hold, linear interpolation with delay, oversampling of D/A converter.

Unit IV: Filter categories, Direct form I, Direct form II, Cascade and parallel structure for IIR and FIR Filter, Frequency sampling structures for F.I.R. filter, Steps in Filter Design, Design by Pole Zero Placements, FIR filter design by Windowing Method, Rectangular, Triangular and Blackman window

Unit V: Analog filter types, Butter worth, Elliptic filter, Specification and formulae to Decide to filter order, Methods to convert analog filter into IIR digital, Mapping of differential, Impulse Invariant, Bilinear, Matched Z transformation.

Unit VI: Multirate DSP and Introduction to DSP Processor, Decimation by a factor D, interpolation by a factor I, sampling rate conversion by a rational factor I/D, Filter Design & Implementation for sampling rate conversion, Multi stage Implementation of sampling rate conversion. General Architecture of DSP, Case Study of TMS320C67XX.

BOOKS RECOMMENDED:

Text Books:

1. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithm and Applications”, (4th Edition), Prentice Hall, 2007

2. N. J. Fliege, “Multirate Digital Signal Processing: Multirate Systems - Filter Banks – Wavelets”, (1st Edition), John Wiley and Sons Ltd, 1999.

Reference Books:

1. S. K. Mitra, “Digital Signal Processing”, 3rdEdition, TMH Edition.
2. Ifaeachor E.C, Jervis B. W., “Digital Signal Processing: A Practical Approach”, Pearson Publication
3. S. K. Mitra, “Digital Signal Processing: A Computer Based Approach”, McGraw Hill, 2011.

7EP03 ENTREPRENEURSHIP AND PROJECT MANAGEMENT

Course Outcomes: After successful completion of this course, students will be able to:

1. Understand the concept of entrepreneurship and its role in economic development.
2. Compare the various business model and select the most suitable.
3. Identify & formulate the project report and Source of finance for a project.
4. Estimate the cost, time & resources for the project work.

Unit I: Entrepreneurship: Introduction to Entrepreneurship, Meaning and concept of entrepreneurship, Need o Entrepreneurship, Types of Entrepreneurships-Social, For Profit, Not for Profit, the Evolution history of entrepreneurship development, role of entrepreneurship in economic development, Institutions/agencies for entrepreneurship development, future Scope of entrepreneurship, Entrepreneurial Ecosystem.

Unit II: Entrepreneur: Entrepreneur: Who? Why? How? the Attributes, skills/traits required to be an entrepreneur; Creative and Design Thinking, types of entrepreneurs. Myths and Realities about entrepreneurs, the entrepreneurial decision process, skill gap analysis, and Entrepreneurial models, entrepreneurial success stories, Pitching for Startups, Marketplace, Market space.

Unit III: Business Model & Business Organization: Types of Business Models; its importance, Business Plan: Importance, Guidelines and Contents, Specimen of a B-Plan and Feasibility Studies, pre- requisites from the perspective of investor. The importance and diversity of business model, components of an effective business model Canvas, Various form of business organization-sole proprietorship, partnership, corporations, Limited Liability Company.

Unit IV: Project Management: Basic concepts & Planning: Life Cycle of a Project. The Steps in managing a Project. International Standards (PMI, IPMA). Different types of projects: industrial, research and more. The role of the Project Manager. Terms of the Project Contract. Project Planning. Goals and Objectives of the Project. Owners and Stakeholder. The Work Breakdown Structure (WBS) to plan a project.

Unit V: Project identification & Evaluation: Selection - project formulation – contents of a project report - planning commission, guidelines for formulating a project - specimen of a project report. Source of finance for a project - Institutional finance supporting projects, project evaluation - objectives - types - methods.

Unit VI: Time and Cost Management: Estimation of Time, Costs and Resources. Scheduling Project Work. Critical Path Method (CPM). Resource balancing. Defining Project Risks. Process to establish the project risk plan. Contingency Reserves. Risk Matrix Analysis. Project Control and Evaluation.

BOOKS RECOMMENDED:

Text Books:

1. S. S. Khanka, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, 2001.
2. Dr. C. B. Gupta, Dr. N.P. Srinivasan, "Entrepreneurial Development", Sultan Chand & Sons.

Reference Books:

1. S. Choudhury, "Project Management", Tata McGraw Hill Education Private Limited, 2009.
2. Denis Lock, "Project Management", Gower Publishing Company, USA.

7EP04 PROFESSIONAL ELECTIVE III

(i) WIND AND SOLAR SYSTEMS

Course Outcomes: After successful completion of this course, students will be able to:

1. Understand the energy scenario and the consequent growth of the power generation fromrenewable energy sources.
2. Understand the basic physics of wind and solar power generation.
3. Understand the power electronic interfaces for wind and solar generation.
4. Understand the issues related to the grid-integration of solar and wind energy systems.

Unit I: Physics of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and powercumulative distribution functions.

Unit II: Wind Generator Topologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator- Converter configurations, Converter Control.

Unit III: The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun

angles, solar day length, Estimation of solar energy availability.

Unit IV: Solar Photovoltaic: Technologies-Amorphous, mono-crystalline, polycrystalline, V-I characteristics of a PV cell, PV model, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control

Unit V: Network Integration Issues: Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behaviour during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Unit VI: Solar Thermal Power Generation:

Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, Elementary analysis.

BOOKS RECOMMENDED:

Text Books:

1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
2. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.

References Books:

1. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
2. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems", John Wileyand Sons Ltd., 2006.
3. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
4. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.

7EP04 PROFESSIONAL ELECTIVE – III
(ii) ELECTRICAL ESTIMATING & COSTING

Course Outcomes: After successful completion of this course, students will be able to:

1. Understand methods of installation and estimation of service connection.
2. Decide type of wiring, its estimation and costing for residential building.
3. Carry out electrification of commercial complex, factory unit installations.
4. Design & estimate for feeders & distributors.
5. Understand contract, tendering and work execution process.

Unit I: Electrical Installation: Classification of Electrical Installation, General requirement of Electrical Installation, Important definitions related to Installation, Service Connection: Concept of service connection, Types of service connection & their features, Methods of Installation of service connection, Estimation of service connection.

Unit II: Residential Building Electrification: Procedures for designing the circuits and deciding the number of circuits, Selection of type of wiring and rating of wires & cables, Earthing of Residential Installation, Estimate and cost Preparation of Residential Installation.

Unit III: Electrification of Commercial Installation: Concept of commercial Installation, differentiate between electrification of Residential and commercial Installation Deciding the size of cables, busbar and busbar chambers, earthing of the electrical Installation Selection of type wire, wiring system, preparation of detailed estimate and costing of commercial Installation.

Unit IV: Electrification of Factory Unit Installation: Concept of Industrial load, Concept of Motor wiring circuit, Important guidelines about power wiring and Motor wiring, Selection and rating of wire, cable size, Sequence to be followed to prepare estimate, preparations of detailed estimate and costing of small factory unit/workshop.

Unit V: Design &Estimate for Feeders & Distributors: Different schemes for feeders & distributors, estimates for different feeders & distributors, Distribution transformer, Deciding Size & location, Estimate for outdoor & indoor type distribution substation.

Unit VI: Contracts, Tenders and Execution: Tender and tender notices, Procedure for submission and opening tenders, Comparative statements, criteria for selecting contractors, General conditions in order form, Principles of Execution of works administrative approval, technical sanctions, Billing of executed work.

BOOKS RECOMMENDED:

Text Book: N. Alagappan S. Ekambaram, "Electrical Estimating and Costing", Tata Mc Graw Hill Publication, New Delhi.

Reference Books:

1. K. B. Raina, S. K. Bhattacharya, "Electrical Design; Estimating and Costing", New Age International (p) Limited, New Delhi
2. Surjit Singh, "Electrical Estimating and Costing", Dhanpat Rai and Company, New Delhi

7EP04 PROFESSIONAL ELECTIVE – III
(III) POWER SYSTEM OPERATION AND CONTROL

Course Outcomes: After successful completion of this course, students will be able to:

1. Summarise the knowledge of preliminaries on power system operation and control.
2. Determine the optimal scheduling of generation for a two-plant system with and without losses for the economic operation of the power system.
3. Develop the mathematical model of the Automatic Load-Frequency Control (ALFC) loop and the Automatic Voltage Regulator (AVR) loop.
4. Build the block diagram of two area system.
5. Explain the role of the power system stabilizer in damping the steady-state oscillations set up in the power system.

Unit I: Preliminaries on Power System Operation and Control: Power sector scenario in India: an overview, Players in the Indian power sector, Concept of grid: necessity and types of grids, Need of voltage and frequency control, Energy control centers (Load dispatch centers): Operation and functions, Levels of power system operation and control, SCADA: components and functions, Operating states of power system: normal state, alert state, emergency state, in extremis state and restorative state, State transition diagram showing various state transitions and control strategies.

Unit II: Economic Operation – Part I: Meaning of optimum scheduling, definition of unit, plant load and system load, UCP and LSP, Input – Output characteristics, Heat rate characteristic, Incremental fuel rate, Incremental fuel cost, Reserve requirements: Installed reserves, spinning reserves, Cold reserves, Hot reserves, Methods of obtaining incremental fuel costs, Conditions for incremental loading, Optimum scheduling of generation between different units (Only two plant system without transmission loss).

A. Economic Operation – Part II: Transmission loss as a function of plant generation, Calculation of loss coefficient (two plant system), Incremental transmission loss, Optimum scheduling of generation between different plants including transmission loss, Concept and significance of penalty factor.

Unit III: Generator Control Loops: Concept of real and reactive power, Effect of real and reactive power on system parameters, Philosophy of real and reactive power control, Basic generator control loops.

1. Automatic Voltage Regulator (AVR): Functions of AVR, Types of Exciters, Brushless AVR loop: Exciter modeling, Generator modeling, Transfer function block diagram representation, Static performance, dynamic response, Stability compensation, Effect of generator loading.

Unit IV: Automatic Load Frequency Control: Automatic generation control (AGC), Speed governing system, Transfer function modeling: Governor, Hydraulic valve actuator, Turbine, Generator, Load, Transfer function representation of an isolated generator, Static performance of speed governor, Closing of ALFC loop.

Unit V: Control Area: Meaning, Primary ALFC Loop: Static response, Dynamic response, physical interpretation of results, Secondary ALFC loop, Integral Control, Pool operation, Tie-line Modeling, Two area system – Dynamic response, Tie-line bias control.

Unit VI: Steady-State Instabilities: Natural torsional oscillatory modes in power system, Natural mode of a single generator operating onto infinite bus, Effect of damper winding, Effect of changing excitation, Power system stabilizer, Introduction to modern control application, Introduction to power system security.

BOOKS RECOMMENDED:

Text Books:

1. O. L. Elgerd, “Electric Energy Systems Theory: An Introduction”, Second edition, McGraw-HillBook Comp. N. Y. 1987.

2. J. Nagrath, D. P. Kothari, “Modern Power System Analysis”, Second edition, Tata Mc-Graw Hill Publishing Company, New Delhi.

Reference Books:

1. L. K. Kirchmayor, “Economic Operation of Power System”, Wiley Eastern Pvt. Ltd., New Delhi.

2. B. R. Gupta, “Generation of Electrical Energy”, S. Chand & Company Ltd.

3. P. S. R. Murty, “Power System Operation and Control”, Tata Mc-Graw Hill Publishing Company, New Delhi.

4.Wood and Wallenberg, “Power Generation, Operation and Control”, Willey Inter Science Publication.

5. Abhijit Chakrabarti, Sunita Halder, “Power System Analysis Operation and Control”, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010

7EP05 PROFESSIONAL ELECTIVE – IV

(i)ARTIFICIAL INTELLIGENCE

Course Outcomes: After successful completion of this course, students will be able to:

1. To understand and communicate fundamentals of Artificial Neural Networks and Systems.
2. To understand and present various learning methods and architectures of neural network.
3. To understand and describe fuzzy logic and genetic algorithm fundamentals and be able to solve problems.
4. To apply AI techniques to solve electrical engineering problems along with inter disciplinary problems.

Unit I: Introduction: Biological Neurons and their artificial models, introduction to neural computing Components of neuron, input and output weight, threshold, weight factors, transfer Functions, concepts of supervised and unsupervised learning.

Unit II: Supervised Learning: Single Layer network, perceptron, Linear Separability, Training algorithm and limitations Multilayer Network: Architecture of feed forward network, learning rule, generalized Delta rule, learning function. Back propagation algorithm.

Unit III: Unsupervised Learning: Introduction, Counter propagation networks, Korhonen’s self-organizing maps, Hopfield’s networks.

Unit IV: Introduction to Fuzzy: Uncertainty in information, basic concepts of Fuzzy sets, operations on fuzzy sets, properties. Fuzzy relations: operations, properties, value assignments.

Unit V: Membership Functions: Features, fuzzification, membership value assignments, Fuzzy Rule based Systems, Graphical technique of inference. De-fuzzification: Lambda-cuts for Fuzzy sets and Fuzzy relations, Defuzzification methods.

Unit VI: Genetic Algorithm (GA): Introduction to genetic algorithm, working principle, coding of variables, Fitness function. GA operators, similarities & differences between Gas and Traditional methods; Unconstrained and constrained optimization using Genetic Algorithm, real coded GA, Advanced GA, global optimization using GA.

BOOKS RECOMMENDED:

Text Books:

1. J.M. Zurada, “Introduction to Artificial Neural Network”, Jaico Publishing House.
2. T J Ross, “Fuzzy Logic with Engineering Application”, Wiley Publication.

Reference Books:

1. G.J. Khir and T.A. Folger, “Fuzzy sets, Uncertainty and Information”, PHI Publication.
2. KoskaBart, “Neural Network & Fuzzy systems”, Prentice Hall of India Pvt Ltd, NewDelhi.

3. MeherotraKishan, Mohan C.K., Ranka Sanjay, "Elements of Artificial Neural Networks", Penram International Publishing (India) Pvt. Ltd.

4. D.E. Goldberg,"Genetic Algorithm in Search Optimization and Machine Learning", Addison-Wesley Longman Publishing Co., US.

5. Kalyanmoy Deb, "Optimization for Engineering Design Algorithms and Examples", Prentice Hall of India, New Delhi.

7EP05 PROFESSIONAL ELECTIVE – IV

(ii) ELECTRICAL DRIVES& CONTROL

Course Outcomes: After successful completion of this course, students will be able to:

1. Explain the basic Concept of electrical drives
2. Demonstrate various modern speed, torque control techniques of DC drives
3. Demonstrate various modern speed, torque control techniques of AC drives

Unit I: Introduction to Electrical Drives: Overview of electrical drive, comparison of DC & AC drive, components of load torque. Stability of an electrical drive. Introduction to frame of references (synchronous and rotating), Park and Clark transformation.

Unit II: DC Drive Control: Introduction to Four quadrant operation of dc drive, reviewof principle of operation of the chopper, four quadrant chopper circuit operation. Steady state analysis of chopper-controlled DC motor drive: continuous and discontinuous current conduction. Closed loop speed controlled separately excited dc motor drive.

Unit III: AC Drive Control: Review of basic principle of operation, speed control of induction motor: Impact of rotor resistance of the induction motor torque--speed curve. Review of slip energy recovery scheme. Closed loop control of slip energy recovery-controlled induction motor drive. Power electronic based rotor side control of slip ring Induction motor.

Unit IV: Scalar Control of Induction Motor: overview of three-phase voltage source inverter, generation of threephase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation, voltage fed inverter control: open loop v/f control, close loop speed control with v/f control and slip regulation. of vector control, direct or feedback vector control, flux vector estimation, indirect or feed forward vector control, vector control of line side PWM rectifier, stator flux-oriented vector control, vector control of current Fed inverter drive.

Unit VI: Direct Torque & Flux Control (DTC): Torque expression with stator & rotor fluxes, control strategy of DTC, Adaptive control: self-tuning control, Model Referencing adaptive control (MRAC), sliding mode control: Control Principle, sliding trajectory control of vector drive.

BOOKS RECOMMENDED:

Text Books:

1. Bimal K. Bose, "Modern Power Electronics and AC Drive",Pearson Education.
2. Vedam Subrahmanyam, "Electric Drives: Concepts & Applications", Tata Mc Graw Hill Publishing Co

Ltd.

3. Austin Hughes and Bill Drury,"Electric Motor and Drives: Fundamentals, Types and Applications", Newnes, Oxford.

Reference Books:

1. S.K.Pillai, "A First Course on Electrical Drives", New Age International Publishing Co. Ltd.
2. Gopal. K. Dubey, "Fundamentals of Electrical Drives", CRC Press
3. R.Krishnan, "Electric Motor Drives: Modeling, Analysis & Control", Prentice Hall of India Pvt. Ltd.
4. M.D. Singh & K.B. Khanchandani, "Power Electronics", Tata Mc Graw Hill Publishing Co Ltd.
5. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall.
6. Dr. P. S. Bimbhra, "Generalized theory of Electrical Machine", Khanna Publishers.

7EP05 PROFESSIONAL ELECTIVE – IV

(iii) DISTRIBUTION AUTOMATION

Course Outcomes: After successful completion of this course, students will be able to:

1. Summarize distribution system planning and automation.
2. Select appropriate communication technology for SCADA applied to distribution automation.
3. Demonstrate the knowledge of substation automation.
4. Improve the voltage profile of distribution feeder using distribution automation.
5. Explain the concept of remote metering.
6. Choose the appropriate type of energy management.

Unit I: Distribution System Planning and Automation: Power Sector Reforms, Basic Distribution Systems, Short-Term Load Forecasting, Long-Term Energy Forecasting, Technological Forecasting, Problems with existing Distribution System, Need for Distribution Automation, Characteristics of Distribution System, Distribution Automation (Objectives, Functions, Benefits), Basic architecture of Distribution automation system, Feeder Automation, Communication Requirements for DA, Remote Terminal Unit (RTU), Communication Technologies for DA.

Unit II: SCADA-Control and Communication: Introduction, Block Diagram, Components of SCADA, Functions of SCADA, SCADA applied to Distribution Automation, Advantages of DA through SCADA, Requirements and Feasibility, DA Integration Mechanisms, Communication Protocols in SCADA Systems.

Unit III: Substation Automation: Introduction, Definition of Substation Automation, Benefits of SubstationAutomation, Functions of Substation Automation System, State and Trends of Substation Automation, Intelligent Affordable Substation Monitoring and Control, Advantages of an EEM (Enterprise Energy Management) Substation Automation Solution.

Unit IV: Feeder Automation: Losses in Distribution Systems, System Losses and Loss Reduction, Network

Reconfiguration, Improvement in Voltage Profile, Capacitor Placement in Distribution System for Reactive Power Compensation, Algorithm for location of capacitor.

Unit V: Remote Metering: Background of Remote Metering, Components of AMR Systems, Communications Methods used for Meter Reading, AMR System, Services and Functions, Financial Analysis, Planning for AMR Implementation.

Unit VI: Energy Management: Energy Management, Need Based Energy Management (NBEM), Demand Side Management (DSM), Maintenance of Automated Distribution Systems, Difficulties in Implementing Distribution Automation in Actual Practice, Urban/Rural Distribution.

BOOKS RECOMMENDED:

Text Book:

Dr. M. K. Khedkar and Dr. G. M. Dhole, "A Textbook of Electric Power Distribution Automation", University Science Press (Laxmi Publications Pvt. Ltd.), 2011.

Reference Books:

1. Bassett, K. Clinard, J. Grainger, S. Purucker, and D. Ward, "Tutorial Course: Distribution Automation", IEEE Tutorial Publication 88EH0280-8-PWR, 1988.

1. James Northcote-Green, Robert Wilson, "Control and Automation of Electrical Power Distribution Systems" CRC Press, Taylor and Francis Group, 2007

2. James A. Momoh, "Electric Power Distribution, Automation, Protection, and Control", CRC Press, Taylor and Francis Group, 2007

3. S. Sivanagaraju, V. Sankar, "Electrical Power Distribution and Automation", Dhanpat Rai and Co, 2006.

7EP06 POWER SYSTEM II – LAB.

Student should perform minimum eight (8) practicals based on syllabus**.**

List of Experiments:

1. Determination of Xd and Xq by slip test.
2. Determination of Xd' and Xd'' by sudden symmetrical short circuit test.
3. Determination of Xd'' and Xq'' by conducting static test.
4. Determination of X1, X2 and Xo by conducting direct test.
5. Determination of X1, X2 and Xo by conducting In-direct test.
6. Symmetrical Component Analysis of Unbalanced Three Phase Vector.
7. Symmetrical and Unsymmetrical Fault Analysis
8. Improvement transient stability using Facts Devices.
9. Power System Stability improvement using STATCOM.
10. Solution of swing equation using Point by Point Method.
11. Solution of swing equation using by Runge-Kutta method.
12. To Study Equal Area Criteria for transient stability.
13. To Study abc to dq0 (Parks) Transformation.

14. Transient stability analysis of a multi-machine power system.

7 EP07 DIGITAL SIGNAL PROCESSING – LAB.

Student will carry out minimum eight (8) assignments based on syllabus. List of experiments is given below for reference.

List of Experiments:

1. To generate various continuous and discrete signals.
2. To verify sampling theorem.
3. To find linear convolution of given sequences.
4. To compute auto-correlation between two sequences.
5. To find impulse response of given system.
6. To find DFT and IDFT of given sequence.
7. To find FFT of a given sequence.
8. To determine power spectrum of a given signal.
9. To find frequency response of a given system.
10. To design and implement FIR filter for given specifications.
11. To implement LP FIR filter for a given sequence.
12. To implement HP FIR filter for a given sequence.
13. To implement LP IIR filter for a given sequence.
14. To implement HP IIR filter for a given sequence.
15. To generate a sinusoidal signal through filtering.
16. To plot magnitude and phase response of digital butter worth low pass and high pass filter.
17. To perform implementation of I/D sampling rate converter.

7EP08 ENTREPRENEURSHIP & PROJECT MANAGEMENT –LAB.

Student will carry out minimum eight (8) assignments based on syllabus. List of assignments is given below for reference.

List of Assignments:

1. Undertake SWOT analysis to arrive at your business idea (Product / services).
2. Undertake self-assessment test to discover your Entrepreneurial traits.
3. Undertake the market survey to identify the need of market.
4. Identify Business opportunity for you.
5. Carry out the survey of industries of your stream and prepare the report.
6. Arrange the Visit to industries/firms of your product/service stream to study their business model.
7. Visit the banks and other financial Institutions to enquire about various funding scheme for set up the new business.
8. Compile the information of government agencies and financial agencies which provide loan/financial support to establish the business.
9. Prepare a report of technological and financial feasibility of chosen product/service.

10. Prepare a marketing strategy for chosen product/service.
11. Prepare a short term &long-term goal of your business.
12. Prepare a business plan for your chosen product/services.
13. Arrange a discussion session with successful entrepreneur to discuss on your business plan.
14. Study the stories of successful entrepreneur.
15. Prepare a DPR (Detail Project Report) of chosen product /services.

7EP09 PROJECT & SEMINAR

Seminar:

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for 50 marks.

Project:

The objective of the project is to enable the students to work in groups of not more than six members in each group on a project involving analytical, experimental, design or combination of these in the area of Electrical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department. The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks. The university examination, which carries a total of 75 marks, will be a Viva Voce examination at the end of VIII Semester, conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

SEMESTER EIGHTH

8EP01 POWER SYSTEM PROTECTION

Course Outcomes: After successful completion of this course, the students will be able to:

1. Explain the need, desirable features & main components of protection system.
2. Design the various protection scheme for transmission line
3. Develop the protection scheme for Alternator, Transformer, Motors & Busbar
4. Demonstrate the knowledge of static relays & Numerical relays
5. Select the proper type & rating of circuit breaker and fuses for various application.

Unit I: Fundamentals of Power System Protection: Importance & need of protection system, faults statistics,Desirable features, CT’s and PT’s for protection circuit, Relay classification. Basic terminology, Construction,operation, characteristics and application of Over-current relay, Directional relay, Distance relay and Differential relays.

Unit II: Protection of Transmission Line: Protection of radial feeder, parallel feeder, and ring main distribution system using over current relay, Combine OC & EF protection system, Distance protection of transmission line, three stepped protection, differential protection using pilot wire, translay system, carrier current protection for EHV line. Power swing, Auto-reclosure.

Unit III: Protection of Power System Equipment's: Alternator Protection: Protection system against failure of prime mover, failure of excitation system, over-speed, overvoltage, unbalanced loading, overloading, stator winding faults & rotor earth fault.

Transformer Protection: Over current protection, Merz Price Protection, Buchholz relay, restricted earth fault protection, Protection against Over-fluxing.

Motor Protection: Faults on Motor, Protection against single phasing, overloading, stator winding faults, locked rotor, bearing failure, phase reversal.

Bus-bar Protection: types of bus-bar arrangement, differential protection, Frame leakage protection.

Unit IV: Static & Numerical relays: Static Relay: General block diagram of static relay, merits & demerits of static relay over electromechanical relay, static over-current, directional, differential and distance relay.

Numerical relay: Numerical relaying fundamentals, block diagram, merits & demerits of numerical relay. Digital Protection scheme for alternator, transformer & Motor.

Unit V: Fuses: Construction, operation & application of HRC fuses, Basic terminology, HV fuses.

Circuit breaker: Basic principle of operation, arc phenomenon, arc interruption methods, arc voltage and current waveform in AC circuit breaking, re-striking and recovery voltage, Inductive and Capacitive current interruptions, current chopping, ratings of circuit breakers.

Unit VI: Circuit Breakers: Construction, operation and important features of oil CB, minimum oil CB, air blast CB, vacuum CB and SF6 CB, Testing, Installation & Maintenance of CB., auto high-speed re-closing. Construction, working and application of MCB, MCCB, ELCB & RCCB.

BOOKS RECOMMENDED:

Text Books:

1. Badri Ram and B. N. Vishwkarma, "Power System Protection and Switchgear", Tata Mc-Graw Hill Publishing Company Limited, New Delhi.

2. Y. G. Paithankar& S. R. Bhide, "Fundamentals of Power System Protection", PHI Publication, Delhi.

Reference Books:

1. Sunil S. Rao, "Switchgear and Protection", Khanna Publications, New Delhi

2. S R Bhide, "Digital Power System Protection", PHI Publication, New Delhi.

3. C. R. Mason, "The Art and Science of Protective Relaying", **4Th Edition by Blackburn J L, Taylor &**

Francis Exclusive (Cbs)

4. R. Van and C. Warringtan, "Protective Relaying", Vol 1 and 2, Chapman Hall, London.

5. B. Ravindranath and M. Chander, “Power System Protection and Switchgear”, Wiley Eastern Ltd, New Delhi.
6. A G. Phadke and J. S. Thorp, “Computer Relaying for Power Systems”, Research Studies Press Ltd., England John Wiley & sons Inc., New York.
7. R. T. Lythall, “Switchgear Handbook”, J and P Newness Butterworth, London

8EP02 COMPUTER METHODS IN POWER SYSTEM ANALYSIS

Course Outcomes: After successful completion of this course, the students will be able to:

1. Develop mathematical model to represent the power system components for computerized analysis.
2. Demonstrate the topology of electrical power system.
3. Formulate Zbus& Ybus by algorithm.
4. Analyze short circuit studies of electrical power system.
5. Analyze load flow studies of electrical power system.
6. Examine stability studies of electrical power system.

Unit I: Representation of Power system for Computerized Analysis: Mathematical model of synchronous generator for steady state and transient analysis. Representation of Induction motor, Fixed tap setting transformer, Phase shifting transformer, On Load Tap Changer, transmission line & loads.

Unit II: Topology of Electrical Power System: Introduction to frame of references (bus, branch and loop), graph theoretic approach: Incidence Matrices: element node, bus incidence, branch path, basic cut set, augmented cut set, basic loop, augmented loop. Representation of Primitive network in impedance & admittance form, formation of network matrices by singular & non-singular transformation.

Unit III: Formation of Zbus & Ybus by Algorithm: Development of Zbus&Ybus by step-by-step algorithm on account for changes in network (addition of branch and link). Derivation of Zloop matrix. Transformation matrix- incidence & network matrices for three phase networks. Three phase balanced network elements: Balanced & unbalanced excitation. Clark component transformation. Algorithm for formulation of three phase bus impedance (Zbus) matrix.

Unit IV: Short Circuit Studies: Need, assumptions for short circuit analysis, three phase networks representation, symmetrical components, Thevenin’s theorem and short circuit analysis using Zbus matrix, Algorithm for calculation of System conditions, short circuit calculations for balanced three phase networks using Zbus matrix: Transforming to symmetrical components.

Unit V: Load Flow Studies: Network performance equation, line flow equation and bus loading equation. Classification of buses. Formation of load flow problem by using Gauss- Seidel and

Newton-Raphson method (Polar & Rectangular), decoupled load flow and Fast Decoupled methods of power flow, sparse Matrices.

Unit VI: Stability Studies of Power system: Development of mathematical model for multi-machine system stability analysis-Formation of equations and methods of solutions. Transient stability analysis including synchronous machines, system networks and loads. Solution of state equation by modified Euler method and Runge Kutta forth order approximation method.

BOOKS RECOMMENDED:

Text Books:

1. G.W.Stagg &Ahmed H. Ei–Abaid, "Computer Methods in Power System Analysis", Mc Graw Hill Book Co. Ltd.
2. M.A.Pai, "Computer Techniques in Power System Analysis", Tata Mc Graw Hill Publishing Co. Ltd.

Reference Books:

1. L.P.Singh, "Advanced Power System analysis and Dynamics", New Academic Science
2. R.N.Dhar, "Computer Aided Power System Operation and Analysis of Power System", Mc Graw Hill Co. Ltd.
3. I.J.Nagrath and D.P.Kothari, "Modern Power System Analysis", Tata Mc Graw Hill Publishing Co. Ltd

8EP03 PROFESSIONAL ELECTIVE-V

(i) HIGH VOLTAGE ENGINEERING

Course Outcomes: After successful completion of this course, students will be able to:

1. Explain the breakdown mechanism in solid, liquid, and gaseous dielectrics.
2. Select an appropriate protective device to protect the power system against overvoltage's caused by internal and external causes.
3. Utilize different circuits used for the generation of high AC, DC, and impulse voltages.
4. Measure high AC, DC, and impulse voltages.
5. Test the insulation of various high voltage apparatus used in the power system.

Unit I :

Breakdown in Gases: Breakdown in Gases, Insulating materials Classification, Gases as insulating media, Ionization and decay process, Breakdown in gases, Townsend's law, Streamer mechanism of spark, Paschen's law, Corona discharge, Electronegative gases.

Unit II:

Breakdown in Liquid & Solid Dielectrics: Breakdown in Liquid and Solid Dielectrics, Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, High voltage bushings, Guarding, Shielding, Field plotting.

Unit III:

Over Voltages in Electrical Power System: Lightning and Switching Over Voltage and Protection, Lightning strokes to lines and towers, Mechanism, Characteristics and protection of transmission lines from lightning, Lightning arrestors, Metal oxide arrestor, Insulation coordination of HV and EHV power system and substation.

Unit IV:

Generation of High Voltages & Impulse Voltages: High Voltage and Current Generation, Generation of high DC, AC and impulse voltages, Standard impulse wave shapes, Switching surges, and High impulse generator.

Unit V:

Measurement of High Voltages & Impulse Voltages: High Voltage and Current Measurement Peak voltage, Impulse voltage and High direct measurement methods, Non-destructive measurement, High voltage dielectrics loss and capacitance measurement, Radio frequency and Partial discharge measurement.

Unit VI:

High Voltage Testing: Basic terminology, High voltage testing of electrical power apparatus as per International and Indian standards - Insulators, Bushings, Cables, Transformers, Surge diverters and Isolators, Electric shock and threshold current, Capacitance of long objects, Electromagnetic interference.

BOOKS RECOMMENDED:

Text Book: M. S. Naidu and V. Kamraju, “High Voltage Engineering”, Tata McGraw Hill Publishing, Company, New Delhi.

Reference Books:

1. E. Kuffel and W. S. Zaenglo, “High Voltage Engineering”, Pergamon Press.

2. Rokosh Das Begamudre, “EHV AC. Transmission Engineering”, Wiley Easter Ltd. New Delhi.

3. E. Kuffel and M. Abdullaha, “High Voltage Engineering”, Pergamon Press.

4. M. S. Naidu and V. N. Maller, “SF6 and Vacuum Insulation for High Voltage Application”, Khanna Publications, Delhi.

5. Subir Ray, “An Introduction to High Voltage Engineering”, Prentice –Hall & India, Private Limited, New Delhi.C.L. Wadhawa, “High Voltage Engineering”, New Age international (P) Ltd. Publications.

8EP03 : PROFESSIONAL ELECTIVE- V

(ii) HVDC and FACTS

Course Outcomes: After successful completion of this course, students will be able to:

1. Discuss different components of HVDC transmission system.
2. Explain the operation and control of HVDC converters.
3. Identify the suitable reactive power compensation technique and filter for HVDC system.

4. Choose proper FACTS controller for the specific application based on system requirements.

5. Analyze the circuits of static shunt and static series compensators used for the prevention of voltage instability and improvement of transient stability and power damping oscillations.

6. Demonstrate the knowledge of Unified power flow controller (UPFC)

Unit I:

Introduction to HVDC:HVDC Transmission Basic principle, Need for HVDC, Comparison of AC and D transmission systems, Advantages and Disadvantages of HVDC Systems, Application of HVDC transmission,Types of HVDC links, Layout of HVDC converter station and various equipment's, Planning for HVDC transmission, Modern trends in HVDC transmission.

Unit II:

HVDC Converters: Choice of converter configuration, types of converters, 6 - pulse and 12- pulse converters, Analysis of Graetz circuit with and without overlap, Principles of DC Link Control, Converters Control Characteristics, System control hierarchy, firing angle control, Constant current (CC) and Constant extinction angle (CEA) control, Starting and stopping of DC link, DC smoothing reactors.

Unit III:

Reactive Power Compensation, Harmonics and Filters : Reactive Power Requirements in steady state, sources of reactive power, Synchronous condensors, Generation of harmonics, AC and DC filters, Introduction to multiterminal DC systems.

Unit IV:

Introduction to FACTS: Transmission Inter connections, Opportunities for FACTS, Flow of power in an AC system, Power flow in parallel paths, Power flow in meshed systems, loading capability limits, Control of Power Flow in AC Transmission Line, Reactive power compensation, Basic types of FACTS controllers, Brief description and definitions of FACTS controllers, Shunt connected controllers, Series connected controllers, Combined Shunt and Series Connected Controllers, Benefits of using FACTS technology.

Unit V:

Static Shunt Compensators: Objectives of Shunt Compensation - Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability, Improvement of Power Damping Oscillations, Methods of Controllable Var Generation - Thyristor controlled Reactor (TCR) and Thyristor Switched Reactor (TSR), Thyristor Switched Capacitor (TSC), Fixed Capacitor - Thyristor Controlled Reactor (FC-TCR), Static VAR Compensator (SVC) and Static Synchronous Compensator (STATCOM), Comparison between SVC and STATCOM, V-I and V-Q Characteristics of SVC and STATCOM.

Static Series Compensators: Concept of Series Capacitive Compensation, Objectives of Series Compensation, Voltage Stability, Improvement of Transient Stability, Power Oscillations Damping, Sub-synchronous Oscillation Damping,Variable Impedance Type Series Compensators -Thyristor

Controlled Series Capacitor (TCSC), Switching Converter Type Series Compensators -Static Synchronous Series Compensator (SSSC).

Unit VI:

Power Flow Controllers: Unified power flow controller (UPFC) – Introduction, operating principle, independent real and reactive power flow controller and control structure. Comparison between UPSC and Controlled Series Compensator, Interline power flow controller (IPFC).

BOOKS RECOMMENDED:

Text Books:

1. K.R. Padiyar, "HVDC Power Transmission Systems: Technology and system Interactions", New Age Publishers, Third *Edition*, 2017.

2. Narain G. Hingorani&LaszloGyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", Wiley India Pvt Ltd,2011.

Reference Books:

1. S. Kamakshaiah, V. Kamaraju, "HVDC Transmission", McGraw Hill Education, 2017.

2. Kimbark, E.W., "Direct current transmission", Vol.1, Wiley Interscience, New York, 1971.

3. Arrilaga, J., "High Voltage Direct current transmission", Peter Peregrinus Ltd., London, UK.,1983.

4. Vijay K. Sood, "HVDC and FACTS Controllers Applications of Static Converters in Power Systems", Kluwer Academic Publishers, 2004.

5. Enrique Acha, "FACTS: Modeling and Simulation in Power Networks", Wiley India Pvt. Ltd., 2012.

6. R. Mohan Mathur, Rajiv K. Varma, "Thyristor Based FACTS Controllers for Electrical Transmission Systems", Wiley Inter-science, 1st Edition, 2002.

8EP03 PROFESSIONAL ELECTIVE- V

(iii) SMART GRID SYSTEM

Course Outcomes: After successful completion of the course, students will be able to:

1. Explain the features, necessity and architecture of Smart Grid.
2. Relate the role of Automation in Transmission and Distribution.
3. Decide different measuring methods and sensors used in Smart Grid.
4. Interpret the role of batteries and energy storages in Smart Grid.
5. Discuss Power Quality issues in Smart Grid.
6. Elaborate the role of communication and networking in Smart Grid.

UNIT I: Introduction to Smart Grid: Evolution of Electric Grid, Smart Grid Concept - Definitions and Need for Smart Grid – Functions – Opportunities - Benefits and challenges, Difference between conventional & Smart Grid.

UNIT II: Smart Grid Architecture and Automation: Components and Architecture of Smart Grid, Fundamental components of Smart Grid designs, Transmission Automation, Distribution Automation, Renewable Integration

UNIT III: Sensors and Measurement: Sensors for Smart Grid, Monitoring and Measurement Technologies, Phase Measurement Unit (PMU), Smart meters, Smart Appliances, Multi Agent Systems (MAS) Technology, Micro grid and Smart grid comparison, Wide Area Measurement

UNIT IV: Smart Substation and Energy Storage: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, Superconducting Magnetic Energy Storage, Super Capacitors, Flywheel, Pumped Hydro Storage, Compressed Air Energy Storage.

UNIT V: Power Quality Management in Smart Grid: Power Quality & Electromagnetic Compatibility (EMC) in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT VI: Communication Technologies and Smart Grid: Elements of communication and networking – architectures, standards, PLC, Zigbee, GSM, Local Area Network (LAN) - House Area Network (HAN) – Wide Area Network (WAN) - Broadband over Power line (BPL) - IP based Protocols - Basics of Web Service and CLOUD Computing, Cyber Security for Smart Grid

BOOKS RECOMMENDED:

Text Books:

1. Stuart Borlase, "Smart Grid: Infrastructure, Technology and Solutions", CRC Press 2012
2. A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer Edition, 2010.

Reference Books:

1. Stephen F. Bush, "Communication-Enabled Intelligence for the Electric Power Grid", Wiley-IEEE.
2. James Momoh, "Smart Grid: Fundamentals of design and analysis", John Wiley & sons Inc, IEEE Press, 2012.

8EP04 PROFESSIONAL ELECTIVE - VI

(i) POWER QUALITY

Course Outcomes: After successful completion of this course, students will be able to:

1. Illustrate the concept, need, and standards of Power Quality.
2. Classify Power quality characteristics.
3. Select power conditioning device for mitigation of power quality problem.
4. Make use of measurement tools for power quality survey.

Unit I: Introduction: Power Quality Definition. Need for Power Quality, Sensitive Loads, Nonlinear Loads, Interconnected Power System, Deregulation and its Effect, Stakeholders of Power Quality and their Role.

Unit II: Power Quality Characteristics: Power Quality Theory, Types of power Quality Problems, Voltage Swells, Long-Duration Over voltages, Under voltages, Interruptions, Transients, Voltage Unbalance, Voltage Fluctuations, Harmonics, Electrical Noise, Sources and Effects of Power Quality Problems, Power Quality Problem-Solving Procedures.

Unit III: Power Quality Standards: Power Quality Standards' Organizations, Institute of Electrical & Electronics Engineers (IEEE), American National Standards institute (ANSI), International Electro technical Commission (IEC) Other International Standards Organizations, Purpose of Power Quality Standards, 'Types of Power Quality Standards, Voltage Sag (Dip) Standards, Transients, Voltage Unbalance, Voltage Fluctuation or Flicker Standards, Harmonics Standards, Transformer Overheating Standards, Natural Conductor Loading Standards, Static Electricity, Telephone Power Quality Standards, Grounding and Wiring Standards, Sensitive Electronics Equipment Standards,

Trends in Power Quality Standards Eliminate Transfer Medium, Install Power Conditioning Equipment, Surge Suppressors, Noise Filters, Isolation Transformers, Line-Voltage Regulators, Motor-Generator Sets, Magnetic Synthesizers Uninterruptible Power

Supply (UPS), Solid-State Switches, Harmonics Solutions, Construction and Working Principle of Shunt Active Power Filter, Series Active Power Filter and Unified Power Quality Conditioner, Selection of Appropriate Power Conditioning Equipment.

Unit V: Wiring and Grounding: Wiring and Grounding Principles, Utility Power System Grounding, Telecommunication System Grounding, End-User Power System Grounding, Wiring and Grounding Problems, Ground Loops, Electromagnetic Interference (EMI) Noise, Loose Connections, Grounding for Lightning and Static Electricity, Wiring Solutions: Separation, Selection of Wire and Cables, Shielding Grounding Solutions: Ground Rods, Ground Ring, Ground and Reference Signal Grids, Other Grounding Systems, Isolated Grounds, Multipoint Grounding, Separately Derived Source Grounding.

Unit VI: Power Quality Measurement Tools & Power Quality Surveys: Factors considered for selection of measurement tools, Kilowatt-Hour Meter, Multimeters, Average-responding versus True RMS Meters, Current Probes, Oscilloscope, Disturbance Analyzer, Harmonics Analyzer, Power Quality Analyzer Purpose of a Power Quality Surveys, planning a power Quality Survey.

BOOKS RECOMMENDED:

Text Book: Roger C Dugan, Santoso & McGranahan, "Electrical Power Systems Quality", McGraw Hill.

Reference Books:

1. G.T. Heydt, "Electric Power Quality", Stars in a circle Publication, Indiana, 1991.

2. Barry W. Kennedy, "Power Quality Primer", McGraw-Hill.

3. Alexander Kusko, "Power Quality in Electrical Systems", McGraw-Hill.

4. Bhim Singh,Ambrish Chandra,Kamal Al-Hadad, "Power Quality Problems and Mitigation Techniques", Wiley Publication.

8EP04 PROFESSIONAL ELECTIVE – VI

(ii) ELECTRICAL ENERGY CONSERVATION AND AUDITING

Course Outcomes: After successful completion of this course, students will be able to:

1. Summarize Indian and global energy scenario.
2. Explain types of energy Audit and its procedure.
3. Discuss economics of energy conservation
4. Elaborate the concepts of energy conservation and management.
5. Choose Appropriate energy efficient techniques for energy conservation
6. Apply the understanding of energy conservation and management for industrial applications.

Unit I: Energy Scenario: Various forms of energy: Primary and secondary energy, commercial and noncommercial energy, renewable and non-renewable. Indian and global energy scenario, energy needs of growing economy, energy pricing, electricity billing and tariff. Energy sector reforms: In coal, oil, natural gas and electricity. Functions and Responsibilities of CERC & SERC. Energy Conservation Act-2001, Indian electricity Act 2003 and its features. Electricity (Amendment) Bill, 2020 – Key Highlights. Energy and environmental Impacts.

Unit II: Energy Audit: Definition, energy audit, need, types of energy audit: Preliminary and detailed energy audit. Energy audit instruments. Procedure for carrying out energy audit. Data Analysis-Energy production relationship, specific energy consumption, Sankey (energy flow) diagram, CUSUM Technique, Bench marking, energy performance.

Unit III: Economics of Energy conservation: Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, and internal rate of return method. Profitability index for benefit cost ratio.

Unit IV: Energy Conservation & Management: Definition and necessity of energy conservation. Review of electric motors, types, losses, motor efficiency, factors affecting motor Performance, transformer types & its losses. Rewinding and motor replacement issues. Definition and Objective of Energy Management, concept of Supply Side Management (SSM) and Demand Side Management (DSM), methods of implementing demand side management and advantages to consumer, utility and society. Energy strategy for the future.

Unit V: Energy Efficient Techniques in Electrical Systems: Review of power factor improvement and its benefit, selection and location of capacitors. Power factor penalties and incentives in tariff for demand control. Recommendations for energy conservation: Maximum demand controllers, automatic power factor controllers, Variable Speed Drives, Energy efficient transformers. Soft starting of motors.

Unit VI: Energy Conservation in Industrial Applications: Energy conservation opportunities in motive power (Motors and drive system)- Energy efficient motors, Heating Ventilation and Air Conditioning(HVAC), Illumination system, Pumps and Pumping systems, thermal power stations, Utility Industries: Transmission & Distribution Sector. Cogeneration &Waste heat recovery systems. Energy Audit Case Study of energy intensive industry.

BOOKS RECOMMENDED:

Text Books:

1. "Energy Audit and Conservation", TERI.
2. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", Mc.Graw Hill, 1991.

Reference Books:

1. "Success stories of Energy Conservation", BEE, New Delhi. (www.beeindia.gov.in)
2. Thumman, "Energy Conservation and Audit", Fairmont Press.
3. SonalDesai, "Handbook of Energy Audit", Mc. Graw Hill.
4. Guide books for National Certification Examination for Energy Manager/Energy.
5. Auditors Books, General Aspects (available online).

8EP04 PROFESSIONAL ELECTIVE – VI

(iii) ELECTRIC AND HYBRID VEHICLES

Course Outcomes: After successful completion of this course, students will be able to:

1. Understand the models to describe hybrid vehicles and their performance.
2. Understand the different possible ways of energy storage.
3. Understand the different strategies related to energy storage systems.

Unit I: Introduction: Conventional Vehicles: Basics of vehicle performance, vehicle power source Characterization, transmission characteristics, mathematical models to describe vehicle performance.

Unit II: Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Unit III: **Hybrid Electric Drive**: Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Unit IV: Electric Trains: Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Unit V: Energy Storage: Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

Unit VI: Energy Management Strategies: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

BOOKS RECOMMENDED:

Text Books:

1. C. Mi, M. A. Masrur and D. W. Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2011.

2. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.

Reference Books:

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and FuelCell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.

2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016.

8EP05 POWER SYSTEM PROTECTION – LAB.

Student will perform minimum 08 experiment based on syllabus of Power System Protection. List of experiment is given below for reference.

List of Experiments:

1. Development of control circuit for power supply control of three phase IM.
2. Development of control circuit for direction control of three phase IM.
3. Polarity test & ratio test on CTs & PTs.
4. Plot the characteristics of Inverse Time OC relay.
5. Plot the characteristics of Differential relay.
6. Plot the operating characteristics of MCB & fuses.
7. Plot the characteristics of impedance relay or MHO relay.
8. Develop the combine OC & EF protection scheme for three phase alternators.
9. Develop the protection system for alternator against unbalanced loading.
10. Develop the Merz Price Protection scheme for three phase transformers.
11. Develop the protection system for three phase IM against single phasing.
12. Develop the static over-current relay.
13. Demonstrate Operation of static overvoltage & under voltage relay.
14. Study the protection scheme for three phase IM using microprocessor-based relays.
15. Demonstration of numerical relays.

8EP06: COMPUTER METHODS IN POWER SYSTEM ANALYSIS – LAB.

Student should perform minimum eight (8) practicals based on the syllabus .

List of Experiments:

1. Write a Program for formation of Bus Admittance Matrix (Ybus) for a given Power System network using Singular Transformation.
2. Write a Program for formation of Bus Impedance Matrix (Zbus) for a given Power System network by stepby- step Algorithm.
3. Write a Program for Short circuit Analysis when three phase to ground fault at bus P of a given Power System network.
4. Write a Program for Short circuit Analysis when three phase faults at bus P of a given Power System network.
5. To determine fault voltage and fault current when three phase faults at bus P of a given power system network by using simulation software.
6. To determine fault voltage and fault current when three phase to ground fault at bus P of a given power system network by using simulation software.
7. Write a program for load flow studies on a given power system network by Gauss- Seidel method using bus Admittance Matrix (Ybus).
8. Write a program for load Flow studies on a given power system network by Newton-Raphson method in Polar Coordinates by using bus Admittance Matrix (Ybus).
9. Write a program for load flow analysis on a given power system network using Fast Decoupled Load Flow (FDLF) Method.
10. To find the critical clearing angle when three phase fault occurs at sending end of transmission line of a given power system network by using simulation software.
11. To find the critical clearing angle when three phase fault occurs at mid-point of transmission line of a given power system network by using simulation software.
12. To plot swing curve of a given power system by using simulation software.
13. To study load flow analysis of a power system by using *Gauss-Seidel, Newton*-Raphson and FDLF Methods.
14. To study short circuit analysis of a Power system network.
15. To study Modified Euler method and Runge Kutta 4th order Approximation Methods for stability studies of a Power System network

8EP07 PROJECT & SEMINAR

Seminar:

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for 50 marks.

Project:

The objective of the project is to enable the students to work in groups of not more than six members in each group on a project involving analytical, experimental, design or combination of these in the area of Electrical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. On completion of the work, a project report should be prepared and submitted to the department. The evaluation is based on continuous internal assessment by an internal assessment committee for 75 marks. The university examination, which carries a total of 75 marks, will be a Viva Voce examination at the end of VIII Semester, conducted by a committee of one external examiner appointed by the University and one internal examiner/Guide.

3KS02 Discrete Structure and Graph Theory

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure and Graph Theory by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Apply logical reasoning to solve a variety of problems.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Analyze and express logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Develop the given problem as graph net works and solve with techniques of graph theory

Unit I: Foundations: Logic and Proofs **Hours: 7**

Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments, Resolution, Combination for Propositions and Quantified Statements; Proofs Terminology, Methods, Direct Proofs, Proof by Contraposition and Contradiction;

Unit II: Sets, Functions and Relations **Hours: 7**

Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations; Inverse Functions, Compositions and Graphs of Functions, Important Functions, Partial Functions; Sequences, Recurrence Relations, Special Integer Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; n-ary Relations, Operations on n- ary Relations; Representing Relations Using Matrices; Closures, Transitive Closures

Unit III: Number Theory and Induction **Hours: 6**

Division, The Division Algorithm, Modular Arithmetic, Arithmetic Modulo m; Primes, Trial Division, Conjectures and Open Problems About Primes, GCD and LCM, The Euclidean Algorithm, gcds as Linear Combinations; Linear Congruences, The Chinese Remainder Theorem, Fermat's Little Theorem, Pseudoprimes, Primitive Roots and Discrete Logarithms, Applications: Hashing Functions, Mathematical Induction and Examples of Proofs, Mistaken Proofs, Guidelines for Proofs; Strong Induction, Examples of Proofs.

Unit IV: Algebraic Structures **Hours: 7**

Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations.

Unit V: Counting **Hours: 7**

Basic Counting Principles, Complex Counting Problems, Subtraction and Division Rule, The Pigeonhole Principle, The Generalized Pigeonhole Principle, Applications; Permutations, Combinations, Generating Permutations, Generating Combinations.

Unit VI: Graphs **Hours: 6**

Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Colorings.

Text Book:

Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill.

Reference Books:

1. J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.
2. Norman L. Biggs: Discrete Mathematics, 2nd Edition, Oxford University Press.
3. Seymour Lipschutz and Marc Lars Lipson: Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill.
4. C. L. Liu and D. P. Mohapatra: Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, McGraw-Hill.

3KS03 Object Oriented Programming

Course Prerequisite: Computer Programming

Course Objectives:

1. To explore the principles of Object Oriented Programming (OOP) such as data abstraction, encapsulation, inheritance and polymorphism.
2. To use the object-oriented paradigm in program design.
3. To Provide programming insight using OOP constructs.
4. To lay a foundation for advanced programming

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Apply Object Oriented approach to design software.
2. Implement programs using classes and objects.
3. Specify the forms of inheritance and use them in programs.
4. Analyze polymorphic behaviour of objects.
5. Design and develop GUI programs.
6. Develop Applets for web applications

Unit I: Introduction to Object Oriented Programming **Hours:7**
Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. Java Programming Constructs: Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, ,Flow of Control.

Unit II: Classes and Objects **Hours:7**
Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments.

Unit III: Inheritance, Interfaces and Packages **Hours:6**
Inheritance: Inheritance vs. Aggregation, Method Overriding, super keyword, final keyword, Abstract class. Interfaces: Defining interfaces, Implementing interfaces, Accessing interface variables, Extending interfaces. Packages: Packages, java.lang package, Enum type.

Unit IV: Exception handling and Input/Output **Hours:7**
Exception: Introduction, Exception handling Techniques, User-defind exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.

Unit V: Applets **Hours:7**
Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, getDocumentBase() and getCodeBase () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics.

Unit VI: Unit Title:Event Handling **Hours:6**
Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar.

Text Books:

1. SachinMalhotra and SaurabhChoudhary: Programming in Java, Oxford University Press 2010.
2. Herbert Schildt: Java Complete References (McGraw Hill)

Reference Books:

1. H.M.Dietel and P.J.Dietel, “Java How to Program” Pearson Education/PHI, Sixth Edition.
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Dr. R. NageswaraRao: Core Java An Integrated Approach (Dreamtech)
4. Khalid Mughal: A Programmer’s Guide to Java Certification, 3rdEdition (Pearson)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners,(SPD),2010.

3KS04/3KE04 Data Structures

Course Prerequisite: Fundamentals of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structures
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

Unit I: Introduction to Data Structures **Hours: 7**

Introduction to Data structures, Data Structure Operations, Algorithmic Notation, Complexity of algorithms. String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms.

Unit II: Array & Record Structure **Hours: 7**

Linear arrays : Memory Representation of arrays, traversing linear arrays, insertion & deletion operations, Bubble sort, Linear search and Binary search algorithms. Multi dimensional arrays, Pointer arrays. Record structures and Matrices.

Unit III: Linked lists **Hours: 6**

Linked lists: Memory Representation of Linked List, traversing a linked list, searching a linked list. Memory allocation & garbage collection. Insertion & deletion operations on linked lists. Header linked lists, Two- way linked lists.

Unit IV: Stack & Queue **Hours: 7**

Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation. Quick sort, Recursion, Tower of Hanoi.

Queues: Sequential Memory Representation of Queue, DeQueue, Priority queues.

Unit V: Trees **Hours: 7**

Introduction to Trees, Binary trees, Memory Representation of Binary Tree, Traversing binary trees, Header nodes, Binary Search Tree, Heap and heapsort, Path length & Huffman's algorithm.

Unit VI: Graphs & Sorting Algorithms **Hours: 6**

Introduction to Graphs, Memory representation of graphs, Warshalls' algorithm, operations on Graphs, Breadth First Search, Depth First Search

Sorting : Insertion Sort, Selection Sort, Radix sort, Merge Sort.

Text Book:

1. Seymour Lipschutz: Data Structures , Schaum's Outline Series, McGraw-Hill, International Editions.
2. Trembley, Sorenson: An Introduction to Data Structures with Applications, McGraw Hill.

Reference Books:

1. Ellis Horowitz, SartajSahni: Fundamentals of Data Structures, CBSPublications.
2. Data Structure Using C, Balagurusamy.
3. Standish: Data Structures in Java, Pearson Education.

3KS05 Analog & Digital Electronics

Course Prerequisite: Basic Physics.

Course Objectives:

1. To get the introductory knowledge of PN Junction Diode, Bipolar Junction Transistor, Field Effect Transistor.
2. To understand number systems and conversion between different number systems.
3. To get basics knowledge about digital ICs and digital systems.
4. To study the design of combinational circuits and sequential circuits

Course Outcomes(Expected Outcome): At the end of course students will able to

1. Explain basic concepts of semiconductor devices and its application.
2. Compare different Number System and basics of conversion of number systems.
3. Realize different minimization technique to obtain minimized expression.
4. Design Combinational Circuits.
5. Design and Develop Sequential Circuits.

Unit I: PN Junction Diode and Bipolar Junction Transistor **Hours: 7**

PN-Junction Diode, Characteristics and Parameters, BJT operation, BJT Voltages and Currents, BJT Amplification: Current and Voltage, BJT Switching, Common-Base Characteristics, Common-Emitter Characteristics, Common- Collector Characteristics

Unit II: Field Effect Transistors **Hours: 7**

Junction Field Effect Transistors, n-Channel and p-Channel JFET, JFET Characteristics, JFET Parameters, FET Amplifications and Switching, MOSFETs: Enhancement MOSFET, Depletion_Enhancement MOSFET, Comparison of p-channel and n-channel FETs, Introduction to CMOS.

Unit III: Number System **Hours: 6**

Binary Number System, Signed and unsigned Number, Octal Number System, Hexadecimal Number System, Conversions between Number Systems, r's and (r-1)'s Complements Representation, Subtraction using 1's and 2's Complements, BCD, Gray Code, Excess 3 Code and Alpha numeric codes.

Unit IV: Minimization Techniques **Hours: 7**

Logic Gates, Boolean Algebra, Logic Operation, Axioms and Laws of Boolean Algebra, Reducing Boolean Expression, Boolean Functions and their representation, SOP Form, POS Form, Karnaugh Map (up to 5 variable), Limitation of Karnaugh Map, Quine- McCluskey Minimization Technique (up to 5 variable).

Unit V: Combinational Circuits **Hours: 7**

Introduction, Design Procedure, Adders, Subtractors, Binary Parallel Adder, 4 Bit Parallel Subtractor, Look-ahead-carry Adder, BCD adder, BCD Subtractor, Multiplexer, De-multiplexer, Decoder, Encoder, Comparator, Parity bit Generator/Checkers, Boolean Expression Implementation using these ICs.

Unit VI: Sequential Circuits **Hours: 6**

Flip-flops: S-R, J-K, Master slave J-K, D-type, T-type, Flip flop Excitation Table, Conversion of Flip Flops, Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register. Counters: Asynchronous and Synchronous counter, Up/Down counter, MOD-N counter, Ring counter, Johnson counter.

Text Book:

1. David A. Bell: "Electronic Devices and Circuits", 5e , Oxford University Press.
2. Jain R.P. "Modern Digital Electronics", 3e, TMH.

Reference Books:

1. Millman&Halkies: "Electronic Devices & Circuits", 2e, McGraw Hill.
2. Sedra& Smith: "Microelectronics Circuits", 5e, Oxford University Press.
3. Anand Kumar: "Switching Theory and Logic Design", 3e, PHI Learning Private Limited
4. Wakerly, "Digital Design: Principles and Practices", 3 e, Pearson Education, 2004.

3KS06 Object Oriented Programming Lab

Course Prerequisite: Basic Computer Programming

Course Objectives: Design, implement, test, and debug simple programs in an object-oriented programming language.

1. To develop the knowledge of object-oriented paradigm in the Java programming language.
2. To evaluate classical problems using java programming.
3. To develop software development skills using java programming for real world applications.

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Design, implement, test, and debug simple programs in an object-oriented programming language.
2. Interpret the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
3. Build applications in Java by applying concepts like interfaces, packages and exception handling.
4. Make use of Java concepts like API, Applets, AWT.

List of Experiments:

This is a sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to Object Oriented Programming and installation of JDK. Write a program to print a message "Hello World..."
2. Develop a program to explain use of Operators in java.
3. Develop a Program to study and implement Looping Statements belonging to Java.
4. Develop a Program to study and implement Selection Statements belonging to Java.
5. Develop a program to study and implement some Pyramid.
6. Develop a program to demonstrate the concept of Class, Method and Object.
7. Develop a program to study and implement the concept of Method Overloading.
8. Develop a program to study and implement concept of Constructor in Java.
9. Develop a program to study and implement concept of Constructor Overloading in Java.
10. Develop a program to study and implement the Array in Java.
11. Develop a Program on various ways to accept data through keyboard(Command Line Argument)
12. Develop a program to study and implement the concept of Inheritance.
13. Develop a program to study and implement the concept of Method Overriding.
14. Develop a program to study and implement the Abstract Class.
15. Develop a program to study and implement the concept of Interface in Java.
16. Develop a program to study and implement Exception Handling Mechanism in Java.
17. Develop a program to study and implement Java I/O.
18. Develop a program to study and implement simple Applet in java.
19. Develop a program on Applet to demonstrate Graphics, Font and Color class.
20. Develop a Program on passing parameters to applets
21. Develop a Program to create GUI application without event handling using AWT controls
22. Develop a Program to create GUI application with event handling using AWT controls
23. Develop a program on Multithreading
24. Develop a Program to create GUI application with event handling using Swing controls
25. Mini Project based on content of the syllabus. (Group of 2-3 students)

3KS07 Data Structure Lab

Course Prerequisite: Basics of programming Language & Logic Building Skills

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Apply various linear and nonlinear data structure.
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

List of Experiments:

This is a sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write a program to find out largest number from the array and also find it's location.
2. Write a program to traverse an array and find the sum and average of data elements from an array.
3. Write a Program to a) insert an element in an array b)delete an element from an array.
4. To study and execute the Linear search method
5. To study and execute the Binary Search method
6. To study and execute the Pattern matching Algorithms(Slow and Fast)
7. To study and execute Bubble sort method.
8. To study and implement various operations on singly linked list
    (a) Traversing the linked list.
    (b) Insert a node at the front of the linked list.
    (c) Delete a last node of the linked list.
    (d) Searching a Linked list.
9. To study and implement following operations on the doubly linked list.
    (a) Insert a node at the front of the linked list.
    (b) Insert a node at the end of the linked list.
    (c) Delete a last node of the linked list.
    (d) Delete a node before specified position.
10. To study and implement following operations on the circular linked list.
    (a) Insert a node at the end of the linked list.
    (b) Insert a node before specified position.
    (c) Delete a first node of the linked list.
    (d) Delete a node after specified position.
11. Understand the stack structure and execute the push, pop operation on it.
12. Understand the Queue structure and execute the insertion, deletion operation on it.
13. Formulate and demonstrate Transforming Infix Expressions to Postfix Expression using Stack.
14. Formulate and demonstrate the Evaluation of Postfix Expression using Stack.
15. To study and execute Quick sort method.
16. Understand the Tree structure and implement the Pre-order, In-order, post-order traversing operations on it.
17. Understand the concept of Recursion and write a program to calculate factorial of a number using Recursion.
18. Understand the Heap sort and implement it on given data.
19. Understand the Insertion sort and implement it on given data.
20. Understand the Selection sort and implement it on given data.
21. To study and execute Merge sort method.
22. To study and execute Radix sort method.
23. Write a Program to implement the concept of BFS algorithm.
24. Write a Program to implement the concept of DFS algorithm.
25. To study and execute Josephus problem.

3KS08 Analog & Digital Electronics Lab

Course Prerequisite: Students should have the knowledge of Basic Physics.

Course Objectives:

1. To impart the concepts of analog and digital electronics practically.
2. To provide students basic experimental experiences in the operation of semiconductor device and Digital ICs.
3. To learn the operation of various logic gates and their implementation using digital IC's.
4. To learn the realization of various combinational and sequential circuits.

Course Outcomes(Expected Outcome): After successfully completing the lab, the students will be able to

1. Apply practically the concepts of analog and digital electronics.
2. Explain the operation and characteristics of semiconductor devices.
3. Illustrate the operation of various logic gates and their implementation using digital IC's.
4. Design and implement various combinational logic circuits.
5. Design and implement various sequential logic circuits

List of Experiments:

This is a sample list of Experiments; minimum 10 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study V-I characteristics of a PN Junction diode in Forward and Reverse bias.
2. To Sketch and Study the input and output characteristics of transistor connected in Common Emitter (CE) configuration..
3. To Sketch and Study the input and output characteristics of transistor connected in Common Base (CB) configuration
4. To Sketch and Study the input and output characteristics of transistor connected in Common Collector (CC) configuration.
5. To plot static characteristics of FET & calculate its parameters g_m, r_d and µ.
6. To implement Logic gates using TTL ICs (7400, 7402, 7404, 7408, 7410, 7411, 7420, 7427, 7432, 7486).
7. Study and verify the truth table of half adder and full adder using logic gates.
8. Study and verify the truth table of half subtractor and full subtractor using logic gates
9. To compare two 4 bits number and verify the output using 4-bit comparator IC 7485.
10. Implementation of 4×1 multiplexer using logic gates.
11. Implementation and verification of Demultiplexer and Encoder using logic gates.
12. Implementation of 4bit parallel adder using 7483 IC.
13. Design and verify the 4 bit synchronous counter.
14. Design and verify the 4 bit asynchronous counter.
15. Verification of truth table of SR, JK, T and D Flip Flops.

List of Experiment beyond syllabus:

1. Design and Implementation of Op-amp as an inverting amplifier.
2. Design and Implementation of Op-amp as a non-inverting amplifier.
3. To design and find frequency of Astablemultivibrator using IC 555.

3KS09 C-Skill-Lab I

Course Prerequisite: Basic knowledge of any Programming Language

Course Objectives:

1. To be able to program design with functions using Python.
2. To understand data and information processing techniques.
3. To understand to Design a program to solve the problems.
4. To be able to access database using python programming.
5. To be able to design web applications using python programming.

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
2. Interpret different Decision Making statements, Functions, Object oriented programming in Python
3. Summarize different File handling operations
4. Explain how to design GUI Applications in Python and evaluate different database operations
5. Develop applications using Django framework or Flask

List of Experiments:

This is a sample list of Experiments, minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write python program to store data in list and then try to print them.
2. Write python program to print list of numbers using range and for loop
3. Write python program to store strings in list and then print them.
4. Write python program in which an function is defined and calling that function prints Hello World.
5. Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017"
6. Write a program to create, append, and remove lists in python.
7. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
8. Write a program to demonstrate working with tuples in python.
9. Write a program to demonstrate working with dictionaries in python.
10. Write a python program to find largest of three numbers.
11. Write python program in which an function(with single string parameter) is defined and calling that function prints the string parameters given to function.
12. Write python program in which an class is define, then create object of that class and call simple print function define in class.
13. Write a Python script that prints prime numbers less than 20.
14. Write a python program to find factorial of a number using Recursion.
15. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
16. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
17. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
18. Write a Python class to convert an integer to a roman numeral.
19. Write a Python class to implement pow(x, n)
20. Write a Python class to reverse a string word by word.
21. Accessing and working with databases using Python.
22. Create data frame from .csv files and operations on it.

23. Plotting various graphs using Python.
24. Developing basic GUI using Python.
25. Developing web applications using Django framework or Flask

Reference Books

1. “Core Python Programming”, R. NageswaraRao, dreamtech press.
2. “Python Programming A Modular Approach With Graphics, Database, Mobile and Web Applications”, Sheetal Taneja, Naveen Kumar, Pearson.
3. Python Web Development with Django By Jeff Forcier, Paul Bissex, Wesley J Chun, Addison-Wesley Professional.
4. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning
5. Allen B. Downey , “ Think Python: How to Think Like a Computer Scientist”, Second Edition, Shroff/O’Reilly Publishers
6. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India
7. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley
8. Introduction to Computation and Programming using Python, by John Guttag, PHI Publisher, Revised and Expanded version (Referred by MIT)

4KS01 Artificial Intelligence

Course Prerequisite: Basic concepts of Data Structures, Algorithms, Programming

Course Objectives:

1. To present an overview of Artificial Intelligence (AI) principles and approaches.
2. To understand the historical evolution of Artificial Intelligence.
3. To learn various searching techniques and identify to address a particular problem).

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Formulate problems as state space search problem & efficiently solve them.
3. Summarize the various searching techniques, constraint satisfaction problem and example problems - game playing techniques.
4. Apply AI techniques in applications which involve perception, reasoning and learning.
5. Compare the importance of knowledge, types of knowledge, issues related to knowledge acquisition and representation.

Unit I: Introduction to AI **Hours: 7**

Introduction : What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI,

Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents

Unit II: Problem Solving Through AI **Hours: 7**

Introduction, Representation the AI Problems, Production System, Algorithm of Problem Solving, Examples of AI Problems, Nature of AI Problems

Unit III: Uninformed Search Strategies **Hours: 6**

Problem-Solving Agents, Example Problems, Search Algorithms, **Uninformed Search Strategies**: Breadth-First Search, Uniform-Cost Search, Depth First Search, Bidirectional Search, Depth Limited Search, Iterative Deepening Depth-First Search

Unit IV: Informed Search Strategies **Hours: 7**

Basic Concept of Heuristic Search and Knowledge, Designing of Heuristic Function, **Heuristic Search Strategies:** Generate-And-Test, Best-First Search, Problem Reduction, Hill Climbing, Constraint Satisfaction, Means-Ends-Analysis

Unit V: Adversarial Search & Games **Hours: 7**

Game Theory, Optimal Decisions in Games, Mini-Max Search, Alpha Beta Pruning, Additional Refinements, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms

Unit VI: Introduction to Knowledge **Hours: 6**

Introduction, Types of Knowledge, Knowledge Representation, Knowledge Storage, Knowledge Acquisition, Knowledge Organization and Management, Basic Concepts of Knowledge Engineering

Text Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell & Peter Norvig (Pearson - 4th Ed.)
2. Artificial Intelligence by Ela Kumar (IK International Publishing House Pvt. Ltd.)

Reference Books:

1. Artificial Intelligence by Elaine Rich and Kevin Knight (Tata McGraw Hill - 3rd Ed.)
2. A First Course in Artificial Intelligence by Deepak Khemani (Tata McGraw Hill - 1st Ed.)
3. Artificial Intelligence and Expert Systems by Patterson (PHI)
4. Introduction to Artificial Intelligence by RajendraAkerkar (PHI Learning Pvt. Ltd.)

4KS02 Data Communication and Networking

Course Prerequisite: Computer and Data Communication Requirements

Course Objectives:

1. To understand the building blocks of digital communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a digital communication system
4. To analyze error performance of a digital communication system in presence of noise and other interferences.
5. To evaluate the errors using various error detection & correction techniques.
6. To understand network based protocols in data communication and networking.

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Describe data communication Components, Networks, Protocols and various topology based network architecture
2. Design and Test different encoding and modulating techniques to change digital –to- digital conversion, analog-to-digital conversion, digital to analog conversion, analog to analog conversion,
3. Explain the various multiplexing methods and evaluate the different error detection & correction techniques.
4. Illustrate and realize the data link control and data link protocols.
5. Describe and demonstrate the various Local area networks and the IEEE standards.

Unit I: Introduction to Data Communication **Hours: 7**

Introduction: Data Communication, Components, Networks, Network types: Local Area Network,Wide Area Network, Switching, The Internet, Accessing the Internet, Standards and Administration: Internet Standards, Internet Administration, Network Models:TCP/IP Protocol Suite, TheOSI Model, Transmission media: Introduction, Guided media & Unguided media-Wireless. Switching: Introduction, Circuit Switched Networks, Packet Switching.

Unit II: Data link Layer **Hours: 6**

Data Link Layer: Introduction, Nodes & Links, Services , Two categories of link, Two sub-layers, Error detection and correction: Introduction, Block Coding, Cyclic codes, Checksum, Forward Error Correction, Data link control: DLC services, Data-Link Layer Protocol, HDLC, Point-To-Point Protocol, Media Access Control (MAC): Random Access, Controlled Access, Channelization.

Unit III: Network Layer **Hours: 7**

Introduction to Network layer Network Layer Services: Packetizing, Routing and Forwarding, Other Services Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service , Network Layer performance: Delay, Throughput, Packet Loss, Congestion Control, IPV4 Address: Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT), Forwarding of IP packets: Forwarding Based on Destination Address, Forwarding Based on Label, Routers as Packet Switches

Unit IV: Network Layer Protocol **Hours: 7**

Network Layer Protocols: Internet Protocol (IP),Datagram Format, Fragmentation, Security of IPv4 Datagrams,ICMPV4: Messages, Debugging Tools, ICMP Checksum,Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP,Routing algorithms: Distance Vector routing, Link State Routing, IPV6 Addressing: Representation, Address Space, Address Space Allocation, Auto configuration, Renumbering, Transition from IPV4 to IPV6: Strategies, Use of IP Addresses

Unit V: Transport Layer **Hours: 6**

Introduction to Transport layer: Introduction, Transport-Layer Services, Connectionless and Connection-Oriented Protocols, Transport-Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol (GBN), Selective-Repeat Protocol, Bidirectional Protocols: Piggybacking,User Datagram Protocols: User Datagram, UDP Services, UDP Applications,Transmission Control Protocol: TCP Services, TCP Features , Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options, SCTP: SCTP Services, SCTP Features

Unit VI: Application layer **Hours: 7**

Introduction to Application layer:Providing Services, Application-Layer Paradigms, Client-Server Programming: Application Programming Interface, Using Services of the Transport Layer, Iterative Communication Using UDP, Iterative Communication Using TCP, Concurrent Communication,World wide web and HTTP: World Wide Web, Hyper-Text Transfer Protocol (HTTP) FTP: Two Connections, Control Connection, Data Connection, Security for FTP,Electronic Mail:Architecture, Web-Based Mail, E-Mail Security,Domain Name System (DNS):Name Space, DNS in the Internet, Resolution, Caching, Resource Records, DNS Messages, Registrars, Security of DNS, Network Management: Introduction. Configuration Management, Fault Management, Performance Management, Security Management, Accounting Management,SNMP: Managers and Agents, Management Components, ASN.1: Language Basics, Data Types, Encoding.

Text Book:

Behrouz A. Forouzan: Data Communication and Networking, (5/e) (TMH

Reference Books:

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education
2. William L. Schweber : Data Communication, McGraw Hill
3. J.Freey : Computer Communication & Networks, AEW Press
4. D. Corner: Computer Networks & Internet, Pearson Education.

4KS03 Operating System

Course Prerequisite: Discrete Structures, Data Structure, Any programming Language

Course Objectives:

1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

Unit I: Introduction to OS **Hours: 7**

Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multithreading Models, Threading Issues, Java Threads

Unit II: Process Scheduling **Hours: 7**

Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue Scheduling

Unit III: Process Synchronization **Hours: 6**

Process Synchronization Basics: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock

Unit IV: Memory Management **Hours: 7**

Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Virtual Memory Management: Background, Demand paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing

Unit V: Unit Title: File System **Hours: 7**

File-System Interface; Directory Structure, File-System Mounting, File Sharing &Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management. File Recovery

Unit VI: Unit Title: I/O System **Hours: 6**

I/O Systems : Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations , Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure.

Text Book: Avi Silberschatz, P. B. Galvin, G. Gagne: “Operating System Concepts” (9/e) John-Wiley & Sons.

Reference Books:

1. A.S. Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings “Operating Systems” Prentice-Hall.
3. D. M. Dhamdhere “Operating Systems” Tata McGraw-Hill.
4. P. Balkrishna Prasad: “Operating Systems” Scitech Publications (I) Pvt.

4KS04 Microprocessor & Assembly Language Programming

Course Prerequisite: Computer Programming and Computer Fundamentals

Course Objectives:

1. To explore 8086 microprocessor and its architecture.
2. To introduce interfacing techniques of 8086 microprocessor.
3. To introduce basics of Internet of Things

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
2. Design and Test assembly language programs using 8086 microprocessor instruction set.
3. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language.
4. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor.
5. Explain the basic concepts of Internet of Things

Unit I: 8086 Architecture **Hours: 7**

8086 architecture and pin configuration, Software model of 8086 microprocessor. Memory addresses space and data organization. Data types. Segment registers, memory segmentation. IP & Data registers, Pointer, Index registers. Memory addresses generation.

Unit II: 8086 Instruction Set **Hours: 7**

8086 Instruction set overview, addressing modes. 8086 instruction formats. 8086 programming: Integer instructions and computations: Data transfer instructions, Arithmetic instructions and their use in 8086 programming.

Unit III: 8086 Instruction Set **Hours: 6**

8086 programming: logical instructions. Shift and rotate instructions and their use in 8086 programming. 8086 flag register and Flag control instructions, compare instruction, control flow and jump instructions, Loops & loop handling instructions. 8086 programming using these instructions.

Unit IV: Subroutines& Macros **Hours: 7**

The 8086 stack segment and stack related instructions. 8086 I/O Address space. Subroutines and related instructions, Parameter passing, Concept of Macros, Status saving on stack. Concept of recursion at assembly program level. 8086 Programming using subroutines, recursion and macros.

Unit V: 8086 Interrupt **Hours: 7**

8086 Interrupts types, priority and instructions. Interrupt vector table, External hardware-interrupt interface signals & interrupts sequence. Software interrupts. Non-maskable interrupts. 8086 microprocessor interrupt programming.

Unit VI: Internet of Things (IoT) **Hours: 6**

Internet of things: An overview, IoT conceptual framework, IoT Architectural View, Technology behind IoT, Sources of IoT, M2M communication, Examples of IoT.

Text Book:

1. A. K. Ray & K. M. Bhurchandi: Advanced Microprocessors & Peripherals, Third Edition (TMH).

2. Raj Kamal: Internet of Things, Architecture and Design Principals, McGraw Hill Education (India) Private Limited

Reference Books:

1. W. A. Triebel& Avatar Singh: The 8088/8086 Microprocessors (4e) (PHI /Pearson Education)
2. Liu & Gibson: The 8088/8086 Microprocessor Architecture Programming and Interface (6/e) (PHI)

4KS05 Theory of Computation

Course Prerequisite: Discrete Mathematics, Data Structures

Course Objectives:

1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

Unit I: Finite State Machines **Hours: 8**

Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines.
Minimization of Finite Automata. (Construction of Minimum Automaton)

Unit II: Regular Expression and Regular Grammar **Hours: 8**

Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden's Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs(proofs not required), Regular grammar, Equivalence of RG (RLG and LLG) and FA.

Unit III: Context Free Grammar and Languages **Hours: 8**

Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

Unit IV: Pushdown Automata **Hours: 8**

Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion , Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

Unit V: Turing Machines **Hours: 8**

Formal definition of a Turing Machine, Design of TM, Computable Functions, Church's hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.

Unit VI: Decidability and Un-Decidability **Hours: 8**

Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory

Text Book:

1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation
2. Peter Linz: An Introduction to Formal Languages and Automata

Reference Books:

1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill,2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra &Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. VivekKulkarni : Theory of Computation, OUP India, 2013

4KS06 Data Communication & Networking Lab

Course Prerequisite: Computer and Data Communication Requirements

Course Objectives:

1. To understand the working principle of various communication protocols
2. To understand and analyze the signal flow in a digital communication system.
3. To analyze error performance of a digital communication system in presence of noise and other interferences.
4. To evaluate the errors using various error detection & correction techniques.
5. To understand network based protocols in data communication and networking.

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Analyze performance of various communication protocols
2. Implement Configure various network protocols.
3. Compare IP Address classes of networks

List of Experiments:

This is a sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study various LAN topologies and their creation using network devices, cables and computers. .
2. To connect the computers in Local Area Network.
3. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
4. Write a program of bit stuffing used by Data Link Layer
5. Write a program to implement CRC(Cyclic Redundancy Check)
6. Write a program to implement Checksum
7. Write a program to implement Sliding window
8. Configure Internet connection and use IP-Config, PING / Tracer and Net stat utilities to debug the network issues.
9. Configuration of TCP/IP Protocols in Windows and Linux.
10. Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network.
11. Write a C Program to determine if the IP Address is in Class A, B, C, D, or E
12. Write a C Program to translate Dotted Decimal IP Address into 32 Bit Address.
13. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration)

4KS07 Operating System Lab

Course Prerequisite: Basic computer programming

Course Objectives:

1. To make students aware of the kernel and shell structure of the operating systems.
2. To make students aware of the purpose, structure and functions of operating systems
3. To equip students with understanding of the various scheduling algorithms in OS.
4. To make students aware of understanding of memory management in different OS.

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Explain memory management issues like external fragmentation, internal fragmentation.
2. Illustrate multithreading and its significance.
3. List various protection and security mechanisms of OS.
4. Analyze and solve the scheduling algorithms.
5. Analyze the deadlock situation and resolve it.
6. Compare various types of operating systems

List of Experiments:

This is a sample list of Experiments, minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. To study Linux Operating System along with its installation.
2. To Study and Execute basic file commands and process related open source Ubuntu commands
   a. Commands to view all executing, block and suspended process.
   b. Command to check and change the priority of process CPU utilization for executing processes.
   c. Commands to check for child process, sub-processes, process tree, abort & end process and all other basics commands related to processes
3. Write a program for multithreading using C.
4. To simulate First Come First Serve & Shortest Job First process scheduling algorithm
5. To simulate Shortest Job First process scheduling algorithm
6. To simulate Preemptive Shortest Job First process scheduling algorithm
7. To implement Round Robin Process scheduling Algorithm
8. To implement Priority Based Process scheduling Algorithm
9. To implement and analyze multi-level queue scheduling algorithm
10. To implement the following file allocation strategies.
11. To simulate paging technique of memory management.
12. To implement the FIFO page replacement policy
13. To implement the LRU page replacement policy
14. To implement the optimal page replacement policy
15. To simulate producer-consumer problem using semaphores.
16. To implement Dining-Philosophers problem to deal with concurrency control mechanism.
17. To implement contiguous memory allocation strategies to detect fragmentation using: First Fit, Best Fit and Worst Fit.
18. To implement FCFS Disk Scheduling algorithm
19. To implement SCAN Disk Scheduling algorithm
20. To implement C-SCAN Disk Scheduling algorithm
21. To simulate Bankers algorithm for deadlock avoidance
22. To implement following memory management techniques
    Implement MVT and MFT where memory block size is 100 for 5 processes. Enter no. of blocks for each process and calculate internal fragmentation.
23. To simulate LFU page replacement algorithms

24. To simulate the Single level directory file organization techniques.
25. To Simulate bankers algorithm for Dead Lock Avoidance (Banker‘s Algorithm)

4KS08 Microprocessor & Assembly Lang. Prog Lab

Course Prerequisite: Computer Programming, Number System

Course Objectives: In this lab student will learn about' Microprocessor and Interfacing' in regards to digital computer, microprocessor architecture, programming with 8086 microprocessor and different peripherals**.**

Course Outcomes(Expected Outcome): On completion of the course, the students will be able to

1. Analyze the internal workings of the microprocessor
2. Design and develop programs in Assembly Language Programming
3. Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.
4. Design and Test assembly language programs using 8086 microprocessor instruction set.
5. Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language
6. Illustrate and realize the Interfacing of memory & various I/O devices with 8086 microprocessor

List of Experiments:

This is a sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Installation and Introduction of TASM Assembler.
2. Write a program for addition of two 8-bits numbers and two 16-bits numbers.
3. Write a program for subtraction of two 8-bits numbers and two 16-bits numbers.
4. Write a program for multiplication of two 8-bits numbers.
5. Write a program for division of two 8-bits numbers
6. Write a program to check whether a given number is even or odd.
7. Write a program to demonstrate Logical Group and Shift Rotate Instructions.
8. Write a program to check whether a given number is positive or negative.
9. Write a program to find greatest of two 8-bits signed &unsigned numbers.
10. Block Transfer Program
11. Write a program to find Factorial of a number using loop instruction.
12. Write a program to find cube of a given number using Subroutine.
13. Write a program to find square of a given number using Subroutine.
14. Write a program to find square of a given number using Macro.
15. Write a program to find whether the string is palindrome or not.
16. To convert BCD Number Program
17. Write a program to perform Reverse of the String
18. Write a program to transfer 10-bytes from one memory bank to another memory bank.
19. Program for sorting an array for 8086 microprocessor.
20. To write an assembly language program to arrange the given numbers in descending order.
21. Program for searching for a number/character in a string for 8086 microprocessor.

4KS09 C-Skill-Lab II

Course Prerequisite: Basic knowledge of scripting language, Programming language. Basic understanding of Electronic concepts.

Course Objectives: To develop an ability to design and implement static and dynamic website and to develop embedded systems with the help of Raspberry Pi/Ardino.

Course Outcomes(Expected Outcome): On completion of the course, a student will be able to

1. Develop client server program and web applications
2. Make use of project-based experience for web application development.
3. Create embedded systems using Raspberry Pi/Ardino

List of Experiments:

This is a sample list of Experiments, minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Introduction to PHP and configure it to work with Apache Web Server.
2. Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
3. Create your class timetable using table tag.
4. Create user Student feedback form (use textbox, text area , checkbox, radio button, select box etc.)
5. Create your resume using HTML tags also experiment with colors, text , link , size and also other tags you studied.
6. Design a web page of your home town with an attractive background color, text color, an Image, font etc. (use internal CSS).
7. Develop a JavaScript to display today's date.
8. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
9. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).

10. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
11. Write a PHP program to display a digital clock which displays the current time of the server.
12. Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find the transpose of a matrix.
13. Write a PHP program to sort the student records which are stored in the database using selection sort.
14. Study and Install IDE of Arduino and different types of Arduino.
15. Write program using Arduino IDE for Blink LED.
16. Write Program for RGB LED using Arduino.
17. Study the Temperature sensor and write a Program for monitor temperature using Arduino.
18. Study and Implement RFID, NFC using Arduino. • Study and implement MQTT protocol using Arduino.
19. Study and Configure Raspberry Pi.
20. WAP for LED blink using Raspberry Pi.
21. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
22. Create Smart Plugs with Arduino and Raspberry Pi.
23. Interfacing digital sensors with raspberry pi.
24. Creating a webpage to control I-O devices, Reading data from sensor and passing to web page.
25. Implement a program to access Analog sensor via wifi with HTML Web server.

14) Study of Electric Heating.
15) Design Scheme of Illumination System.
16) Study of Electric Traction System .

- Basics of IoT, IoT based Monitoring & Controlling of various Electrical Equipments.

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B.E. COMPUTER SCIENCE & ENGINEERING SEM. V & VI

Syllabus of B.E. Sem. V (Computer Science & Engineering)

5KS01 Database Management Systems (L-4, T-0, C-4)

Course Prerequisite: Discrete Mathematics, Data Structures and Algorithm
Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Database Management Systems by being able to do each of the following:
- To understand the fundamental concepts of database management system.
- To learn database query languages.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To understand the query processing and optimization.
- To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design & develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS **Hours: 8**
Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to Relational Schemas, E-R design issues, Extended E-R Features. (8)

Unit II: Relational Algebra, SQL **Hours: 8**
Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra, Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database Operations, Join expressions, Views.

Unit III: Relational Database Design **Hours: 8**
Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs,atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Algorithms for decomposition, Decomposition using multi-valued dependencies, More Normal Forms, Database Design Process.

Unit IV: Query Processing and Query Optimization **Hours: 8**
Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Query Optimization: Overview, Transformation of Relational Expressions ,Estimating Statistics of Expression Results, , Choice of Evaluation Plans, Materialized Views.

Unit V: Transaction Management **Hours: 8**
Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity, transaction isolation levels, Implementation of Isolation levels, Transactions as SQL statements

Unit VI: Concurrency Control and recovery system **Hours: 8**
Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols, Multi-version schemes, Recovery system :Failure classification, Storage , Recovery & Atomicity, Recovery algorithm, buffer management, Failure with loss of nonvolatile storage , early lock release and logical undo operations, , Remote Backup Systems

Text Book: Abraham Silberschatz, Henry F. Korth, S. Sudarshan, DATABASE SYSTEM CONCEPTS, Sixth Edition, McGraw Hill

Reference Books:
1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaum's Outlines)

5KS02 COMPILER DESIGN (L-3, T-0, C-3)

Course Pre-requisite: Basic knowledge of Discrete Mathematics, Theory of Computation

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

- To learn concepts of programming language translation and phases of compiler design
- To understand the common forms of parsers.
- To study concept of syntax directed definition and translation scheme for the representation of language
- To illustrate the various optimization techniques for designing various optimizing compilers

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate-Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

Unit I: Introduction to Compiler **Hours: 06**
Introduction to Compilers: Language Processor, The Structure of a Compiler. Lexical Analysis: The role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The lexical analyzer generator Lex, Finite Automata, From Regular Expressions to Finite Automata, State minimization of DFA.

Unit II: Syntax Analysis **Hours: 07**
Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis: Parse Tree and Derivation, Ambiguity in Grammar, Elimination of left recursion and left factoring. Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, FIRST and FOLLOW, LL (1) Grammars, Construction of predictive parsing tables, Non recursive predictive parsing, Error recovery in predictive parsing.

Unit III: Bottom up parsing **Hours: 07**
Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing Introduction to LR parsing: Simple LR, Items and the LR(0) Automation, The LR-Parsing algorithm, Construction of SLR parsing table, More powerful LR Parsers: canonical LR(1) Items, Constructing LR(1) sets of items and canonical LR(1) parsing tables, Constructing LALR parsing tables, The parser generator Yacc.

Unit IV: Syntax Directed Translation **Hours: 07**
Syntax Directed Translation: Syntax directed definitions, Inherited and synthesized attributes, Evaluation orders of SDD's: Dependency Graphs, S-attributed definitions, L-attributed definition. Application of Syntax-Directed Translation: Construction of syntax trees. Syntax-directed Translation Schemes.

Unit V: Intermediate-Code Generation **Hours: 07**
Intermediate-Code Generation: Variants of Syntax Trees: Directed Acyclic Graphs(DAG), Three Address Code. Run Time Environments: Storage Organization, Static versus Dynamic Storage Organization, Stack Allocation of Space: Activation trees, Activation Records, Calling Sequences, Variable- Length data on stack. Access to Nonlocal Data on the Stack. Heap Manager: The Memory Manager. Introduction to Garbage Collection: Design Goals for Garbage Collectors.

Unit VI: Code Generation **Hours: 06**

Code Generation: Issues in Design of a Code generator, The Target Language, Address in the target code, Basic blocks and flow graphs. Optimization of Basic Blocks, Peephole Optimization and The Principal sources of Optimization.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: “Principles, Techniques and Tools”, Pearson Education Second Edition.

Reference Books:

1. D. M. Dhamdhere, Compiler Construction—Principles and Practice, (2/e), Macmillan India.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: “Principles, Techniques and Tools”, Pearson Education (Low Price Edition).
3. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press.
4. K C. Louden “Compiler Construction—Principles and Practice” India Edition, CENGAGE.
5. Bennett J.P., “Introduction to Compiling Techniques”, 2/e (TMH).

5KS03 COMPUTER ARCHITECTURE & ORGANIZATION (L-3, T-0, C-3)

Course Pre-requisite: Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Architecture & Organization by being able to do each of the following:

- To discuss the basic concepts and structure of computers.
- To solve concepts of arithmetic operations.
- To understand addressing modes and memory organization.
- To analyze conceptualize multitasking ability of a computer and pipelining
- To explain IO communication

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Discuss basic structure of computer.
2. Understand the basic operation of CPU.
3. Compare and select various Memory and I/O devices as per requirement.
4. Solve the concepts of number representation and their operation.
5. Explain the concept of parallel processing and pipelining.

Unit I: Basic Structure of Computer **Hours: 7**

Basic Structure of Computer H/W & S/W: Functional Units, Basic Operational Concepts, Bus structures, Addressing Methods and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing, Addressing Modes. Basic I/O Operations.

Unit II: Memory Unit **Hours: 7**

Basic Concepts, Memory Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic Memories, Read Only Memories, Speed, Size and Cost.

Unit III: Processing Unit **Hours: 8**

Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Microprogrammed Control, Microinstructions, Microprogram Sequencing.

Unit IV: I/O Organization **Hours:6**

Accessing I/O Devices, Interrupts, Enabling and Disabling Inerrupts, Handling Multiple Devices, DMA,I/O Hardware, Standard I/O Interfaces:SCSI

Unit V: Arithmetic **Hours: 7**

Number Representations, Design of Fast Adders, Signed Addition and Subtraction, Multiplication of Positive Numbers ,Booth Multiplier, Fast Multiplication ,Integer Division, Floating Point Numbers and Operations.

Unit VI: Parallel Organization and Pipelining **Hours: 7**

Parallel Processing, Array Processors, The Structure of General Purpose Multiple Processors, Symmetric, Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Memory Organization in Multiprocessors. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Text Book: Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata McGraw-Hill.

Reference Books:

1. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Eighth Edition, Pearson.
   John P. Hayes, “Computer Architecture and Organization”, McGraw Hill Publication.
2. DA Patterson and JL Hennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition
3. A.S. Tanenbaum, "Structured Computer Organization", PHI Publication.

5KS04 COGNITIVE TECHNOLOGIES (L-3, T-0, C-3)

Course Prerequisite: Basic knowledge of Artificial Intelligence, Programming and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cognitive Technologies by being able to do each of the following:

- This course intends to introduce concept of cognitive technologies and important approaches of cognitive technologies.
- Student will learn and analyze key concept of cognitive technologies.
- Students will gain an understanding of innovation concepts, terminology, current and future trends in cognitive technologies.
- Introduces students to IBM Watson platform, an artificially intelligent computer system capable of answering questions posed in natural language, developed in IBM's Deep QA project.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe the Cognitive computing and principles of cognitive systems.
2. Identify role of Natural Language Processing in cognitive system.
3. Outline application of advanced analytics in cognitive computing.
4. Justify role of Cloud and Distributed Computing in Cognitive Computing.
5. Assess the process of building a Cognitive Application.
6. Identify the Emerging Areas and Future Applications of Cognitive Computing.

Unit I: Foundation of Cognitive Computing & Design Principle of Cognitive Systems Hours: 07

The Foundation of Cognitive Computing: Cognitive Computing as a New Generation, The Uses of Cognitive Systems, What Makes a System Cognitive, Gaining Insights from Data, Domains Where Cognitive Computing Is Well Suited, Artificial Intelligence as the Foundation of Cognitive Computing, Understanding Cognition, Two Systems of Judgment and Choice, Understanding Complex Relationships Between Systems, The Elements of a Cognitive System, Infrastructure and Deployment Modalities.

Design Principles for Cognitive Systems: Components of a Cognitive System, Building the Corpus, Bringing Data into the Cognitive System, Machine Learning, Hypotheses Generation and Scoring, Presentation and Visualization Services.

Unit II: NLP and Big Data in Cognitive System Hours: 07

Natural Language Processing in Support of a Cognitive System: The Role of NLP in a Cognitive System, Semantic Web, Applying Natural Language Technologies to Business Problems.

The Relationship Between Big Data and Cognitive Computing**:** Dealing with Human-Generated Data, Defining Big Data, The Architectural Foundation for Big Data, Analytical Data Warehouses, Hadoop, Data in Motion and Streaming Data, Integration of Big Data with Traditional Data.

Unit III: Knowledge Representation and Advance Analytics in Cognitive Computing Hours: 06

Representing Knowledge in Taxonomies and Ontologies: Representing Knowledge, Developing a Cognitive System, Defining Taxonomies and Ontologies, Explaining How to Represent Knowledge, Models for Knowledge Representation. Applying Advanced Analytics to Cognitive Computing: Advanced Analytics Is on a Path to Cognitive Computing, Key Capabilities in Advanced Analytics, Using Advanced Analytics to Create Value, Impact of Open Source Tools on Advanced Analytics.

Unit IV: Role of Cloud and Distributed Computing in Cognitive Computing Hours: 07

The Role of Cloud and Distributed Computing in Cognitive Computing: Leveraging Distributed Computing for Shared Resources, Why Cloud Services Are Fundamental to Cognitive Computing Systems, Characteristics of Cloud Computing, Cloud Computing Models, Delivery Models of the Cloud, Managing Workloads, Security and Governance, Data Integration and Management in the Cloud.

The Business Implications of Cognitive Computing: Preparing for Change, Advantages of New Disruptive Models, What Does Knowledge Mean to the Business?, The Difference with a Cognitive Systems Approach, Meshing Data Together Differently, Using Business Knowledge to Plan for the Future, Answering Business Questions in New Ways, Building Business Specific Solutions, Making Cognitive Computing a Reality, How a Cognitive Application Can Change a Market.

Unit V: IBM Watson and Process of Building a Cognitive Application Hours: 07

IBM's Watson as a Cognitive System: Watson Defined, Advancing Research with a "Grand Challenge", Preparing Watson for Jeopardy, Preparing Watson for Commercial Applications, The Components of DeepQA Architecture.

The Process of Building a Cognitive Application: The Emerging Cognitive Platform, Defining the Objective, Defining the Domain, Understanding the Intended Users and Defining their Attributes, Defining Questions and Exploring Insights, Creating and Refining the Corpora, Training and Testing.

Building a Cognitive Healthcare Application: Foundations of Cognitive Computing for Healthcare, Constituents in the Healthcare Ecosystem, Learning from Patterns in Healthcare Data, Building on a Foundation of Big Data Analytics, Cognitive Applications across the Healthcare Ecosystem, Starting with a Cognitive Application for Healthcare, Using Cognitive Applications to Improve Health and Wellness, to Enhance the Electronic Medical Record and to Improve Clinical Teaching.

Unit VI: Emerging Areas and Future Application **Hours: 06**

Smarter Cities: Cognitive Computing in Government: How Cities Have Operated, The Characteristics of a Smart City, The Rise of the Open Data Movement Will Fuel Cognitive Cities, The Internet of Everything and Smarter Cities, Understanding the Ownership and Value of Data, Smarter Approaches to Preventative Healthcare, Building a Smarter Transportation Infrastructure, Using Analytics to Close the Workforce Skills Gap, Creating a Cognitive Community Infrastructure, The Next Phase of Cognitive Cities.

Emerging Cognitive Computing Areas: Characteristics of Ideal Markets for Cognitive, Computing Vertical Markets and Industries.

Future Applications for Cognitive Computing: Requirements for the Next Generation, Technical Advancements That Will Change the Future of Cognitive Computing, What the Future Will Look Like, Emerging Innovations.

Text Book:

Judith Hurwitz, Marcia Kaufman and Adrian Bowles, "Cognitive Computing and Big Data Analytics", publication John Wiley & Sons, Inc, 2015.

Reference Books:

1. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, publication Cambridge University Press, New York, Second Edition.
2. Jay Friedenberg and Gordon Silverman, Cognitive Science: An Introduction to the Study of Mind, Sage Publications, Inc. London, 2014.
3. Huimin Lu (Editor), Cognitive Internet of Things: Frameworks, Tools and Applications, Springer Nature Switzerland AG 2020.
4. Danish Contractor and Aaditya Telang (Editors), Applications of Cognitive Computing Systems and IBM Watson, 8th IBM Collaborative Academia Research Exchange, publication Springer Nature Singapore Pte Ltd., 2017.
5. S. Bird, E. Klein, E. Loper (2009), Natural Language Processing with Python, O' Reilly Media.

5KS04 DATA SCIENCE AND STATISTICS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:

- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Apply the learned concepts for the skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate proficiency with statistical analysis of data.
2. Build skills in transformation and merging of data for use in analytic tools.
3. Perform linear and multiple linear regression analysis.
4. Develop the ability to build and assess data-based models.
5. Evaluate outcomes and make decisions based on data.

Unit I: Data Science and Statistical Learning **Hours: 6**

Introduction: What Is Data Science?, Statistical Inference, Exploratory Data Analysis, and the Data Science Process, Exploratory Data Analysis, Stages of a Data Science Project, The Data Science Process, Why Statistical Learning: f Estimation- Why and How, Tradeoff Between Prediction Accuracy and Model Interpretability, Supervised vs Unsupervised Learning, Regression vs Classification Problems, Accessing Model Accuracy: Measuring the Quality of Fit, The Bias Variance Trade-off, The Classification Setting.

Unit II: Linear Regression **Hours: 7**

Simple Linear Regression: Estimating the Coefficients, Assessing the Accuracy of the Coefficient Estimates, Assessing the Accuracy of the Model, Multiple Linear Regression: Estimating the Regression Coefficients, Other Considerations in the Regression Model: Qualitative Predictors, Extensions of the Linear Model, Potential Problems, The Marketing Plan, Comparison of Linear Regression with K-Nearest Neighbors.

Unit III: Classification and Cross Validation **Hours: 7**

Classification: An Overview of Classification, Why not Linear Regression?, Logical Regression: The Logistic Model, Regression Coefficients, Making Predictions, Multiple Logistic Regression, >2 Response Classes, Linear Discriminant Analysis: Using Bayes' Theorem, LDA for p = 1 and p >1, Quadratic Discriminant Analysis, Comparison of Classification Methods, Cross Validation: The Validation Set Approach, Leave-One-Out and k-Fold Cross-Validation, Bias-Variance Trade-Off for k-Fold Cross-Validation, Classification Problems, The Bootstrap

Unit IV: Linear Model Selection and Regularization **Hours: 6**

Subset Selection: Best Subset Selection, Stepwise Selection, Choosing the Optimal Model, Shrinkage Methods: Ridge Regression, The Lasso, Selecting the Tuning Parameter, Dimension Reduction Methods: Principal Components Regression, Partial Least Squares, Considerations in High Dimensions: High-Dimensional Data, What Goes Wrong in High Dimensions?, Regression in High Dimensions, Interpreting Results in High Dimensions

Unit V: Nonlinearity and Tree Based Methods **Hours: 7**

Moving Beyond Linearity: Polynomial Regression, Step Functions, Basis Functions, Regression Splines: Piecewise Polynomials, Constraints and Splines, Representation, Number and Locations of the Knots, Comparison to Polynomial Regression, Smoothing Splines: An Overview and Smoothing
Parameter λ, Local Regression, Generalized Additive Models: Regression Problems and Classification Problems, Tree-Based Methods: Decision, Regression and Classification Trees, Trees Versus Linear Models, Advantages and Disadvantages, Bagging, Random Forests, Boosting

Unit VI: SVM and Unsupervised Learning **Hours: 7**

Maximal Margin Classifier: Hyperplane and Classification, The Maximal Margin Classifier, Construction, The Non-separable Case, Support Vector Classifiers: Overview and Details, Support Vector Machines: Classification with Non-linear Decision Boundaries, SVM, Application, SVMs with More than Two Classes, Relationship to Logistic Regression, Unsupervised Learning: The Challenge of Unsupervised Learning: Principal Components Analysis, Clustering Methods: K-Means Clustering, Hierarchical Clustering, Practical Issues in Clustering.

Text Books:

1. Cathy O'Neil and Rachel Schutt: Doing Data Science, First Edition, 2014, O'reilly Publications, ISBN: 978-1-449-35865-5
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0.

Reference Book:

Nina Zumel, John Mount: Practical Data Science with R, First Edition, 2014, Manning Publications Co., ISBN: 9781617291562.

5KS04 INTERNET OF THINGS [L-3, T-0, C-3]

Course Prerequisite: Basic knowledge of Internet and Microprocessor & Assembly Language Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Internet of Things by being able to do each of the following:

- To learn and understand fundamental of IoT
- To study the design methodology and different IoT platform
- To understand usefulness of IoT for society
- To design and implement application of IoT using various sensor

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Understand the basics of IoT
2. Understand design methodology and platforms involved in IoT
3. Apply the knowledge to interface various sensors with IoT development
4. Design and Implement IoT system for real time application

Unit I: **Hours: 6**

Introduction to Internet of Things, Definition & Characteristics of IoT, Physical Design of IoT Logical Design of IoT, IoT Enabled Technologies like Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels & Deployment Templates, Domain Specific IoTs: Home, Cities, Environment, Energy systems, Logistics, Agriculture, Health & Lifestyle.

Unit II: **Hours: 7**

IOT & M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software defined networks, network function virtualization, IoT Systems Management, Simple Network Management Protocol (SNMP) ,Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG, NETOPEER.

Unit III: **Hours: 7**

IoT Platforms Design Methodology, Case Study on IoT System for Weather Monitoring, Motivation for Using Python, IoT Systems - Logical Design using Python ,Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling l, Date/Time Operations, Classes, Python Packages of Interest for IoT

Unit IV: (Hours: 7) IoT Physical Devices & Endpoints, Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces serial, SPI, I2C, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, Interfacing an LED and switch with Raspberry Pi, Interfacing Light Sensor with Raspberry Pi Other IoT Devices, pcDuino, BeagleBone Black, Cubieboard.

Unit V: **Hours: 7**

IoT Physical Servers & Cloud Offerings, Introduction to Cloud Storage Models & Communication APIs , WAMP - AutoBahn for IoT , Xively Cloud for IoT , Python Web Application Framework - Django , Designing a RESTful Web API , Amazon Web Services for ,SkyNet IoT Messaging Platform.

Unit VI: **Hours: 7**
Case Studies Illustrating IoT Design, Introduction, Home Automation: Smart Lighting, Home Intrusion detection, Cities: Smart parking, Environment: Weather Monitoring System, Weather reporting Bot, Air pollution monitoring, Forest fire detection, Agriculture: Smart Irrigation, Productivity Applications: IoT printer.

Text Book: Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN:0: 0996025510, 13: 978-0996025515.

Reference Books:
1. Fundamentals of Python, K.A.Lambert and B.L.Juneja, Cengage Learning, 2012.
2. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014

5KS04 INTRODUCTION TO CYBER SECURITY [L-3, T-0,C-3]

Course Prerequisite: Computer Programming, Data Structure, Data Communication & Networking.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Introduction to Cyber Security by being able to do each of the following:
- Understand basics of Cybercrime and Information Security.
- To familiarize various cyber threats, attacks, Cyber offenses.
- Understand Cybercrime on Mobile and Wireless devices.
- Understand tools and methods used in Cybercrime.
- Understand Access Control and Authentication.
- Understand Intrusion Detection and Prevention.

Course Outcomes (Expected Outcome): After completion of this course, the students should be able to:
1. Know fundamentals of Cybercrimes and Cyber offenses
2. Realize the Cyber threats, attacks and Vulnerabilities.
3. Explore the industry practices and tools.
4. Comprehend the Access Control and Authentication Process.
5. Implement Intrusion Detection and Prevention.

Unit I: **Hours:6**
Introduction to Cybercrime: Introduction, Cybercrime, Cybercrime and Information Security, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era.

Unit II: **Hours: 6**
Cyber offenses: Introduction, Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrime, Botnets, Attack Vector, Cloud Computing.

Unit III: **Hours: 6**
Cybercrime: Mobile and Wireless Devices Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Cards Frauds in Mobile and Wireless Computing, Security Challenges posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implementations for Organizations, Organizational Measures for Handling Mobile, Devices Related Security Issues Organizational Security Policies and Measures in Mobile Computing, Laptops.

Unit IV: **Hours: 6**
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Unit V: **Hours:6**
Access Control and Authorization: Definitions, Access Rights, Access Control Systems, Authorization, Types of Authorization Systems, Authorization Principles, Authorization Granularity, Web Access and Authorization.
Authentication: Definition, Multiple Factors and Effectiveness of Authentication, Authentication Elements, Types of Authentication, Authentication Methods.

Unit VI: **(Hours: 6)** System Intrusion Detection and Prevention: Definition, Intrusion Detection, Intrusion Detection Systems (IDSs), Types of Intrusion Detection Systems, The Changing Nature of IDS Tools, Response to System Intrusion, Challenges to Intrusion Detection Systems, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools
Disaster Management: Introduction, Disaster Prevention, Disaster Response, Disaster Recovery, Make your Business Disaster Ready, Resources for Disaster Planning and Recovery.

Text Books:
1. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791,2013
2. Joseph Migga Kizza, "A Guide to Computer Network Security", Springer 2009.

Reference Books:
1. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
2. Nina Godbole, "Information Systems Security", Wiley India, New Delhi
3. Kennetch J. Knapp, "Cyber Security & Global Information Assurance", Information Science Publishing.
4. James Graham, Richard Howard, Ryan Olson, "Cyber Security Essentials" CRC Press.
5. Jeetendra Pande, "Introduction to Cyber Security" Uttarakhand Open University, 2017

5KS05 PRINCIPLES OF MARKETING FOR ENGINEERING [L-3, T-0, C-3]

Course Pre-requisite: Basic knowledge of Computers.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Principles of Marketing for Engineering by being able to do each of the following:
- To provide students with the knowledge about business advantages of the digital marketing and its importance for marketing success;
- To develop a digital marketing plan; to make SWOT analysis;
- To define a target group; to introduced to various digital channels, their advantages and ways of integration;
- To integrate different digital media and create marketing content to manage a digital marketing performance efficiently.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Identify the importance of the digital marketing for marketing success,
2. Manage customer relationships across all digital channels and build better customer relationships,
3. Create a digital marketing plan, starting from the SWOT analysis and defining a target group,
4. Identify digital channels, their advantages and limitations, to perceiving ways of their integration taking into consideration the available budget

Unit I: Introduction to e-Marketing: **Hours: 7**
Introduction, Wired-up world, B2C, B2B, C2B and C2C Model, Objectives: Sell, Serve, Speak, Save, Sizzle, Introduction to e-strategy.
Unit II: Remix and e-Models **Hours: 7**
Introduction to Remix: Product, Price, Place, Promotion, People, Process. Introduction to e-Models, e-Marketplace, Digital Communication market, Web & Social Network Models, Customer buying models, Loyalty models
Unit III: e-Customers **Hours: 7**
Introduction to e-Customers, Motivations, Expectations, Fears & Phobias, Online Buying Process, information processing, relationship & royalty, Communities & social networks, Customer profiles
Unit IV: e-Tools & Site Design **Hours:7**
Introduction to e-Tools, Technology development & customer impact, Interactive digital TV, Digital Radio, Mobile Devices, Interactive self-service kiosks, Convergence, Integrated Campaigns, Web-site design, Integrated design, online value proposition, Dynamic & aesthetics design
Unit V: Traffic Building **Hours: 7**
Search Engine Marketing, Online PR & Partnerships, Interactive Advertising, e-mail & viral marketing, Online traffic building, Control, Resourcing
Unit VI: e-CRM & e-Business **Hours: 7**
Introduction to e-CRM, Database marketing, e-CRM, Profiling, Personalization, Introduction to e-Business, e-Business Architecture & framework, e-business security.

Text Book: E-Marketing excellence: Planning & Optimizing your Digital Marketing, Dave Chaffey & P R Smith, 3rd Edition, Butterworth-Heinemann, Elsevier.

Reference Books:
1. Marketing 4.0: Moving from Traditional to Digital, Philip Kotler, H. Kartajaya, I. Setiawan, Wiley.
2. Business Marketing and Management Principles for IT and Engineering, D. N. Chorafas, CRC Press.
3. Marketing Management, Philip Kotler, Kevin Keller, 12th Edition, Pearson Prentice Hall.
4. Marketing Insights from A to Z, Philip Kotler, John Wiley & Sons..

5KS05 Open Elect. I (i) FUNDAMENTALS OF FINANCE & ACCOUNTING [L-3, T-0, C-3]

Course Prerequisite: Basic Knowledge of Mathematics
Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Fundamentals of Finance & Accounting by being able to do each of the following:
- Know and apply accounting and finance theory
- Critically evaluate financial statement information
- Evaluate and compare different investments

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Define bookkeeping and accounting
2. Explain the general purposes and functions of accounting
3. Explain the differences between management and financial accounting
4. Describe the main elements of financial accounting information – assets, liabilities, revenue and expenses
5. Identify the main financial statements and their purposes.

Unit I: The basics of Accounting I **Hours: 7**
The Assets, Liabilities and Balance Sheets, Procedure for creating a Balance Sheet, Different forms of Balance Sheet, Basic concepts of Accounting
Unit II: The basics of Accounting II **Hours: 7**
The Profit & Loss Account, Cash Flow Statement, Creating Profit & Loss Account, Creating Cash Flow Statement, Book Keeping Basic terminology, Debt & Credit Convention
Unit III: Interpretation of Accounts **Hours: 8**
Accounting Rules, Reports, Assets, Liabilities, Shareholders' Equity, P&L Statement,
Unit IV: Introduction to Financial Management **Hours:6**
What is Finance, Forms of Business Organization, Stock Price & Shareholder Value, Intrinsic Value, Stock Price, Business trends and ethics, Conflicts management.
Unit V: Financial Markets and Institutions **Hours: 7**
Financial Markets, Capital Allocation, Financial Institutions, Stock Market, Market for Common Stock, Stock Market Returns, Stock Market Efficiency
Unit VI: Financial Statements & Analysis **Hours: 7**
Financial Statements & Reports, Stockholders' Equity, Free Cash Flow, Income Taxes, Analysis of Financial Statements: Ratio Analysis, Liquidity Ratios, Asset & Debt Management Ratio, Profitability Ratio, Trend Analysis

Text Books:
1. Accounts Demystified, 5th Edition, Anthony Rice, Pearson – Prentice Hall
2. Fundamentals of Financial Management, 6th Edition, E. F. Brigham, J.F. Houston, Cengage Learning.

Reference Books:
1. Engineering Economics: Financial Decision Making for Engineering, N. M. Fraser, E. M. Jewkes, 5th Edition, Pearson Publication.
2. Financial Fundamentals for Engineers, Richard Hill & George Slot, Butterworth-Heinemann, Elsevier.
3. Financial Accounting, Jerry Weygandt, Paul Kimmel, Donald Kieso, 9th Edition, Wiley
4. Financial Accounting: Tools for Business Decision Making, Jerry Weygandt, Paul Kimmel, Donald Kieso, 6th Edition, Wiley Plus.

5KS05 ENTREPRENEURSHIP [L-3,T-0,C-3]

Course Prerequisite:
Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Entrepreneurship by being able to do each of the following:
- Understand basic concepts in the area of entrepreneurship
- Understand the role and importance of entrepreneurship for economic development
- Develop personal creativity and entrepreneurial initiative,
- Adopt the key steps in the elaboration of business idea

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:
1. Analyse the business environment in order to identify business opportunities,
2. Identify the elements of success of entrepreneurial ventures,
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Specify the basic performance indicators of entrepreneurial activity,
5. Explain the importance of marketing and management in small businesses venture,
6. Interpret their own business plan.

Unit I: **Hours:6**
Introduction to Entrepreneurship: Introduction, Common Myths About Entrepreneurs, Types of Start- Up Firms, Changing Demographics of Entrepreneurs, Entrepreneurship Importance.
Recognizing Opportunities and Generating Ideas: Identifying and Recognizing Opportunities, Finding Gaps in the Marketplace, Techniques for Generating Ideas, Encouraging and Protecting New Ideas.
Unit II: **Hours:6**
Feasibility Analysis: Product/Service Feasibility Analysis, Industry/Target Market Feasibility Analysis, Organizational Feasibility Analysis and Financial Feasibility Analysis.
Writing A Business Plan: The Business Plan, Outline of the Business Plan, Presenting the Business Plan to Investors.
Unit III: **Hours:6**
Industry and Competitor Analysis: Industry Analysis, Industry Trends, The Five Competitive Forces Model, The Value of the Five Forces Model, Industry Types and the Opportunities, Competitor Analysis, Identifying Competitors, Sources of Competitive Intelligence, Completing a Competitive Analysis Grid. Developing an Effective Business Model: Business Models, Components of an Effective Business Model.

Unit IV: **Hours: 6**
Ethical and Legal Foundation: Initial Ethical and Legal issues facing a New Firm, Drafting a Founders Agreement, Avoiding Legal Disputes, Business Licenses and Permits, Choosing a Form of Business Organization.
Assessing A New Venture's Financial Strength and Viability: Introduction to Financial Management, Financial Statements and Forecasts, Pro forma Financial Statements.
Unit V: **Hours: 6**
New Venture Team: Creating a New-Venture Team, Rounding out the Team: The Role of Professional Advisers.
Getting Financing or Funding: The Importance of Getting Financing or Funding, Sources of Equity Funding, Sources of DEBT Financing, Creative Sources of Financing and Funding.
Unit VI: **Hours:6**
Unique Marketing Issues: Selecting a Market and Establishing a Position, Key Marketing issues for New Ventures, The 4Ps of Marketing for New Ventures.
The Importance of Intellectual Property: The Importance of Intellectual Property, Patents, Trademarks, Copyrights, Trade Secrets, Conducting an Intellectual Property Audit.

Text Book: Bruce R. Barringer, R. Duane Ireland, "Entrepreneurship Successfully Launching New Ventures", Pearson Education, Third Edition.

Reference Books:
1. Ram Chandran, "Entrepreneurial Development", Tata McGraw Hill, New Delhi
2. Khanka, S S. "Entrepreneurial Development", S Chand & Company Ltd. New Delhi
3. Badhai, B "Entrepreneurship for Engineers", Dhanpat Rai & Co. (p) Ltd.
4. Gupta and Srinivasan, "Entrepreneurial Development", S Chand & Sons, New Delhi.
5. Arya Kumar, Entrepreneurship, Pearson, Delhi
6. Poornima MCH, Entrepreneurship Development –Small Business Enterprises, Pearson, Delhi
7. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
8. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press, Delhi

5KS06 DATABASE MANAGEMENT SYSTEMS LAB [P-2, C-1]

Course Prerequisite: Basic concept of programming, Basic concepts of data structures
Course Objectives:
- To study the ER model which provides a high level view of the issues in database design, to capture the semantics of realistic applications within the constraints of a data model.
- To study the primary data model (relational model) for commercial data processing applications.
- To study the standard structured query language and retrieve the information from the database in various ways.
- To study the integrity and security constraints of the database by enforcing constraints.

Course Outcomes (Expected Outcome) On completion of the course, the students will be able to
1. Design ER model for any kind of application.
2. Design and develop database.
3. Apply normalization.
4. Query the database.
5. Apply various integrity constraints
6. Build indices, views
7. Implement triggers, assertions

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

Practical 1: To Study a Database Modeling Tool.
Study of Data Modeling Tools:
- Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:
- Logical / Physical Modeling
- Adding an entity / its attributes, relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
- Forward / reverse engineering
- Details of forward engineering / schema generation
- Steps to generate the schema

Practical 2: To Study and implement DDL Commands
Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.
- Creating the proper tables
- Insert the data into it.
- Study Dropping and Altering the Tables. Study the cascaded deletes.

Practical 3: To Study and implement DML Commands-I
- SQL queries : Write and execute different SQL queries
- Execute Simple queries using SELECT, FROM, WHERE clauses,
- In Where clause use different predicates involving OR,AND, NOT
- Rename operation
- Tuple Variables
- Write SQL for various String operations (%,_,*)
- Match beginning with
- Match ending with
- Substring
- Match exactly n characters
- Match at least n characters
- Sort the output of the query using Order by
- Write SQL using Having

Practical 4 : To Study and implement DML Commands-II Write SQL queries and perform
- Set membership operations
- In, not in
- Some
- All
- Exists and not exists, Test for emptyness using exists, not exists
- Test for absence of duplicates.
- Nested queries

Practical 5. Study and implement aggregation functions.
- Write different queries using following Aggregate functions
- Min (minimum 3 SQL queries)
- Max (minimum 3 SQL queries)
- Avg (minimum 3 SQL queries)
- Sum (minimum 3 SQL queries)
- Count (minimum 3 SQL queries)

Practical 6: Write SQL to create Views and Indexes.
Practical 7: Write SQL to perform the modifications to the database
Practical 8 : PL /SQL
Practical 9 : Database Access Using Cursors
Write a trigger to find the names and cities of customers who have more than xyz in any account.
Practical 10 : Triggers
- Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
- Write a trigger for dealing with blank cities (set the city field to null when it is blank)

Practical 11: Procedures, functions
- Write atleast 2 functions, and demonstrate its use
- Write atleast 2 procedures, and demonstrate its use

Practical 12 : Web Programming with PL/SQL. (Contents beyond Syllabus)
HTTP, A Simple Example, Printing HTML Tables., Passing Parameters, Processing HTML Forms., Multi-Valued Parameters.
Practical 13: Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) (Contents Beyond Syllabus)
Practical 14: Web Programming with Java Servlets. (Connecting to the database) (Contents beyond Syllabus)
A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.
Practical 15: PHP : Develop a simple application to access the database using PHP (Contents beyond Syllabus)
Study of Open Source NoSQL Databases
Based on the concepts covered in text create a Mini Project:

Suggested Topics:
i. Bank database (Given in Korth book)
ii. University Database (Given in Korth book)
iii. Airline Flight Information System.
iv. Library Database Application.
v. University Student Database.
vi. Video Chain Database.
vii. Banking Database.
viii. BiBTeX Database.
ix. Music Store Database.
x. Online Auctions Database.
xi. A Web Survey Management System.

Text Book: Korth, Sudarshan, Silberschatz, Database System Concept, Mc-Graw Hill Mysql Reference Manual (for Mysql database)

Reference Books: (may be 5 to 6)
1. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereopty Limited, ISBN: 1743045743, 9781743045749
2. Kristina Chodorow, Michael Dirolf, "MangoDB: The Definitive Guide" ,O"Reilly Publications, ISBN: 978-1-449-34468-9.
3. Adam Fowler, "NoSQL For Dummies", John Wiley & Sons, ISBN-1118905628
4. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719.

5KS07 COMPILER DESIGN – Lab [P-2, C-1]

Course Prerequisite: Basic knowledge of C Programming, Data Structures, Theory of Computation.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:
- Know the basic components of a Compiler.
- To implement Lexical Analyzer using Lex tool and Syntax Analyzer using Yaac Tool.
- To implement various parsing methods.
- To implement code optimization techniques .

Course Outcomes (Expected Outcome):

On completion of the course, the students will be able to
1. Identify the fundamentals of compiler and its phases.
2. Use the powerful compiler generation tools such as Lex and Yacc.
3. Write a lexical scanner, either from scratch or using Lex.
4. Develop program for solving parser problems.
5. Examine the various optimization techniques.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)
1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.
2. Write a C program to identify whether a given line is a comment or not.
3. Implement a C program to check parenthesis of regular expression is balanced or not.
4. Implement a C program to construct NFA from regular expression.
5. Implement a C program to simulate Deterministic Finite Automation (DFA) for a string which ending with 'a', 'a*b+', 'abb'.
6. Write a C program to construct of DFA from NFA.
7. Implement a Lex program to verify the parenthesis of a given expression is balanced.
8. Implement a Lex program to recognize the token like Digit, Identifier & Delimiter.
9. Implement the Lexical Analyzer using JLex, flex or other lexical analyzer generating tools.
10. Implement a Lex program to a valid arithmetic expression and to recognize the identifier and operators present.
11. Implement a Lex program to count words, characters, lines, vowels and consonants from given input.
12. Implement a Lex program to check given number is positive negative or zero.
13. Implement a Lex program to generate string which is ending with zeros.
14. Implement LEX and Yacc tool to implement desk calculator.
15. Write a C program for constructing of SLR parsing.
16. Write a C program for constructing of LL (1) parsing.
17. Write a C program for constructing of LALR parsing.
18. Write a C program for constructing recursive descent parsing.
19. Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.
20. Write a C program for Tokenizing the file which reads a source code in C/C++ from an unformatted file and extract various types of tokens from it
21. Write functions to find FIRST and FOLLOW of all the variables / given grammar.
22. Implement a Shift Reduce Parser for the following productions.
23. E → E+E / E*E / a / b
24. Implement a symbol table containing functions create(), modify(), search(), display() and delete().
25. Implement three address Code for the input a=b*c.
26. Implement Recursive Decent Parser for the productions.

List of Experiments beyond Syllabus: (Maximum 05)
1. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
2. Write a C program to generate machine code from abstract syntax tree generated by the parser.
3. Write a Lex program to find out total number of vowels, and consonants from the given input string.
4. Implementation of Finite State machines DFA, NFAs .
5. Computation of Leading & Trailing Sets.

Text Book: Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniques and Tools", Pearson Education, Second Edition.

Reference Books:

1. Doug Brown, John Levine, and Tony Mason, "Lex & Yacc", O'Reilly & Associates, Inc., Second Edition.
2. Andrew Appel, "Modern Compiler Implementation in C", Cambridge University press.
3. K C. Louden "Compiler Construction - Principles and Practice" India Edition, CENGAGE.
4. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs and Koen Langendoen, "Modern Compiler Design", Second Edition, John Wiley & Sons Publication.
5. Keith Cooper and Linda Torczon, "Engineering: A Compiler", Second Edition, Morgan Kaufmann Publication.

5KS09 C-Skill Lab – III [P-2, C-1]

Course Prerequisite: Basic knowledge of Web Development, HTML, CSS, JavaScript and IDE.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of C-Skill Lab - III by being able to do each of the following:

- To develop an ability to set up a local JS Library/Framework development Environment.
- To be able to install and implement different JS Libraries and Frameworks
- To be able to develop single-page/multi-page static and dynamic Web Applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain the various tools, packages and modules required for Web Development.
2. Discuss the workings of web server, cookies, routes, etc.
3. Develop a mobile application using JS Framework.
4. Design GUI using JS framework and/or Libraries.
5. Create applications using Angular, React, Node and Express.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

1. Introduction to the Node.js and its installation to print Hello World
2. To study built-in modules and implement the user defined built-in modules in the Node.js
3. To study HTTP module and implement Node.js as a web server
4. To study and implement Node.js File system module to read, write, create, update, delete and rename the file
5. To study the URL module of the Node.js and write a program that opens the requested file and returns the content of the file to the client. If anything goes wrong, throw a 404 error.
6. To convert the output "Hello World!" into upper-case letters by installing the "upper-case" package of NPM.
7. To study event handling in Node.js and demonstrate it using event module and EventEmitter object.
8. To study and implement the Formidable module of Node.js to upload the file on the server.
9. To study and implement the Nodemailer module of Node.js to send emails from your server.
10. To install MySQL and its driver and create connection with it using Node.js.
11. To demonstrate the creation database and table in MySQL using Node.js
12. To demonstrate the insertion of single and multiple records in the MySQL using "INSERT" statement and Node.js
13. To demonstrate the display of records from the MySQL database using "SELECT" statement and display it using Node.js
14. To demonstrate the display the records based on condition from the MySQL database using "WHERE" statement using Node.js
15. To demonstrate deletion of records from database using "DELETE" statement and Node.js
16. To demonstrate updating existing records in a table by using the "UPDATE" statement and Node.js
17. To demonstrate combining rows from two or more tables, based on a related column between them, by using a JOIN statement using Node.js

List of Experiments beyond Syllabus: (Maximum 05)

1. Create an Email sender app using Node.js
2. Create an Basic User database: Site in which User can Sign up/Login and can see other User's Profile Information.
3. Create a User model covering Registration, Email verification(send an email), login (with remember me, display user details and allow to save/update user details(DOB, Location, Hobbies etc or anything)
4. A random number generator web application.

Text Books:

1. Simon Holmes: Getting Mean with Mongo, Express, Angular, and Node, 2nd Edition, Manning.
2. Alex Banks and Eve Porcello: Learning React: Functional Web Development with React and Redux, O'Reilly .

Reference Books:

1. ShyamSeshadri: Angular Up and Running, O'Reilly
2. Akshat Paul and Abhishek Nalwaya: React Native for Mobile development, Apress.
3. Jos Dirksen: Learn Three.js, 3rd Edition, Packt Publishing.
4. Patrick Mulder and Kelsey Breseman: Node.js for Embedded Systems, O'Reilly

5KS08 EMERGING TECHNOLOGY LAB I

5KS08 Emerging Technology Lab 1 is based on 5KS04 Professional Elective-I. Tentative FOSS Tools & Technology for Practical's are as follows:

AI : IBM Watson, Microsoft Cognitive Toolkit , TensorFlow, Apache SystemML, Caffe, OpenNN, Torch, Neuroph

DS :R, Python, Cassandra, Apache Hadoop,

IoT : Arduino, DeviceHive, Kaa, Home Assistant

Cyber Security: Kali Linux, OpenVPN, NMAP, Metasploit Framework

5KS08 DATA SCIENCE AND STATISTICS – LAB [P-2, C-1]

Course Prerequisite: Basic knowledge of Mathematics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Science and Statistics by being able to do each of the following:

- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Apply the learned concepts for the skillful data management.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate proficiency with statistical analysis of data.
2. Build skills in transformation and merging of data for use in analytic tools.
3. Perform linear and multiple linear regression analysis.
4. Develop the ability to build and assess data-based models.
5. Evaluate outcomes and make decisions based on data.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus:

Introduction to R:

[1] To learn and implement the Basic Commands and Graphics in R
[2] To perform Indexing and Loading Data

Linear Regression:

[3] To learn different Libraries in R and To perform Simple Linear Regression and Multiple Linear Regression
[4] To learn Interaction Terms and to perform Non-linear Transformations of the Predictors
[5] To learn and evaluate Qualitative Predictors
[6] To learn to Write Functions

Logistic Regression, LDA, QDA, and KNN

[7] To perform Logistic Regression
[8] To perform Linear Discriminant Analysis
[9] To perform Quadratic Discriminant Analysis
[10] To implement K-Nearest Neighbors technique
[11] To use Caravan Insurance Data for LR, LDA, QDA, and KNN

Cross-Validation and the Bootstrap

[12] To learn and perform The Validation Set Approach
[13] To learn and perform Leave-One-Out Cross-Validation
[14] To learn and perform k-Fold Cross-Validation
[15] To learn and perform The Bootstrap

Subset Selection Methods

[16] To learn and perform Best Subset Selection
[17] To learn and perform Forward and Backward Stepwise Selection
[18] To learn to Choose Among Models Using the Validation Set Approach and Cross-Validation

Ridge Regression and the Lasso

[19] To learn and perform Ridge Regression
[20] To learn and perform The Lasso

PCR and PLS Regression

[21] To learn and perform Principal Components Regression
[22] To learn and perform Partial Least Squares

Non-linear Modeling

[23] To learn and perform Polynomial Regression and Step Functions
[24] To learn and perform Splines
[25] To learn and perform GAMs

Decision Trees
[26] To learn and perform Fitting Classification Trees
[27] To learn and perform Fitting Regression Trees
[28] To learn and implement Bagging and Random Forests
[29] To learn and perform Boosting
Support Vector Machines
[30] To learn and perform Support Vector Classifier
[31] To learn and perform Support Vector Machine
[32] To learn and perform ROC Curves
[33] To learn and perform SVM with Multiple Classes
[34] To use Gene Expression Data
Clustering
[35] To implement K-Means Clustering
[36] To implement Hierarchical Clustering
NCI60 Data Example
[37] To implement PCA on the NCI60 Data
To Cluster the Observations of the NCI60 Data

List of Experiments beyond Syllabus: (Maximum 05)

1. To implement the Association Rules
2. To implement the kernel method to increase data separation
3. Develop a data model and deploy it as R HTTP Services or by export
4. Develop a data model and present it to end user with proper presentations
5. Carry out your assigned task and present it to other data scientist with proper presentations

Text Books:
1. Cathy O'Neil and Rachel Schutt: Doing Data Science, First Edition, 2014, O'reilly Publications, ISBN: 978-1-449-35865-5
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani: An Introduction to Statistical Learning with Applications in R, First Edition, 2013, Springer-Verlag New York, ISBN: 978-1- 4614-7137-0

Reference Book:
Nina Zumel, John Mount: Practical Data Science with R, First Edition, 2014, Manning Publications Co., ISBN: 9781617291562.

B.E. (COMPUTER SCIENCE & ENGINEERING) SEM. VI

6KS01 SECURITY POLICY & GOVERNANCE [L-3, T-0, C-3]

Course Prerequisite: Data Communication and Networking,

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Security Policy & Governance by being able to do each of the following:
1. Understand the legal and regulatory environment and its relationship to Information Security.
2. Understand Information Security Concepts.
3. Understand the role of Information Security governance and planning within the organizational context.
4. Understand how to develop, implement and maintain various types of Information Security policies.
5. Understand risk management and its role in the organization.
6. Understand how to identify risk control classification categories

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. List and discuss the key characteristics of Information Security, Leadership and Management
2. Differentiate between Law and Ethics
3. Describe why ethical codes of conduct are important to Information Security
4. Discuss the importance, benefits and desired outcomes of Information Security Governance
5. Discuss the process of developing, implementing and maintaining various types of Information Security Policies.
6. Define Risk Management and its role in the organization.

Unit I: Hours:6
Introduction to the Management of Information Security: Introduction to Security, Key Concepts of Information Security: Threats and Attacks, Management and Leadership, Principles of Information Security Management.
Unit II: Hours:6
Compliance: Law and Ethics: Introduction to Law and Ethics, Ethics in information Security, Professional Organizations and Their Codes of Conduct, Information Security and Law Organizational Liability and the Management of Digital Forensics.
Unit III: Hours:6
Governance and Strategic Planning for Security: The Role of Planning, Strategic Planning, Information Security Governance, Planning for Information Security Implementation.

Unit IV: Hours:6
Information Security Policy: Policy, Enterprise Information Security Policy, Issue-Specific Security Policy, System-Specific Security Policy, Guidelines for Effective Policy Development and Implementation.
Unit V: Hours:6
Risk Management: Assessing Risk: Introduction to the Management of Risk in Information Security, The Risk Management Process.
Unit VI: Hours:6
Risk Management: Treating Risk: Introduction to Risk Treatment, Managing Risk, Alternative Risk Management Methodologies.
Text Book: Michael E. Whitman, Herbert J. Mofford, "Management of Information Security" Sixth Edition, Cengage Learning, 2016.

Reference Books:
[1] Robert F Smallwood, "Information Governance for Business Documents and Records" Wiley 2014
[2] Michael E. Whitman and Herbert J. Mofford, "Principles of Information Security" Sixth Edition, Cengage Learning, 2018
[3] Krag Brotby, "Information Security Governance: A Practical Development and Implementation Approach" 2009 by John Wiley & Sons.
[4] Brijendra Singh, "Network Security and Management" Second Edition, PHI.
[5] Alan Calder and Steve Watkins, "IT Governance an international guide to data security and ISO27001/ISO27002" 2015, Kogan Page Limited.
[6] Evan Wheeler, "Security Risk Management, Building an Information Security Risk Management Program from the Ground Up" 2011, Syngress publications.
[7] Mike Chapple, James Michael Stewart and Darril Gibson, "CISSP® Certified Information Systems Security Professional Official Study Guide" Eighth Edition, 2018, John Wiley & Sons.

6KS02 DESIGN AND ANALYSIS OF ALGORITHMS [L-4, T-0, C-4]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

Unit I: Iterative Algorithm Design Issue: Hours: 8
Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion
Unit II: Divide And Conquer Hours: 8
Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Covex Hulls, Drawbacks of D & C & Timing Analysis.
Unit III: Greedy Methods Hours: 8
Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm, Dijkstras Shortest Path Algorithm.
Unit IV: Dynamic Programming Hours: 8
Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.
Unit V: Backtracking Hours: 8
Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.
Unit VI: Efficiency of Algorithm Hours: 8
Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: "Design and Analysis of Algorithms" Pearson Education.

Reference Books:
[1] Aho,Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
[2] G. Brassard, P.Bratley: "Fundamentals of Algorithmics" , PHI
[3] Horowitz & Sahani: " Fundamental Algorithms" , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: " Introduction to Algorithms", Mc Graw-Hill.

6KS03 SOFTWARE ENGINEERING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Programming Languages.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. To learn and understand the principles of Software Engineering
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To apply Design and Testing principles to S/W project development.
4. To understand project management through life cycle of the project.
5. To understand software quality attributes.
6. To understand of the role of project management including planning, scheduling, risk management.

Course Outcomes (Expected Outcome): On completion of the course, student will be able to–
1. Decide on a process model for a developing a software project
2. Classify software applications and identify unique features of various domains
3. Design test cases of a software system.
4. Understand basics of Project management.
5. Plan, schedule and execute a project considering the risk management.
6. Apply quality attributes in software development life cycle.
7. Understand quality control and to ensure good quality software.

Unit I: Introduction to Software Engineering, Software Process Models Hours: 6
Evolving role of Software, Software crises & myths, Software engineering, Software process & process models, Linear sequential, prototyping ,RAD ,Evolutionary Product & Process, Project management concepts, People, Product, Process, Project W5HH principles, critical practice
Unit II: Project Management: Process, Metrics, And Estimations & Risks Hours:6
Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks: identification, risk projection, refinement & RMMM plan

Unit III: Project Scheduling & Quality Management Hours: 6
Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

Unit IV: Requirement Engineering & System Engineering Hours:6
System engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

Unit V: Software architecture & User interface design Hours: 6
Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design: Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design: Structure programming, Comparison of design notation.

Unit VI: Software Testing Hours: 6
Software testing fundamentals; test case design, White box testing. Basis path, control structure-, Black box-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, and system testing. Debugging. Technical metrics for software.

Text Book: Pressman Roger. S: Software Engineering, A Practitioner's Approach, TMH.

Reference Books:
[1] Somerville: Software Engineering (Addison-Wesley) (5/e)
[2] Fairly R: Software Engineering (McGraw Hill)
[3] Davis A: Principles of Software Development (McGraw Hill)
[4] Shooman, M.L: Software Engineering (McGraw-Hill)

6KS04 NATURAL LANGUAGE PROCESSING [L-3, T-0, C-3]

Course Prerequisite: Fundamentals of Artificial Intelligence.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Natural Language Processing by being able to do each of the following:
1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To gain knowledge in Information Extraction.

Course Outcomes (Expected Outcome): On completion of the course, student will be able to–
1. Understand how to tag a given text with basic Language features
2. Design an innovative application using NLP components
3. Implement a rule-based system to tackle morphology/syntax of a language
4. Design a tag set to be used for statistical processing for real-time applications
5. Compare and contrast the use of different statistical approaches for different types of NLP applications.

Unit I: Overview and Morphology Hours: 6
Introduction, Models and Algorithms, Regular Expressions Basic Regular Expression Patterns, Finite State Automata, Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing

Unit II: Word Level Analysis Hours: 6
Role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Part Of Speech Tagging and Sequence Labeling Lexical syntax. Hidden Markov Models. Maximum Entropy models.

Unit III: Syntactic Analysis Hours: 6
Context-Free Grammars, Grammar rules for English, Treebanks, and Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Probabilistic CFG, and Probabilistic Lexicalized CFGs.

Unit IV: Semantic Analysis Hours: 6
Representing Meaning, Meaning Structure of Languages, First Order Predicate Calculus, Syntax-Driven Semantic Analysis, Semantic Attachments, Syntax-Driven Analyzer, Robust Analysis, Relations among Lexemes and their Senses, Word Sense Disambiguation

Unit V: Learning to Classify Text: Hours: 6
Supervised classification, further examples of supervised classification, Evaluation, Decision Trees, Naïve Bayes classifiers, Modelling Linguistic Patterns.

Unit VI: Extraction Information from Text: Hours: 6
Information Extraction, Chunking, Developing and Evaluating Chunks, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction.

Text Books:
[1] Daniel Jurafsky, James H. Martin - Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
[2] Steven Bird, Ewan Klein and Edward Loper - Natural Language Processing with Python, First Edition, OReilly Media, 2009.
[3] Christopher D.Manning and Hinrich Schuetze - Foundations of Statistical Natural Language Processing, MIT press, 1999.

Reference Books:
[1] Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
[2] Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015.
[3] Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
[4] Roland R.Hausser - Foundations of Computational Linguistics: Human Computer Communication in Natural Language, Paperback, MIT press,2011
[5] Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008
[6] Daniel Jurafsky and James H. Martin - Speech and Language Processing, 2nd
[7] Edition , Prentice Hall,2008.
[8] Charu C.Aggarwal - Machine Learning for Text, Springer,2018 edition

6KS04 BIG DATA ANALYTICS [L-3, T-0, C-3]

Course Prerequisite: Knowledge of basic computer science principles and skills, Basic knowledge of Linear Algebra and Probability Theory, Basic knowledge of Data Base Management Systems

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Big Data Analytics by being able to do each of the following:
1. To know the fundamental concepts of big data and analytics.
2. To explore tools and practices for working with big data.
3. To know about the research that requires the integration of large amounts of data.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Work with big data tools and its analysis techniques.
2. Analyze data by utilizing clustering and classification algorithms.
3. Learn and apply different algorithms and recommendation systems for large volumes of data.
4. Perform analytics on data streams.
5. Learn NoSQL databases and management.

Unit I: Big Data Analytics and Lifecycle Hours: 6
Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics, Data Analytics Lifecycle: Overview, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communicate Results, Phase 6: Operationalize, Case Study: Global Innovation Network and Analysis (GINA).

Unit II: Review of Basic Data Analytics Methods, Clustering and Association Rules Hours: 7
Exploratory Data Analysis, Statistical Methods for Evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and II Errors, ANOVA, Overview of Clustering, K-means: Use Cases, Overview, Number of Clusters, Diagnostics, Additional Algorithms, Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, An Example: Transactions in a Grocery Store, The Groceries Dataset, Frequent Itemset Generation, Rule Generation and Visualization, Validation and Testing, Diagnostics.

Unit III: Regression and Classification Hours: 7
Linear Regression: Use Cases, Model Description, Diagnostics, Logistic Regression: Use Cases, Model Description, Diagnostics, Reasons to Choose and Cautions, Additional Regression Models, Decision Trees: Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree, Decision Trees, Naïve Bayes: Bayes' Theorem, Naïve Bayes Classifier, Smoothing, Diagnostics, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods.

Unit IV: Time Series Analysis and Text Analysis Hours: 6
Overview of Time Series Analysis: Box-Jenkins Methodology, ARIMA Model: Autocorrelation Function (ACF), Autoregressive Models, Moving Average Models, ARMA and ARIMA Models, Building and Evaluating an ARIMA Model, Reasons to Choose and Cautions, Additional Methods, Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency—Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.

Unit V: Tool and Techniques: MapReduce & Hadoop Hours: 7
Big Data Tool and Techniques: Big Data Storage, High-Performance Architecture, HDFS, MapReduce and YARN, Big Data Application Ecosystem, Zookeeper, HBase, Hive, Pig, Mahout, Developing Big Data Applications: Parallelism, Myth, Application Development Framework, MapReduce Programming Model, Simple Example, More on MapReduce, Other Frameworks, The Execution Model, Analytics for Unstructured Data: Use Cases, MapReduce, Apache Hadoop, The Hadoop Ecosystem: Pig, Hive, HBase, Mahout, NoSQL.

Unit VI: Database Analytics, NoSQL and Graph Analytics Hours: 7
SQL Essentials, In-Database Text Analysis, Advanced SQL, NoSQL Data Management: What is NoSQL, Schema-less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph Database, Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Graph Analytics: Model, Triples, Graphs and Network Organization, Graph Analytics and Use Cases, Graph Analysis Algorithms, Technical Complexity, Features of Graph Analytic Platform, Data Visualization Basics.

Text Books:
[1] EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", 2015, John Wiley & Sons, Inc., ISBN: 978-1-118-87613-8.
[2] David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", First Edition, 2013, Morgan Kaufmann/Elsevier Publishers, ISBN: 978-0-12-417319-4.

Reference Books:
[1] Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", First Edition, 2014, Wiley Publishers, ISBN: 978-1-118-89271-8.
[2] Mohammad Guller, "Big Data Analytics with Spark A Practitioner's Guide to Using Spark for Large-Scale Data Processing, Machine Learning, and Graph Analytics, and High-Velocity Data Stream Processing", First Edition, 2015, Apress Publisher, ISBN-13 (pbk): 978-1-4842-0965-3.
[3] Arshdeep Bahga & Vijay Madisetti, "Big Data Science & Analytics: A Hands-On Approach",
First Edition, 2019, ISBN: 978-1-949978-00-1.

6KS04 SENSORS AND ACTUATORS [L-3, T-0, C-3]

Course Prerequisite: Internet of Things, Micro-technology

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Sensors and Actuators by being able to do each of the following:
1. To understand the fundamentals of sensors and actuators
2. An exposure to sensors and its importance in the real world
3. To understand functional safety in machinery and emergency stop applications

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Fabricate some of those sensors
2. Simulate sensors and characterize before fabricating it
3. Design application with sensors and actuators for real world

Unit I: Hours: 7
Introduction: Sensors and Actuators, Technologies related to Sensors: Data Logger, Metal Detector, Photoelectric Sensor, Global Positioning System, Wireless Sensor Network, Sonar, Echo Sounding, Level Sensor, Biosensor, Blood Glucose Monitoring, Load Cell

Unit II: Hours: 7
Application of Sensors: On-board Automobile Sensors, Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Medical Diagnostic Sensors, Sensors for Environmental Monitoring

Unit III: Hours: 7
Varied Types of Actuators: Pneumatic Actuator, Hydraulic Cylinder, Linear Actuator, Plasma Actuator, Rotary Actuator

Unit IV: Hours: 7
Actuators: Technologies and Devices- Pneumatic Motor, Pneumatic Cylinder, Hydraulic Press, Jackscrew, Hoist (Device), Electroactive Polymers, Roller Screw, MEMS Magnetic Actuator.

Unit V: Hours: 7
Remote Sensing: An Overview- Water Remote Sensing, Remote Sensing, Lidar, ERDAS Imagine, TerrSet, Remote Sensing (Archaeology)

Unit VI: Hours: 7
Rader and its application: Radar, Radar Imaging, Radar Navigation

Text Books:

[1] Princeton Brown, "Sensors and Actuators: Technology and Applications", Library Press, 2017.
[2] D. Patranabis, "SENSORS AND TRANSDUCERS", Second Edition, PHI Learning Private Limited, 2003.

Reference Books:

[1] D.A. Hall and C.E.Millar, "Sensors and Actuators", CRC Press, 1999.
[2] Nathan Ida, "Sensors, Actuators, and their Interfaces: A multidisciplinary introduction (Materials, Circuits and Devices)", Large Print, 2011.

6KSO4 CRYPTOGRAPHY [L-3,T-0,C-3]

Course Prerequisite: Discrete Structure & Graph Theory, Data Communication and Networking, Introduction to Cyber security

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cryptography by being able to do each of the following:
1. Understand Security Concepts.
2. Know about various encryption techniques.
3. Understand the concept of public key cryptography.
4. Study about message authentication and hash functions.
5. Impart knowledge on Network security, Internet Security Protocols.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Classify the symmetric encryption techniques
2. Illustrate various public key cryptographic techniques
3. Evaluate the authentication and hash algorithms.
4. Discuss authentication applications
5. Summarize the intrusion detection and its solutions to overcome the attacks.
6. Understand basic concepts of system level security

Unit I: Hours: 6
Attacks on Computers and Computer Security: Introduction, Need for Security, Security Approaches, Principles of Security, Types of Attacks. Cryptography: Concepts and Techniques Introduction, Plain Text and Cipher Text, Substitution and Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Stenography, Key Range and Key Size, Possible Types of Attacks

Unit II: Hours: 6
Symmetric Key Algorithms and AES: Introduction, Algorithm Types and Modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard(DES), International Data Encryption Algorithm(IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard(AES).

Unit III: Hours:6
Asymmetric Key Algorithms, Digital Signatures and RSA: Introduction, History and Overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Cryptography, Digital Signatures, Knapsack and other Algorithms.

Unit IV: Hours:6
Digital Certificates and Public Key Infrastructure (PKI): Introduction, Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography Standards (PKCS), XML,PKI and Security, Creating Digital Certificate.

Unit V: Hours:6
Internet Security Protocols: Introduction, Concepts, Secure Socket Layer(SSL), Transport Layer Security(TLS), Secure Hypertext Transport Protocol(SHTTP), Time Stamping Protocol(TSP), Secure Electronic Transaction(SET), SSL Versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol(WAP)Security, Security in GSM, Security in 3G.

Unit VI: Hours:6
User Authentication and Kerberos: Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based-Authentication, Biometric Authentication, Kerberos, Key Distribution Center(KDC), Security Handshake Pitfalls, Single Sign On (SSO) Approaches.

Text Book:

[1] Atul Kahate, " Cryptography and Network Security", McGraw Hill, Second Edition.

Reference Books:

[1] William Stallings, "Cryptography and Network Security, Principles and Practice", PHI Fourth Edition.
[2] Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", McGraw Hill, Second Edition.
[3] Matt Bishop, "Computer Security Arts and Science", Pearson Education.
[4] Douglas R Stinson, "Cryptography, Theory and Practice" CRC Press.
[5] Keith M Martin, "Everyday Cryptography, Fundamental Principles and Applications", Oxford University Press, Second Edition.

6KSO5 COMPUTATIONAL BIOLOGY [L-3, T-0, C-3]

Course Pre-requisite:

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computational Biology by being able to do each of the following:
1. To familiarize the students with most basic and useful algorithms for sequence analysis
2. To aware the students with basic file formats
3. To transform the basic molecular data for interpreting their patterns for various analysis
4. To compare genomes of different species, gene finding, and gene regulation

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Understand what types of biological questions can be investigated using computers, and what limitations computational methods impose on the understanding of biology.
2. Describe the properties of DNA, RNA, and proteins, the relationships among these molecules.
3. Analyze how to convert a biological question into a computational problem that can be solved using computers.
4. Explain general approaches for solving computational problems, and will be able to apply these approaches to new problems you encounter.
5. Understand how implement the algorithms by writing computer programs.

Unit I: Cellular and Molecular Biology Fundamentals Hours: 6
The structure of DNA & RNA, Gene Structure and control, Tree of Life and evolution, Primary & Secondary Structure of Protein, Implications for Bioinformatics Protein fold to form compact structures. Dealing with Databases: Structure of databases, Types of databases, Data Quality.

Unit II: Sequence Alignments Hours: 6
Principles of sequence alignments, scoring alignments, substitution matrices, Inserting gaps, Types of Alignments, Searching Databases, Searching with Nucleic Acid or protein sequences, Protein Sequences Motifs or Patterns, Searching using Motifs and patterns, Patterns & protein function.

Unit III: Pairwise Sequence Alignments & Database Searching Hours:6
Substitution Matrices and scoring, Dynamic Programming Algorithms, Indexing Techniques & Algorithmic approximations, Alignments score significance, aligning complete genome sequences

Unit IV: Patterns Profiles and Multiple Alignments Hours:6
Profile & sequence logos, Profile Hidden Markov Models, Aligning Profiles, Multiple Sequence Alignment by Gradual Sequence Addition, Sequence Pattern Discovery.

Unit V: Revealing Genome Features Hours:6
Preliminary examination of Genome Sequence, Gene Predictions, Splice site Detection, Prediction of Promoter Regions, Confirming Predictions, Genome Annotation, Large Genome Comparisons.

Unit VI: Gene Detection and Genome Annotation Hours:6
Detection of Functional RNA Molecules using Decision Trees, Algorithms for Gene Detection in Prokaryotes, Features used in Eukaryotic Gene Detection, Predicting Eukaryotic Gene Signals, Predicting Exon/Intron Structure, Beyond the Prediction of Individual Genes.

Text Books:

[1] Understanding Bioinformatics , Marketa Zvelbil and Jeremy O. Baum, Garland Sceincem Taylor & Francis Group, LLC

[2] Bioinformatics: Principles and Applications, Bal, H. P. (2005), Tata McGraw-Hill.

Reference Books:

[1] Bioinformatics Algorithms – Design and Implementation in Python, Miguel Rocha & Pedro Ferreira, Academic Press, Elsevier Inc.

[2] Bioinformatics Algorithms: An Active Learning Approach, Edition 2, Volume 1. Phillip Compeau & Pavel Pevzner.

[3] Bioinformatics computing, Bergeron, B. P. (2003), Prentice Hall Professional.

[4] Bioinformatics Technologies, Chen, Y. P. P. (Ed.). (2005). Springer.

[5] Bioinformatics for dummies, Claverie, J. M., & Notredame, C. (2011), John Wiley & Sons.

[6] Fundamental Concepts of Bioinformatics, Dan. E. Krane, & Raymer, M. L. (2003), Pearson Education International.

6KSO5 CYBER LAWS & ETHICS [L-3,T-0,C-3]

Course Prerequisite: Basic Knowledge of Internet

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cyber Laws & Ethics by being able to do each of the following:
1. Understand Cyber Space, Cyber Crime, Cyber Laws, Information Technology, Internet, Internet Services
2. Know Legal Aspects of Regulation concerned with Cyber Space, Technology and Forms of Cyber Crimes
3. Understand Computer Crimes and Cyber Crimes, Cyber Crime in Global and Indian Response.
4. Understand Criminal Liability, Cyber Crime implications and challenges.
5. Learn Precaution & Prevention of Cyber Crimes, Human Rights perspective of Cyber Crime

Course Outcomes (Expected Outcome): On completion of this course, the students should be able to:
1. Understand Cyber Space, Cyber Crime, Information Technology, Internet & Services.
2. List and discuss various forms of Cyber Crimes
3. Explain Computer and Cyber Crimes
4. Understand Cyber Crime at Global and Indian Perspective.
5. Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights.

Unit I: Hours:6
Information Technology & Cyber Crimes: Introduction, Glimpses, Definition and Scope, Nature and Extent, Know no Boundaries, Rapid Transmission and Accuracy, Diversity and Span of Victimization, Cyber World, Inadequacy of Law, Influence of Teenagers Information Technology: Definition & Perspective, Growth & Future, Various Facets & Dimensions. Regulatory Perspective on Technology: Impact of Information and Technology, Regulation of Cyber Space, Legal Aspects of Regulation.

Unit II: Hours:6
Technology & Forms of Cyber Crimes: Influence of Technology on Criminality, Forms of Cyber Crimes.
Computer Crimes & Cyber Crimes: A Criminological Analysis Computer Crimes and Cyber Crimes: Terminological Aspects, Opportunities to Cyber Criminals, Motives of Offenders, Problems Affecting Prosecution, Cyber Crimes: Challenges of Prevention and Control, Need and Prospects (~f Criminological Research.

Unit III: Hours:6
Cyber Crimes 'and Global Response: Global Perspective, Country wise Legal Response, Country wise Analysis. Cyber Crimes and Indian Response: Introduction, The Indian Information Technology Act 2000,
Preamble & Coverage, Nature of Offences and Penalties, Miscellaneous and Subsidiary Provisions Certain Shortcomings, Future Prospects and Needs.

Unit IV: Hours:6
Mens Rea & Criminal Liability: Introduction, Historical Perspectives, Mens Rea in Indian Criminal Law, Mens Rea in English Criminal Law, Abetment of Offence, Criminal Liability and Role of Mens Rea in Indian Information Technology Act, 2000 Investigation in Cyber Crimes: Implications and Challenges: : Introduction, Procedural Aspects, Issues, Complications and Challenges Concerning Cyber Crimes, Problems and Precautionary measures for Investigation.

Unit V: Hours:7
Cyber Crimes : Discovery and Appreciation of Evidences: Introduction, Law of Evidence, Evidences in Cyber Crimes : Challenges and Implications, Computer Generated Evidence and their Admissibility, Judicial Interpretation of Computer related Evidence Prevention of Cyber Crimes :National and International Endeavours: Introduction, International Services on Discovery and Recovery of Electronic and Internet Evidence, International Organisation on Computer Evidence (IOCE), OECD Initiatives, Efforts of G-7 and G-8 Groups, Endeavours of Council of Europe, Measures of United Nations, Efforts of WTO, Measures of World Intellectual Property Organisation (WIPO),Interpol and its Measures, Efforts in India, Need of International Assistance and Appropriate Amendments, U.S. Laws on Cyber Crimes, U.S. Case-law on Cyber Evidences and Related Issues

Unit VI: Hours:7

Human Rights Perspectives Cyber Crimes: Introduction, Ideological Aspects, Fundamental Rights and Civil Liberties, Various Issues and Challenges. Cyber Crimes : Precaution and Prevention: Introduction, Awareness and Law Reforms, Improving Criminal Justice Administration, Increasing International Cooperation, Curricular Endeavours and Checking Kids' Net Addiction, Role of Guardians, Mobile Pornography: No Nearer Solution in Sight, Self-regulation in Cyber Space.

Text Book:

[1] Dr Pramod Kr.Singh, "Laws on Cyber Crimes [Along with IT Act and Relevant Rules]" Book Enclave Jaipur India.

Reference Books:

[1] Craig B, "Cyber Law: The Law of the Internet and Information Technology". Pearson Education.
[2] Pawan Duggal, "Cyber Laws" Universal Law Publishing.
[3] K.Kumar," Cyber Laws: Intellectual property & E Commerce, Security", First Edition, Dominant Publisher, 2011.
[4] Rodney D. Ryder, "Guide to Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.
[5] Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, Second Edition, PHI, 2003.
[6] Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, First Edition, New Delhi, 2003.
[7] Sharma, S.R., "Dimensions of Cyber Crime", Annual Publications Pvt. Ltd., First Edition, 2004.
[8] Augastine, Paul T., "Cyber Crimes and Legal Issues", Crecent Publishing Corporation, 2007.

6KS05 INTELLECTUAL PROPERTY RIGHTS [L-3,T-0,C-3]

Course Prerequisite: Basic knowledge of Communication skills, Soft skills, Presentation and Ethics.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:

1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret.
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

Unit I: Overview of Intellectual Property Rights Hours: 06

Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

Unit II: Patents Hours: 08

Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

Unit III: Copyrights Hours: 06

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights.

Unit IV: Trademarks Hours: 07

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

Unit V: Design & Geographical Indication Hours: 07
Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

Unit VI: IPR: Current Contour Hours: 06
India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP - IPR in current scenario with case studies.

Text Books:
[1] K. V. Nithyananda (2019), "Intellectual Property Rights: Protection and Management", IN: Cengage Learning India Private Limited.
[2] P. Neeraj and D. Khusdeep (2014), "Intellectual Property Rights", PHI learning Private Limited.

Reference Books:
[1] Deborah E. Bouchoux, "Intellectual Property for Paralegals – The law of Trademarks, Copyrights, Patents & Trade secrets", 4th Edition, Cengage learning, 2012.
[2] N. S. Gopalakrishnan and T. G. Agitha, "Principles of Intellectual Property", Eastern Book Company, Lucknow, 2009.
[3] M. M. S. Karki, "Intellectual Property Rights: Basic Concepts", Atlantic Publishers, 2009.
[4] Ganguli Prabuddha, "Intellectual Property Rights--Unleashing the Knowledge Economy", Tata McGrawHill, 2001.
[5] V. K. Ahuja, "Law relating to Intellectual Property Rights". India, IN: Lexis Nexis, 2017.
[6] P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
[7] Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd, 2006.
[8] B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
[9] Ganguli Prabuddha, "Gearing up for Patents… The Indian Scenario", Universities Press, 1998.

6KS06 DESIGN AND ANALYSIS OF ALGORITHMS – LAB [P-2, C-1]

Course Prerequisite: Any programming language, Discrete Mathematics and Data Structures

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:
1. To understand asymptotic analysis of algorithms.
2. To apply algorithmic strategies while solving problems.
3. Ability to analyze time and space complexity.
4. Demonstrate a familiarity with major algorithms.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Carry out the analysis of various Algorithms for mainly Time complexity.
2. Apply design principles and concepts to algorithm design.
3. Understand different algorithmic design strategies.
4. Analyze the efficiency of algorithms using time complexity.
5. Apply the standard sorting algorithms.

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

List of Experiments based on Syllabus: (Maximum 20)

[1] Implement C programs to perform recursive calls using the following searching algorithms.
  1. Linear Search when the list is given.
  2. Binary Search when the given list is not sorted.

[2] Study and analyze to sort an array of integers using merge sort.
[3] Implement and analyze to sort an array of integers using quicksort.
[4] Write a program to implement the Closest Pair of Points problem using the divide and conquer strategy.
[5] Study and Implement the Divide and Conquer strategy using the Merge sort Algorithm and determine the complexity of an algorithm. DATA- {23, 12, 3, 5, 89, 1, 24}
[6] Write a C program for Implementing (n X n) matrix multiplication using the Strassen matrix multiplication algorithm.
[7] Explain the knapsack algorithm to find an optimal solution of getting maximum profit and implement using the program.
[8] Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and implement using C.
[9] Implement programs to find minimum cost spanning trees from a given graph using Prim's algorithm.
[10]Implement Prim's algorithm to find the Minimum Cost Spanning Tree of an undirected graph using the program.
[11] Develop a program to implement Floyd's algorithm which will produce the shortest distance between all vertex pairs of a weighted graph.

[12] Implement programs to find the shortest path in a given graph using Dijkstra's algorithm.
[13] Implement programs factorial knapsack problem.
[14] Develop a program to implement Strassen's matrix multiplication algorithm.
[15] Implement programs to implement LCS problems using Dynamic Programming.
[16] Develop a program to implement matrix chain multiplication problems using dynamic programming.
[17] Explain Breadth-First Search and Implement BFS to print all the nodes reachable from a given starting node in a digraph.
[18] Develop a program to Print all the nodes reachable from a given starting node in a digraph using Depth First Search.
[19] Study an algorithm Tower of Hanoi where the aim is to move the entire stack to another rod for n=3 and understand the concept of recursion.
[20] Implement C programs N Queen's problem using Back Tracking.

List of Experiments beyond Syllabus: (Maximum 05)

[1] Implement the Work Function Algorithm and the Greedy Algorithm for the k-Server problem on graph metrics.
[2] Design and Implement Boyer Moore Algorithm for Pattern Searching.
[3] Design and Implement Topological Sort of a graph using departure time of vertex.
[4] Implement programs to find an s-t cut of minimum capacity. Minimum Cut Problem s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 A Capacity = 10 + 8 + 10 = 28
[5] Implement programs to s-t flow of maximum value. Maximum Flow Problem 10 9 9 14 4 10 4 8 9 1 0 0 0 14 capacity flow s 2 3 4 5 6 7 t 15 5 30 15 10 8 15 9 6 10 15 4 4 0 Value = 28

Text Books:
[1] Dave and Dave: "Design and Analysis of Algorithms" Pearson Education.

Reference Books:
[1] Aho,Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
[2] G. Brassard, P.Bratley: "Fundamentals of Algorithmics" , PHI
[3] Horowitz & Sahani: " Fundamental Algorithms" , Galgotia.
[4] Cormen, T.H, Lierson & Rivest: " Introduction to Algorithms", Mc Graw-Hill.

6KS07 SOFTWARE ENGINEERING LAB.

Course Prerequisite: A Scripting Language, IDEs (Integrated Development Environment), Databases, Software Development Life Cycle (SDLC)

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Software Engineering by being able to do each of the following:
1. Impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner
2. Present case studies to demonstrate the practical applications of different concepts
3. Provide a scope to the students where they can solve small, real-life problems
4. All the while it is intended to present Software Engineering as an interesting subject to the students where learning and fun can go alongside.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Understand basic Software engineering methods and practices, and their appropriate application.
2. Describe software process models such as the waterfall and evolutionary models.
3. Discuss role of project management including planning, scheduling and, risk management.
4. Explain data models, object models, context models and behavioral models.
5. Understand of different software architectural styles and Process frame work.

List of experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

[1] Identifying the Requirements from Problem Statements
Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements
[2] Estimation of Project Metrics
Project Estimation Techniques, COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics
[3] Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
Use case diagrams |,Actor , Use Case , Subject , Graphical Representation , Association between Actors and Use Cases , Use Case Relationships , Include Relationship , Extend Relationship , Generalization Relationship ,Identifying Actors , Identifying Use cases , Guidelines for drawing Use Case diagrams
[4] E-R Modeling from the Problem Statements
Entity Relationship Model , Entity Set and Relationship Set , Attributes of Entity , Keys , Weak Entity , Entity Generalization and Specialization ,Mapping Cardinalities , ER Diagram , Graphical Notations for ER Diagram , Importance of ER modeling
[5] Identifying Domain Classes from the Problem Statements
Domain Class , Traditional Techniques for Identification of Classes ,Grammatical Approach Using Nouns , Advantages , Disadvantages ,Using Generalization ,Using Subclasses , Steps to Identify Domain Classes from Problem Statement , Advanced Concepts

[6] State chart and Activity Modeling
State chart Diagrams , Building Blocks of a State chart Diagram , State , Transition , Action , Guidelines for drawing State chart Diagrams , Activity Diagrams , Components of an Activity Diagram, Activity , Flow , Decision , Merge , Fork ,Join , Note , Partition ,A Simple Example , Guidelines for drawing an Activity Diagram
[7] Modeling UML Class Diagrams and Sequence diagrams
Structural and Behavioral aspects , Class diagram , Elements in class diagram , Class , Relationships , Sequence diagram , Elements in sequence diagram , Object , Life-line bar , Messages
[8] Modeling Data Flow Diagrams
Data Flow Diagram, Graphical notations for Data Flow Diagram, Explanation of Symbols used in DFD , Context diagram and leveling DFD
[9] Estimation of Test Coverage Metrics and Structural Complexity
Control Flow Graph, Terminologies, McCabe's Cyclomatic Complexity, Computing Cyclomatic Complexity, Optimum Value of Cyclomatic Complexity, Merits , Demerits
[10] Designing Test Suites
Software Testing , Standards for Software Test Documentation , Testing Frameworks , Need for Software Testing , Test Cases and Test Suite , Types of Software Testing , Unit Testing , Integration Testing , System Testing , Example , Some Remarks.

Software Requirements: StarUML

Text Book: Pressman Roger. S: Software Engineering, A Practitioner's Approach, TMH.

Reference Books:

[1] Somerville: Software Engineering (Addison-Wesley) (5/e)
[2] Fairly R: Software Engineering (McGraw Hill)
[3] Davis A: Principles of Software Development (McGraw Hill)
[4] Shooman, M.L: Software Engineering (McGraw-Hill).

6KS09 C SKILL LAB IV– LAB (DevOps) [P-2, C-1]

Course Prerequisite: Basic knowledge on SDLC and STLC

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of DevOps learning by being able to do each of the following:
1. Learn what Jenkins, continuous integration is and where does Jenkins fits into SDLC (Software Development Life Cycle)
2. Learn how to setup Jenkins and use Jenkins on their systems, create and configure jobs in Jenkins
3. Learn how to use and manage plugins, how to create and manage users in Jenkins
4. Learn how to deploy application on server, how to work with multiple nodes
5. Learn how to create pipelines

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Install and setup of Jenkins on your systems
2. Create and run jobs in Jenkins
3. Add and manage plugins. Use plugins in jobs
4. Create and run pipelines in Jenkins
5. Setup, configure, and deploy jobs

List of Experiments: This is the sample list of Experiments; minimum 12 experiments are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)
List of Experiments based on Syllabus: (Maximum 20)

1. Study and implement Linux commands
2. Study practical on installation of java, Tomcat Server
3. Study practical on software development life cycle
4. Study practical on DevOps life cycle & stages
5. Study practical on DevOps Tools (Docker, Jenkins, Git, Jira, copado)
6. Learn about DevOps Pipeline (CI /CD) using any tool
7. Study Practical on AWS for DevOps
8. Study Practical on Microsoft Azur for DevOps
9. Study Practical on Google Cloud for DevOps
10. Study Practical on Salesforce with Copado for DevOps
11. To setup and configure of Jenkins
12. To create Job and manage it using Jenkins
13. To experiment plugin management with jenkins
14. To study and demonstrate User role creation and management using Jenkins
15. To study and demonstrate Integration with Git using Jenkins
16. To study and demonstrate Automated deployments using Jenkins
17. To study and demonstrate Build and delivery pipelines using Jenkins
18. To study and demonstrate Job Parameterization using Jenkins
19. To study and demonstrate Command line executions using Jenkins
20. To study and demonstrate Jenkins node management

List of Experiments beyond Syllabus: (Maximum 05)

1. Learn how to setup Jenkins on docker
2. Learn how to do Jenkins maintenance
3. Learn how to work with Git and Jenkins

Text Book: John Ferguson Smart: Jenkins: The Definitive Guide, O'Reilly Media, Inc.

Reference Books:
[1] Gene Kim, Jez Humble, Patrick Debois, and John Willis,: The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations
[2] Gene Kim, Kevin Behr, and George Spafford,: The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win,
[3] Andrew Davis, : Mastering Salesforce DevOps: A Practical Guide to Building Trust While Delivering Innovation, Apress

6KS08 EMERGING TECHNOLOGY LAB II

6KS08 Emerging Technology Lab II is based on 6KS04 Professional Elective-II. Tentative FOSS Tools & Technology for Practical's are as follows:

AI : Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural, Retext, TextBlob

DS : KNIME, Spark, Neo4J, MongoDB, Hive, Storm,

IoT : Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring

Cyber Security : VeraCrypt, ModSecurity, AdBlocker, CheckShortURL, SPAMfighter, SpamBully

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B.E. COMPUTER ENGINEERING (SEM. V& VI)

SYLLABUS OF B.E. SEM. V (COMPUTER ENGINEERING)

5KE01 DATABASES [L-4, T-0, C-4]

Course Prerequisite: Discrete Mathematics, Data Structures and Algorithm.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Databases by being able to do each of the following:

1. To understand the fundamental concepts of database management system.
2. To learn database query languages.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To understand the query processing and optimization.
5. To learn basics of transaction management and concurrency control.

Course Outcomes (Expected Outcome):
On completion of the course, the students will be able to

1. Model, design and normalize databases for real life applications.
2. Discuss data models, conceptualize and depict a database system using ER diagram.
3. Query Database applications using Query Languages like SQL.
4. Design & develop transaction processing approach for relational databases.
5. Understand validation framework like integrity constraints, triggers and assertions.

Unit I: Introduction to DBMS **Hours: 8**
Database System Applications, Purpose of database systems, View of Data, Database Languages Database Architecture, Database Users and Administrators, Entity- Relationship Model, Constraints, Removing redundant attributes in Entity sets, E-R diagrams, Reduction to Relational Schemas, E-R design issues, Extended E-R Features

Unit II: Relational Algebra, SQL **Hours: 8**
Relational Model: Structure of Relational Databases, Database schema, keys, schema diagram, relational query languages, relational operators, The Relational Algebra,Overview of SQL query language, SQL data definition, Basic Structure of SQL queries, Additional basic operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the DatabaseOperations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database,Join expressions, Views

Unit III: Relational Database Design **Hours: 8**
Integrity Constraints, SQL data types and schemas, Authorization, Triggers, Features of good relational designs,atomic domains and First Normal Form, decomposition using functional dependencies, Functional dependency theory, Algorithms for decomposition, Decomposition using multivalued dependencies, More Normal Forms, Database Design Process.

NOTIFICATION

No.68/2022 Date : 18/06/2022

Subject : Implementation of new Syllabi of Semester VII & VIII of B.E. (Computer Science & Engineering) and Computer Engineering (C.B.C.S.) as per A.I.C.T.E. Model Curriculum.

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester VII & VIII of B.E. (Computer Science & Engg.) and B.E. (Computer Engg.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2022-23 onwards as per "**Appendix – A**" as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

"**Appendix A**"

SYLLABUS OF B.E. SEM. VII & VIII (COMPUTER SCIENCE & ENGINEERING) [C.B.C.S.]

SEMESTER SEVENTH

7KS01 / 7KE01 SOCIAL SCIENCES AND ENGINEERING ECONOMICS

Course Objectives:
The phenomenal progress of technology in the twentieth century has brought dramatic changes in human lifestyles from the social and economic point of view. This subject helps students to get an understanding of market trends, economic transformations, changes in the laws and equip them to have a better understanding of the market.

Course objectives are:
1. To help students to understand the importance of economics to engineers
2. To let them know about the Indian Parliament
3. To enhance their knowledge about culture and civilization
4. To help students to get an understanding of Market Trends, Economic Transformations, Changes in the Laws & equip them to have a better understanding of Market
5. To critically examine the market trends.

Course Outcomes:
At the end of the course, students will have-
1. An ability to understand the importance of social science and economics in professional life.
2. An ability to utilize high-level interpersonal skills to negotiate with stakeholders and maintain cordial relationships with them reflecting the professional ethics and responsibilities.
3. Understanding of professional responsibility with socioeconomic constraints and norms
4. An ability to understand the need of society and design the system to fulfil it with deep analysis.
5. An ability to understand the social science and engage in a lifelong learning process performing better in the group as well as individually.

SECTION - A

Unit I : Study of Social Science : Importance to Engineer, salient features of Indian constitution. Fundamental Rights and Duties. Directive Principles of State Policy. (8)

Unit II : Indian Parliament : Composition and powers, President of India : Election and Powers. Council of Ministers and Prime Minister (8)

Unit III : Impact of Science and Technology on culture and Civilization. Human Society: Community Groups. Marriage and Family: Functions, Types and problems. (8)

SECTION – B

Unit IV: Production : Factors of production, Laws of return, Forms of Business Organization. (8)

Unit V: Banking : Functions of Central and Commercial Banks. Introduction to GST, Market : Forms, perfect, imperfect competition and monopoly. (8)

Unit VI: Nature and scope of Economics : Special significance of Economics to Engineers. Economics of Development : Meaning, Characteristics of under development, obstacles to Economic growth and vicious circle of poverty. (8)

Books Recommended :

1. Pylee M.V. : Constitutional Govt. in India, S.Chand and Co.
2. C N Shankar Rao: Sociology, S.Chand and Co.
3. Dewett and Varma J.D. : Elementary Economic Theory, S.Chand and Co.
4. A.N.Agrawal : Indian Economy, Problem of Development and Planning (Wiley Eastern Ltd), New Delhi.
5. S.K.Mishra : Indian Economy, Its Development Experience. Himalaya Pub.House, Bombay.
6. E.Kuper : Economics of W.R. Development, McGraw Hill Co.,
7. Brij Kishore Sharma. : The Constitution of India, PHI.
8. Mahajan : The Constitution of India, S.Chand, New Delhi.
9. Maclaver and Page : Principle of Sociology.
10. Davis K. : Human Society
11. Datt R.K. : Indian Economy, S.Chand and Comp. New Delhi P.M.Sundharam
12. Dhingra I.C. : Indian Economy
13. Jemes L.E., R.R.Lee : Economics of W.R.Planning, McGraw Hill Co.

7KS02 COMPUTER GRAPHICS (L-3, T-0, C-3)

Course Prerequisite: Data Structures and algorithms, Basic Mathematics, Geometry, linear algebra, vectors and matrices.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Graphics by being able to do each of the following:

- To acquaint the learner with the basic concepts of Computer Graphics.
- To learn the various algorithms for generating and rendering graphical figures.
- To get familiar with mathematics behind the graphical transformations.
- To understand various methods and techniques regarding projections, animation, shading, illumination and lighting

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe the basic concepts of Computer Graphics.
2. Demonstrate various algorithms for basic graphics primitives.
3. Apply 2-D geometric transformations on graphical objects.
4. Use various Clipping algorithms on graphical objects
5. Explore 3-D geometric transformations, curve representation techniques and projections methods
6. Explain visible surface detection techniques and Animation.

Unit I: Introduction and Overview of Graphics System **Hours: 7**
Definition and Representative uses of computer graphics, Overview of coordinate system, Definition of scan conversion, rasterization and rendering. Raster scan & random scan displays, Architecture of raster graphics system with display processor, Architecture of random scan systems.

Unit II: Output Primitives **Hours: 7**
Scan conversions of point, line, circle and ellipse: DDA algorithm and Bresenham algorithm for line drawing, midpoint algorithm for circle, midpoint algorithm for ellipse drawing (Mathematical derivation for above algorithms is expected); Aliasing, Antialiasing techniques like Pre and post filtering, super sampling, and pixel phasing).; Filled Area Primitive: Scan line Polygon Fill algorithm, inside outside tests, Boundary Fill and Flood fill algorithm

Unit III: Two Dimensional Geometric Transformations **Hours: 7**
Basic transformations: Translation, Scaling, Rotation , Matrix representation and Homogeneous Coordinates Composite transformation Other transformations: Reflection and Shear

Unit IV: Two-Dimensional Viewing and Clipping **Hours: 7**
Viewing transformation pipeline and Window to Viewport coordinate transformation , Clipping operations: Point clipping, Line clipping algorithms: Cohen-Sutherland, Liang: Barsky, Polygon Clipping Algorithms: Sutherland-Hodgeman, Weiler-Atherton.

Unit V: Three Dimensional Geometric Transformations, Curves and Fractal Generation **Hours: 7**
3D Transformations: Translation, Rotation, Scaling and Reflection, Composite transformations: Rotation about an arbitrary axis, Projections – Parallel, Perspective. (Matrix Representation), Bezier Curve, B-Spline Curve, Fractal-Geometry: Fractal Dimension, Koch Curve.

Unit VI: Visible Surface Detection and Animation **Hours: 7**
Visible Surface Detection: Classification of Visible Surface Detection algorithm, Back Surface detection method, Depth Buffer method, Area Subdivision method
Animation: Introduction, Design of animation sequences, Animation languages, Keyframe, Morphing, Motion specification.

Text Book: Hearn, Baker, "Computer Graphics (C version)" – Pearson Education.

Reference Books:

1. J. Foley, V. Dam, S. Feiner, J. Hughes, ―Computer Graphics Principles and Practice‖, 2nd Edition,Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
2. D. Rogers, J. Adams, ―Mathematical Elements for Computer Graphics‖, 2nd Edition, TataMcGrawHill Publication, 2002, ISBN 0 – 07 – 048677 – 8.
3. Mario Zechner, Robert Green, ―Beginning Android 4 Games Development‖, Apress, ISBN: 978-81- 322-0575-3.

7KS03 CLOUD COMPUTING (L-4, T-0, C-4)

Course Prerequisite: Data Communication and Networks

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cloud Computing by being able to do each of the following:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a foundation of Cloud Computing, Cloud Computing services and tools in real life scenarios.
- To enable student to explore some important Cloud Computing driven commercial systems and applications.
- To provide students with essentials of Cloud Computing architecture, Virtualization, Storage and Network concepts.

Course Outcomes (Expected Outcomes): On completion of the course, the students will be able to:

1. Describe the fundamental concept, architecture and applications of Cloud Computing.
2. Discuss the problems related to cloud deployment model.
3. Examine the concept of virtualization.
4. Identify the role of network connectivity in the cloud.
5. Assess different Cloud service providers.
6. Inspect the security issues in cloud service models.

Unit I: Cloud Computing Fundamental, Architecture and Management: Hours: 8

Computing Paradigm and various computing types, Cloud Computing Fundamentals: Motivation for Cloud Computing, The need for Cloud Computing, Defining Cloud Computing, Principles of Cloud Computing, Requirements of Cloud Services, Cloud Applications, Benefits and Drawbacks. Cloud Computing Architecture and Management: Introduction, Cloud Architecture, Network connectivity in Cloud Computing, Applications on the cloud, Managing Cloud, Migrating Application to cloud.

Unit II: Cloud Deployment and Service Models: Hours: 8

Cloud Deployment Models: Introduction, Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud. Cloud Service Models: Introduction, Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models.

Unit III: Operating System and Virtualization: Hours: 8

Types of Operating Systems, Role of OS in Cloud Computing, Features of Cloud OS. Application Environment: Need for Effective ADE, Application Development Methodologies, Cloud Application Development Platforms and Cloud Computing API's. Virtualization: Introduction, Virtualization Opportunities, Approaches to Virtualization, Hypervisors, Virtualization to Cloud Computing.

Unit IV: Software Development in Cloud and Networking for Cloud Computing: Hours: 8

Introduction, Different Perspectives on SaaS Development, New Challenges, Cloud-Aware Software Development Using PaaS Technology. Networking for Cloud Computing: Introduction, Overview of Data Center Environment, Networking Issues in Data Centers, Transport Layer Issues in DCNs.

Unit V: Cloud Service Providers: Hours: 8

Introduction, EMC: IT, and captive cloud toolkit, Google: Platform, Storage, Cloud connects, Cloud Print and App Engine, Amazon Web Services: Elastic Compute Cloud, Simple storage, Simple Queue Service, Microsoft: Windows Azure, IBM Cloud models and IBM Smart Cloud, SAP Labs: SAP HANA Cloud Platform, Virtualization Services Salesforce: Sales Cloud and Service Cloud, Rackspace and VMware.

Unit VI: Open-Source Support for Cloud and Security in Cloud Computing: Hours: 8

Open-Source Support for Cloud: Introduction, Open Source Tools for IaaS, Open Source Tools for PaaS, Open Source Tools for SaaS, Open Source Tools for Research, Distributed Computing Tools for Management of Distributed Systems. Security in Cloud Computing: Introduction, Security Aspects: Data, Virtualization and Network Security, Platform-Related Security: Security issues in Cloud Service Models, SaaS, PaaS, IaaS security issues, Audit and Compliance: Disaster Recovery, Privacy and Integrity.

Text Book: K. Chandrasekaran: Essentials of Cloud Computing, Edition, CRC Press Taylor & Francis Group.

Reference Books:

1. A. Shrinivasan, J. Suresh: Cloud computing a practical approach for learning and implementation, Pearson publication.
2. M. N. Rao: Cloud Computing, PHI Learning Pvt. Ltd, 2015.
3. Dr. Kumar Saurabh: Cloud computing, 2nd Edition, Wiley India 2012.
4. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski: Cloud Computing: Principles and Paradigms, John Wiley & Sons, Inc. 2011.
5. Anthony T. Velte , Toby J. Velte and Robert Elsenpeter, Cloud computing a practical approach, Tata McGraw- Hill , New Delhi – 2010.
6. Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, “Cloud computing for dummies” Wiley Publishing, Inc, 2010.

7KS04 ROBOTICS (L-3, T-0, C-3)

Course Prerequisite: Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Robotics by being able to do each of the following:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe basic concept of robotics.
2. Explain Components of a Robot System & Mechanical Systems
3. Illustrate Control of Actuators in Robotic Mechanisms
4. Compare and contrast Robotic Sensory Devices
5. Recommend Robotics Hardware & Software Considerations in Computer Vision
6. Design Robotic system by taking real time considerations.

Unit I: Introduction to Robotics: Objectives, Motivation, Historical Perspective of Robots, Classification of Robots, Classification by Control Method, Continuous-path servo-controlled robots, Major Components of a Robot, Fixed versus Flexible Automation. **(Hours: 7)**

Unit II: Components of a Robot System & Mechanical Systems: Basic Components of a Robot System, Functions of a Robot System Specifications of Robot Systems, Kinematic Chains the Manipulator End Effectors, Resolution, Forces Encountered in Moving Coordinate Systems Lagrangian Analysis of a Manipulator. **(Hours: 7)**

Unit III: Control of Actuators in Robotic Mechanisms: Closed-Loop Control in a Position Servo, the Effect of Friction and Gravity, Frequency-Domain Considerations, Control of a Robotic Joint Brushless DC Motors, Direct-Drive Actuator, Hydraulic Actuators. **(Hours: 7)**

Unit IV: Robotic Sensory Devices: Non-Optical-Position Sensors, Optical Position Sensors, Robot Calibration Using an Optical Incremental Encoder, Instability Resulting from Using an Incremental Encoder, Velocity Sensors, Accelerometers. **(Hours: 7)**

Unit V: Computer Vision for Robotics Systems: A Functional Approach: Imaging Components, Image Representation, Hardware Considerations, Picture Coding, Object Recognition and Categorization, Software Considerations, Need for Vision Training and Adaptations. **(Hours: 7)**

Unit VI: Computer Considerations for Robotic Systems: Architectural Considerations, Hardware Considerations, Computational Elements in Robotic Applications Real-Time Considerations, Robot Programming, Path Planning, The Robot's Computer System. **(Hours: 7)**

Text Books:

1. Richard D.Klafter Thomas , Achmielewski and Michael Negin Robotic Engineering- An Integrated Approach Prentice Hall India – New Delhi.
2. Saeed B Nikku Introduction to Robotics , analysis control and applications Wiley-India 2nd Edition-2011

Reference Books:

1. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.
2. S.Ghoshal, “ Embedded Systems & Robotics” – Projects using the 8051 Microcontroller”, Cengage Learning, 2009.
3. David Jefferis, “Artificial Intelligence: Robotics and Machine Evolution”, Crabtree Publishing Company, 1992.
4. Robin Murphy, Robin R. Murphy, Ronald C. Arkin, “Introduction to AI Robotics”, MIT Press, 2000.
5. Francis.X.Govers, “Artificial Intelligence for Robotics”, Packt Publishing, 2018.
6. Huimin Lu, Xing Lu, “Artificial Intelligence and Robotics”, Springer, 2017.

7. Lentin Joseph, "Robot Operating Systems (ROS) for Absolute Beginners, Apress, 2018
8. Aaron Martinez, Enrique Fernández, "Learning ROS for Robotics Programming", Packt Publishing Ltd, 2013.
9. Wyatt Newman, "A Systematic Approach to learning Robot Programming with ROS", CRC Press, 2017.
10. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
11. K. K.AppuKuttan, Robotics, I K International, 2007.
12. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
13. Richard D. Klafter, Thomas .A, ChriElewski, Michael Negin - Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 2009.
14. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
15. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012
16. Deb. S. R. "Robotics technology and flexible automation", Tata McGraw Hill publishing company.

7KS04 DATA WAREHOUSE AND MINING (L-3, T-0, C-3)

Course Prerequisite: Basic knowledge of Database management system

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Warehouse and Mining by being able to do each of the following:

1. Introduce the basics of data mining, data types, similarity and dissimilarity measures
2. Explain association rules and algorithms
3. Be familiar with mathematical foundations of data mining tools.
4. To identify the scope and essentiality of Data Warehousing and Mining
5. Demonstrate the appropriate data mining techniques for decision making.
6. To develop research interest towards advances in data mining.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to
1. Explain the basics of data mining techniques.
2. Identify the similarity and dissimilarity between the data sets.
3. Apply Data Preprocessing to techniques.
4. Describe Data Warehouse fundamentals, Data Mining Principles.
5. Illustrate Multidimensional Data Analysis in Cube Space
6. Assess Mining Frequent Patterns, Associations, and Correlations

Unit I: Introduction: Why Data Mining?, What Is Data Mining? , What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used? , Which Kinds of Applications Are Targeted? , Major Issues in Data Mining. **(Hours: 7)**

Unit II: Getting to Know Your Data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. **(Hours: 7)**

Unit III: Data Preprocessing: Data Preprocessing: An Overview , Data Cleaning , Data Integration , Data Reduction , Data Transformation and Data Discretization. **(Hours: 7)**

Unit IV: Data Warehousing and Online Analytical Processing:
Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction. **(Hours: 7)**

Unit V: Data Cube Technology
Data Cube Computation: Preliminary Concepts, Data Cube Computation Methods, Processing Advanced Kinds of Queries by Exploring Cube Technology, Multidimensional Data Analysis in Cube Space. **(Hours: 7)**

Unit VI: Mining Frequent Patterns, Associations, and Correlations :
Basic Concepts and Methods: Basic Concepts , Frequent Itemset Mining Methods , Which Patterns Are Interesting?- Pattern Evaluation Methods . **(Hours: 7)**

Text Book:
Data Mining – Concepts and Techniques, Jiawei Han & Micheline Kamber, Morgan Kaufmann(MK) Publishers, Elsevier, 3rd Edition, 2006.

Reference Books:
1. Data Mining Techniques, Arun K Pujari, 3rd edition, Orient Blackswan/Universities Press, 2013.
2. Data Warehousing Fundamentals, PaulrajPonnaiah, John Wiley & Sons, 2001.
3. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education, 2007
4. Insight into Data mining Theory and Practice, K.P. Soman, Shyam Diwakar and V. Ajay, Easter Economy Edition, Prentice Hall of India, 2006.
5. G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.

7KS04 EMBEDDED SYSTEM (L-3, T-0, C-3)

Course Pre-requisite: Microprocessor and Assembly Language Programming, Computer Architecture and Organization

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Embedded System by being able to do each of the following:

1. Introduce the fundamentals and building blocks of Embedded System.
2. Impart the knowledge of basic embedded programming in various languages as well as data structures.
3. Introduce hardware units, bus communication in processors and input/output interfacing.
4. Impart knowledge of real-time operating system and various task scheduling algorithms.
5. Introduce basics of real-time operating system and case study example to elaborate importance of real-time operating system.

Course Outcomes (Expected Outcomes): On completion of the course, the students will be able to:

1. Describe the basics of embedded systems and structural core units as well as memory organization for embedded system.
2. Explain components of embedded system, characteristics and quality attributes of embedded systems.
3. Discuss role of 8051 microcontroller and its architecture in design of embedded systems
4. Examine the different Addressing modes and Instruction Set of 8051 microcontrollers.
5. Use knowledge of C programming to do embedded programming.
6. Assess the Real-Time Operating System concepts with VxWorks RTOS.

UNIT I: Introduction to Embedded System: What is Embedded System, Embedded Systems Vs General Computing Systems, History, classification, major application areas and purpose of Embedded Systems, Wearable Devices. The Typical Embedded System: Core of the Embedded System, Memory. **(Hours: 7)**

UNIT II: The Typical Embedded System: Sensors & Actuators, Communication Interface, Embedded Firmware, Other System Components, PCB and Passive Components. Characteristics of an Embedded System, Quality Attributes of Embedded Systems. Embedded Systems Application and Domain Specific Examples: Washing machine, Automotive. **(Hours: 7)**

UNIT III: Designing Embedded Systems with 8-bit Microcontroller - 8051: Factors to be considered in Selecting a Controller. Why 8051 Microcontroller. Designing with 8051 Microcontroller: 8051 Architecture, 8051 Memory Organization, Registers, Oscillator Unit, Ports, 8051 Interrupt System, Timer units, the Serial Port, 8051 Power Saving Modes. **(Hours: 7)**

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UNIT IV: Programming the 8051 Microcontroller: Different Addressing modes supported by 8051. The 8051 Instruction Set: Data transfer instructions, Arithmetic instructions, Logical instructions, Boolean instructions, and Program Control Transfer instructions. Embedded Firmware Design Approaches, Assembly Language based Embedded Firmware development. **(Hours: 7)**

UNIT V:

Programming in Embedded C: Review of various constructs in C. Constant declarations, 'volatile' type qualifier, Delay generation and Infinite loops in Embedded C. Coding Interrupt Service Routines, Recursive and Re-entrant Functions, Dynamic memory allocation. **(Hours: 7)**

UNIT VI:

VxWorks Real Time Operating System (RTOS): How to choose an RTOS, Characteristics, Real Time Kernel, Hard/Soft Real time. VxWorks Task Creation, Management and Task Scheduling, Kernel Services, Inter Task Communication, VxWorks Task Synchronization and Mutual Exclusion, Interrupt Handling, Watchdog for task Execution monitoring, Timing and Reference in VxWorks.
The Embedded Product Development Life Cycle (EDLC): What is EDLC, Why EDLC, Objectives of EDLC, Different Phases of EDLC, EDLC approaches. **(Hours: 7)**

Text Book: Shibu K V "Introduction to Embedded Systems", Second Edition, McGraw-Hill.

References:
1. Rajkamal, "Embedded Systems, Architecture, Programming & Design", Third Edition, TMH.
2. Tammy Noergaard, "Embedded Systems Architecture" Elsevier Newness Publication.
3. Vahid and Givargis, "Embedded System Design" John Wiley & Sons P Ltd.
4. Peter Marwedel, "Embedded Systems Design" Springer, Netherland.
5. Jane W. S. Liu, "Real Time Systems", Pearson Education.
6. Mohammad Ali Mazidi, "The 8051 Microcontroller and Embedded System using Assembly and C" Pearson.

7KS04 DIGITAL FORENSICS (L-3, T-0, C-3)

Course Prerequisite: Data Communication & Networking, Introduction to Cyber Security, Cryptography

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Digital Forensics by being able to do each of the following:

- To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- To understand how to examine digital evidences such as the data acquisition, identification analysis.
- To understand the basics of mobile phone forensics.
- To understand the network based cyber security intrusion detection.
- To know the various forensics tool.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe Digital Forensics and its related preparation
2. Outline Data Acquisition tools
3. Use knowledgeto improve crime investigations.
4. Examine Digital Forensic and its validation
5. Assess role of email and social media in investigations
6. Discuss Cloud Forensics.

Unit I: **Hours: 7**

Introduction: An Overview of Digital Forensics, Preparing for Digital Investigations, Preparing A Digital Forensics Investigations, Procedure for Private Sector High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Unit II: **Hours: 7**

Data Acquisition: Understanding storage formats for digital evidence, determining the best acquisition method, Contingency planning for Image acquisition, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Unit III: **Hours: 7**

Processing Crime and Incident Scenes: Identifying Digital Evidence, Collection Evidence in Private Sector Scenes, Processing Law Enforcement Crime Scenes, Preparing for a search, Securing a Digital Incident or Crime Scene, Seizing Digital Evidence at the scene, Storing a Digital Evidence, Obtaining a Digital Hash,

Unit IV: **Hours: 7**

Digital Forensic Analysis and Validation: Data to collect and analyze, Validating Forensic data, Addressing data hiding techniques, Virtual Machine Forensics, Live Acquisition and Network Forensics

Unit V: **Hours:7**

Email and Social Media Investigations: Role of Email in investigations, Roles of Client and server in Email, Investigating Emails Crimes and Violations, Email Servers, Specialize Email Forensic Tools, Digital Forensics to Social Media Communications. Mobile Device Forensics and Internet of Anything: Mobile Device Forensics, Acquisitions procedure for Mobile Devices, Forensics in Internet of Anything.

Unit VI: **Hours: 7**

Cloud Forensics: Cloud Computing, Legal Challenges in Cloud Forensics, Technical Challenges in Cloud Forensics, Acquisitions in the cloud, Conducting a cloud investigation, Tools for Cloud Forensics. Digital Forensics Tools: Evaluating Digital Forensics Tools Needs, Software and Hardware Tools, Validating and Testing Software.

Text Book: Nelson, B, Phillips, A, Stuart, C., "Guide to Computer Forensics and Investigations", 6th Ed., Cengage Learning.

Reference Books:

1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2. Davidoff, S. and Ham, J., Network Forensics Tracking Hackers through Cyberspace, Prentice Hall, 2012.
3. Michael G. Solomon, K Rudolph, Ed Tittel, Broom N., and Barrett D., Computer Forensics Jump Start, Willey Publishing, Inc., 2011.
4. Marcella, Albert J., Cyber forensics: A field manual for collecting, examining and preserving evidence of computer crimes, New York, Auerbach publications, 2008.
5. Davidoff, Sherri, Network forensics: Tracking hackers through cyberspace, Pearson education India private limited, 2017.
6. John Sammons, The Basics of Digital Forensics, Elsevier, 1st Edition, 2015.

7KS05 BLOCK CHAIN FUNDAMENTALS (L-3, T-0, C-3)

Course Prerequisite: Expertise in Programming, Basic Knowledge of Computer Security, Cryptography, Networking, Computer Systems Security

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Block Chain Fundamentals by being able to do each of the following:

- To provide conceptual understanding of the function of Block chain as a method of securing distributed ledgers.
- To understand the structure of a block chain and why/when it is better than a simple distributed database
- To understand the technological underpinnings of block chain operations as distributed data structures and decision-making systems.
- To gain understanding of a "smart" contract and its legal implications.
- To provide a critical evaluation of existing "smart contract" capabilities and platforms, and examine their future directions, opportunities, risks and challenges.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe Crypto currency as application of block chain technology
2. Examine Basic Cryptographic primitives used in Block chain
3. Illustrate Consensus in a Blockchain
4. Discuss empirical study oof bitcoin the mining
5. Compare and contrast Ethereum and Bitcoin
6. Use concepts of Block chain technology that are commonly used across multiple industries to solve large scale problems.

Unit I: Introduction to Block Chain: Hours: 7

Introduction to Block chain, Structure of a Block, Types of Block chain, Public Ledgers, Block chain as public ledgers, Crypto currency as application of block chain technology

Unit II: Basic Cryptographic primitives used in Block chain: Hours: 7

Basic Cryptographic primitives used in Block chain – Secure, Collision-resistant hash functions, Digital signature, Public key cryptosystems, Zero-knowledge proof systems Cryptographic Hash Function, SHA-256,Properties of a hash function, Hash pointer and Merkle tree.

Unit III: Consensus: Hours: 7

Consensus, Distributed consensus in open environments, Consensus in a Bitcoin network, Types of consensus algorithm: Proof of Work (PoW), Proof of Stake (PoS), Delegated Proof of Stake (DPoS), Ripple, Proof of Burn

Unit IV: Introduction to Bitcoin: Hours: 7

Introduction to Bitcoin, History of Bitcoin, Bitcoin Transactions, Bitcoin Mining,Bitcoin Address.

Unit V: Introduction to Ethereum: Hours: 7

Introduction to Ethereum - Ethereum Virtual Machine (EVM), Wallets for Ethereum, Differences between Ethereum and Bitcoin, Block format, Mining algorithm, Solidity, Smart Contracts, Some attacks on smart contracts.

Unit VI: Block chain Technology Hours: 7

Blockchain Technology: Hyper ledger Fabric: System architecture, ledger format, chain code execution, transaction flow and ordering, private channels, membership service providers, Fabric Peer and Certificate Authority, Case studies of applications

Text Book: S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Block chain Technology: Crypto currency and Applications', Oxford University Press, 2019.

Reference Books:

1. Mastering Bitcoin: Unlocking Digital Crypto currencies, by Andreas Antonopoulos, O'Reilly publisher
2. Blockchain Blueprint for a New Economy, by Melanie Swan, O'Reilly.
3. Narayanan, Arvind, et al. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press, 2016.
4. Antonopoulos, Andreas M. Mastering Bitcoin: Programming the Open Blockchain. O'Reilly Media, Inc., 2017
5. Antonopoulos, Andreas M. and Wood, Gavin. Mastering Ethereum. O'Reilly Media, Inc., 2018. (Free draft available at https://github.com/ethereumbook/ethereumbook)
6. Ethereum project documentation. Online: http://www.ethdocs.org/en/latest/
7. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

7KS05 IMAGE PROCESSING (L-3, T-0, C-3)

Course Prerequisite: Calculus, Linear Algebra, Differential Equation

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Image Processing by being able to do each of the following:

- To introduce and discuss the fundamental concepts and applications of Digital Image Processing.
- To discuss various basic operations in Digital Image Processing.
- To know various transform domains

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain fundamental steps in Image Processing
2. Compare different methods for image transform with its properties
3. Illustrate Image Enhancement in spatial domain
4. Examine Image Enhancement in Frequency Domain
5. Apply various methods for segmenting image and identifying image components
6. Investigate morphological operations to improve the quality of image.

Unit I: Introduction to Image processing: **Hours: 7**
Fundamental steps in image processing, Components of image processing system, Pixels, coordinate conventions, Imaging Geometry, Spatial Domain, Frequency Domain, sampling and quantization, Basic relationship between pixels, Applications of Image Processing.

Unit II : Image transforms and its properties: **Hours: 7**
Unitary transform, Discrete Fourier Transform, Discrete Cosine Transform, Walsh Transform, Hadamard Transform.

Unit III: Image Enhancement in spatial domain: **Hours: 7**
Basic Gray Level Transformation functions – Image Negatives, Log Transformations, Power- Law Transformations. Piecewise-Linear Transformation Functions: Contrast Stretching, Gray Level Slicing, Bit Plane Slicing, Histogram Processing–Equalization, Specification. Basics of Spatial Filtering – Smoothing: Smoothing Linear Filters, Ordered Statistic Filters, Sharpening: Laplacian, Unsharp Masking and High Boost Filtering.

Unit IV: Image Enhancement in Frequency Domain: **Hours: 7**
Basics of Filtering in Frequency Domain, Filters -Smoothing Frequency Domain Filters : Ideal Low Pass Filter, Gaussian Low Pass Filter, Butterworth Low Pass Filter, Sharpening Frequency Domain Filters: Ideal High Pass Filter, Gaussian High Pass Filter, Butterworth High Pass Filter, Homomorphic Filtering.

Unit V: Image Segmentation: **Hours: 7**
Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method, Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge, Edge Detection - Edge Operators, Line Detection, Corner Detection.

Unit VI: Morphological Operations: **Hours: 7**
Basics of Set Theory, Dilation and Erosion - Dilation, Erosion, Structuring Element, Opening and Closing, Hit or Miss Transformation. Representation and Description Representation - Boundary, Chain codes, Polygonal approximation approaches, Boundary segments.

Text Books:

1. A K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.
2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing (English) 3rd Edition, Pearson India, 2013.

Reference Books:

1. Al Bovik, The Essential Guide to Image Processing, Academic Press, 2009.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision, Thomson Learning, 2008.
3. S Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Procesing, McGraw Hill Education , 2009.

7KS05 OPTIMIZATION TECHNIQUES (L-3, T-0, C-3)

Course Prerequisite: Mathematics III

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Optimization Technique by being able to do each of the following:

- To familiarize with optimization techniques using both linear and non-linear programming.
- To study convex optimization though some techniques
- To gain understanding of linear algebra and probability theory

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe statement of an optimization problem
2. Examine linear programming procedures to solve optimization problems.
3. Compare different nonlinear programming methods of optimization
4. Discuss Geometric Programming with different constraint
5. Identify the appropriate optimization technique for the given problem
6. Synthesize algorithms to solve real time optimization problems.

Unit I: **Hours: 7**

Introduction to Optimization: Introduction, Historical Development, Engineering Applications of Optimization, Statement of an Optimization Problem, Classification of Optimization Problems, Classification Based on the Existence of Constraints.

Classical Optimization Techniques: Introduction, Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints, Multivariable Optimization with Inequality Constraints.

Unit II: **Hours: 7**

Linear Programming I: Simplex Method Introduction, Applications of Linear Programming, Standard Form of a Linear Programming Problem, Geometry of Linear Programming Problems, Definitions and Theorems, Solution of a System of Linear Simultaneous Equations, Pivotal Reduction of a General System of Equations, Motivation of the Simplex Method, Simplex Algorithm, Two Phases of the Simplex Method, Revised Simplex Method, Duality in Linear Programming, Decomposition Principle Sensitivity or Post optimality Analysis, Transportation Problem.

Unit III: **Hours: 7**

Nonlinear Programming: One-Dimensional Minimization Methods Unimodal Function, ELIMINATION METHODS: Unrestricted Search, Search with Fixed Step Size, Search with Accelerated Step Size, Exhaustive Search, Dichotomous Search, Interval Halving Method, Fibonacci Method, Golden Section Method, Comparison of Elimination Methods, INTERPOLATION METHODS, Quadratic Interpolation Method, Cubic Interpolation Method, Direct Root Methods, Newton Method, Quasi-Newton Method , Secant Method.

Unit IV: **Hours: 7**

Nonlinear Programming: Unconstrained Optimization Techniques Introduction, Classification of Unconstrained Minimization Methods, General Approach, Rate of Convergence, Scaling of Design Variables, DIRECT SEARCH METHODS Random Search Methods, Random Jumping Method, Random Walk Method, Random Walk Method with Direction Exploitation, Advantages of Random Search Methods, Grid Search Method, Univariate Method ,Pattern Directions, Powell's Method, Simplex Method, INDIRECT SEARCH (DESCENT) METHODS Gradient of a Function, Steepest Descent (Cauchy) Method, Conjugate Gradient (Fletcher–Reeves) Method, Newton's Method, Marquardt Method, Quasi-Newton Methods, Davidon–Fletcher–Powell Method, Broyden–Fletcher–Goldfarb–Shanno Method

Unit V: **Hours: 7**

Nonlinear Programming: Constrained Optimization Techniques Introduction, Characteristics of a Constrained Problem, DIRECT METHODS Random Search Methods, Complex Method, Sequential Linear Programming , Basic Approach in the Methods of Feasible Directions, Zoutendijk's Method of Feasible Directions, Rosen's Gradient Projection Method, Generalized Reduced Gradient Method, Sequential Quadratic Programming, INDIRECT METHODS Transformation Techniques, Basic Approach of the Penalty Function Method, Interior Penalty Function Method, Convex Programming Problem, Exterior Penalty Function Method, Extrapolation Techniques in the Interior Penalty Function Method, Extended Interior Penalty Function Methods

Unit VI: **Hours: 7**

Dynamic Programming Introduction, Multistage Decision Processes, Concept of Sub optimization and Principle of Optimality, Computational Procedure in Dynamic Programming, Conversion of a Final Value Problem into an Initial Value Problem, Linear Programming as a Case of Dynamic Programming, Continuous Dynamic Programming Stochastic Programming Introduction, Basic Concepts of Probability Theory, Stochastic Linear Programming, Stochastic Nonlinear Programming, Stochastic Geometric Programming.

Text Book: Engineering Optimization: Theory and Practice, Fourth Edition Singiresu S. Rao Copyright © 2009 by John Wiley & Sons, Inc.

Reference Books:

1. Mokhtar S. Bazaaraa, Hanif D. Shirali and M.C.Shetty, "Nonlinear Programming, Theory and Algorithms", John Wiley & Sons, New York (2004).
2. Kwang Y. Lee, Mohamed A. El-Sharkawi, "Modern heuristic optimization techniques: theory and applications", Kluwer (2008).
3. Hamdy A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson Education (2008).
4. G. V. Reklaitis, A. Ravindran, K. M. Ragsdell, "Engineering Optimization: Methods and Applications", Wiley (2006).
5. Michael C. Bartholomew-Biggs, "Nonlinear optimization with engineering applications", Springer (2008).

7KS06 COMPUTER GRAPHICS – LAB. (P-2, C-1)

Course Prerequisite: Knowledge of C or C++ Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Graphics Lab by being able to do each of the following:

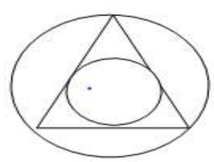
- To acquaint the learner with the basic concepts of Computer Graphics.
- To learn the various algorithms for generating and rendering graphical figures.
- To get familiar with mathematics behind the graphical transformations.
- To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting
- To prepare the student for advance areas like Image Processing or Computer Vision or Virtual Reality and professional avenues in the field of Computer Graphics.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe the basic concepts of Computer Graphics.
2. Demonstrate various algorithms for basic graphics primitives.
3. Apply 2-D geometric transformations on graphical objects.
4. Use various Clipping algorithms on graphical objects
5. Explore 3-D geometric transformations, curve representation techniques and projections methods
6. Explain visible surface detection techniques and Animation.

List of Experiments: This is the sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write a program to draw line using DDA algorithm.
2. Write a program to draw line using Bresenham‘s algorithm
3. Write a program to draw circle using Bresenham‘s algorithm
4. Write a program for 2-D transformations, a) Scaling b) Translation c) Rotation
5. Write a program for 3-D transformations, a) Scaling b) Translation c) Rotation
6. Write program to fill polygon using scan line algorithm
7. Write a program to draw the polygons by using the mouse. Choose colors by clicking on the designed color pane. Use window port to draw. Use DDA algorithm for line drawing.
8. Write a program to clip line using following algorithm : Cohen-Sutherland algorithm
9. Write a program to draw following type of curve-Hilbert’s Curve
10. Write a program to draw following type of curve-Koch curve, Bezier curves
11. Write a program to draw inscribed and Circumscribed circles in the triangle as shown as an example below. (Use any Circle drawing and Line drawing algorithms)



12. Write a program to move circle to forward direction.
13. Write a program to draw a cube using in build library function and perform 3D transformations
14. Write a program to fill color in rectangle
15. Write a program to generate Bouncing ball animation using Direct3D/Maya/Blender
16. Write a program to generate snowflake using concept of fractals.
17. Write a program to implement translation, sheer, rotation and scaling transformations on equilateral triangle and rhombus
18. Write program to draw any object such as flower, waves using any curve generation technique
19. Write a program of man walking in rain
20. Write a program to draw a house
21. Write a program for moving a cycle
22. Write a graphics program analog clock
23. Write a program to draw 3-D cube and perform following transformations on it using OpenGL.

7KS07 EMERGING TECHNOLOGY LAB III (P-2, C-1)

7KS07 Emerging Technology Lab III is based on 7KS04 Professional Elective-III. Tentative FOSS Tools & Technology for Practical’s are as follows:

AI : ROS, YARP, MRPT, Gazebo, OROCOS.
DS :RapidMiner, Weka, Scrapy, Pandas
IoT :ThingsBoard, Kinoma, SiteWhere
Cyber Security: Security Onion, LastPass,KeePAss.

7KS08 EMERGING TECHNOLOGY LAB IV(P-2, C-1)

7KS08 Emerging Technology Lab IV is based on 7KS05 Professional Elective-IV. Tentative FOSS Tools & Technology for Practical's are as follows:

Blockchain: Ethereum,Bigchain DB, Corda
Image Processing:Open CV, SimpleCV, Keras, Caffe
Optimization :Open Eaagles, Repast, Open Simulator.

7KS09 PROJECT AND SEMINAR (P-8, C-4)

Seminar shall bebased on the advanced topic in thefield. It may be related to domain of the project. The seminar should be conducted in seventh semester andevaluated. Each candidate shall submit a seminar report, deliver the seminarand face the viva-voce. The distribution of internal 50 marks shall be asfollows.

1. Seminar report preparation and submission :- 10 marks
2. Seminar delivery/ presentation:- 20 marks
3. Seminar viva-voce:- 10 marks
4. Attendance in all seminar sessions:- 10 marks.

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SEMESTER EIGHTH

8KS01 OBJECT ORIENTED ANALYSIS AND DESIGN (L-3, T-0, C-3)

Course Prerequisite: Data Structures and algorithms, Basic Mathematics, Geometry, linear algebra, vectors and matrices

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Object-Oriented Analysis and Design by being able to do each of the following:

- To learn the basic concepts of Object-Oriented Analysis and Design, UML, Software Development Processes and Design pattern.
- To study requirement analysis in the Inception phase of software development and relate
- To present Object Oriented Analysis and Design through case studies.
- To introduce design patterns that can be used for development of object-oriented software systems.
- To study UML notation and frequently used UML diagrams for designing Object Oriented software.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe Object Oriented principles, for performing object-oriented analysis and design.
2. Explain the basic concepts of UML, Software Development Processes and Design pattern.
3. Illustrate requirements for developing a software.
4. Create initial domain model & system sequence diagram for use case scenario.
5. Design static and dynamic objects for modeling.
6. Construct UML and Design Patterns for developing object-oriented software.

Unit I: **Hours: 07**
Introduction to Object Oriented Analysis and Design: Analysis and Design, Object-Oriented Analysis and Design; UML, Iterative, Evolutionary and Agile: UP, Iterative and Evolutionary Development, Waterfall Lifecycle, Iterative and Evolutionary Analysis and Design, Risk-Driven and Client-Driven Iterative Planning, Agile Methods and Attitudes, Agile Modeling, Agile UP, UP Phases, UP Disciplines.

Unit II: **Hours:07**

Defining Inception: Inception, Artifacts Start in Inception, Evolutionary requirements: Requirements, Evolutionary vs. Waterfall Requirements, Types and Categories of Requirements, Requirements Organized in UP Artifacts
Use cases: Actors, Scenarios and Use Case, Use Cases and the Use-Case Model, Importance of Use Cases, Three Kinds of Actors, Three Common Use Case Format, Sections Mean, Take an Actor and Actor- goal perspective, Use Case Diagrams, Activity Diagrams

Unit III: **Hours:07**

Domain Models: Domain Model, Need of Create a Domain Model, create a Domain Model, Conceptual Classes, Sketching a Class Diagram, Common Mistake with Attributes vs. Classes, Associations, Attributes.
System Sequence Diagrams: System Sequence Diagrams, Need of SSD, Relationship between SSDs and Use Cases, Naming System Events and Operations, Model SSDs Involving Other External Systems, Process: Iterative and Evolutionary SSDs, Operation Contracts.

7KS08 EMERGING TECHNOLOGY LAB IV(P-2, C-1)

7KS08 Emerging Technology Lab IV is based on 7KS05 Professional Elective-IV. Tentative FOSS Tools & Technology for Practical's are as follows:

Blockchain: Ethereum,Bigchain DB, Corda
Image Processing:Open CV, SimpleCV, Keras, Caffe
Optimization :Open Eaagles, Repast, Open Simulator.

7KS09 PROJECT AND SEMINAR (P-8, C-4)

Seminar shall bebased on the advanced topic in thefield. It may be related to domain of the project. The seminar should be conducted in seventh semester andevaluated. Each candidate shall submit a seminar report, deliver the seminarand face the viva-voce. The distribution of internal 50 marks shall be asfollows.

1. Seminar report preparation and submission :- 10 marks
2. Seminar delivery/ presentation:- 20 marks
3. Seminar viva-voce:- 10 marks
4. Attendance in all seminar sessions:- 10 marks.

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SEMESTER EIGHTH

8KS01 OBJECT ORIENTED ANALYSIS AND DESIGN (L-3, T-0, C-3)

Course Prerequisite: Data Structures and algorithms, Basic Mathematics, Geometry, linear algebra, vectors and matrices

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Object-Oriented Analysis and Design by being able to do each of the following:

- To learn the basic concepts of Object-Oriented Analysis and Design, UML, Software Development Processes and Design pattern.
- To study requirement analysis in the Inception phase of software development and relate
- To present Object Oriented Analysis and Design through case studies.
- To introduce design patterns that can be used for development of object-oriented software systems.
- To study UML notation and frequently used UML diagrams for designing Object Oriented software.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe Object Oriented principles, for performing object-oriented analysis and design.
2. Explain the basic concepts of UML, Software Development Processes and Design pattern.
3. Illustrate requirements for developing a software.
4. Create initial domain model & system sequence diagram for use case scenario.
5. Design static and dynamic objects for modeling.
6. Construct UML and Design Patterns for developing object-oriented software.

Unit I: **Hours: 07**
Introduction to Object Oriented Analysis and Design: Analysis and Design, Object-Oriented Analysis and Design; UML, Iterative, Evolutionary and Agile: UP, Iterative and Evolutionary Development, Waterfall Lifecycle, Iterative and Evolutionary Analysis and Design, Risk-Driven and Client-Driven Iterative Planning, Agile Methods and Attitudes, Agile Modeling, Agile UP, UP Phases, UP Disciplines.

Unit II: **Hours:07**

Defining Inception: Inception, Artifacts Start in Inception, Evolutionary requirements: Requirements, Evolutionary vs. Waterfall Requirements, Types and Categories of Requirements, Requirements Organized in UP Artifacts
Use cases: Actors, Scenarios and Use Case, Use Cases and the Use-Case Model, Importance of Use Cases, Three Kinds of Actors, Three Common Use Case Format, Sections Mean, Take an Actor and Actor- goal perspective, Use Case Diagrams, Activity Diagrams

Unit III: **Hours:07**

Domain Models: Domain Model, Need of Create a Domain Model, create a Domain Model, Conceptual Classes, Sketching a Class Diagram, Common Mistake with Attributes vs. Classes, Associations, Attributes.
System Sequence Diagrams: System Sequence Diagrams, Need of SSD, Relationship between SSDs and Use Cases, Naming System Events and Operations, Model SSDs Involving Other External Systems, Process: Iterative and Evolutionary SSDs, Operation Contracts.

Unit IV: **Hours:07**

Logical Architecture and UML Package Diagrams: Logical Architecture, Layers, Software Architecture, UML Package Diagrams, Design with Layers, Benefits of Using Layers
On to Object Design: Designing Objects: Static and Dynamic Modeling, The Importance of Object Design Skill over UML Notation Skill
UML Interaction Diagrams: Sequence and Communication Diagrams, Common UML Interaction Diagram Notation, Basic Sequence Diagram Notation, Basic Communication Diagram Notation.
UML Class Diagram: Common Class Diagram Notation, Design Class Diagram, Attribute Text and Association Lines, Notes, Comments, Constrains and Method Bodies, Operations and Methods, Keywords, Stereotypes, Profiles and Tags

Unit V: **Hours:07**
GRASP: Designing Objects with Responsibilities: Object Design: Example Inputs, Activities and Outputs, Responsibilities and Responsibility-Driven Design, GRASP: A Methodological Approach to Basic OO Design, the Connection between Responsibilities, GRASP and UML Diagrams, Patterns, A Short Example of Object Design with GRASP Designing for Visibility: Visibility between Objects Mapping Designs to Code: Creating Class Definitions from DCDs, Creating Methods from Interaction Diagrams, Collection Classes in Code

Unit VI: **Hours:07**
Applying GoF Design Patterns: Adapter(GoF), Factory, Singleton(GoF), Strategy (GoF), Composite (GoF) and Other Design Principles, Façade (GoF), Observer (GoF).
UML State Machine Diagrams and Modeling: Event, State and Transition, Apply State Machine Diagrams, More UML State Machine Diagram Notation, State Machine Diagrams in UP.
Relating Use Cases: The include Relationship, The extend Relationship, The Generalize Relationship, Use Case Diagrams.

Text Books:

1. Craig Larman: ”Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development, Third Edition, Addison Wesley Professional.
2. Erich Gamma et al., Design Patterns, Elements of Reusable OO Software, Addison-Wesley.

Reference Books:

1. Blaha, Rumbaugh: “Object Oriented Modeling and Design with UML” (2/e) Pearson Education.
2. Arlow, Jim, “UML and the Unified Process”, Pearson Education.
3. Dathan, Ramnath: “Object Oriented Analysis, Design & Implementation, ”OUP.
4. McRobb& Farmer: “Object Oriented System Analysis & Design” Mc Graw Hill.
5. Booch, Rumbaugh & Jacobson: “ The UML User guide” Pearson Education.
6. Whitten & Bentley: “System Analysis & Design Methods” Tata McGraw Hill.
7. Booch: “Object Oriented Analysis & Design with Applications”, Pearson Education.

8KS02 PROFESSIONAL ETHICS AND MANAGEMENT (L-3, T-0, C-3)

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Professional Ethics and Management by being able to do each of the following:

- To enable the students to create an awareness of engineering and professional ethics
- To instill moral, social values and appreciate the rights of others
- To regulate the student’s behavior in a professional environment
- To conscious about the impact of non-ethical engineering decisions
- To comprehend ‘mind and desire control’ needs for being ethical

Course Outcomes (Expected Outcomes): On completion of the course, the students will be able to:

1. Relate ethical and non-ethical situations
2. Outline ethics in the society & environment
3. Examine the moral judgment & correlate the concepts in addressing the ethical dilemmas
4. Identify risk and safety measures in various engineering fields
5. Justify ethical issues related to engineering responsibilities and rights
6. Synthesize cognitive skills in solving social problems

Unit I: Introduction to Ethics **Hours: 07**
Senses of Engineering and professional ethics, Engineering profession & its view, Ethical issues for engineers, distinction between ethics, morals and laws, opinions vs. judgments, Ethical theories: utilitarianism, duty, right, virtue; Cost-benefit analysis in engineering, McCuen’s ethical dimensions, IEEE: Code of conducts & Code of ethics

Unit II: Professional Practices in Engineering **Hours: 07**
Professional attributes, Difference in engineering and other professions; Ethical dilemma: right-wrong or better-worse; Code of ethics for engineers in India: need and its roles; abuse of codes, ethical relativism, well-being and profession, Ethics as Design - Doing Justice to Moral Problems, Kohlberg’s theory – Gilligan’s theory.

Unit III: Central Professional Responsibilities of Engineers **Hours: 07**
Confidentiality and Proprietary Information, Conflict of interest, Competitive bidding, rights of Engineers: fundamental, professional conscience, conscientious refusal, professional recognition, employee, privacy; types of conflict of interest, avoiding conflict of interest, competitive bidding, situations for conflict of interest, ethical corporate climate & its features.

Unit IV: Intellectual Property Rights and Ethics **Hours: 07**
Patent: IP chain of activities, IP as intangible property, protection offered by patent, right of patent owner; Trademarks (TM): purpose, what can be registered under trademark, categories of TM, industrial design, geographical indications; Copyright & related rights: advances in technology and copyright, benefits, World IP organization, TRIPS & WTO.

Unit V: Computers, Software and Digital Information **Hours: 07**
Emergence of Computer ethics, issues in Computer ethics: distribution of power issues, property issues, issues of privacy, professional issues, Computer crimes, Computer Software and Digital Information: Characteristics of digital information, s/w as IP, and challenges in information age, IEEE code of conduct and code of ethics.

Unit VI: Responsibilities and Management **Hours: 07**
Responsibility for the Environment, Engineering as Social Experimentation, Safety and Risk management, IT Professional relationship management with: Employers, Clients, Suppliers, IT Users, other professionals, and society at large.

Text Books:
1. Prof. Susmita Mukhopadhyay, 'Ethics in Engineering Practice' IIT Kharagpur
2. Mike Martin and Roland Schinzinger, 'Ethics in Engineering', Tata McGraw Hill, New York, 2005

Reference Books:
1. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, 'Engineering Ethics – Conceptsand Cases', Cengage Learning, 2009 & Thompson Learning, 2000
2. Govindarajan M., Natarajan,'Engineering Ethics', Prentice Hall of India, New Delhi, 2004
3. Stephen Byars, 'Business Ethics', USC Marshal School of Business Kurt Stanberry, University of Houston (https://openstax.org/details/books/business-ethics)

8KS03 VIRTUAL AND AUGMENTED REALITY (L-3, T- 0, C-3)

Course Prerequisite: Basics of Computers & Multimedia

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Virtual and Augmented Reality by being able to do each of the following:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications
- To know the intricacies of these platform to develop PDA applications with better optimality

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe Virtual reality & its applications.
2. Discuss virtual reality world and types.
3. Examine geometry of virtual world and the physiology of human vision
4. Investigate Visual Perception, Motion and Tracking
5. Inspect Physics of Sound and the Physiology of Human Hearing.
6. Explain Augmented reality & examples based on Augmented reality

Unit I: **Hours: 07**
Introduction to Virtual Reality: Defining Virtual Reality, History ofVR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output-Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Unit II: **Hours: 07**

Representing the Virtual World: Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR

Unit III: **Hours: 07**

The Geometry of Virtual Worlds &The Physiology of Human Vision: Geometric Models, Changing Position and Orientation, Axis- Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.

Unit IV: **Hours: 07**

Visual Perception, Motion & Tracking: Visual Perception -Perception of Depth, Motion, & Color, Ray Motion in Real and Virtual Worlds- Velocities and Accelerations, Tracking 2D & 3D Orientation, Tracking Position and Orientation.

Unit V: **Hours:07**

Interaction & Audio: Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Unit VI: **Hours: 07**

Basics of Augmented Reality: Introduction to Augmented Reality , Examples based on Augmented reality , Mixed Reality Continuum ,Computer Vision for Augmented Reality , Confluence of Virtual Reality and Augmented Reality , Requirements of AR Authoring ,Taking AR Outdoors.

Text Books:

1. M. LaValle, "Virtual Reality, Steven", Cambridge University Press, 2016.
2. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575

Reference Books:

1. William R Sherman and Alan B Craig, "Understanding Virtual Reality", Interface, Application and Design, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
2. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2004
3. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Inter science, India, 2008
4. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
5. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
6. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
7. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Merging Real and Virtual Worlds", 2005
8. Jason Jerald - The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan and Claypool, New York, NY, USA.
9. Dieter Schmalstieg and Tobias Hollerer - Augmented Reality: Principles and Practice (Usability), Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016.
   1. 8. Steve Aukstakalnis - Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability), Addison-Wesley Professional; 1st edition, 2016.
10. Robert Scoble and Shel Israel - The Fourth Transformation: How Augmented Reality and Artificial Intelligence Will Change Everything, Patrick Brewster Press; 1st edition, 2016.
11. Tony Parisi - Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, OReilly Media; 1st edition, 2015.
12. Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages, Tony Parisi, OReilly Media; 1st edition, 2014.
13. John Vince - Virtual Reality Systems, Addison Wesley, 1995.
14. Howard Rheingold - Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society, Simon and Schuster, 1991.

Supplementary Resources:

1. http://lavalle.pl/vr/book.html

Mapped with MOOCS/other Courses:

1. https://nptel.ac.in/courses/106/106/106106138/
2. https://nptel.ac.in/courses/106105195/13
3. https://www.coursera.org/learn/introduction-virtual-reality.

8KS03 MACHINE LEARNING AND AI (L-3, T-0, C-3)

Course Prerequisite: Basic Mathematics, Linear algebra, Vectors and matrices, Data Science & Statistics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Machine Learning and AI by being able to do each of the following:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability-based learning techniques
- To understand neural network

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe Machine learning and its types.
2. Discuss Bayesian Decision Theory and Parametric Methods
3. Illustrate Multivariate and Dimensionality Reduction methods.
4. Categorize Non-Parametric methods
5. Justify discrimination techniques in Machine learning
6. Synthesize Neural network using Multilayer Perceptron

Unit I: **Hours:07**

Introduction: What Is Machine Learning Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning

Supervised Learning: Learning a Class from Examples, Vapnik-Chervonenk is Dimension, Probably Approximately Correct Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm.

Unit II: **Hours:07**

Bayesian Decision Theory: Introduction, Classification, Losses and Risks, Discriminant Functions, Association Rules

Parametric Methods: Introduction, Maximum Likelihood Estimation, Bernoulli Density, Multinomial Density Gaussian (Normal) Density, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator , Parametric Classification, Regression, Tuning Model Complexity: Bias/Variance Dilemma, Model Selection Procedures

Unit III: **Hours:07**

Multivariate Methods: Multivariate Data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity, Discrete Features, Multivariate Regression

Dimensionality Reduction: Introduction, Subset Selection, Principal Component Analysis, Feature Embedding, Factor Analysis, Singular Value Decomposition and Matrix Factorization, Multidimensional Scaling, Linear Discriminant Analysis, Canonical Correlation Analysis

Unit IV: **Hours:07**

Clustering: Introduction, Mixture Densities,k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Spectral Clustering, Hierarchical Clustering, Choosing the Number of Clusters

Nonparametric Methods: Introduction, Nonparametric Density Estimation, Histogram Estimator, Kernel Estimator, k-Nearest Neighbor Estimator, Generalization to Multivariate Data, Nonparametric Classification, Condensed Nearest Neighbor, Distance-Based Classification, Outlier Detection

Unit V: **Hours:07**

Decision Trees: Introduction, Univariate Trees, Classification Trees, Regression Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees.

Linear Discrimination: Introduction, Generalizing the Linear Model, Geometry of the Linear Discriminant: Two Classes, Multiple Classes; Pairwise Separation, Parametric Discrimination Revisited, Gradient Descent, Logistic Discrimination: Two Classes, Multiple Classes; Discrimination by Regression.

Unit VI: **Hours:07**

Multilayer Perceptrons : Introduction: Understanding the Brain, Neural Networks as a Paradigm for Parallel Processing; The Perceptron, Training a Perceptron, Learning Boolean Functions, Multilayer Perceptrons, MLP as a Universal Approximator, Back propagation Algorithm: Nonlinear Regression, Two-Class Discrimination, Multiclass Discrimination, Multiple Hidden Layers

Text Book:

EthemAlpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and MachineLearning Series), Third Edition, MIT Press, 2014

Reference Books:

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013.
3. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.

8KS03 WIRELESS SENSOR NETWORKS (L-3, T-0, C-3)

Course Prerequisite: Computer Networks, Internet of Things, Sensors and Actuators

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Wireless Sensor Network by being able to do each of the following:

- To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.
- To study the various protocols at various layers and its differences with traditional protocols.
- To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe Network of Wireless Sensor Nodes
2. Explain Node Architecture and Physical Layer.
3. Discuss Medium Access Control and its related properties.
4. Analyze the protocols and algorithms used at different network protocollayers in sensor systems.
5. Compare different power management techniques and clocks and the Synchronization problems.
6. Explain time synchronization and its problems.

Unit I: **Hours:07**
Network of Wireless Sensor Nodes- Definitions and Background, Sensing and Sensors, Wireless Sensor Networks, Challenges and Constraints, Energy, Self-Management, Wireless Networking, Decentralized Management, Design Constraints, Security, Other Challenges. Applications: Structural Health Monitoring, Traffic Control, Health Care, Pipeline Monitoring, Precision Agriculture, Active Volcano, Underground Mining.

Unit II: **Hours:07**
Node Architecture: The Sensing Subsystem, The Processor Subsystem, Communication Interfaces, Prototypes. Physical Layer: Basic Components, Source Encoding, Channel Encoding, Modulation, Signal Propagation.

Unit III: **Hours:07**
Medium Access Control: Contention-Free Medium Access, Contention-Based Medium Access, Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols.

Unit IV: **Hours:07**
Network Layer: Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing, QoS-Based Routing Protocols.

Unit V: **Hours:07**
Power Management: Local Power Management Aspects, Dynamic Power Management, Conceptual Architecture. Time Synchronization: Clocks and the Synchronization Problem, Time Synchronization in Wireless Sensor Networks, Basics of Time Synchronization, Time Synchronization Protocols.

Unit VI: **Hours:07**
Localization: Ranging Techniques, Range-Based Localization, Range-Free Localization, Event-Driven Localization. Security: Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and Zig Bee Security.

Text Book:
Fundamentals of Wireless Sensor Networks: Theory and Practice / Waltenegus Dargie, Christian Poellabauer, 2010 John Wiley & Sons Ltd.

Reference Books:
1. .Wireless sensor networks: technology, protocols, and applications by Kazem Sohraby, Daniel Minoli, TaiebZnati, Copyright _ 2007 by John Wiley & Sons, Inc.
2. Wireless Sensor Network Designs by Anna Hac, John Wiley & Sons Ltd.
3. Wireless Sensor Networks by Ian F. Akyildiz, Mehmet Can Vuran, 2010 John Wiley & Sons Ltd.
4. Wireless Sensor Networks: An Information Processing Approach by Feng Zhao, Leonidas J. Guibas, The Morgan Kaufmann Series in Networking.

8KS03 SYSTEM & SOFTWARE SECURITY (L-3, T-0, C-3)

Course Prerequisite: Networking, Operating System, Basics of Cyber Security & Cryptography

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of System and Software Security by being able to do each of the following:

- To provide an in-depth study of concepts and threats in computer security.
- To provide knowledge of common vulnerabilities, attack mechanisms and methods against computer and information system
- To familiarize security issues at various levels such as operating systems and databases.
- To provide the study of vulnerability issues and its counter measures at advanced application such as networks and Clouds

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:
1. Relate malicious and non-malicious attacks.
2. Outline web common vulnerabilities, attack mechanisms and methods against computer and information systems.
3. Apply relevant methods for security modeling and analysis of Operating System.
4. Investigate a secure network by monitoring and analyzing the nature of attacks.
5. Explain cryptography, intrusion detection and firewall system
6. Implement different security solutions at various levels such as operating systems, databases and clouds.

Unit I: **Hours:07**

Programs and Programming: Unintentional (Non malicious) Programming: Buffer Overflow, Incomplete Mediation, Time-of-Check to Time-of Use, Undocumented Access Point, Off-by-One Error, Integer Overflow, Un-terminated Null-Terminated String, Parameter Length, Type and Number, Unsafe Utility Program, Race Condition. Malicious Code: Malware: Viruses, Trojan Horses, and Worms, Technical Details: Malicious Code. Countermeasures: Countermeasures for Users, Countermeasures for Developers, Countermeasure Specifically for Security, Countermeasures that Don't Work.

Unit II: **Hours:07**

The Web: Browser Attacks: Browser Attack Types, How Browser Attacks Succeed: Failed Identification and Authentication. Web Attacks Targeting Users: False or Misleading Content, Malicious Web Content, Protecting Against Malicious Web Pages. Obtaining User or Website Data: Code Within Data, Website Data: A User's Problem, Too Foiling Data Attacks. Email Attacks: Fake Email, Fake Email Messages as Spam, Fake (Inaccurate) Email Header Data, Phishing, Protecting Against Email Attacks.

Unit III: **Hours 7**

Operating System: Security in Operating Systems: Operating System Structure, Security Features of Ordinary Operating Systems, Protected Objects, Operating System Tools to Implement Security Functions. Security in the Design of Operating Systems: Simplicity of Design, Layered Design, Kernelized Design, Reference Monitor, Correctness and Completeness, Secure Design Principles, Trusted Systems, Trusted System Functions, The Results of Trusted Systems Research Rootkit: Phone Rootkit, Rootkit Evades Detection, Rootkit Operates Unchecked, Sony XCP Rootkit, TDSS Rootkits, Other Rootkits.

Unit IV: **Hours:07**

Networks: Network Concepts, Threats to Network Communications: Interception: Eavesdropping and Wiretapping, Modification, Fabrication: Data Corruption Interruption: Loss of Service, Port Scanning, Vulnerability. Wireless Network Security: Vulnerabilities in Wireless Networks, Failed Countermeasure: WEP (Wired Equivalent Privacy), Stronger Protocol Suite: WPA (Wi-Fi Protected Access) Denial of Service: Network Flooding Caused by Malicious Code, Network Flooding by Resource Exhaustion, Denial of Service by Addressing Failures, Traffic Redirection, DNS Attacks, Exploiting Known Vulnerabilities, Physical Disconnection. Distributed Denial-of-Service: Scripted Denial-of-Service Attacks, Bots, Botnets, Malicious Autonomous Mobile Agents, Autonomous Mobile Protective Agents.

Unit V: **Hours:7**

Cryptography in Network Security Browser Encryption, Onion Routing, IP Security Protocol Suite (IPsec), Virtual Private Networks, System Architecture. Firewalls: Firewall, Design of Firewalls, Types of Firewalls, Personal Firewalls Comparison of Firewall Types, Example Firewall Configurations. Intrusion Detection and Prevention Systems: Types of IDSs, Other Intrusion Detection Technology, Intrusion Prevention Systems, Intrusion Response, Goals for Intrusion Detection Systems, IDS Strengths and Limitations.

Unit VI: **Hours:07**

Database: Security Requirements of Databases: Integrity of the Database, Element Integrity, Auditability, Access Control, User Authentication, Availability, Integrity / Confidentiality/Availability. Reliability and Integrity: Protection Features from the Operating System, Two-Phase Update Redundancy/Internal Consistency, Recovery, Concurrency/Consistency. Database Disclosure: Sensitive Data, Types of Disclosures, Preventing Disclosure: Data Suppression and Modification, Security Versus Precision Data Mining and Big Data: Data Mining, Big Data. Cloud Computing: Cloud Computing Concepts: Service Models, Deployment Models. Risk Analysis: Cloud Provider Assessment, Switching Cloud Providers, Cloud as a Security Control. Cloud Security Tools and Techniques: Data Protection in the Cloud, Cloud Application Security, Logging and Incident Response. Cloud Identity Management: Security Assertion Markup Language OAuth: OAuth for Authentication. Securing IaaS: Public IaaS Versus Private Network Security

Text Book:

Security in Computing, Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Fifth Edition, Prentice Hall, 2015

Reference Books:

1. Computer Security: Principles and Practice, William Stallings and Lawrie Brown, Third Edition, Pearson Prentice Hall
2. Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing Achyut S. Godbole,Tata Mc Graw-Hill Education, 2013
3. Cryptography and Network Security Principles and Practices, William Stallings, Seventh Edition, Pearson
4. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.

8KS04 DISTRIBUTED LEDGER TECHNOLOGY (L-3, T-0, C-3)

Course Prerequisite: Data structures and Algorithms, Design and Analysis of Algorithms, Discrete Mathematics and basic knowledge of Cryptography

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Distributed Ledger Technology by being able to do each of the following:

- To develop an understanding of the requirements for electronic payment systems
- To understand key cryptographic constructs, economic incentive mechanisms and distributed algorithms underpinning crypto currencies such as Bitcoin and Ethereum
- To develop a basic facility with programming smart contracts on one crypto currency platform.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe basic knowledge of Distributed Ledger Technologies
2. Outline Analytical Framework for Distributed ledger technology
3. Use Cryptographic method for ledgers.
4. Explain knowledge of Bitcoin
5. Inspect Bitcoin cryptocurrency mechanisms
6. Synthesize bitcoin mining process.

Unit I: **Hours:07**
Distributed ledger technology: Introduction, Background, Technical design elements, Institutional design elements: Operation of the arrangement, Access to the arrangement (unrestricted or restricted)

Unit II: **Hours:07**
Analytical framework: Understanding the arrangement, Potential implications for efficiency, Potential implications for safety, Potential broader financial market implications

Unit III: **Hours:07**
Introduction to Cryptography & Cryptocurrencies: Cryptographic Hash Functions, SHA-256, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency

Unit IV: **Hours:07**
Bitcoin: Centralization vs. Decentralization, Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work

Unit V: **Hours:07**
Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, Bitcoin network. How to Store and Use Bitcoins, Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets

Unit VI: **Hours:07**
Bitcoin Mining: The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies.

Text Book:
Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction: Andrew Miller, Arvind Narayanan, Edward Felten, Joseph Bonneau, and Steven Goldfeder. Princeton University.

Reference Books:
1. Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition
2. Distributed ledger technology in payment, clearing and settlement - An analytical framework
3. Dr. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts.

8KS04 MULTIMEDIA COMPUTING (L-3, T-0, C-3)

Course Prerequisite: Computer Network, Image Processing

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Multimedia Computing by being able to do each of the following:
- To learn and understand technical aspect of Multimedia Computing.
- To understand the standards available for different audio video and text applications.
- To Design and develop various Multimedia Systems applicable in real time.
- To learn various multimedia compression algorithms.
- To understand various networking aspects used for multimedia applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:
1. Describe technical aspect of Multimedia Computing.
2. Compare various file formats for audio, video and text media.
3. Examine lossless data compression techniques in real time.
4. Illustrate lossy data compression techniques in real time scenario
5. Investigate video compression technique
6. Construct various networking protocols for multimedia applications.

Unit I: Introduction **Hours:07**
Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

Unit II : Video and Digital Audio **Hours:07**
Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

Unit III: Data Compression-I **Hours:07**
Multimedia data compression I: Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression.

Unit IV: Data Compression-II **Hours:07**
Multimedia data compression II: Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).

Unit V: Video Compression **Hours:07**
Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.

Unit VI: Multimedia Networks **Hours:07**
Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand (MOD).

Text Book: ‘Fundamentals of Multimedia’ by Ze-Nian Li and Mark S. Drew Pearson Education.

Reference Books:
1. Digital Multimedia, Nigel chapman and jenny chapman, Wiley-Dreamtech
2. Macromedia Flash MX Professional 2004 Unleashed, Pearson.
3. Multimedia and communications Technology, Steve Heath, Elsevier (Focal Press).
4. Multimedia Applications, Steinmetz, Nahrstedt, Springer.
5. Multimedia Technology and Applications, David Hilman ,Galgotia.

8KS04 MODELLING & SIMULATION (L-3, T-0, C-3)

Course Prerequisite: Familiarity with Linear Algebra, Probability and Statistics, Discrete structures, graph theory, Object-oriented design and programming.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Modelling & Simulation by being able to do each of the following:

- To understand the basic concepts in modeling and simulation
- To introduce the simulation and modeling techniques
- To introduce basic simulation and modeling skills with respect to carrying out research projects using any simulation method on the computer.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:
1. Describe System models & system modelling.
2. Explain continuous system methods of obtaining solutions.
3. Illustrate the need of simulation and mathematical modeling
4. Examine simulation of Queuing System and PERT network.
5. Inspect experimentation of Simulation.
6. List different special purpose languages use for continuous and discrete systems

Unit I: **Hours:7**

System Models and System studies: Basic concepts of systems and system modeling static and dynamic/physical and mathematical models-principles used in modeling-corporate models-analysis, design and postulation of system.

Unit II: **Hours:7**

Basic Concepts and continuous system: Techniques used - distributed lag models and cobweb models continuous system Model-Analytical equations &methods of obtaining solutions–analog and hybrid computers and simulations CSSLS examples of different continuous system.

Unit III: **Hours:7**

System dynamics, probability concepts and basic principles of discrete simulation Growth and decay models system dynamics diagrams examples - stochastic process-probability functions and their evaluation –random number generation-rejection method-comparison of Monte-Carlo method and stochastic simulation – examples

Unit IV: **Hours:7**

Simulation of Queuing system and PERT Network, Simulation of Queuing system: Rudiments of queuing theory, simulation of a single serve queue, simulation of a two-server queue, simulation of more general queues, Simulation of a PERT Network: Network model of a project, Analysis of an activity network, critical path.

Unit V: **Hours:7**

Simulation of Inventory Control & Forecasting Design and Evaluation of Simulation Experiments Inventory Control and Forecasting, Elements of inventory theory, more Complex inventory models simulation example= 1 Generation of Poisson and Erlanger variates, Simulation example-2 Forecasting and regression Analysis. Design and Evaluation of simulation Experiments: Length of Simulation runs, Variance reduction techniques, Experimental layout, Validation summary and conclusion.

Unit VI: **Hours:7**

Simulation of Languages and Introduction to GPSS, Different special purpose languages use for continuous and discrete systems and comparison, factors affecting the selection of discrete system simulation languages-comparison of GPSS sans SIMSCRIPT.A detailed study of GPSS with examples.

Text Books:

1. Geoffrey Gordon, System Simulation, PHI Learning/Pearson.
2. Narsingh Deo, System Simulation with Digital Computer, PHI Learning/Pearson.

Reference Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, P. Shahabudeen, Discrete-Event System Simulation, Fourth Edition, Pearson Publication.
2. Sheldon Ross, Simulation , Academic Press.
3. Law & Kelton, Simulation Modeling & Analysis, Tata McGraw Hill
4. Kai Velten, Mathematical Modeling and Simulation: Introduction for Scientists and Engineers, Wiley.
5. Shannon, R.E. Systems simulation, The art and science, Prentice Hall, 1975.
6. Thomas J. Schriber, Simulation using GPSS, John Wiley, 1991.

8KS05 EMERGING TECHNOLOGY LAB V (P-2, C-1)

8KS05 Emerging Technology Lab V is based on 8KS03 Professional Elective-V. Tentative FOSS Tools & Technology for Practical's are as follows:

AI :Google's ARCore, AR.js, ARToolKit, DroidAR, Brio, Adobe Aero
DS :R Studio, Orange, D3.js, Ggplot2, Jupyter Notebooks
IoT :DSA,Thinger,RIOT, OpenRemote,Anjay
Cyber Security: Wireshark, Burp Suit, Nessus.

8KS06 EMERGING TECHNOLOGY LAB VI (P-2, C-1)

8KS06 Emerging Technology Lab V is based on 8KS04 Professional Elective-VI. Tentative FOSS Tools & Technology for Practical's are as follows:

Blockchain: Hyperledger, HydraChain, MultiChain, Elements
Image Processing:Google Colab, GPUImage, Cuda, Aforge/Accord.NET
Optimization: OR-Tools, Locust.io, httperf, Apache JMeter, Siege.

8KS07 PROJECT & SEMINAR (P-12, C-6)

The student batch size for project may be preferably 04. The project shall be internally evaluated (for 75 Internal Marks) inthree phases based on theprogress of the project work. Each phase shallbe internally evaluated for 25 marks as follows:
Phase I: - Problem Definition and Design
Phase II: - Problem Implementation and Testing
Phase III: - Project Demonstration & Report submission.
The external evaluation of the project shall be based ondemonstration of the project and viva-voce.

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DRAFT SYLLABUS OF B.E. [MECH.] SEM. III & IV

3ME01 MATHEMATICS - III

Course Learning Objectives :

1. To provide the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. To understand the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. To provide knowledge to apply False Position, Newton Raphson method to solve nonlinear & polynomial equations, Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. To understand the Gradient, divergent and curl of vector point functions. To find the directional derivatives of scalar point functions. To discuss the Irrotational and solenoidal vector fields. To define line surface and volume integrals.

Course Outcomes :

Students will be able to -

1. Demonstrate the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. Define the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. Apply False Position, Newton Raphson method to solve nonlinear & polynomial equations Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. Define Gradient, divergent and curl of vector point functions. Finds the directional derivatives of scalar point functions. Discuss the Irrotational and solenoidal vector fields. Define line surface and volume integrals

SECTION-A

UNIT-I : Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (10 Hrs)

UNIT-II: Laplace transforms : Definition, standard forms, properties of Laplace transform, inverse Laplace transform, initial and final value theorem, convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function. Solution of Linear differential equations. (10 Hrs)

UNIT-III : a) Partial differential equation of first order of following form- (i) $f(p,q)=0$; (ii) $f(p,q,z)=0$; (iii) $f(x,p)=g(y,q)$; (iv) $Pp+Qq=R$ (Lagranges form); (v) $z=px+qy+f(p,q)$ (Clairaut form)

b) Statistics : Curve fitting by method of least squares (Straight and parabola only), Correlation, Regression.

c) Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (10 Hrs.)

SECTION-B

UNIT-IV: Complex Analysis :- Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation), singular points, expansion of function in Tayler's and Laurent's series. Cauchy's integral theorem and formula, Residue theorem. (12 Hrs.)

UNIT-V: Numerical Analysis : Solution of algebric and transcendental equations by Newton-Raphson method & method of false position. Solution of system of linear equations by Gauss-Seidal method, Relaxation method. Solution of first order ordinary differential equations by Picard's, modified Euler's, Runge-Kutta and Taylor's method. (10 Hrs.)

UNIT-VI: Vector Calculus :- Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof). (10 Hrs.)

Books Recommended :-

Text Books:

1. Text book on Applied Engineering Mathematics, Vol. II, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
2. Higher Engineering Mathematics, B.S Grewal, Himalaya Publishing House.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference Book:

Advanced Engineering Mathematics, Erwin Kreyzig, John Wiley.

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3ME02 MANUFACTURING PROCESSES

Course Learning Objectives :

1. To study the manufacturing processes in sand casting industries, tooling and equipment
2. To study the metal melting process, melting furnaces and defects in casting
3. To study the various types of casting processes
4. To study the mechanical working of metals and allied processes
5. To study the mechanical joining processes and fastenings
6. To study welding processes and surface treatment processes

Course Outcomes :

Students will understand the

1. basic concept of foundry process and related activities
2. concept of complete sand casting process with advance casting methods
3. fundamentals of welding processes
4. various processes like electroplating, anodizing etc and their importance in industries

SECTION- A

Unit-I : Introduction to manufacturing processes & classification; Introduction to pattern making Pattern materials, pattern making tools, allowances, Types of patterns, functions of patterns, General properties of moulding sands, Mold hardness. Preparation of sand moulds of different types, Moulding processes, core making, core prints, core boxes. Sand casting Processes - Basic principle and Terminology of sand casting, design of gating and riser system – by numerical approach. (9Hrs)

Unit-II : Technology of melting and casting - Melting furnaces, crucibles, pit, open hearth, gas fired cupola, cupola operation and electric hearth furnaces, Electric furnaces - Direct Arc, Indirect arc and electric induction furnace.
Defects in castings and its types, Causes and remedies of casting defects. Origin and classification of defects, shaping faults, Inclusion and sand defects, Gas defects, shrinkage defects, contraction defects, dimensional errors. Inspection and testing of castings:- Radiography, ultrasonic, Eddy current testing, fluorescent penetrant test. (7 Hrs)

Unit III: Casting processes and their principle of operation and applications permanent mold casting, slush casting, shell molding, Investment or lost wax casting, vacuum process, centrifugal casting, continuous casting, Die casting equipment and processes for Gravity, pressure and vacuum casting methods, cleaning of castings, Modernisation & Mechanisation of Foundries. (8 Hrs)

SECTION – B

Unit IV: Mechanical working of metals: Principle of hot and cold working process and its types, Extrusion, piercing, pipe and tube production, manufacture of seamless pipe and tubing. Shearing operations, tube drawing, wire drawing, spinning, embossing and coining, squeezing and bending operations, rotary swaging, load estimation for bulk forming (forging and drawing), rolling and types of rolling mills. (8 Hrs)

Unit V: Joining processes:- Mechanical joining processes, Mechanical fastening, riveting, soldering, brazing Welding, Types of welding processes-Arc welding: principle and working, Gas welding- principle and working Types and purpose of Electrodes, Electrode coatings(flux). TIG & MIG processes – Working principles and its applications, shielding gases, MIG-Spray transfer and dip transfer processes. (6 Hrs.)

Unit VI: Submerged arc welding & resistance welding :- Heat generation in resistance welding, operational characteristics of resistance welding processes such as spot welding, projection welding, butt welding.
Principle of operation of friction welding, forge welding, plasma arc, thermit welding. Welding defects, Testing and Inspection of welds, Ultrasonic, Electroslag, Electron Beam, laser welding, weldability.
Surface Treatment-Electroplating, electroforming, and iodising, metal spraying, shot peening, polishing, mechanical cleaning. (9 Hrs)

Books Recommended :

Text Books:-

1. Workshop Technology Vol. I by Bawa, Tata Mc-Graw Hill Publication.
2. Workshop Technology Vol I by Hajra Chaudhary, Dhanpat Rai & Sons 2001.

References:-

1. Workshop Technology Vol I by Raghuwanshi.
2. Manufacturing Processes by J.P. Kaushish; PHI
3. Processes and Materials of Manufacture by R.A.Lindberg, PHI Pub 2001.
4. Manufacturing technology Vol. I, by P. N. Rao

3ME07 MANUFACTURING PROCESSES - LAB

Practices:-

1. Study of safety precautions in workshop practices.

2. Foundary:- Any two of the following jobs Sand preparation and practice in moulding of various types of patterns:- Pattern making - one job, Moulding - one job Casting - one job.
3. Joining Processes:- Two composite jobs involving electric welding, gas welding and resistance welding process.
4. One job on Mechanical Working of Metals like piercing / drawing / bending/ embossing/ spinning/ upsetting, etc.

A journal should be prepared and submitted on above term work.

The practical examination shall consist of a job preparation and college assessment should be based upon the jobs, term work and viva examination.

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3ME03 MECHANICS OF MATERIALS

Course Learning Objectives :

1. To develop theoretical basis for stress, strain concept in various components under study
2. To study mechanical behavior of engineering material
3. To familiarize about finding shear force, bending moment, torsion, slope and deflection of various types of beams with different loading conditions
4. To build the necessary background to apply the knowledge of mechanics of materials on engineering applications

Course Outcomes :

Students will be able to -

1. Determine the stress & strain in the member subjected to axial, bending & torsional load
2. To observe different types of material behavior such as elastic, plastic, ductile and brittle
3. Apply SF and BM diagrams to analyse resistance offered by the beam and able to solve practical problems in real world
4. Apply deflection criteria to check the stability of beam

SECTION-A

Unit-I 1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety, stress and strain of bar due to self weight.

2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only, introduction to theory of elasticity and photoelasticity. (10 Hrs.)

Unit-II: 1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.

2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section, leaf springs. (7 Hrs.)

Unit-III 1.Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load.

2. Shear stress distribution on beam rectangular and circular cross sections. (7 Hrs.)

SECTION – B

Unit-IV: Thin and thick cylinders and thin spherical shells subjected to internal pressures. (4 Hrs.)

Unit –V: 1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.
2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.
3. Strain energy and resilience : proof resilience, shear resilience, strain energy due to self load (7 Hrs.)

Unit-VI: Deflection in simply supported beam, cantilever beam subjected to point loads, uniformly distributed loads, moments by Macauley's method. (7 Hrs.)

Books Recommended:

Text Books :

1. Ramamruthm : Strength of Materials, Danpat Rai and Sons, New Delhi .
2. R. S. Khurmi: Strength of Material, S. Chand Publication, Delhi.
3. F. L. Singer : Strength of Materials, Harper and Row Publication, New York .

Reference Books :

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material : A Practical Approach, University Press, Hydrabad.

3ME08 MECHANICS OF MATERIALS - LAB

Practicals:

Minimum Six to Eight out of the following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

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3ME04 ENGINEERING THERMODYNAMICS

Course Learning Objectives :

1. To study the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. To study the laws of thermodynamics and their applications
3. To study the properties of steam, work done and concept of heat transfer
4. To study the air standard cycles

Course Outcomes :

Students will be able to

1. Understand the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. Apply first law of thermodynamics and application of first law to flow and non-flow processes
3. Apply second law of thermodynamics and understand concept of entropy
4. Understand the properties of steam, work done and heat transfer during various thermodynamics processes with steam as working fluid
5. Understand the concept of air standard cycles

SECTION – A

Unit-I: Introduction to basic concepts of thermodynamics, Macroscopic and microscopic approaches, properties of system, state, processes and cycle, thermodynamic equilibrium, types of thermodynamic systems, Temperatures and Zeroth law of thermodynamics, Quasi-static process, Gas Laws and Ideal gas equation of states, gas constant and universal gas constant.

Work and Heat: Definition of work, thermodynamic work, displacement work and other forms of work, Definition of Heat, Work and heat transfer as path function, comparison of work and heat, work done during various processes, P-V diagrams (10 hrs)

Unit-II: First law of thermodynamics: Energy of a system, classification of energy, law of conservation of energy law, Joules experiment. Energy a property of system, internal energy-a function of temperature, Enthalpy, specific heat at constant volume and constant pressure. Application of first law to non-flow processes, Change in internal energy, work done and Heat transfer during various non-flow processes. (7 hrs)

Unit-III: First Law applied to flow processes: Steady state, steady flow process, equation for work done in steady flow process and its representation on P-V diagram, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, turbine and compressor pumps, heat exchangers, Throttle valve etc. work done and Heat transfer during steady flow processes. (9 hrs)

SECTION – B

Unit-IV: Second Law of thermodynamics: Limitations of First law, Thermal energy reservoir, heat engines refrigerator and heat pumps, COP and tonne of refrigeration, COP for heat pump and refrigerator, Kelvin-Plank and Clausious statements, their equivalence, reversible and irreversible processes, Carnot cycle, Carnot theorem and its corollary, The thermodynamic temperature scale, Reverse Carnot cycle, Inequality of Clausius.

Introduction to Entropy, availability and irreversibility. Principle of increase of entropy. (8Hrs)

Unit-V: Properties of Steam: Triple point and critical point, Sensible heat, latent heat, superheat and total heat of steam. Wet steam, dryness fraction, Internal energy of steam, External work of evaporation, internal latent hear, Specific volume, enthalpy, internal energy and entropy of steam. T-S diagram Mollier chart, Steam tables and their use. Work done and heat transfer during various thermodynamics processes with steam as working fluid. Throttling of steam, determination of dryness fraction using various calorimeters. (8 Hrs)

Unit VI : Air Standard Cycles: Ottto, diesel, semidiesel, Brayton, Sterling and joule cycles etc., their efficiencies and mean effective pressure, comparison of auto, diesel and duel cycles.

Vapour Cycles:- Rankine and Modified Rankine Cycle. Comparison of Rankine and Carnot cycle, representation on P-V, T-S and H-S diagram. (No numerical on this unit) (numerical on air standard cycle) (8 Hrs)

BOOKS RECOMMENDED:

Text Books :

1. Engineering Thermodynamic - by P. K. Nag.
2. Fundamentals of Engineering Thermodynamics; R. Yadav;
3. Thermodynamics Basics and Applied: by V. Ganeshan
4. Thermal Engineerirng: by Mahesh M. Rathore

Reference Books :

1. Basic Engineering Thermodynamics - by Reyner Joel
2. Thermodynamics - by C.P. Arora.
3. Fundamentals of Classical Thermodynamics - by G. J.Vanwylen.
4. Engineering Thermodynamics; P. Chattopadhyay; Oxford
5. Engineering Thermodynamics; Gordon Rogers, Yon Mayhew; Pearson.

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3ME05 FLUID MECHANICS

Course Learning Objectives :

1. To introduce and explain the fundamentals of Fluid Mechanics used in applications of Hydraulics, Aerodynamics, Gas dynamics, etc.
2. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
3. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
4. To imbibe basic laws and equations used for analysis of static and dynamic fluids.
5. To inculcate the importance of boundary layer flow and its applications
6. To determine the losses in a flow system, flow through pipes, impact of jet

Course Outcomes :

The student will be able to:

1. identify importance of various fluid properties at rest and in motion
2. derive and apply general governing equations for various fluid flows
3. understand the concept of boundary layer theory and flow separation.
4. calculate energy losses in pipe flow.
5. evaluate the performance characteristics of hydraulic jets

SECTION – A

UNIT-I : 1. Basic properties of fluid such as Density, Specific weight, Specific Volume, Specific gravity, Viscocity of fluid, Surface Tension, Capilarity, vapour pressure & cavitation.

2. pressure & its measurement: Pascals law, Hydrostatic law of pressure & pressure variation in fluid, measurement of pressure by Manometer. (10 Hours)

UNIT-II : 1. Hydrostatic pressure force on plane & curved surfaces. Measurment of total pressure & centre of pressure.

2. Buoyancy & floatation: Concept of buoyancy, centre of buoyancy. Stability of floating body, Metacentre & metacentric height. Condition of equilibrium of floating & sub-merged body. (08 Hours)

UNIT III : 1. Kinematics of fluid flow, Methods of describing fluid motion, Types of flow, rate of flow, streamline, potential line, flow net, velocity & acceleration, continuity equation in three dimensional flow.

2. Dynamics of fluid flow : Eulers equation of motion, Bernoullis equation measurement of fluid flow with venture meter. (08 Hours)

UNIT-IV : Flow through pipes: Losses in pipe, major losses, Darcy's Weisbach equation, monor losses due to sudden enlargement, contraction, entry, exit & pipe fitting. Hydraulic gradient & total energy line, flow through series & parallel pipes, concept of water hammer in pipes. (08 Hours)

UNIT-V : Motion of viscous fluid: Introduction to Laminar & Turbulent flow, Concept of Boundary layer & its type. Drag & Lift force on object. Boundary layer separation, Reynolds number & its significance. (08 Hours)

UNIT-VI : Principal of fluid machinery : Force exerted by fluid jet on plane, curved, stationary & moving vanes. Velocity diagrams, work done & efficiency. (08 Hours)

Books Recommended :-

Text Books:-

1. Fluid Mechanics & Machinery by Modi & Sheth.
2. Fluid Mechanics and Hydraulic Machines by R. K. Bansal.
3. Engineering fluid Mechanics by R. K. Rajput.
4. Fluid mechanics & Machinery by CRSP. Ojha, R. Berndtsson.
5. Fluid Mechanics by Strecter; Tata Macgraw Hill.

Reference Books:-

1. R.K.Rajput; Engineering Fluid Mechanics; S. Chand publications.
2. Dr. Mody & Seth; Hydraulics and Fluid Mechanics; Standard book house
3. S. Ramamrutham, Hydraulic, Fluid Mechanics & Fluid Machines, Dhanpatrai publishing company.
4. Strecter, Fluid Mechanics, Tata McGraw Hill.

3ME09 FLUID MECHANICS - LAB

Practical Term Work:-

At least six (6) practicals (study/Trials) based on above syllabus, as given below shall be performed and a report there of submitted by the students :

1. Measurement of fluid pressure by manometer.
2. Determination of metacentric height.
3. Verification of Bernoulli's equation.
4. Determination of co-efficient discharge by Venturimeter.
5. Calculation of Reynolds number for Laminar & Turbulent flow.
6. Determination of co-efficient of friction (Major losses in Pipes) through pipe.
7. Determination of head loss due to sudden enlargement.
8. Determination of head loss due to sudden contraction.
9. Determination of loss of head in bends & in elbows.
10. Verification of momentum equation.

Note :- Practical examination shall consist of oral or Experimentation based on above term work.

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3ME10 Machine Drawing - Lab

Course Learning Objectives :

1. To study the techniques of sectioning and visualizing the objects
2. To imagine and develop the missing views of objects

3. To seek the knowledge of development of surfaces
4. To seek the knowledge of intersection of solid objects
5. To know the conventions for materials and parts used in industries
6. To prepare the drawings for machine assembly

Course Outcomes :

Student will be able to -

1. Demonstrate the techniques of sectioning and visualizing the objects
2. Imagine, understand and sketch the missing views
3. Develop surfaces of objects and apply knowledge during their fabrication
4. Understand the concept of intersection of solid objects
5. Understand and apply the conventions for materials and parts used in industries
6. Prepare detail machine assembly drawings

List of Practicals :

1. Conversion of pictorial view into Sectional Orthographic Projection
2. Missing Views
3. Development of surfaces of Cubes / Prisms / Cylinders / Pyramids / Cones & their cut sections
4. Intersections of Solids – Prism & Prism /Cylinder & Cylinder /Cylinder & Prism / Cone & Prism
5. Conventions for various materials & parts
6. Preparation of detail drawings of simple machine assembly
7. Preparation of assembly drawing of simple machines

Books recommended:

Text Books:

1. Engineering drawing by N.D. Bhatt; Charactor Publications.
2. Machine Drawing by A. M. Bisen; New Edge International publication.
3. Machine Drawing by R. K. Dhawan, S. Chand
4. Machine Drawing by Basant Agrawal, McGraw Hill.

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FOURTH SEMESTER

4ME01 MATERIAL SCIENCE

Course Learning Objectives:

1. To study the basic concepts of metallurgy and classification of materials
2. To study the process of formation of microstructures of metal materials and composites
3. To study the alloying elements, their effects and applications
4. To study the ferrous and non-ferrous metals and respective alloys
5. To study the various heat treatment processes and their industrial applications
6. To study the mechanical working of metals and process of powder metallurgy

Course Outcomes:

Students will understand the -

1. Basic concepts of metallurgy and types of materials.
2. Iron-Carbon Equilibrium Diagram, critical temperatures, formation of microstructures and they will get the knowledge of alloys.
3. Uses and practical applications of ferrous & non ferrous materials

4. Various heat treatment processes, powder metallurgy and industrial applications.

SECTION - A

UNIT-I: Introduction to metallurgy: Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy, Classification of materials & their application, Structure of metals and alloys, formation of Alloys, Solid solutions, types and their formation, lever rule for phase mixtures. Solidification of pure metals, nucleation and growth, ingot structure, dendritic solidification. (8 Hrs)

UNIT II: Study of binary equilibrium diagram and invariant reactions, Construction and study of Iron-carbon Equilibrium Diagram, Critical temperatures, Microstructure of slowly cooled steel, Estimation of carbon from microstructure, structure property relation, Introduction to composite materials, advantages and applications. (8 Hrs)

UNIT III: **Alloy Steels:** Purpose of alloying, Classification of alloy steels, classification of alloying elements, Effect of alloying elements on eutectoid composition, Eutectoid temperature, and on the S curve, , alloying elements and their effect on properties of steels, OHNS steels, Hadfield'S Manganese steels, High speed steels, their heat treatments and applications, Ferritic, Austenitic and Martensitic stainless steels, their properties and applications, weld decay in stainless steel. (8 Hrs)

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SECTION - B

UNIT IV: Cast irons **:** Factors governing condition of carbon in cast iron, Maurer's diagram, Solidification of grey and white cast iron, Malleabalizing, Constitution and properties of white, gray, Nodular and Malleable cast irons, their applications, Alloy cast irons.

Non Ferrous Metals and Alloys : Types, Properties and uses of Brasses and Bronzes. Important alloys of Aluminium,Lead,TinandZinc,theirapplications.Bearing materials,Seasoncracking,precipitationhardening. (8 Hrs)

UNIT V: Principles of Heat Treatment: - Annealing, Normalizing, Tempering Iso-thermal transformation diagrams(S-curve), super imposition of continuous cooling curves on 's' Curve, pearlite, bainite and martenste transformation, Quenching media, severity of quench, Austempering, Martempering and patenting, Retained austenite and sub-zero treatment. Hardenability. (8 Hrs)

UNIT VI: Methods of surface hardening: Carburizing, Nitriding, Cyaniding, Flame and Induction Hardening. Mechanical working of Metals: - Hot and cold working, Relative advantages and disadvantages, study of stress strain curve, Luder's bands, Work hardening, strain Ageing; Recovery, Recrystallization and grain growth. Metallurgical factors affecting various Mechanical working processes, preferred orientation, Deformation mechanisms-Slip& twining, critical resolved shear stress.

Powder Metallurgy: Concept, Methods of Manufacture of metal powders, compaction Process- Single die and double die, sintering, stages of sintering, Manufacture of porous bearings & cemented carbide tip tools by P.M.T. Advantages, limitations and applications of powder metallurgy. (8 Hrs)

BOOK RECOMMENDED :-

Text Books :-

1. Introduction to physical metallurgy ;Sidney H Avner, TATA Mc-Graw hill
2. Engineering materials & metallurgy R.K.Rajput, S chand publication.
3. Material nScience & Mettalurgy, by V.D. Kodgire. Everest Publication House.

Reference Books:

1. Mechanical Metallurgy, G. E. Dieter, Mc- Graw Hill International, London 3rd Edn. 1999
2. Physical metallurgy for engineers, Clarke and Varney, second Edn.,1987.
3. Power metallurgy, A.K Sinha First Edn. 1991.
4. Material Science and Metallurgy; V.D. Kodgire; Everest Publishing House
5. Engineering physical Metallugrgy, Y Lakhtin, Mir Publications. Second Ed. 1999
6. Material Science and Meallurgy- C Daniel Yesudian, Scitech Publication.

4ME07 MATERIAL SCIENCE - LAB

List of Practicals: - (At least eight (8) practicals out of the following list.)

1. Study of metallurgical microscope.
2. Preparation of specimen for micro-examination.
3. Moulding of specimen for micro-examination.
4. Study of micro structures of Annealed and normalized plain carbon steels.
5. Study of micro structures of alloy steels and H.S.S.
6. Study of micro structures of various cast irons.
7. Study of micro structures of non ferrous metals.(brasses, bronzes)
8. Study of micro structures of hardened and tempered steels.
9. Study of Iron carbon Equilibrium diagram & Allotropic forms of iron.
10. Study different Heat Treatment Process for steel.
11. Study of different surface Hardening processes for steels.
12. Study of effect of alloying elements on the properties of steels.
13. Measurement of hardenability by Jominy end quench test apparatus.
14. Study of hardness tester and conversion of Hardness number
15. Industrial visit to study heat treatment plant.
16. Measurement of particle size, grain size, nodularity, coating thickness etc. by using some software like Metzer Microcam 4.0

Practical Examination:

Note : Practical examination shall consist of viva voce/performance based on the above syllabus and practical work.

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4ME02 ENERGY CONVERSION - I

Course Learning Objectives:

1. To study the properties of steam and its behavior for different thermodynamic process.
2. To study different types of boilers, their mountings, accessories, performance of boilers and different efficiencies.
3. To study the various fuel handling and ash handling system in power plant.
4. To study various types of condensers and cooling towers.
5. To study various thermodynamic aspects of flow of steam through nozzle and diffuser.
6. To study flow of steam through steam turbine and concept of compounding.

Course Outcomes:

1. Students will study the concept steam and steam power plant, mounting and accessories.
2. Students will demonstrate the calculation of various efficiency & related parameters.
3. Student will show the adequate knowledge of fuel & ash handling systems.
4. Students will demonstrate the knowledge of condenser & application.
5. Students will understand the concepts of steam nozzles & steam turbine.

SECTION – A

Unit I : Flow diagram for steam power plant with basic units such as steam generator, turbine, condenser and pump. Steam power plant layout, site selection. Boilers: Introduction to water tube and fire tube boilers used in thermal power plants, packaged Boilers, High pressure boilers; Loeffler, Benson, Lamont Boilers, Boiler mountings and accessories—devices for improving Boiler efficiency. Principle of fluidized bed combustion. Concept of co-generation. (7 Hrs.)

Unit II : Boiler draught; Types of draught, expression for diameter & height of chimney, condition for maximum discharge, efficiency of chimney, reasons for draught loss. Boiler performance:- Boiler rating, boiler power, equivalent evaporation, efficiency. Effect of accessories on boiler efficiency and heat balance. (7 Hrs)

Unit III : CONDENSERS : Need, Types of condensers, quantity of cooling water required. Dalton's law of partial pressure, condenser and vacuum efficiency. Sources of air in condensers and its effect on performance. cooling towers: Natural and mechanical wet type cooling tower.

Steam nozzles : Flow of steam through nozzles & diffusers, Maximum discharge, critical pressure ratio, chocking in nozzles, Effect of friction. Determination of throat & exit areas, Nozzle efficiency, no numerical on concept of super saturated flow & Wilson line. (7 Hrs.)

SECTION – B

UNIT IV : Steam Turbines:- Principle of working, Types of steam turbines such as impulse, reaction, axial & radial flow, back pressure & condensing turbines. Compounding. Reheat, regenerative cycles, bleeding. Analysis limited to two stages only. Analysis of steam Turbines : Flow of steam through impulse & impulse reaction turbine blades, Velocity diagrams. Graphical & analytical methods for work & power developed, axial thrust and efficiency. Height of turbine blades. losses in steam turbines:- blade friction, partial admission, disc friction, gland leakage losses and velocity losses. Governing of steam turbines. (7Hrs)

UNIT V : NUCLEAR POWER:- Fusion, fission, Chain reaction, conversion and breeding in nuclear fission. Components of Nuclear Power Plant such as Reactor, Steam generator, turbine, Moderator, Control Rods etc., Types of nuclear reactors like BWR, PWR, CANDU and liquidized metal cooled thermal reactors. (7 Hrs.)

UNIT VI : Introduction to renewable energy, Wind Energy, solar, fuel cell, bio-gas, MHD, Geothermal, OTEC, tidal power plants, Applications of Non conventional energy. (7 Hours)

RECOMMENDED BOOKS:

Text books :

1. Thermal engineering; Mahesh M Rathore; Tata McGraw-Hill
2. Thermal Engineering R.Yadav; Central publication
3. Non-conventional Energy Sources B. H. Khan Tata McGraw-Hill
4. Non-conventional Energy Sources G. D. Rai.

Reference books:

1. Steam Turbine; Kearton; Oscar Publications.
2. Thermal Power Engineering; Mathur Mehta; Tata McGraw-Hill
3. Power Plant Engineeirng. P. K. Nag
4. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications
5. Thermal Engineering, P.L.Ballaney; Laxmi Publications.

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4ME03 MANUFACTURING TECHNOLOGY

Course Learning Objectives :

1. To study the mechanics of metal cutting, tool characteristics and cutting forces
2. To study the turning operations using lathe and CNC machines
3. To study the working of drilling and boring machines
4. To study the working of milling and gear cutting machines
5. To study the machining operations using grinding, shaper, planer and slotter machines
6. To study the unconventional machining processes

Course Outcomes :

Students will be able to -

1. Apply the knowledge of theory of metal cutting, tool selection & calculate cutting forces
2. Demonstrate the knowledge of basics of turning operations
3. Understand the drilling and boring operations and working of drilling & boring machines
4. Understand the milling and gear cutting operations and working of respective machines
5. Understand the working of grinding, shaper, planer and slotter machines
6. Understand the knowledge of unconventional machining processes

SECTION – A

UNIT I : Theory of Metal cutting: Mechanics of Metal cutting, Tool material, Tool Geometry, Cutting tool classification, Tool life, Tool wear, Calculation of Cutting forces, Machinability, Cutting fluids, Chip thickness ratio, Merchant circle. (8 Hrs)

UNIT II : Construction, Operations and accessories of centre lathe, introduction of capstan & turret lathe, indexing mechanism, bar feeding mechanism, Machine tool classification. Numerical approach. Taper turning & Screw cutting & basic concept of CNC. Introduction, working principal & CNC turning operation.

(10 Hrs)

UNIT III : a) Drilling operation : Drilling M/cs general purpose, Mass production and special purpose drilling M/cs.

b) Introduction & types of Boring. Boring M/c :- Horizontal, Vertical and jig Boring M/c. Introduction to Broaching and its types, broach terminologies, etc. (8 Hrs)

SECTION - B

UNIT IV : a) Calculation of machining time for Milling.

b) Milling M/c :- Types, Types of Milling Cutters, Dividing head, Compound and differential indexing.

c) Gear producing M/cs. (6 Hrs)

UNIT V : a) Grinding Machines: Bench grinders, surface grinders, centreles grinders, types of bonds & Abrasive modification of grinding wheels.

b) Study of various part & Operation of Shaper, Planer, Sloter. (6 Hrs)

UNIT VI : Unconventional Machining Processes:-

a) Mechanical Processes:- Ultrasonic Machining - principle and applications. process parameters; Abrasive and water parameters involved.

b) Thermal processes:- Election Beam Machining – Generation of beam, principle and applications : Laser Beam machining applications : Plasma-arc machining- Concept and generation of plasma, principle of PAM, applications.

c) Electric discharge Machining - Types die-sinking, wire cut EDM, Mechanism of material removal, process parameters, advantages and applications. (8 Hrs)

BOOKS RECOMMENDED :

Text Books:

1. Manufacturing Technology-Vol 1 & 2; R.L.Timings, S.P. Wilkinson; Pearson Publication.
2. Workshop Technology - By Hajra Choudhaury Vol II.

3. Manufacturing Technology Vol. II P. N. Rao, McGraw Hill Publication

References:-

1. Pandya & Shah, Modern Machining process, Tata McGraw Hill 1998.
2. Workshop Technology, O.P. Khanna, Dhanpatrai & Sons.
3. Workshop Technology - By Raghuwanshi. Vol II.

4ME08 MANUFACTURING TECHNOLOGY - LAB

Practicals:-

1. Demonstration of operations related to lathe, shaper, slotter, drilling & grinding m/cs.
2. One job on lathe covering taper turning and threading.
3. One job on shaping covering plane and inclined surfaces.

The above jobs should include drilling, grinding, tapping etc. Term work should be submitted in the form of journal.

N.B. :- The practical examination shall consists of preparation of practical jobs and assessment by external and internal examiner.

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4ME04 BASIC ELECTRICAL DRIVES AND CONTROL

Course Learning Objectives :

7. To study the working of electrical drives and their components
8. To study the basics of DC motors and their characteristics
9. To study the working of AC motors, Induction motors and concept of braking
10. To study the different speed control methods of A.C. and D.C. motors
11. To study and design of transducers and their applications
12. To study the industrial applications of different drives

Course Outcomes :

Students will be able to -

7. Understand the working of electrical drives and their components
8. Understand the basics of DC motors and their characteristics
9. Understand the working of AC motors, induction motors and concept of braking
10. Understand the different speed control methods of A.C. and D.C. motors
11. Understand the design of transducers and their applications
12. Understand the industrial applications of different drives

SECTION-A

Unit I : Concept of general electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Introduction to mechatronics, Theory and principle of Power Transistor, SCR. (8 Hrs)

Unit II : Basic characteristics of D.C. motor, Torque equation, Modified speed – Torque characteristics. Starting and braking of Electrical D.C. motors, comparison of mechanical and electrical braking methods. Introduction, Principle, construction and working of Servo motors, stepper motors, Brushless D.C. motors. (8 Hrs)

Unit III : Classification of A.C. motors, construction, types, principle of working and characteristics of 3 phase Induction motors, applications. Starting and braking of 3 phase induction motors. Classification of single phase induction motors. construction, principle and working and applications. Principle and working of universal motor. (8 Hours)

SECTION-B

Unit IV : Conventional methods of speed control of A.C. and D.C. motors. Thyristorized stator voltage control of 3 phase induction motor, (v/f) control method, slip-power recovery scheme. Thyristorized armature voltage control of D.C. motors using phase control & Thyristorized chopper. **(**8 Hours**)**

Unit V : Basic principle, construction & applications of sensors and transducers, contact - non- contact type, optical proximity sensors. Switches, contact type, magnet type, electromagnetic type, sound, light, pressure, vibration transducers, Hall effect-sensors A.C./D.C. Tachogenerators. **(**8 Hours**)**

Unit VI: Industrial applications - classes of duty selection of an electric drive for particular applications such as steel mill, paper mill, cement mill, textile mill, sugar mill, electric traction, coal mining, etc. Induction heating, surface hardening & Dielectric heating. **(8 Hours)**

BOOKS RECOMMENDED :

Text Books:-

1. A First Course on Electrical Drives - S.K. Pillai.
2. Basic Electrical Technology (Vol. 11) - B.L. Theraja

Reference Books :

1. Drives and Control - N. Dutta
2. Mechatronics - W. Bolton, Addison Wesley, Longman Ltd.
3. A Course in Electrical, Electronics Measurement and Instrumentation, By A.K.Sawhney, Dhanpat Rai & Sons,

4ME09 BASIC ELECTRICAL DRIVES AND CONTROL - LAB

List of Experiments :

Any EIGHT practicals from the following list :

1. To study the Specification of Various Electrical Machines.
2. To study the D.C. Motor Starters.
3. To study the Running and Reversing of D.C. Motor.
4. Speed Measurements using Magnetic Pick-up.
5. To study the Speed reversal of counter Current Breaking of 3-phase Induction Motor.
6. To control the speed of D.C. Motor by a) Armature Control b) Field Control.
7. To perform Load Test on Induction Motor.
8. To study Dynamic/Rheostatic Breaking of D.C. Motor.
9. To study Characteristics of Thyristor.
10. To study the speed -Torque Characteristic of Servo Motor.

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4ME05 HYDRAULIC AND PNEUMATIC SYSTEMS

Course Learning Objectives:

1. To get fundamental background about the hydroelectric power plants
2. To study operation, working principle & performance characteristics of hydraulic turbines
3. To study operation, working principle & performance characteristics of centrifugal pump, reciprocating pump and other hydraulic pumps
4. To study the behavior of compressible fluid flow
5. To study different hydrostatic & hydro kinematics industrial applications

Course Outcomes:

Students will be able to -

1. Demonstrate basic concepts of prime movers and turbines
2. Utilize the knowledge of centrifugal and reciprocating pumps for applications
3. Reveal the importance of other water lifting devices
4. Solve the elementary treatment on compressible fluid flow
5. Understand the concept of hydrostatic and hydrokinetic systems
6. Use the knowledge of hydraulics & pneumatics in developing project work

SECTION - A

Unit I :
Hydraulic Turbines - Theory of impulse and reaction turbines. Pelton, Francis and Kaplan turbines, their construction, classification, analysis, characteristics and governing, draft tube. (10 Hours)

Unit II :
Centrifugal pumps :- Basic Theory, classification, construction, operation, characteristics, multistage, NPSH and cavitations in pumps. (7 Hours)

Unit III:
1. Axial flow pump :- Basic theory, construction, & operation.
2. Other water lifting devices :- (a) Air lift pump. (b) Jet Pump. (c) Hydraulic Ram.
3. Computational Fluid Dynamics (CFD)
4. Introduction to CFD: Necessity, limitations, philosophy behind CFD, applications (6 Hours)

SECTION - B

Unit IV :
Positive Displacement and other Pumps: Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels. Comparison of centrifugal and reciprocating pumps, performance characteristics. (9 Hours)

Unit V :
Compressible fluid flow :- Perfect gas relationship, speed of sound wave, mach number, Isothermal and isotropic flows, shock waves (8 Hours)

Unit VI :
Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic coupling, hydraulic torque converter (8 Hours)

BOOKS RECOMMENDED :-

Text Books:-

1. CSP Ojha, R. Berndtsson, Fluid mechanics and machinery; Oxford University.
2. Bansal R.K., Fluid mechanics and fluid machines; Laxmi publications.

Reference Books:-

1. Jagdish Lal, Hydraulic machines; Metropolitan Book Co. Pvt. Ltd.
2. Dr. Modi & Seth, Hydraulics and Fluid Mechanics; Standard house book.
3. Sen gupta, Computational fluid dynamics; Pearson Publishers.
4. Sameer sheikh, Iliyas Khan, Treaties on Hydraulics; Pneumatics, R.K. Publication.

4ME10 HYDRAULIC & PNEUMATIC SYSTEMS - LAB

List of Practicals:- At least **SIX** (6) practicals based on following :

1) Trial/Study of Pelton wheel
2) Trial/Study of Francis Turbine
3) Trial/Study of Kaplan Turbine
4) Trial/Study of centrifugal pump
5) Trial/Study of reciprocating pump
6) Trial/Study of axial flow pump
7) Trial/Study of hydraulic ram
8) Trial/Study of multistage pump
9) Trial/Study of special pumps (air lift pump/ jet pump)
10) Trial/Study of Gear pump
10) Any one practical based on CFD software

Note : Practical Examination : Practical examination shall consist of Viva Voce/performance based on above syllabus & practical work.

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SYLLABUS PRESCRIBED FOR BACHELOR OF MECHANICAL ENGINEERING
SEMESTER PATTERN (CHOICE BASED CREDIT SYSTEM)

FIFTH: SEMESTER

An Orientation Program: At the beginning of the semester, an orientation program of 15 hours duration/ MOOC on, "Indian constitution" should be offered to the students.

5ME01 HEAT TRANSFER

Course Learning Objectives (CLOs)

1. To provide details of heat transfer involving conduction, convention and radiation mechanisms.
2. To carry out heat transfer analysis and to demonstrate different techniques used in solving a heat transfer problem.
3. To impart basics of designing heat transfer equipment.

Course Outcome (COs)

At the end of Heat Transfer course the student will be able to:

1. **Solve** steady state heat transfer problems of 1-D heat conduction with and without internal heat generation.
2. **Design** and to **analyze** the performance of extended surfaces.
3. **Apply** Lumped heat capacity method for analysis of unsteady state heat transfer.
4. **Explain** the laws of radiation and its applications.
5. **Predict** heat transfer coefficients for forced and free convection heat transfer applied to internal and external flow conditions.
6. **Design** and **analyze** the performance of heat exchangers using NTU and LMTD methods.

UNIT - I : Introduction, heat transfer in engineering, modes of heat transfer, basic laws of heat transfer and their basic equations. Conduction- thermal conductivity and thermal diffusivity effect of phase & temperature on thermal conductivity, one dimensional steady state heat conduction through slab, cylinder & sphere-simple and composite. Combined conduction- convection, overall heattransfer coefficient. General heat conduction differential equation. One dimensional steady state conduction with internal heat generation for infinite slab, wire & cylinder. **(8 Hrs)**

UNIT II : Insulations, critical radius of insulation, Conduction through extended surfaces, analysis of a uniform C.S. fin, fin efficiency, fin effectiveness, Biot number. Introduction to unsteady state heat conduction, Newton's law of cooling, lumped heat capacityanalysis. **(8 Hrs)**

UNIT III :
Radiation-general concepts and definitions, black body & greybody concept. Laws

of radiation- Kirchoff's, Plank's, Stefan- Boltzman's, Wien's law. Concept of shape factor, emissivity factor and radiation heat transfer equation. (No numericals).Radiation errors in temperature, measurement, radiation shield.**(7 Hrs)**

UNIT IV: Forced convection- heat convection, forced and natural convection, boundary layer theory, hydrodynamic & thermal boundary layers, boundary layer thickness. Laminar & turbulentflow over flat plate and through pipes & tubes (only concept, no derivation & analytical treatment). Dimensionless number and their physical significance Reynold, Prandtl, Nusselt, Grashoff number, empirical correlations for forced convection for flow over flat plate, through pipes & tubes & their applications in problem solving. **(8 Hrs)**

UNIT V: Free convection- velocity and thermal boundary layers for vertical plate, free convection over vertical cylinder and horizontal plate/cylinder (only concept, no derivation & analytical treatment). Use of empirical correlations in problem solving. Condensation & Boiling - introduction to condensation heat transfer, film & drop condensation. Boiling heat transfer, pool boiling curves. **(7 Hrs)**

UNIT VI : Heat exchanger - applications, classification, overall heat transfer coefficient, fouling. L.M.T.D. & E.N.T.U. methods, temperature profiles, selection of heat exchangers. Introduction to workingof heat pipe with and without wick. **(7 Hrs)**

Books Recommended

Text Books:-

1. Heat and Mass Transfer; R.K Rajput; S. Chand, New Delhi
2. Heat and Mass Transfer; V.M. Domkundwar; Dhanpat Rai & Co. Delhi
3. Heat Transfer; A. F.Mills, V. Ganesan, Pearson Publication

Reference Books:-

1. Heat Transfer; J.P. Holman; McGraw Hill
2. Heat Transfer; P.K. Nag; TMH.
3. Heat and Mass Transfer Data book, V.M. Domkundwar, Dhanpat Rai & Co.
4. Heat and Mass Transfer Data book; C.P. Kothandaraman; New age International

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5ME02 METROLOGY & QUALITY CONTROL

Course Learning Objectives:

1. To study generalized production technology, applications, general configuration and functional elements of inspection instruments.
2. To study about quality in production and services and quality management.
3. To study application of non destructive test for increasing productivity and efficiency of the work.
4. To study design and applications of various gauges and comparators used in inspection.
5. To study various techniques for the inspection of gears and threads.
6. To study various techniques for angular measurement, surface texture measurement, and geometric features measurement.
7. To study advance inspection techniques CMM, profile projector etc.

Course Outcomes:

1. Create & apply the concept of inspection, quality control and its importance to industry.
2. Demonstrate the skills of controlling various out of control processes using statistical quality
control tools.
3. Understand the importance of improving production and productivity using work study
approach.
4. Apply the knowledge of various measurement standards and techniques in the industry to measure various parameters related to metrology.

UNIT I : Concept of quality and quality control, quality of design and quality of conformance, Quality characteristics, Cost of quality & Value of quality, Specification of quality, quality control & inspection.

Concept of TQM & Quality assurance,

Concept of variation, variable and attribute data, Frequencydistribution, Measures of Central tendency-

Mean, mode & median, Measures of dispersion. -Range, std.deviation & variance. (8 **Hrs**)

UNIT II : Concept of universe and population, Normal distribution curve; Control charts for variables, process capability, Control charts for attributes; comparison between variable charts and attribute charts; precision & accuracy, Sampling plans,Operating Characteristic curve, Quality circle. (7 **Hrs**)

UNIT III : Introduction to Non-Destructive testing, Ultrasonic testing, X-ray or Radiography Testing, Liquid Penetrant testing, Magnetic Particle Testing, Eddy current testing, it's applications, Advantages & Disadvantages. (7 **Hrs**)

UNIT IV : Standards of measurements: line standards, end standard, wave length standard. Limits, fits and gauges: terminology of limits, Fits and gauges, concept of interchangeability, allowance tolerance, Indian Standard Specification for limits, fits and gauges, B.S. System. Limit gauging - designof Go, No Go gauges. (8 **Hrs**)

UNIT V : Linear measurement: various comparators such as mechanical, electrical, optical, pneumatic comparators, their principle, operations and applications.

Angular measurements: vernier, optical, bevel protractor universal bevel protector, Sine bar level clinometers, tapergauges. Thread measurement: screw thread limit and fit limits gauging of screw threads (8 **Hrs**)

UNIT VI : Gear measurement : alignment error, master gear, Parkinson tester.

Study and use of optical dividing head, auto collimator, tool makers microscope.

Interferometry, flatness testing, squareness testing. Surface texture testing.

Coordinate measuring machine- types, role and application. **(7 Hrs**)

Books Recommended:

Text Books:

1. Engineering Metrology – R.K.Jain - Khanna Publishers.
2. Statistical Quality Control- M. Mahajan – Dhanpatrai & Co. Pvt.Ltd.
3. Non Destructive Testing techniques by Ravi Prakash, New Age Publications.

Reference Books:

1. Quality Control - By Juran - Mc. Graw Hill Pub. Company.
2. Statistical Quality Control- By Grant E.L. – R.S.L.Leavgen Worth-.Mc. Graw Hill Pub. Company
3. Statistical Quality Control- By Gupta - Dhanpatrai & Com. Pvt. Ltd

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5ME03 KINEMATICS OF MACHINES

Course Learning Objectives:

1. To get the basic Knowledge about the mechanism used in automobiles, industrial machines etc.
2. To study about the synthesis and analysis of the mechanism used in machines.
3. To get the operational knowledge about the power transmitting devices used in automobiles.
4. To study the designing and importance of cams in machines.
5. To study the most effective power transmission device used in automobiles, industrial equipment, toys, etc.

Course Outcomes:

Students will be able to-

1. Understand & apply the concept and its applications of link, mechanisms and machines.
2. Demonstrate the ability to analyze the mechanisms and machines on the basis of velocity and acceleration and they will show the ability to solve analytical methods.
3. Show the ability to use graphical and analytical methods for synthesis of mechanisms to develop mini projects in the course duration.
4. Understand the practical for study of brake, clutch, dynamometer, gear train etc.

Unit I: 1. Introduction to study of mechanisms, machines, different types of links, kinematic pairs. Grashof's law- class-I and class –II mechanisms. Grubler's criterion, Kutzbach's criterion for planer mechanism. Inversions of four bar, single slider, double slider mechanisms.
2. Transmission angle, Mechanical Advantage, Transmission angle and Mechanical Advantage of 4-bar mechanism. **(7 Hrs)**

Unit II: 1**. Velocity analysis**: - Relative velocity method, method of equivalent mechanisms, Instantaneous centre of rotation method for 4-bar mechanism, body and space centroids.
2**. Acceleration analysis**:- Relative acceleration method and analytical method. **(8 Hrs)**

Unit III: Synthesis of Mechanisms:- Introduction to type, number and dimensional synthesis, graphical method of two position, three position and four position synthesis for input output coordination, Freudenstien's equation, Bloch's method. **(7 Hrs)**

Unit IV: Frictional torque in pivot and collar bearing. Clutches and Dynamometers: types, constructional details, operation. **(7 Hrs)**
Unit V: Special purpose mechanisms:- Steering mechanisms, Geneva wheel mechanism.
Cams:- Introduction, types of cam & follower, different motions of followers, graphical

layout of cam profiles, cam with specified contours. **(8 Hrs)**

Unit VI: 1. **Gear**: Introduction, terminology, gear tooth profiles, law of gearing, involumetry, interference of spur gears, minimum number of teeth to avoid interference.
2.**Gear Trains**:- Types of gear trains and its speed ratio applications. **(7 Hrs)**

Books Recommended:

Text Books:

1) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai and sons-N Delhi.
2) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
3) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by Eurasia Publishing house-N Delhi.

Reference Books:

1) Theory of Machines and Mechanisms, J.E.Shigley, Uicker and Gordon, Published by Oxford University press-New York.
2) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
3) Theory of Machines and Mechanisms, Ghosh and Amitabh, Published Affiliated East West Press, N-Delhi.

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5ME04 MEASUREMENT SYSTEMS

Course Learning Objectives:

1. To study the generalized measurement system and the general performance characteristics of measuring instruments, applications, general configuration and functional elements of measuring instruments.
2. To study the strain gauges, their types, strain gauge circuits for strain measurement and to study the pressure measurement methods and devices
3. To study the types, constructional details and working of force, torque and flow measuring devices.
4. To study the different types of temperature measuring devices, standards, construction details and their working and to study the different types of liquid level measuring devices.
5. To study the mechanical and electrical types of speed measuring devices, contact and contactless speed measuring devices and their applications.
6. To study the methods of vibrations measurement and methods of linear and angular displacements.

Course Outcomes:

At the end of Measurement System course, the student will be able to:

1. Analyze different measurement systems.
2. Calculate different types of errors in the measurement system.
3. Use strain gauges and pressure measurement devices for several applications.
4. Compare different methods of force, Power and flow measurement using different methods.
5. Select appropriate liquid level and temperature measurement devices for given applications.

6. Measure speed of motors and rotating shafts by using tachometers, stroboscope.

UNIT I : 1. Generalized Measurement system: Significance of measurement, generalized systems. application of measuring instruments. Types of measuring instruments.

2. General configuration and functional elements of measuring instruments, types of inputs, various methods of correction for interfering and modifying inputs. (6 Hrs)

UNIT II : General performance Characteristics:-

1. Static characteristics, different types of errors, combination of component errors in overall systems.
2. Dynamic characteristics : General mathematical model of zero order, first order and second order instruments, response of first and second order instruments to following inputs step, ramp, impulse and frequency. **(8 Hrs)**

UNIT III : Strain Measurement :

1. Types of strain gauges, strain gauge circuits, calibration, Temperature compensation, use of strain gauges on rotating shafts, selection and installation of strain gauges.
2. Pressure Measurements:-
   Basic methods of pressure measurement: strain gauge pressure cell, High pressure measurement Bridgeman type, low pressure Measurement - Mcleod, Knudsen, ionisation, Thermal conductivity gauges.**(8 Hrs)**

UNIT IV : 1. Force Measurement: Various mechanical. Hydraulic, pneumatic and electrical methods.

2. Torque and Power Measurements : Various mechanical, hydraulic & electric methods.
3. Flow Measurements : Construction- orifice, Rota meter. Pressure probes- Pitot static tube, turbine meter, electro-magnetic flow meter. **(6 Hrs)**

UNIT V : 1. Temperature Measurements : Standards, Various temperature measuring devices, Bimetallic strip, pressure thermometers, thermo couples, electrical resistance thermometers, Thermistors, radiation Thermometers.

2. Liquid Level Measurements : Various methods such as- single float, displacement or force transducers. Pressure sensitivity, bubbler or Page system, capacitance variation type (for both conducting and non conducting type liquids) Resistance variation type. **(8 Hrs)**

UNIT VI: 1. Speed Measurements : Various mechanical type tachometers, electrical types tachometers, stroboscope etc.

2. Vibration Measurements : Seismic, Strain gauge and piezoelectric accelerometers.
3. Displacement measurements : Linear and angular displacement measurements, LVDT, LDR, Capacitive & inductive pick ups.

(8 Hrs)

Books Recommended-

Text Books:-

1. Measurement Systems : - By Erenest O. Doebelins - MC Graw Hill.
2. Mechanical Measurement & Control: By D.S.Kumar.

References Books:-

1. Mechanical Measurements :- By T.G.Beckwith & N.L.Bulk - AddisonWerllv.
2. Instrumental Measurement & Analysis : By Nakra Choudhari TataMc Graw Hill.
3. Mechanical Measurement & Instrumentation :By R.K.Rajput,KatsonsBooks Publications

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5ME05 OPEN ELECTIVE-I
(1) PRODUCTION MANAGEMENT

Course Learning Objectives:

1. To study the new product design & manufacturing process technology.
2. To study the objectives of forecasting, factors affecting forecasting.
3. To study method study, work measurement.
4. To study objectives and functions of Production Planning and Control.
5. To study inventory control & inventory control application
6. To study quality management, quality related costs, quality function deployment & total quality management.

Course Outcomes:

1. Apply the knowledge of operations management and its applications in industrial environment.
2. Demonstrate the knowledge of advanced manufacturing technologies and philosophies.
3. Students will demonstrate the importance of inventory control, JIT in manufacturing.
4. Apply the basic concept of quality management, TQM etc.

UNIT I : Designing products, services and processes; Historical evolution of productions and operations management, new product designs, manufacturing process technology.

Flexible manufacturing systems (FMS) and computer integrated manufacturing (CIM). **(9 Hrs.)**

UNIT II : Sales Forecasting: Objectives, types of forecasting, factors affecting forecasting, process of sales forecasting, methods of sales forecasting. **(7 Hrs.)**

UNIT III : Work study: method study, recording techniques of method study, principles of motion economy. Work measurement techniques. **(7 Hrs.)**

UNIT IV: Production planning and control: Objectives and functions of PPC, types of production systems, principles of sound production control system. **(7 Hrs.)**

UNIT V: Inventory Control: Demand and control system characteristics, inventory concepts, costs Modeling, Deterministic inventory models, stochastic inventory models, inventory control application, just-in-time manufacturing. **(7 Hrs.)**

UNIT VI: Quality Management: Quality and quality related costs, quality function deployment(QFD), Taguchi's off-line quality control methods, managerial responsibility in managing for quality products & services. TQM. Failure analysis, bath tub curve, Reliability of system. **(8 Hrs.)**

Books Recommended

Text Books:

1. Production and operations management- concepts models and Behaviour by Everett E. Adam,Jr., & Ronald J. Ebert (Prentice- Hallof India)
2. Industrial engineering & production Management by M. Mahajan(Dhanpat Rai & Co.)

References Books

1. Production and operations management – Total Quality and responsiveness by Hamid Noori & Russell Radfort (Mc Graw Hill, Inc.)
2. Industrial engineering & management by O. P. Khanna (Dhanpat Rai& Co.)
3. Production and Operations Management; J.P. Saxena; McGraw Hill

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5ME05 OPEN ELECTIVE-I
(2) MANUFACTURING TECHNIQUES

COURSE LEARNING OBJECTIVES

1. To study the fundamentals of different manufacturing processes and various activities in manufacturing.
2. To study the fundamentals of metals & alloys, properties of engineering materials like ferrous, non- ferrous metals and their alloys
3. To study different machine tools. cutting tools used in machine shop , various operations performed with working principles of these machine tools
4. To study the activities related to mechanical working of metals, various hot working & cold working operations fundamentals of metal forming ; sheet metal working processes with different tools and equipment
5. To study the necessary details regarding pattern making, moulding, core making and casting with foundry tools & equipment, also melting practice by cupola furnace.
6. To study different Joining processes, basic terms of welding processes tike arc welding, gas welding, resistance welding. friction welding , soldering ; brazing processes with tools & processes.
7. To study the methods of producing metal powders
8. To study plastic part manufacturing by different processes like extrusion. Injection, blow, compression, and transfer moulding processes.

COURSE OUTCOMES:

1. Apply the knowledge of various manufacturing techniques and its applications in engineering.
2. Understand the knowledge of machining operations, sheet metal working and processes.
3. Students will show the ability to apply various joining methods in practice.
4. Students will exhibit the knowledge of powder metallurgy.

Unit I : Overview of manufacturing: Classification of manufacturing processes, selection of manufacturing processes, types & properties of materials, selection of materials, Introduction to conventional and non-conventional machining processes. **(6Hrs)**

Unit II : Introduction to cutting type shaping processes, Basic concept of metal cutting, Types of cutting tools, Orthogonal & oblique cutting, General purpose machines Vs Special purpose machines. (8Hrs)

Unit III: Introduction & application of various metal cutting operations – Turning, drilling, boring, milling, shaping, planning and grinding process. (8Hrs)

Unit IV: Introduction to metal forming and sheet metal process: Forming process- Forging, rolling, extrusion, wire drawing. Sheet metal processes- Forming, bending, drawing, coining, embossing. Cutting process: Punching, blanking, shearing, lancing. (7Hrs)

Unit V : Metal casting: Steps involved in casting, advantages of casting, pattern, difference between pattern and casting, pattern allowances, material used for patterns, molding sand, sand mould making core, types of cores, defects of castings, melting furnace(Cupola), casting process and its applications. (6Hrs)

Unit VI: Joining process with its types, advantages and disadvantages of riveting, soldering, brazing. Arc welding, gas welding, resistance welding, friction welding. (6Hrs)

Books Recommended:

Text Books:

1. Manufacturing processes –Workshop practice, R.A. Khan, Ali Hassan, Scitech Pub.
2. Workshop Technology - Hajra Chaudhary, Dhanpat Rai and Sons.

Reference Books :

1. Processes and materials of manufacture E.P. Degarmo, Prentice Hall of India (PHI)
2. Material and processes in manufacturing Lindberg, Tata McGraw Hill Pub.

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5ME06 HEAT TRANSFER-LAB.

Course learning objective: The lab work should clear the vision about all the modes of heat transfer. The practical knowledge should enhance the approach of student towards real life applications of the subject.

Course Outcome:

Upon successful completion of lab Course, student will be able to:

i) Understand various modes of heat transfer

ii) evaluate various parameters of the heat transfer process

List of Practicals (Any six of the following):-

1. Determination of thermal conductivity of a metal bar.
2. Determination of thermal conductivity of insulating powder.
3. Study of heat transfer through composite wall.
4. Study of heat transfer through composite cylinders.
5. Determination of fin efficiency.
6. Verification of Stefan-Boltzman's law.
7. Determination of emissivity of grey body.
8. Determination of heat transfer coefficient for forced convection.
9. Determination of heat transfer coefficient for natural convection.
10. Study of pool & nucleate boiling.
11. Trial on double pipe heat exchanger.
12. Determination of efficiency of cross flow heat exchanger.
13. To write a computer program for conduction heat transfer problem.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

5ME07 METROLOGY & QUALITY CONTROL-LAB.

Course learning objective:

The course aims at understanding the principles of metrology for precision measurement of various mechanical components using various measuring tools. Students shall also learn to use standard practices and standard data, learn to use statistical concept, control chart for variables, control chart for attributes.

Course Outcome: Upon successful completion of lab Course, students will be able to

i) Explain the principles involved in measurement and inspection.

ii) Select and use appropriate measurement instrument for a given application

iii) Apply the basics of sampling in the context of manufacturing

Practicals : At least six from the below list.

1. Determination of Linear dimensions of a given specimen/part using Precision/Non-Precision Measuring instruments.
2. Determination of Angular Measurement using Precision/Non-Precision Measuring instruments.
3. Measurement of Gear Tooth Thickness by Gear Tooth VernierCaliper/Constant Chord/Span Micrometer.
4. Measurement of Circularity/Roundness of a given specimen.
5. Measurement of Screw Thread Element by Floating Carriage Micrometer.
6. Testing of Surfaces by using Optical Flat.
7. Measurements of various angles of single point cutting tool by usingProfile Projector and Tool Maker's Microscope.
8. Preparation of Variable Control Charts for the given lot of sample.
9. Preparation of Attribute Control Charts for the given lot of sample.

Practical Examination :-

The practical examination shall consist of oral on term work.

5ME08 KINEMNATICS OF MACHINES - LAB.

Course Learning Objectives: Objectives of this lab are to impart practical knowledge on design and analysis of mechanisms for the specified type of motion in a machine. With the study of rigid bodies motions and forces for the transmission systems, machine kinematics can be well understood.

Course Outcome: On successful completion of the course students will be able to:
Design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship, identify the basic relations between velocity & acceleration and use graphical and analytic methods to study the motions of various mechanisms

PRACTICALS:- *At least eight practicals from the below list shall be performed.*

1. To Study, Analyse and drawing of inversions of four bar mechanism to identify the types and number of links, types of motion and its mode of fixing arrangement for the required application.
2. To Study and analyse of inversions of slider crank mechanism using working models and graphical representations to find type & number kinematic pair , type of joint and Degree of freedom.
3. To Study and analyse of inversions of double slider crank mechanism using working models and graphical representations to find type & number kinematic pair , type of joint and Degree of freedom.
4. To determine Velocity and acceleration of links in mechanism by relative velocity method. (2 Problem)
5. To determine Velocity and acceleration of Piston of a reciprocating engine by clein's construction method.(2 Problem)
6. To find braking force, braking toque of internal expanding and external expanding brake .
7. To study, understand and observe the actual working and function of each part of single plate clutch by dismantling and assembling.
8. To study, understand and observe the actual working and function of each part of centrifugal clutch by dismantling and assembling.
9. Study of dynamometers.
10. To draw Cam profile for a given follower type and follower motion. (2 Problem.)
11. To Study and find train value and speed ratio of various types of gear trains
12. To study and drawing of Simple four bar Mechanism using position synthesis.
13. To Study and drawing of four bar mechanism by input-output coordination methods using Bloch's Synthesis and Freudenstein's equation.
14. To study interference and undercutting of spur gear pair using graphical layout.
15. To study and drawing of Generation of Involute and Cycloidal Spur Gear Tooth Profile.

The practical examination shall consist of viva-voce on the above syllabus & practical work.

5ME09 MEASUREMENT SYSTEMS-LAB.

Course Learning Objectives : i)To study various sensers and measuring instruments required to measure various properties and quantities occurring in a typical engineering system. ii)To understand general performance characteristics of measuring instruments, applications and general configuration of the measuring instruments.

Course Outcome: Upon completion of this course students will be able to:

i) Choose appropriate measuring device for measurement of various quantities
ii) Analyse the performance of various
iii) Analyse and execute the calibration process for measuring instruments

List of Practicals :

At least eight practicals from the following list:

1. Measurement of strain using strain gauges.
2. Calibration of pressure gauge with pressure gauge tester.
3. Measurement of linear displacement by LDR and inductive pick-uptransducers.
4. Performance of capacitance transducer as an angular displacement measuring device.
5. Performance of inductive Transducers.
6. Measurement of flow using optical flow meter and Rotameter.
7. Speed measurement by a stroboscope.
8. Speed measurement by magnetic pick up or photo electric pick up tachometer.
9. Pressure measurement by strains gauge type transducer.
10. Vibration measurement by using Seismic Transducer.
11. Measurement of Liquid level by using capacitive pickup transducer.
12. Temperature measurement using contact and non contact type instruments or various types of sensors.

*The practical examination shall consist of viva-voce on the above syllabus & practical work.

SYLLABUS PRESCRIBED FOR BACHELOR OF MECHANICAL ENGINEERING SEMESTER PATTERN (CHOICE BASED CREDIT SYSTEM)

SEMESTER : SIXTH

An Orientation Program: At the beginning of the semester, an orientation program of 15 hours duration/ MOOC on, "Essence of Indian Knowledge Tradition" should be offered to the students.

6ME01 DESIGN OF MACHINE ELEMENTS

COURSE LEARNING OBJECTIVES (CLOs):

1. To study the concept of stresses and understand the design procedure of riveted and welded joints.
2. To study design procedure of knuckle joint, springs and power screw.
3. To analyze & select types of shafts, keys, couplings for various machines and industrial applications.

COURSE OUTCOMES (COs):

1. Understand the concept of various stresses and apply the design procedure to riveted joints and welded joints.
2. Understand design procedure of knuckle joint, springs and power screw.
3. Analyze & select types of shafts, keys, couplings for various machines and industrial applications.
4. Analyze the various types of bearings and understand the design procedure of IC Engine parts.

Unit I : (A) Meaning of design, Phases of design, Simple stresses, Thermal stresses, Impact Stress, Torsional stress, bending stresses in straight & curved beams, it's applications, Hooks, C-clamps.

(B) Rivetted Joints- Design, failures, strength & efficiency of riveted joint.

(C) Welded Joint- Strength, of transverse & parallel fillet welded section.

(11 hrs)

Unit II :(A) Design of knuckle joint.

(B) Design of spiral & leaf spring.

(C) Design of power screw- Torque required to raise loads, efficiency & helix angle, overhauling & self locking of screw, ACME threads, stresses in power screws. **(11 hrs)**

Unit III : (A) Design of Shaft – Subjected to twisting, bending & combined twisting & bending loads, based on rigidity.

(B) Design of coupling, rigid coupling, sleeve, muff coupling, flange coupling & flexible coupling. **(11 hrs)**

Unit IV : (A) Antifriction bearing: Types of bearing, construction, life of bearings, selection of bearings.

(B) Journal bearing: Lubrication, selection of lubrication, design procedure & numerical.

(C) Design of IC Engine parts: Connecting rod, design of flywheel based on TM diagram. **(11 hrs)**

Books Recommended :-

Text Books:-

1. Machine Design by Dr. P.C. Sharma & dr. D. K. Agrawal, Katsons Publications Ltd.
2. Machine Design by R.K.Jain ,Khanna Publisher's
3. Machine Design, R.S. Khurmi, J.K. gupta, Eurasia Publications, New Delhi.
4. Machine Design Data book by PSG, Coimbtore
5. Machine Design data book by Mahadevan

Reference Books:-

1. Design of Machine Element by V.B. Bhandari, Tata McGraw Hill Publuication.
2. Machine Design – Jindal, Pearson Publication.
3. Design of Machine Element – C. S. Sharma & Kamlesh Purohit, PHI Publication.

6ME02 DYNAMICS OF MACHINES

Course Learning Objectives:

1. To study Static force analysis and Dynamic force analysis of plane mechanisms.
2. To demonstrate the use of gyroscopic effect on ship, aeroplane, four wheeler and two wheeler
3. To determine natural frequency vibrations.
4. To seek the knowledge of static and dynamic balancing.

Course Outcomes:

Students will be able to

1. Apply basic concept of static force analysis and lubrication mechanism.
2. Understand the knowledge of dynamic force analysis analytically and graphically.
3. Apply the knowledge of space mechanism and vehicle dynamics.
4. Understand concept of free vibration and force vibration, concept of Torsional vibration.
5. Analyze the concept of balancing of machinery.

Unit I: 1. Static equilibrium, superstition principle, Static force analysis applied to plane motion mechanisms, virtual work method, static force analysis without and with friction.
2. Theory of hydrodynamic lubrication, boundary lubrication, film lubrication, rolling friction, performance of bearing. **(8 Hrs)**
Unit II: 1. D'Alemberts Principle. Engine force analysis-piston effort, thrust along connecting rod, side of cylinder, on the bearings, crank effort and turning moment on the crank shaft.
2. Dynamic equivalent system of connecting rod.
3.Turning moment diagrams for two stroke, four stroke and multi cylinder engines, fluctuations of speed & energy, Flywheel requirements **(7 Hrs)**
Unit III: 1**. Space mechanism**:- Gyroscope, gyroscopic effect as applied to ship, aeroplane,

four wheeler, two wheeler, universal joint.

2**. Vehicle dynamics**: - Coefficient of adhesion, resistance to vehicle motion, relative drive effectiveness, braking of vehicles. **(7 Hrs)**

Unit IV: Types of vibrations, elements of mechanical vibrating systems, degree of freedom in mechanical vibratory system.

1.**Longitudinal vibrations**- Natural frequency of free longitudinal vibrations by equilibrium, energy and Rayleigh method. Effect of inertia constraint in longitudinal vibrations. Damped vibrations with mass, spring and dash pot. Definitions of logarithmic decrement, magnification factor, transmissibility, vibration isolation.

2. **Torsional vibration**- single rotor systems, Two Rotor system, three rotor system, geared systems. **(8 Hrs)**

Unit V: 1.**Transverse vibrations**- Natural frequency of free transverse vibrations. Effect of inertia constraints in transverse vibrations. Natural frequency of free transverse vibrations due to point load and uniform distributed load acting over a simply supported shaft. Frequency of free transverse vibrations of a shaft subject to a number of point loads by energy and Dunkerley's method.

2.**Whirling or critical speed shaft**. **(6 Hrs)**

Unit VI: Balancing :- Balancing of rotating masses in same and different transverse planes, Partial balancing of reciprocating masses & Study of its effect. **(8 Hrs)**

Books Recommended:

Text Books:

1) Theory of Machines, P.L.Ballaney, Published by Dhanpat Rai andsons-N Delhi.
2) Theory of Machines, S.S.Ratan, Published by Tata Mc Graw Hill.
3) Theory of Machines, V.P.Singh, Published by Dhanpat Rai-N Delhi.
4) Theory of Machine, R.S.Khurmi and Gupta J.K., Published by EurasiaPublishing house-N Delhi.

Reference Books:

1) Theory of Machines and Mechanisms, J.E.Shigley, Uicker andGordon, Published by Oxford University press-New York.
2) Theory of Machines and Mechanisms, Ghosh and Amitabh, Published Affiliated East West Press N-Delhi.

6ME03 CONTROL SYSTEM ENGINEERING

COURSE LEARNING OBJECTIVES:

1. To study the basics of control systems and their mathematical modeling along with reduction methods.
2. Study the basic control actions and Industrial controllers.
3. To study the analysis of control systems with respect to transient time response and their errors.
4. To study the different pneumatic controllers and prime movers and their actions.
5. To understand stability analysis, frequency analysis by using bode plot for analytical problems.
6. Study of important automatic speed control systems.

COURSE OUTCOMES:

1. Understand the basic system concept and study different types of systems.
2. Understand the concept Transient- Response analysis and will apply in numerical methods, the knowledge of basic control action and industrial controllers.
3. Understand the concept of Stability and exhibit the knowledge of root locus concept.
4. Understand the concept of Frequency Response method and use bode diagram in solving analytical problems.

Unit I: Introduction system concept, open & closed loop systems, Mathematical models of physical systems, transfer functions. Block diagrams reduction and signal flow graphs.(8 Hrs)

Unit II : Basic control actions and Industrial controllers :-Classification of industrial automatic controllers, control actions, proportional controllers, obtaining derivative and integral control action, effects of integral and derivative control action on systems performance.(7 Hrs)

Unit III : Transient Response Analysis :- Introduction Std. Test signals, steady state response of first and second order systems for stop, ramp and impulse input, transient response specifications,steady state error & error constants.(7 Hrs)

Unit IV: Concept stability, necessary condition for stability, Rauths stability criterion, Root locus concept, construction of Root loci, systems with transporation lag.(8 Hrs)

Unit V : Frequency Response methods :-Introduction, concept of Bode diagrams.(7 Hrs)

Unit VI : Study of important automatic speed control systems in machine tools, Prime movers, system generators, etc. Analysis of performance characteristics.(7 Hrs)

BOOKS RECOMMENDED:-

TEXT BOOKS :

1. Automatic Control Engineering by F. H. Ravan Mc-Graw-Hill.
2. Modern Control Engg. - by Katsuhiko Ogata, PHI, .
3. Control System Engg. - by Nagrath & Gopal,

REFERENCE BOOKS:

1) Automatic Control Engg. - by Kuo B.C. & F. Golnaraghi,
2) Modern Control System by Richard C. Dorf, Robert H. Bishop,

6ME04 PROFESSIONAL ELECTIVE-I
(1) TOOL ENGINEERING

Course Learning Objectives (CLOs):

1)To study the basic geometries of different cutting tools, chip formation mechanism, tool force analysis etc. in metal cutting.

2)To understand the steps in designing and drawing of single and multipoint cutting tools and form tools.

3) To study the basic principles of workpiece positioning and clamping. To get acquainted with designs of locators, clamps, drill bushes and methods of location.

4) To understand the design and operation of various types of Jigs and Fixtures.
5) To develop a graphical design of a jig or fixture suitable to the requirements of a workpiece.
6)To understand the theory of metal cutting and how to estimate the required force and clearance amount in sheet metal cutting and forming operations.
7)To study construction and working of various types of dies used for different press working operations.
8) To study the steps in designing and drawing of different cutting, drawing and forming dies in press working.

Course Outcomes:

1. Create the design of single and multi-point cutting tools.
2. Apply the knowledge related to machining in order to estimate tool life and selection of cutting fluids.
3. Create the design of multipoint tools like twist drills, reamers, broach and milling cutters & press working dies like punching, blanking and drawing.
4. Analyze the real time problems of work holding by designing jigs and fixtures.

Unit 1:
Single Point cutting Tool:
Shear angle, shear strain, velocity relations, un-deformed chip thickness, Merchant's circle, energy relations, nomenclature, single point cutting tool design, recommended speed, feed and depth of cut Form tools.
Graphical approach of circular form tool design. (08 Hours)

Unit II:
Jig & Fixture Design: Economics, principles of locations, types of locations, prevention of jamming, problems of chip & dust in location, use of dowels. Redundant location, Principles of clamping, types of clamps, power clamping, Tool guiding & tool setting, types of drill Jigs & fixtures, (07 Hours)

Unit III:
Jig & Fixture Design:
Design of Plate, Channel, Box, Turnover and Post type Drill Jigs.
Design of Turning, Milling, Fixture, Broaching, Assembly & Welding Fixtures.
(07 Hours)

Unit IV:
Multi-point Cutting Tools:
Types, Geometric elements and forces in various tools like Twist drills & Reamers, Circular Broaches, Milling Cutters, Taps and Dies, Gear shaper cutter & Gear Hobs.(07 Hours)

Unit V:
Press tools: Classification of presses, Theory of sheet metal cutting, clearance, cutting force calculations, Methods of reducing cutting forces, Centre of pressure & its significance, Classification of press working operations, Theory of bending, spring back action in metals, drawing fundamentals, calculation of drawing & bending forces, planning for cupping operation, Stock layout. (07 Hours)

Unit VI :
Design of Press working Tools:
Types of die construction, function & nomenclature of die components, Cutting Dies-Blanking & Punching,
Forming Dies-Forming, Drawing and Bending etc. Design of Compound, Combination and progressive dies Miscellaneous dies- Horn die, Cam-action die, Rubber & Building die, Suppress die (08 Hours)

Text Books:

1. Tool Design - Cyril Donaldson (Tata Mc-graw Hill)
2. Jigs & Fixtures - P.H.Joshi (Tata Mc-graw Hill)
3. Fundamentals of Metal Cutting & M/c Tools - Juneja (New Age International).
4. Fundamentals of Tool Design - A.Kumar (Dhanpatrai & Sons).
5. A Text book of Production Engineering- P.C.sharma (S.Chand Publication).

REFERENCE BOOKS :

1. Metal Cutting Theory & Cutting Tool Design- Arshinov (Mir Publications)
2. Tool Design - ASTME (ASTME)
3. Jigs and Fixture- Grantt.

6ME04 PROFESSIONAL ELECTIVE – I

(2) NON-CONVENTIONAL ENERGY SOURCES

Course Learning Objectives(CLOs):

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):

1. Able to study the concept of renewable and non-renewable sources.
2. Apply the basic concept of solar energy utilization and storage.
3. Apply the concept of energy from ocean and wind.
4. Study the concept of bio-mass energy resources.

UNIT I

1. Introduction:- Global and Indian energy scenario, Need of Renewable energy, need, Renewable and non renewable energy sources, energy and environment,

2. Solar Radiation: Solar constant, Definitions of basic earth-sun angles. Types of Solar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder, estimation of solar radiation intensity. (7 hrs)

UNIT II

1.Solar thermal systems : Low temperature applications: solar water heating, space heating, drying. High temperature applications, dish and parabolic collectors. Central tower solar thermal power plants. Solar energy storage and utilization: Methods of storage- mechanical, thermal, electrical storage systems.

2. Solar Photovoltaic Systems: Basic principle of power generation in a PV cell ; Types of photovoltaic cell, Application of PV ; Brief outline of solar PV stand-alone system ; Storage battery and Balance of system. (8 Hrs)

Unit III

Wind Energy Systems: Potential of wind electricity generation in India and current scenario. Wind pattern and wind speed data, Types of turbines, Coefficient of Power, Betz limit. Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid. Application for pumping (7 Hrs.)

Unit IV

Biomass Energy: Biomass: Sources and Characteristics; Wet biogas plants; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems.

Biogas-Types of bio gas plants, factors affecting production rates.

Introduction to biodiesel and ethanol as alternative fuels, (7 Hrs.)

Unit V

Energy from Ocean:

Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy.

Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India.

Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy (7 Hrs.)

UNIT VI

Fuel Cells: Introduction, working principle of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.

Hydrogen Energy: Hydrogen as alternative fuel, Production methods, Hydrogen storage, **Geothermal Energy Resources:** Hot Dry Rock system, Vapor dominated, liquid dominated, flash steam, binary fluid and total flow concept of power generation. **(8Hrs)**

Books Recommended:

TEXT BOOKS:-

1. Solar Energy, S.P.Sukhatme,TMH
2. Non-Conventional Energy Sources, G.D.Rai, Khanna Publications
3. Non-Conventional Energy Sources, B. H. Khan

REFERENCE BOOKS:-

1. Treatise on Solar Energy : H.P. Garg; John Wiley & Sons

Renewable Energy Conversion, Transmission and Storage, Bent Sorenson; Elsevier Publication

2. Renewalle Energy; GodfreyBoyle, Oxford University Press, Mumbai.

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6ME04 PROFESSIONAL ELECTIVE-I
(3) COMPUTER AIDED DESIGN & SIMULATION

Course Learning Objectives(CLOs):

1. To study product cycle & fundamentals of CAD/CAM.
2. To understand the concept of representations of curves and surfaces.
3. To study the solid modeling techniques.
4. To study the geometric transformation techniques.
5. To study basic probability & statistics and physical modeling.
6. To study Simulation of Mechanical Systems & Simulation of Manufacturing systems.

Course Outcomes (COs):

1. Understand the concept of CAD/ CAM and CIM .
2. Apply knowledge using CAD modeling for component design
3. Apply the knowledge of geometric transformation.
4. Understand the Mechanical & Manufacturing simulation systems.

Unit I: Fundamentals of CAD/CAM

Product cycle and scope of CAD/CAM/CIM in product cycle, CAD/CAM, Hardware and software, selection of software, CAD workstation configurations. (6 Hrs)

Unit II: Representations of curves and surfaces

Introduction to analytical curves, synthetic curves: Hermite cubic Spline, Bezier Curve, B-Spline curve. Surface Representation : Synthetic Surfaces, Applications of surface modeling. (6 Hrs)

Unit III: Solid Modeling

2D Vs 3D modeling, Comparison of Wireframe, surface and solid modeling techniques, Geometry Vs Topology, Requirements of Solid Modeling Methods: Constructive Solid Geometry (CSG), Boundary Representation (B-rep), etc. (6 Hrs)

Unit IV: Geometric transformation

2D geometric transformations, Homogeneous co- ordinate representation, Composite Transformations, 3D transformations, Inverse transformations, geometric mapping.(8 Hrs)

Unit V: Introduction to statistics and physical modeling

A review of basic probability and statistics, random variables and their properties ,

Estimation of means variances and correlation.
Physical Modeling- Concept of System and environment, Principles of modeling, types of models. (8Hrs)

Unit VI: Simulation of Mechanical Systems

Basic Simulation modeling, Role of simulation in model evaluation and studies, advantages of simulation

Simulation of manufacturing Systems: Introduction to Flexible manufacturing systems, Simulation software for manufacturing. (8 Hrs)

Book's Recommended-

Text Books:

1) P. N. Rao; CAD/CAM Principles and Applications; McGraw Hills Publications.
2) Mikel P. Groover and Emory W. Zimmers: Computer Aided Design and Manufacturing, Prentice hall.
3) Ibrahim Zeid: Mastering in CAD- CAM, Tata McGraw Hill Publication.
4) Geoffrey Gordon, System Simulation; Prentice Hall

Reference Book:

1) Mikell P. Groover: Automation, Production systems & Computer Integraded manufacturing, Prentice Hall.
2) Robert E. Shannon; System Simulation: The Art and Science ; Prentice Hall
3) J. Schwarzenbach and K.F. Gill Edward Arnold; System Modelling and Control
4) P. Radhakrishnan and Subramaniam: CAD/CAM/CIM, wiley Eastern Ltd.

6ME05 OPEN ELECTIVE-II
(1) NON-CONVENTIONAL ENERGY SOURCES

Course Learning Objectives(CLOs):

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):

1. Understand concept of renewable and non-renewable sources.
2. Understand the basic concept of radiation transmission through covers and solar energy collections, the basic concept of Solar energy utilization and storage.
3. Demonstrate, concept of energy from ocean and wind.
4. Understand the concept of bio-mass energy resources, concept of direct energy conversion and fuel cell.

UNIT I

1. **Introduction:-** Global and Indian energy scenario, Need of Renewable energy, need, Renewable and non renewable energy sources, energy and environment,
2. **Solar Radiation:** Solar constant, Definitions of basic earth-sun angles. Types of Solar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder, estimation of solar radiation intensity. (7 hrs)

UNIT II

Solar thermal systems. Low temperature applications: solar water heating, space heating, drying. High temperature applications, dish and parabolic collectors. Central tower solar thermal power plants.

Solar Photovoltaic Systems: Basic principle of power generation in a PV cell ; Types of photovoltaic cell, Application of PV ; Brief outline of solar PV stand-alone system ; Storage battery and Balance of system. (8 Hrs)

Unit III

Wind Energy Systems: Potential of wind electricity generation in India and current scenario. Types of turbines, Coefficient of Power, Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid. (7 Hrs.)

Unit IV

Biomass Energy: Biomass: Sources and Characteristics; Wet biogas plants ; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems. Introduction to biodiesel and ethanol as alternative fuels, (7 Hrs.)

Unit V

Energy from Ocean: Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy.

Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India.

Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy (7 Hrs.)

UNIT VI

1. **Fuel Cells :** working principle, types of fuel cells, applications.
2. **Geothermal Energy Resources:** Hot Dry Rock system, Vapor dominated, liquid dominated, flash steam, binary fluid and total flow concept of power generation. **(8Hrs)**

Books Recommended:

Text Books:-

1. Solar Energy; S.P. Sukhatme; TMH
2. Non-Conventional Energy Sources; G.D. Rai; Khanna Publications

3. Non-Conventional Energy Sources; B. H. Khan

Reference Books:-

1. Treatise on Solar Energy; H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage; BentSorensen; Elsevier Publication
3. Renewable Energy; Godfrey Boyle; Oxford University Press, Mumbai
4. Renewable Energy Sources and Emerging Technology; D.P. Kothari, K.C. Singal, Rakesh Ranjan; PHI

6ME05 OPEN ELECTIVE-II
(2) AUTOMOBILE ENGINEERING

Course Learning Objectives:

1. To study the Introduction of automobiles, engine types and working of SI and CI engines.
2. To study the fuel feed systems, their types and to understand the basics of cooling system.
3. To study the electrical system, Battery capacity and its ratings, starter motor drive and to understand the basics of Ignition system.
4. To study the basics of transmission system, clutches, gear boxes and to understand the principle of differential.
5. To study the braking system, steering system, wheel balancing and alignment and to study the introduction of power steering.
6. To study the basics of suspension system, shock absorbers and to study the types of lubricants and lubrication system, crankcase ventilation.

Course Outcomes (COs):

1. Understand the basics of automobile engineering and its components.
2. Analyze &develop about the cooling system and its function.
3. Understand basic concept of transmission system and types of gears box, basic concept of electrical system and ignition system.
4. Apply the knowledge of suspension and lubrication.

UNIT I : Introduction, Classification of automobiles, chassis layout, basic working of SI and CI engines, engine parts, engine types, Multiple cylinder engines. (7 Hrs)

UNIT II : Fuel feed systems- fuel feed systems for petrol and diesel engines, Basic principles of Multipoint Fuel Injection Systems(MPFI) and Common Rail Diesel Injection Systems(CRDI). Cooling system: purpose, Air cooling and liquid cooling system, radiator, by pass recirculation system, antifreeze mixtures. (7 Hrs)

UNIT III : The electrical system. Battery Capacity, standard capacity ratings, starter motor drive-Bendix drive. Ignition system:- Battery coil ignition system, Electronic ignition system (7 Hrs)

UNIT IV: Transmission system:- Layout, Working principle of clutch, single plate friction clutch and multiplate clutch, Gear Boxes:- Sliding mesh, constant mesh gear box, Propeller shaft, Hotchkiss drive, torque tube drive, differential. (8 Hrs)

UNIT V: Braking system: Mechanical, hydraulic brakes, power brakes and vacuum brakes. Steering system:- Function, types of linkages, steering gears, wheel balancing, wheel alignment, camber, castor, king pin inclination, toe-in& toe-out & their effects, Introduction to power steering. (7 Hrs)

UNIT VI: Suspensions : shock absorbers, Rigid axle and independent suspension system, Auto lubrication :-Types of lubricants, their ratings, multi viscosity oils. Engine lubrication:- types of lubricating systems, full pressure system, dry sump system, crankcase ventilation. (6Hrs)

Books Recommended

Text Books:-

1. Automobile Engineering- Vol. I & II; Kirpal Singh; Standard Publishers Distributors
2. Automobile Engineering; R.K. Rajput; Laxmi Publications, New Delhi

Reference Books:-

1. Automotive Mechanics; Crouse & Anglin; TMH.
2. Automotive Mechanics; J. Heitner; East West Press
3. Automotive Mechanics; S. Srinivasan; TMH.

6ME06 DESIGN OF MACHINE ELEMENTS-LAB.

Course learning objective:

1. To study the basic design principles
2. To familiarize with use of design data books & various codes of practice
3. To make conversant with preparation of working drawings based on designs

Course Outcome: After successfully completion of this course students will be able to:

1. Design various machine elements like joints, springs, couplings etc, under various conditions
2. Convert design dimensions into working/manufacturing drawing
3. Use design data book/standard codes to standardize the designed dimensions

Practical Term Work :

At least Six exercises based on the following:

1. Design of Cotter or Knuckle joint.
2. Design & drawing of screw jack.
3. Design & drawing of Riveted joints.
4. Design & drawing of leaf spring.
5. Design of shaft on the basis of various loading.
6. Design and drawing of Coupling(any one type).
7. Design and drawing of Journal Bearing Plumber Block Type).
8. Design and drawing of connecting rod in IC Engine.
9. Design and drawing of Flywheel.
10. Determine Hydrodynamic lubrication profile using Journal Bearing Apparatus.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME07 DYNAMICS OF MACHINES -LAB.

Course Learning Objectives:

1. To understand Static force analysis and Dynamic force analysis of plane mechanisms.
2. To demonstrate the use of gyroscopic couple and its effect.
3. To understand the phenomenon of vibrations.
4. To demonstrate the effect of static and dynamic balancing.

Course Outcomes:

Students will be able to

1. Apply basic concept of force analysis and lubrication mechanism.
2. Understand the knowledge of dynamic force analysis analytically and graphically.
3. Apply the knowledge of space mechanism and vehicle dynamics.
4. Understand concept of vibrations.
5. Analyze the concept of balancing of machinery.

Practicals:-

At least eight practical from the following list:

1. Study of static force analysis of mechanism. (any 2 problem)
2. Determining the inertia forces of connecting rod
3. Determination of gyroscopic couple using motorized gyroscope .
4. Study of vehicle dynamics.
5. To study the longitudinal vibration of helical spring and to determine the frequency and time period of oscillation theoretically and experimentally.
6. Experiment on free and damped vibration of systems with one degree of freedom.
7. Experiment on forced damped vibration of systems with one degree of freedom.
8. Experiment on free damped torsional vibration.
9. To verify the Dunkerley's rule.
10. To determine the natural frequency of free torsional vibration of single rotor system.
11. To determine the natural frequency of free torsional vibration of two rotor system.
12. Experiment on whirling speed of shaft.
13. Experiment on static balancing of rotating masses.
14. Experiment on dynamic balancing of rotating masses.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME08 PROFESSIONAL ELECTIVE -I - LAB
(1) TOOL ENGINEERING – LAB.

Course learning objective:

1)To study the basic geometries of different cutting tools,
2. To study cutting forces involved in machining operation using tool dynamometer.
3. To understand the steps involved in designing and drawing of various tools.
4) To understand the design and operation of various types of Jigs and Fixtures.

Course Outcome: On completion of this course students will be able to :

1. Create the design of single and multi-point cutting tools.
2. Create the design of multipoint tools like twist drills, reamers, broach and milling cutters & press working dies like punching, blanking and drawing.
3. Analyze the real time problems of work holding by designing jigs and fixtures.

TERM WORK:

(Any Six of the following)-
1. Design & Drawing of single point cutting tool.
2. Design & Drawing of Form Tools(Using Graphical Method).
3. Measurement of forces in Orthogonal cutting by Lathe Tool Dynamometer. 4. Measurement of forces & Torque in Drilling by Drill Tool Dynamometer.
5. Study of geometric Elements & Forces in Multi-Point Cutting Tool. 6. Design & drawing of Post Drill Jig.
7. Design & Drawing of Turnover Drill Jig.
8. Design & Drawing of Milling Fixture.
9. Design & Drawing of Turning Fixture.
10. Design & Drawing of Compound Die.
11. Design & Drawing of Progressive Die.
12. Design & Drawing of Drawing die.

Practical Examination : Practical exam shall consist of viva-voce based on the term work and theory syllabus.

6ME08 PROFESSIONAL ELECTIVE -I – LAB
(2) NON-CONVENTIONAL ENERGY SOURCES – LAB.

Course Learning Objectives(CLOs):

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

Course Outcomes (COs):

1. Understand concept of renewable and non-renewable sources.
2. Understand the basic concept of radiation transmission through covers and solar energy collections, the basic concept of Solar energy utilization and storage.
3. Demonstrate, concept of energy from ocean and wind.
4. Understand the concept of bio-mass energy resources, concept of direct energy conversion and fuel cell.

List of practicals :

Any six practicals will be based on the following topics :-

1. Study of Pyrheliometer and measurement of direct radiation.
2. Study of pyranometer and measurement of global and diffuse radiation.
3. Study of sunshine recorder and measurement of sunshine hours.
4. Study and testing of a flat plate recorder.
5. Study of biogas plant.
6. Study of photovoltaic system,
7. Study of various types of Wind mill.
8. Study of various solar equipment.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME08 PROFESSIONAL ELECTIVE -I – LAB

(3) COMPUTER AIDED DESIGN & SIMULATION

Course Learning Objectives(CLOs):

1. To understand fundamentals of CAD.
2. To study the solid modeling techniques.
3. To study the geometric transformation techniques.
4. To demonstrate Simulation of Mechanical Systems.

Course Outcomes (COs):

1. Understand the concept of CAD.
2. Apply knowledge using CAD modeling for component design
3. Apply the knowledge of geometric transformation.
4. Understand the Mechanical & Manufacturing simulation systems.

Practicals:-

Any six practicals from the list should be performed.

1. Creation of 2D drawing (Sketching Module) of any mechanical machine component using any modeling/drawing software.
2. Creation of isometric view from given orthographic view of any mechanical machine part using any modeling software.
3. Creation of 3D drawing of any mechanical machine part using any modeling software.
4. Creation of assembly of Knuckle joint/ Cotter joint using any modeling software.
5. Creation of sheet metal component using any modeling software.
6. Simulation of Four bar chain mechanism using any modeling software.
7. Simulation of Slider crank chain mechanism using any modeling software.

Practical Examination:- The practical examination shall consist of oral on the termwork and syllabus.

6ME09 RESEARCH SKILLS – LAB

Course learning objective:

1. Apply fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study.
2. Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
3. Use effectively oral, written and visual communication.
4. Identify, analyze, and solve problems creatively through sustained critical investigation.
5. Integrate information from multiple sources.
6. Demonstrate an awareness and application of appropriate personal, societal, and professional ethical standards.

7. Practice the skills, diligence, and commitment to excellence needed to engage in lifelong learning.

Course Outcome:

1. Demonstrate a sound technical knowledge of their selected research topic.

2. Undertake problem identification, formulation and solution.

3. Design engineering solutions to complex problems utilizing a systems approach.

4. Conduct an engineering research.

5. Demonstrate the knowledge, skills and attitudes of a professional engineer.

Students will have to perform any one task and prepare a report on it; from the following list

1. A mini project involving mechanisms/ electromechanical systems/
2. CAD modeling/ simulation of any thermal, hydraulic or mechanical system.
3. IoT based system for any domestic/ rural/ agricultural/ industrial application
4. A system using non- conventional energy source
5. Market research for launching a new product.
6. Study of any Small Scale Industry.
7. Any other innovative concept for promoting research and innovation among students.

***Practical Examination:-** The practical examination shall consist of oral based on the task and the report.

NOTIFICATION

No. 67 /2022 Date : 18/06/2022

Subject : Implementation of new Syllabi of Semester VII & VIII of B.E. (Mechanical Engg.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum…

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of **Semester VII & VIII of B.E. (Mechanical Engineering)** (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2022-23 onwards as per ñ**Appendix – A**ò as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

ñ**Appendix A**ò

SYLLABUS OF B.E. SEM. VII & VIII (MECHANICAL ENGINEERING) [C.B.C.S.]

SEMESTER VII

7ME01 MECHATRONICS

Course Learning Objectives (CLOs):

1. To study various types of switches, sensors, motors and their working.
1. To understand the concept of computer process control.
2. To study various parts of mechatronic system.
3. To study various types of valves and their working.
4. To understand and create pneumatic and hydraulic circuits for various industrial applications.

Course outcomes (CO):

2. Understand the concept of computer process control.
3. Create the working models for various mechatronics system for industrial applications.
4. Create mini projects on material handling systems like pick and place type robot, machine loading system etc.
5. Create pneumatic and hydraulic circuits for various industrial applications.

SECTION-A

Unit I : Introduction to Mechatronics :
Definition, Block diagram & Example, Basics of Sensors, Position & Speed Sensors, Proximity Sensors & Switches, LVDT, Digital optical encoder, Temperature Sensors Actuators-Functions, Electromagnetic Principles, Solenoids and Relays, working of DC motors and stepper motors, hydraulic and pneumatic actuators. (6 Hrs.)

Unit II: Data Acquisition: Analog signal processing using operational amplifier- Introduction, types of amplifiers, sample and hold circuit, introduction to data acaquisiton, sampling thermo, Quantizing theory, Analog to digital conversion, Analog to digitalconvertor, Digital to analog conversion, Multiplexer. (6Hrs)

Unit III: Mechatronic Systems – control architecture Introduction, Control architecture, Analog circuits, digital circuits, Design of logic networks, sequential logic, flip-flops, application of flip-flops, micro-controlrs, Programmable logic controller. (6Hrs)

SECTION - B

Unit IV: Control Valves –
Study of different control components and pneumatic & Hydraulic system- Construction, worling and function of Directional control valve, Flow control valves, Pressure relief valve, pressure reducing valve, sequence valve with symbols. (7 Hrs)

Unit V: Pneumatic System –
Design and analysis of pneumatic circuits, Synchronizing, Powerchucking operations, controlling the rate of speed of piston, circuit to move with piece around a corner, circuit to move a workpiece at a constant speed. (6 Hrs)

Unit VI: Hydraulic System –
Design analysis of Hydraulic systems-Sequencing, pneumo-hydraulic, regeneration circuit, circuit to control tool movement on lathers, grinders, etc.(7Hrs)

BOOKS RECOMMENDED :

Text Books:

1. Introduction to Mechatronics and Measurement systems- 2/e byAciatore and M.B.Histant, Tata McGraw Hill edition.
2. Pneumatics and Hydrautics by H.L.Stewart.

Reference Books:

1) Introduction to Mechatronics by Appus Kuttan K.K.- OxfordUniversity Press.
2) Mechatronics ï A multidisciplinary approach 4/e by W.Bolton-Pearson Publication,
3) Automation, Production systems and CIM by M.PGroover- PearsonPublication.

7ME02 PRODUCTIVITY TECHNIQUES

Course Learning Objectives:
1-To measure and evaluate productivity
2-To Plan and implement various productivity techniques
3-Reengineer the process for improve productivity
4-To implement BPR tools for improving the productivity

Course Outcomes: After learning the course the students should be able to:
1. Understand Productivity.
2. Differentiate Method Study & Work Measurement.
3. Apply Ergonomics Principles.
4. Analyze Wedge payment & Incentive Plans.
5. Implement reengineering.
6. Understand different Maintenance methods.

SECTION-A

UNIT-I: **Productivity** Definition, Concept and Importance of productivity, Difference between Production and Productivity, Tools of productivity, Reasons for low productivity, Factors that help increasing productivity, Productivity index, Productivity ratio , Kinds of productivity measurement, Causes of low productivity and techniques of their elimination, Factors affecting productivity, Technical methods to improve productivity, Main contributors to productivity improvement, Advantages from increased productivity. (7 Hrs)

UNIT-II: **Method Study** Definition, Concept , Objectives and Procedure of method study, Process chart symbols, recording techniques like Flow process charts, Operation, Flow and Two handed Process charts, Flow diagram, String diagram, Multiple Activity chart, Operation Analysis, Analysis of motion, Motion economy, Design of work place layout, Therbligs, SIMO chart. (7 Hrs)

UNIT-III-Work Measurement Definition, Concept and Objectives of work measurement, Stop watch procedure for collecting time study data, Time estimating techniques like analytical estimating, Predetermine Motion Time System-PMTS, Elemental Motion Time System, Basic Motion Time System, Method Time Measurement, Work factor. (7 Hrs)

SECTION-B

UNIT-IV-Ergonomics Introduction, Principles, Work system design, Man-machine system, Human behavior and equipment design, Tools, Techniques and applications, Effect of environment on performance of worker. (7 Hrs)
UNIT-V- **Performance Rating, Wage Payment & Incentive Plans** Introduction, Various incentive schemes, Performance Rating.

Contemporary Issues in Productivity Activities of National Productivity Council and other organizations, Productivity Scenario and changes. (7 Hrs)

UNIT-VI: **Business Process Re-engineering (BPR)** Introduction, Development of Business Process Re-engine, BPR is not for everyone, Advantages of BPR, Steps involved in BPR, Application of BPR, Training for BPR, When to reengineer, Ways to fail at BPR, Requirements of BPR, Human Resource Engineering, Fundamentals of BPR, Implementation methodology of BPR, Organizational re-engineering, Organizational reengineering process, Reengineering values, Approach to reengineering, Re-engineering tools, What re-engineering is not, Kinds of changes that occurs in re-engineering, succeeding. (7 Hrs)

RECOMMENDED BOOKS:

Text Books:

1.Work Study, Khanna , Dhanpat Rai Publications
2.Total Quality Management , K.C.Arora, Katsons
3.Industrial Engineering and Management, Khana, Dhanpat Rai.

Reference Books:

1. Introduction to Work study, ILO, Oxford
2. Industrial Engineering and Management, Reddy, New Age
3. Industrial Engineering and Management, Verma.

7ME03 INDUSTRIAL MANAGEMENT & COSTING

Course Learning Objectives (CLOs):

1. To study basic concepts & techniques of management.
2. To study the concept of marketing management.
3. To understand the personnel management & materials management techniques.
4. To study the estimation procedure for raw material and machining processes in manufacturing.
5. To study the costing process & costing techniques.
6. To study business finance, financial statements and depreciation analysis.

Course Objectives (COs):

1. Understand the working of business environment.
2. Understand the management thoughts, its evolution and functions.
3. Apply standard and scientific techniques in materials management.
4. Evaluate time, costs, cost sheet and depreciation of industry.

SECTION-A

UNIT I : Concept, Principles and Techniques of Management; Evolution of management thoughts, functions of management, organizationstructure & relationship. (6-Hrs)

UNIT II: Marketing and Management : Marketing strategy market research, buying, motives, types of market, new product development, Product life cycle, Sales Organization, advertising, methods of selling, consumer behaviour. (6-Hrs)

UNIT III: a) Functions of personnel management, Human resource planning, Recruitment, training and development, workersparticipation in management, joint consultation, collective bargaining.

b) Materials management, classes of materials, scope of material control, scope and function of purchasing department, purchasing procedure, inventory control, ordering procedure, material identification, store function. . (7Hrs)

SECTION-B

UNIT IV: Objectives, functions, principle factors of estimating and estimating procedure, Estimation of weights & materials, Estimation of machining time, estimation of fabrication cost, forging cost, and foundry cost. (6-Hrs)

UNIT V : a) Introduction to costing and costing Techniques: Definitions, objectives, elements of costs, components of cost, job costing, simple process costing, normal and subnormal losses in process, waste, scrap. (8 Hours)

UNITVI: a) Financing of Business: - Basis of business finance, need of finance, Kinds of capital, sources of fixed & working capital.

b) Financial statements :- Profit and loss statement, balance sheet

c) Depreciation Analysis: - Causes and significance, methods of calculation of depreciation. (7 Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Management-principles, processes and practicals, Anil Bhat, Aryakumar; Oxford University Press
2. Management Accounting; Paresh Shah; Oxford University Press
3. Estimating and costing; TTTI Madras.

Reference Books:

1. Essentials of Management; Koontz, Harold; McGraw-HillEducation(India)
2. Cost Accounting; Jawahar Lal; Tata Mcgraw Hill Publishing
3. Cost Accounting by Bhar.

7ME04 ENERGY CONVERSION – II

Course Learning Objectives (CLOs):

1. To study the construction, working and overall performance of a reciprocating compressor.
2. To study the construction, working and overall performance of a rotary compressor.
3. To study the vapour compression refrigeration system with reference to domestic refrigerator.
4. To study various types of air conditioning systems.
5. To study various aspects of a gas turbine plant along with different techniques to improve its performance.

Course Outcomes(CO):

1. Understand the working of different types of compressors.
2. Analyze, handle and resolve the problems related to working of air compressor.
3. Understand the principle of working of refrigeration systems, air conditioning and its applications.
4. Understand various nuclear reactions and issues related to working and maintenance of nuclear power generation.

SECTION – A

UNIT-I: **Reciprocating, Air Compressions**: **-** Industrial uses of compressed air , Methods of compression and efficiencies of compression, Methods of reducing losses during compression
single and multistage of compressions, clearance volume and its effect on work done and volumetric efficiency, condition forminimum work in tow stage compression, inter-cooling and itseffects, Overall, isothermal and adiabatic efficiencies, IHP, BHP,requirements and after cooler. (7 Hours)

UNIT-II: **Rotary Compressors** :- Comparison between reciprocating androtary compressors, difference between fans, blowers and compressors, general equations for rotary machines, Vane, Roots blower, construction, working and velocity diagrams of centrifugal and axial flow compressors, performance characteristics of blowers and compressors. (8 Hours)

UNIT-III: **Refrigeration:** Principle of refrigeration, Applications, Unit of refrigeration, Carnot vapour cycle, reversed heat engine, CoP.
Air refrigeration System, Vapour compression Refrigeration cycle Coefficient of Performance, Numericals based on simple saturated cycle. Vapour absorption refrigeration systems (8 hours)

SECTION-B

UNIT IV: Air-conditioning: Principle of Air conditioning , Classification and applications of Air conditioning system, Psychrometry, Psychrometric chart, Psychrometric processes related to Air conditioning, Adiabatic Mixing of two Air-streams. Elementary simple problems based on Psychrometric chart. (7 hours)

UNIT -V: **Classification of gas turbines**, construction and working Gas turbine ideal and actual cycles constant volume, constant pressure, (Open and Closed) cycle analysis, Inter cooling, Regeneration and reheating application, optimum and maximum pressure ratios, work rations, Performance characteristics. Fields of application of gas turbine power plant, Introduction to Jet Propulsion, Ram jet, turbo jet. (No numerical treatment for JetPropulsion). (8 Hours)

UNIT-VI: **Introduction to Automobiles and Electric vehicles:**,

General lay out of the automobile, Classification of automobiles, various subsystems and their role. Basics of vehicle performance.

Introduction to Hybrid and Electric Vehicles: basic concept of hybrid and electric vehicles and their configurations, environmental importance of hybrid and electric vehicles, Basic concept of electric traction and architecture. Introduction to electric components used in hybrid and electric vehicles, Configuration and control of; drives use in EV. (8 Hours)

RECOMMENDED BOOKS:

Text Books:

1. Steam and gas turbines R, Yadav; Central Publication Allahabad.
2. Thermal Engineering, Domkundwar, Kothandarawar, Dhanpat Rai &Co.
3. Power Plant Engineering; R.K.Rajput; Laxmi publication.
4. Solar Energy by S.P.Sukhatme; Tata McGraw-Hill in New Delhi.

Reference Books:

1. Thermal engineering by Mahesh M.Rathore; Tata McGraw-Hill inNew Delhi
2. Gas Turbines Theory- By Cohen and C.F.Rogers, P.H.I.H.Saravanamuttoo Heritage Publishers,
3. Gas Turbines and Rotary compressors, Khajuria and Dubey, DhanpatRai & Co.
4. Thermal Engineering: R.K.Rajput, Laxmi Publication.
5. Renewable Energy; Godbfrey Boyle, Oxford University Press.

7ME05 PROFESSIONAL ELECTIVE – II
7ME05 (i) COMPUTER INTEGRATED MANUFACTURING

Course Learning Objectives:

1. Apply technical knowledge of manufacturing processes to the fabrication of mechanical parts.
2. To produce knowledgeable users of CAD systems.
3. Understand the various CAD/CAM and CNC processes.
4. To understand the associatively between design and manufacturing.

Course Outcomes:

1. Able to Specify a quality control method for analyzing a finished product.
2. To develop a strategy for implementing computer integrated manufacturing.
3. To synthesize and apply the concepts learnt
4. Describe various operation in numerical control system and part programming
5. Describe CNC machining and interfaces of CAM and CNC
6. Undertake, under supervision, laboratory experiments to design in CAD and to program in CAM for machining.

SECTION A

Unit I - Computer aided design, Fundamentals of CAD, Design process, Application of computer for Design, The design of workstation, Function of graphic package , constructing the geometry, Transformation (2D), wire frame , Surface , Solid modeling, Benefits of CAD. **(7-Hrs)**

Unit II-Computer aided manufacturing:- Automation and its types, Numerical control, Basic concept, NC Control- point to point, Straight line, Continuous path control, Machine control unit, Drives in NC/CNC- Servo and Stepper motors, CNC & DNC types. **(7-Hrs)**

Unit III-CNC Part Programming: Part programming manual, Computer assisted part programming, Programming formats, Programming codes, Programming for drilling, milling, turning.
Programming with APT: MACRO statements, Subroutine and loops in programming. **(7-Hrs)**

SECTION B

Unit IV-Robotics: Technical features of robots, Geometric configurations of robots, Robot anatomy, Arm geometry, End effectors, Drives system, sensors- tactile, proximity range finder, machine vision, work cell controller and interlocking sensor commands, programming technique for robot, Application of robots in manufacturing, Economic justification of robots (Payback, Returns on Investment methods). **(7-Hrs)**

Unit V -Flexible Manufacturing System:
Basic concept, group technology, part families, part classification and coding system, GT machine cells, Types of FMS, FMS layout configurations, Planning of FMS, Types of CAPP. **(7-Hrs)**

Unit VI-Computer Integrated Manufacturing:
Concept, Elements of CIM system, Structure of CIM data base system, CIM wheel, CIM shop floor control and process monitoring, Automation.
Inspection and testing: **-** Online and offline inspection, Distributed inspection.
ASRS and its elements, AGVS, Guidance, routing and traffic control in AGV. **(7-Hrs)**

BOOKS RECOMMENDED:

Text Books:

1) Robotics by Rajput
2) CAD/CAM by P.N. Rao.

Reference Books:

1) Computer aided Design and Manufacturing by Sadhu Singh
2) Production system, Automation and CIM, Mikhal Groover, Pearson Publication.
3) CNC Machines: M. Aditham & B.S. Pabla, New Age International.

7ME05 PROFESSIONAL ELECTIVE – II
(ii) AUTOMOBILE ENGINEERING

Course Learning Objectives (CLOs):

1. To study types of automobiles, chassis and engine types, engine parts, firing orders for multi-cylinder engines, general considerations of engine balancing.
2. To study the fuel feed systems, fuel pump, fuel filters, air filters, MPFI and CRDI systems, types of cooling systems, antifreeze mixtures.
3. To study electrical system, battery capacity and ratings, starter motor drives, ignition systems, ignition timing and its effect on engine performance, ignition advance mechanisms.
4. To study the transmission system, types of clutches and gear boxes, overdrive, propeller shaft, differential gear, rear axle drives, automatic transmission.
5. To study braking system, types of brakes, steering system, steering gears, steering gear ratio, wheel balancing and alignment, power steering.
6. To study suspension systems, shock absorbers, different lubricants and their properties, engine lubrication systems, oil pumps, chassis lubrication, crankcase ventilation.

Course Outcomes (COs):

1. Understand the basics of automobile engineering and its components.
2. Idea creation of cooling system, electrical system and ignition system.
3. Analysis of transmission system and types of gears box.
4. Design and development of suspension and lubrication.

SECTION – A

Unit I : Classification of automobiles, chasis types, Power Unit- Functions and locations power for propulsion, engine parts- types, construction and functions, Multiple cylinder engines, General considerations of engine balancing, firing order. (7 -Hrs)

Unit II : Lubrication system: Purpose, types of lubricants, Types of lubricating system- splash, pressure and dry sump lubricating system.
Fuel supply system: types of fuel supply system, components of fuel supply system, M.P.F.I. and C.R.D.I.
Cooling system ï purpose, types, bypass recirculation system and antifreeze mixture. (6-Hrs)

Unit III: Ignition system- types of ignition system- Battery and Electronic ignition system, Ignition timing, Ignition advance mechanism ï centrifugal and vaccum type advanced mechanism.
Starting system- Purpose, starting drives- Bendix drive. (7 Hrs)

SECTION – B

Unit IV : Transmission system : Clutches, Single plate & multiplate, Gear Boxes :- Sliding mesh, constant meshand synchromesh gear box, Automatic gear box.

Differential- Construction and working.

Suspension system- types, telescopic type, shock absorber. (8 Hrs)

Unit V: Braking system:- Mechanical, Hydraulic, Vaccum and air brake system, Anti-braking system. Steering system:- Layout, steering gears, wheel alignment, steering geometry, camber, caster, king pin inclination and toe in and out. **Power steering-** Principle and working.. (7-Hrs)

Unit VI : Electric &Hybrid vehicles. Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives. Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices (8 Hrs)

BOOKS RECOMMENDED :

Text Books :

1. Automobile Engineering- Vol.I & II, Kirpal Singh, Standard PublishersDistributors
2. Automobile Engineering ï R.K.Rajput; Laxmi publications, New Delhi.
3. Iqbal Hussain, ñElectric & Hybrid Vehicles ï Design Fundamentalsò, Second Edition, CRC Press, 2011.

Reference Books:

1. Automotive Mechanics; Crouse & Anglin, TMH.
2. Automotive Mechanics ; J Heitner; East West Press.
3. Automotive Mechanics ; S.Srinivisan; TMH.
4. James Larminie, ñElectric Vehicle Technology Explainedò, John Wiley & Sons, 2003.

7ME05 PROFESSIONAL ELECTIVE – II
(iii) DESIGN OF TRANSMISSION SYSTEM

Course Learning Objectives:

1. To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
2. To understand the standard procedure available for Design of Transmission of Mechanical elements.
3. To learn to use/selection of standard data and catalogues from data book .

Course Outcomes:

Upon the completion of this course the students will be able to design of transmission systems for engines and machines elements includes -

1. Slection of belts, chains and rope drives
2. Failure theories Gears & design of spur gear
3. Interpret the concepts of design of fluid couplings and torque converters
4. Design of gear boxes
5. Design of design of cams, brakes and clutches

SECTION-A

UNIT I -Design of Flexible Elements:

a) Design &Selection of Flat belts,
b) Selection of V belts,
c) Selection of hoisting wire ropes
d) Selection of transmission roller chains and Sprockets. (07 Hrs.)

UNIT II -SPUR GEAR:
Speed ratios and number of teeth, Force analysis, Tooth stresses, Dynamic effects, Fatigue strength ,Factor of safety ,Gear materials, Design of straight tooth spur. (06 Hrs.)

UNIT III: FLUID COUPLING AND TORQUE CONVERTER:

a) Fluid Coupling- Fluid Coupling Diagram, Working Of Fluid Coupling, Application of Fluid Coupling.
b) Torque Converters ï Torque Converter Diagram ,working of Torque converter , Application of Torque Converter. Difference between Fluid Coupling and Torque Converter. (06 Hrs.)

SECTION-B

UNIT IV GEAR BOXES:
Geometric progression ,Standard step ratio , Ray diagram, kinematics layout, Design of sliding mesh gear box ,working of constant mesh gear box ,working of multi speed gear boxs. (07 Hrs.)

UNIT V CAMS :
Cam Design: Types, pressure angle and under cutting base circle determination, forces and surface stresses. (6 Hrs.)

UNIT VI CLUTCHES AND BRAKES
a) Design of plate clutches, axial clutches, cone clutches, internal expanding rim clutches, Concept & working of Electromagnetic clutches.
b) Design of Band and Block brakes, external shoe brakes, Internal expanding shoe brake. (07 Hrs.)

BOOKS RECOMMENDED:

Text Books:
1) Machine Design- R.S.Khurmi and Gupta J.K., Published by S Chand.
2) Machine Design-Dr.P.C.Sharma, D.K.Agrawal, S.K.Kataria and Sonôs Publications.
3) Prabhu. T.J., ñDesign of Transmission Elementsò, Mani Offset, Chennai.

Reference Books:

1) Machine Design Exercises - S.N. Trikha, Khanna Publications, Delhi
2) Machine Design - An Integrated Approach - Robert L. Norton - Pearson Education Asia.
3) Maitra G.M., Prasad L.V., ñHand book of Mechanical Designò, II Edition, Tata McGrawHill.
4) Machine Design fundamentals ï Mechanical designer workbook, J.E.Shigley, Published by Mc Graw hill .
5) Design of Machine Elements-V B Bhandari,McGraw hill .
6) Machine Elements in Mechanical M.F. Spotts , prentice hall india,
7) Machine Design, Black P.H., Published by Mc Graw Hill.
8) Design Data Book by- P.S.G. Coimbatore,
9) Design Data Book by V.B.Bhandari,

(Use of any data book from the above will be permitted during the examination).

7ME05 PROFESSINAL ELECTIVE-II
(iv) COMPUTATIONAL FLUID DYNAMICS

Course Learning Objectives:
- To numerically **solve** governing partial differential equations for physical problems in fluid mechanics and heat transfer.
- To **analyze** different mathematical models and computational methods for transport processes.
- To **study**, and **apply** discretization methods & schemes and analyze its effect on the accuracy of numerical solution and computational time.
- To **demonstrate** the ability to use modern CFD software tools.

Course Outcomes:
On completion of the course, student will be able to:

- Numerically **solve** the governing partial differential equations of fluid flow and heat transfer problems.
- **Construct** and solve the different mathematical models and computational methods for fluid flows.
- **Apply** the discretization methods to solve fluid flow and heat transfer problems.
- **Choose** and justify the CFD schemes for the respective fluid flow/transport phenomena problem.
- **Perform** verification and validation of numerical model.
- **Demonstrate** the ability to use modern CFD software tools.

SECTION – A

Unit I: Governing equations and Boundary conditions:
Introduction to Computational Fluid Dynamics, Governing equations of fluid dynamics: Continuity, momentum and energy equations, Classification of partial differential equations: parabolic, elliptic, hyperbolic. Boundary and initial conditions; physical behaviour, overview of finite difference, finite element and finite volume methods. Overview of numerical methods. (7-Hrs)

Unit II: Finite Difference Method - Derivation of finite difference equations ï Simple Methods ï General Methods for first and second order accuracy- explicit, implicit, stability requirement, boundary conditions. Convergence, Errors and analysis of stability.
Methods of Solution: Solution of finite difference equations Solution procedures: direct and iterative methods. (7-Hrs)

Unit III: Finite volume method: fundamental concepts, discretization of 1-D steady state and 1-D unsteady state diffusion problems, explicit and implicit schemes, consistency, stability and convergence, discretization of 1-D and 2-D diffusion problems. Difference between the FDM and FVM methods. (7-Hrs)

SECTION – B

Unit IV: Grid Generation Method: Definition and types of grid, Transformation of equation, Matrices and Jacobians, Stretched Grids, Elliptic Grids, Adaptive grids. Numerical solution of the flow field: QUICK and SIMPLE algorithm. (7-Hrs)

Unit V: Turbulence models: Reynolds Average Navier-Stokes equation, RANS turbulence Models, two equation (k-ɩ) models, Large Eddy Simulation. (Elementary treatment only) (7-Hrs)

Unit VI: Introduction to CFD software and Applications:

Application of modern CFD software Open FOAM/ANSYS/FLUENT/STAR-CCM+/MATLAB: analysis for fluid and heat transfer problems. Heat transfer analysis in a double pipe heat exchanger. Internal fluid flow and heat transfer study in a centrifugal pump. Heat conduction study in 2D flat plate. Simulation of a generic convection-diffusion transport equation with forced/natural convention over flat plat/in pipe. External flow analysis over airfoil and over cylinder. (7-Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Anderson, D., Tannehill, J. C., &Pletcher, R. H. (2016). Computational fluid mechanics and heat transfer. CRC Press.
2. Patankar, Suhas. Numerical heat transfer and fluid flow. Taylor & Francis, 2018.
3. Introduction to Computational Fluid Dynamics Anil W. Date Cambridge University Press, 2005.
4. Ghoshdastidar, P.S., Computer Simulation of flow and heat transfer, Tata McGraw.

Reference books:

1. Introduction to Computational Fluid Dynamics: The Finite Volume Method, Versteeg, H. K. and Malalasekara, W., Second Edition (Indian Reprint) Pearson Education, 2008.
2. Muralidhar, K., &Sundarajan, T. (2003). Computational fluid flow and heat transfer. Alpha Science International.
3. Chung, T. J. (2010). Computational fluid dynamics. Cambridge university press.
4. Prodip Niyogi, Chakrabarty .S.K., Laha .M.K. Introduction to Computational Fluid Dynamics, Pearson Education, 2005.

7ME06 MECHATRONICS – LAB.

Course Learning Objectives:

1. Understand key elements of Mechatronics system, representation into block diagram
2. Understand concept of transfer function, reduction and analysis
3. Understand principles of sensors, its characteristics, interfacing with DAQ microcontroller
4. Understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial application
5. Understand the system modeling and analysis in time domain and frequency domain.
6. Understand control actions such as Proportional, derivative and integral and study its significance in industrial applications.

Course Outcomes:

1 **-** Identification of key elements of mechatronics system and its representation in terms of block diagram.
2 **-** Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O .
3 **-** Interfacing of Sensors, Actuators using appropriate DAQ micro-controller.
4 **-** Time and Frequency domain analysis of system model (for control application).
5 **-** PID control implementation on real time systems.
6 **-** Development of PLC ladder programming and implementation of real life system.

List of Practicals: (Any- 5):

1. Study of pneumatic system
2. Study of PLC and implementation of real life system.
3. Study of Pick & Place robot.
4. Study of bottling plant
5. Study of digital to analog converter
6. Study of D.C. motor control unit.
7. To study applications of sensors and actuators

***Practical Examination:** Practical Examination shall consist of viva voce based on the term work and syllabus.

7ME07 ENERGY CONVERSION II – LAB.

Course Learning Objectives:
1. To study performance of a reciprocating compressor.
2. To study the construction, working and overall performance of a rotary compressor.
3. To study the vapour compression refrigeration system with reference to domestic refrigerator.
4. To study various types of air conditioning systems.
5. To study gas turbine plant with different techniques to improve its performance.

Course Outcomes: Students are able to**-**
1. Understand the working of different types of compressors.
2. Analyze, handle and resolve the problems related to working of air compressor.
3. Understand the principle of working of refrigeration systems, air conditioning and its applications.
4. Understand various nuclear reactions and issues related to working and maintenance of nuclear power generation.

List of Experiments (any 8) :

Any six of the following :-
1. Trial on reciprocating compressor.
2. Trial on centrifugal blower.
3. Studies of domestic refrigerator.
4. COP calculation of vapour compression system.
5. Study of vapour absorption system
6. Study of room air conditioner.
7. Study of gas turbine with the help of models.
8. Study of general layout of conventional automobile and its subsystems.
9. Study of the general layout of electric vehicle.

***Practical Examination shall consist of viva voce based on above term work.**

7ME08 **PROFESSIONAL ELECTIVE – II`**
(i) COMPUTER INTEGRATED MANUFACTURING- LAB.

Course Learning Objectives:
1. Apply knowledge of manufacturing processes .
2. knowledgeable users of CAD systems.
3. Understand the various CAD/CAM and CNC processes.
4. Understand the application based conceptual knowledge design and manufacturing for COE

Course Outcomes:
1. Able to specify a quality control & analyzing a finished product.
2. To apply strategy for implementing computer integrated manufacturing.
3. To synthesize and apply the concepts learnt
4. To understand laboratory experiments to design in CAD and to program in CAM for machining.

List of Practicals: (Any 6):

1. Preparation of Manual part program.
2. Preparation of CNC part program.
3. Study of anatomy, configuration of industrial robot.
4. Simulation of CNC Machining.
5. Performance on NC and CNC m/c.
6. Study of programming methods of industrial robots.
7. Creation of 2D Drawing (Sketching module) of any mechanical machine component using any modeling /drafting software.
8. Creation of 3D drawing (part Module) of any mechanical machine parts using any modeling software.

***Practical Examination shall consist of viva voce based on above term work.**

7ME08 PROFESSIONAL ELECTIVE – II
(ii) AUTOMOBILE ENGINEERING – Lab.

Course Learning Objectives (CLOs):

1) To study types of automobiles and its parts functioning.
2) To study the fuel feed systems ,cooling.
3) To study electrical system, battery capacity and ratings.
4) To study the transmission system
5) To study braking system
6) To study and understand suspension systems.

Course Outcomes (COs):

1. Apply basic principles and knowledge of automobile engineering and its components for proper functioning.
2. Analysis concept of cooling system, electrical system and ignition system.
3. Interpret basic concept of transmission system and types of gears box.
4. Remember the concept of suspension and lubrication.

List of Practicals (Any 6):

1) Classification of Automobiles & Automobile Chassis.
2) Study of Differential Mechanism of an Automobile .
3) Study & Application of Multiple Clutch of an Automobile
4)Study ,working and operation of Braking System (Hydraulic / Air Brake)
5) Study and Demonstration of different circuit of carburetor
6) Checking the spark plug and setting the port and check the ignition in the spark plug
7) Study & Demonstration of Electrical System of an Automobile
8) Study the assembly of Car Engine
9) Study and demonstration of E vehicle.
10) Study of types of Batteries and Batteries maintenance used in E vehicle.
11) To study the stepper motor and to execute microprocessor computer based control of the same by changing number of steps, the direction of rotation and speed E vehicle.

***Practical Examination shall consist of viva voce based on above term work.**

7ME08 PROFESSIONAL ELECTIVE-II
(iii) DESIGN OF TRANSMISSION SYSTEMS-LAB.

Course Learning Objectives:
1. To apply standard design procedure available for Design of Transmission of Mechanical elements.
2. To Learn to use/selection of standard data from catalogues /data book .

Course Outcomes:
Upon the completion of this course the students will be able :
1. To implement and selection of belts, chains and rope drives
2. To **identify** failure spur gear and design its dimensions.
3. To **study** idea of fluid couplings and torque converters
4. To **interpret** design of gear boxes
5. To **analyze** failure theories of cams, brakes and clutches

List of Exercises for Term Work:
1. Sheet 1: Design of Flexible Elements (any one ï flat belt drive, V belt drive or Wire rope).
2. Sheet 2: Design and Selection of Roller Chain with sprocket.
3. Sheet 3: Design of spur gear.
4. Sheet 4: Design Fluid Coupling.
5. Sheet 5: Design of Torque Converter.
6. Sheet 6: Design of sliding mesh gear box.
7. Sheet 7: Design of Plane flat Radial Cam.
8. Design of Clutch (any one - plate clutches, axial clutches, cone clutches, internal expanding rim clutches)
9. Design of Brake (any one - external shoe brakes or Internal expanding shoe brake).

[Note: - Minimum 5 term work should be submitted for lab work.]

***Practical Examination:-**shall consist of Viva-voce on the above syllabus and submission of term work.

7ME08 PROFESSIONAL ELECTIVE –II
(iv) COMPUTATIONAL FLUID DYNAMICS -LAB.

Course Objectives:

- To utilize the various computational tools to understand the fluid flow.
- To employ the various computational tools to comprehend heat transfer problems.
- To apply the knowledge of several numerical schemes to solve the governing equations of physical systems.
- To understand and simulate several flow situations with forced/natural convection with Internal and external flows.
- To validate the simulation results with that of existing experimental/analytical results.

Course Outcomes:
On completion of the course, student will be able to:

- Understand the computational software tools to analyze the fluid flow problems.
- Utilize various computational tools to comprehend heat transfer problems.
- Classify and evaluate the physics of problems and apply the appropriate discretization schemes.
- Analyze and understand the results through post-processing for a given problem.
- Compare the simulation results with that of existing experimental/analytical results.

List of Experiments: (Any six experiments)
1. Perform numerical analysis on flow through pipe with varying Reynolds Number.
2. To calculate hydrodynamic length and boundary layer thickness for pipe flow numerically.
3. To calculate lift and drag co-efficient for a cylinder by using numerical analysis.
4. External flow analysis over airfoil for different angle of attacks.
5. Fluid flow and heat transfer analysis in a double pipe heat exchanger.
6. Perform Numerical analysis on compressible flow in nozzle.
7. Perform Numerical analysis on heat conduction through wall.
8. Couette flow analysis for either explicit or implicit formulation (Parabolic equation).
9. Heat conduction in 2D flat plate with explicit and implicit formulation (Elliptic equation).
10. Perform Numerical analysis on steady flow past a cylinder
11. Study of different turbulent models to analyze the flow in a pipe for various Reynolds number.
12. Perform Numerical analysis on convective heat transfer.

*Practical Examination shall consist of viva voce based on above term work.

7ME09 : TECHNICAL SEMINAR & PROJECT

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SEMESTER: VIII

8ME01 OPERATION RESEARCH TECHNIQUES

Course Learning Objectives (CLOs):
1. To study operation research models and linear programming methods.
2. To understand transportation models and assignment models.
3. To study waiting line models and understand the concept of sequencing.
4. To study replacement models and simulation models.
5. To understand the concept network models, CPM and PERT analysis.

Course Outcomes (CO):
1. Understand the knowledge of OR and OR models.
2. Analyze the transportation problems and related issues.
3. Understand the concept network models, CPM and PERT analysis.
4. Understand the concept replacement models and solve the problem on simulation techniques.

SECTION – A

UNIT I: Operations Research : Introduction, characteristics, Phases, Limitations, Models and classification of O.R.Models.
Linear Programming: Formulation, Standard Form, Graphical and simplex methods, Primal-Dual relationship. (8 Hrs)

UNIT II: **Transportation Models: Introduction**, LP Formulation of transportation problems, Methods for finding initial solution, MODI method.
Assignment Models : Introduction, Mathematical statement and solution methods of assignm. Problems, variations of assignment Problems. (6 Hrs)

UNIT III: **Network Models :** Network construction, PERT analysis, CPM analysis, cost analysis & Crashing the network, Updating resources smoothing and leveling. (6 Hrs)

SECTION-B

UNIT IV: Waiting line models : Introduction, characteristics, classification, analysis of M/M/1 and M/M/s models.
Sequencing : processing of n jobs through two machines, n jobs through m machines, two jobs through m machines. (7 Hrs)

UNIT V: **Replacement models :** introduction, value of money, individual and group replacement policies.
` **Simulation :** introduction, Monte Carlo simulation, advantages and limitations, applications of simulation to queuing models, inventory models, maintenance models , etc. (7 Hrs)

UNITVI: **Dynamic programming**: introduction, characteristics, applications of dynamic programming to capital budgeting, production scheduling, travelling sales men, cargo loading problems, etc. (6 Hrs)

RECOMMENDED BOOKS:

Text Books:
1. Operations Research and Theory applications- II ed.J.K.Sharma; Macmilan Business Books
2. Operations Research; Prem kumar Gupta, D.S.Hira; S.Chand & Co. ltd.

Reference Books:
1. Introduction to Research Operation, 7th Edition; Hiller/Lieberman; Tata Mc-graw Hills.
2. Operations Research : An Introduction, 7th Edition, H.A.Taha; PHI.
3. Operations Research: Principles and practices; 2nd Edition, Ravindran, Philips, Solberg, John Willey & Sons.
4. Operations Research: Kapoor.

8ME02 : I. C. ENGINES

Course Learning Objectives (CLOs):
1. To study basic of engines, Air standard cycles, Fuel air cycle, actual cycle and review of other losses in IC engines.
2. To study conventional fuels, requirement, properties, fuel additive and limitations of fossil fuels.
3. To study stages of combustion, factors influencing various stages, Detonation, Factors and effect of detonation, rating of fuel and combustion chambers.
4. To study delay period, diesel knock, cetane rating, requirements of combustion chamber and methods of generating turbulence.
5. To Evaluate performance of Engines by using heat balance sheet, excess air calculation and determination of friction power, effect of supercharging.
6. To study Emission from Engines, EURO emission norms and Recent trends in Engines.

Course Outcomes (COs):
1. Remember fundamentals of I.C. engines, their types and cycle analysis.
2. Remember the knowledge of fuels and alternative fuels, study of fuel injection pump.
3. Remember the concept of combustion of CI engine.
4. Understand the concept of supercharging its objectives, advantages and limitations.

SECTION-A

UNIT I: **Introduction to IC Engines and cycle analysis:** Basic of I.C. Engines , Details of two stroke and four stroke engines, Air standard cycles, Fuel air cycle and actual cycle. Variation in specific heat, Dissociation and their effect on engine performance. Review of other losses in IC engines. (7 Hrs)

UNIT II: Fuels and alternative fuels : Conventional fuels for IC engines,requirement, properties, fuel additive, limitations of fossil fuels. Review of various alternative/non-conventional fuels . Studies of fuel injection systems : Fuel pump and their working, differenttypes of fuel feed systems, studies of injectors nozzles, Bosch type fuel pump. (8 Hrs)

UNIT III: **Combustion SI Engine:-** Stages of combustion, factors influencing various stages, Normal and abnormal combustion, Detonation, Factors responsible for detonation. Effect of detonation. Octane rating of fuel, Requirement of combustion chambers for SI engines, important types, relative advantages and disadvantages and application. (8 Hrs.)

SECTION- B

UNIT IV: Combustion in CI. Engines:- Stages of combustion in CI Engines, Delay period, factor affecting delay period, diesel knock, cetanerating, Requirements of combustion chamber for CI Engines. Methods of generating turbulence in combustion chamber. Typesof combustion chambers for CI Engies. (8 Hours)

UNIT V: **Performance testing of IC Engines:** Evaluation of various performance parameters of IC Engines including heat balance, sheet and excess air calculation. Methods of determination of friction power. Supercharging : Basic principles, objectives, arrangements for super charging, advantages and limitations ofsuper charging. (8 Hours)

UNIT VI: **Emission from IC Engines :** review, their effect on human health,cause of formation and approaches to control this pollutants. Studyof BIS, EURO emission norms, IC Engines: Recent trends: Microprocessor based engines, management multi-point fuel injection engines, common rail direct injections engines, variablevalve timing engines. (8 Hours)

BOOKS RECOMMENDED:

Text Books:
1. Internal combustion Engines - M.L.Mathur & Sharma Dhanpatrai &Sons.
2. Internal combustion Engines ï V.Ganeshan, Tata Mcgraw Hills.

Reference Books:

1. Internal combustion Engines Fundaments- John B. Heywood, Mcgraw Hills
2. Internal combustion Engines & Air Pollution- Obert E.F.Intext Educational.

8ME03 PROFESSIONAL ELECTIVE – III
(i) ENERGY CONSERVATION & MANAGEMENT

Course Learning Objectives:
Students are expected to learn the importance and the need for conserving the Energy and apply the knowledge gain through methodologies and the management techniques in the energy conservation.

Course Outcome:
After learning the course the students should be able:

1. To understand the basic knowledge of different terms & principles of energy conservation, audit and management.
2. To Evaluate the energy saving & conservation in different mechanical utilities
3. To understand efficient heat & electricity utilization, saving and recovery in different thermal and electrical system.
4. To prepare energy audit report for different energy conservation instances.

SECTION – A

Unit-I: Energy Scenario and importance of energy conservation:
Energy Scenario: Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future. Energy Conservation Act 2001 and related policies: Schemes of Bureau of Energy Efficiency (BEE), State Designated Agencies, Electricity Act 2003. Clean Development Mechanism (CDM). (7-Hrs)

Unit-II: Thermal Systems: Boilers and Industrial furnaces: Energy conservation opportunities in Boilers, efficiency testing, excess air control, performance evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Steam distribution & use ï steam traps, condensate recovery, flash steam utilization. Electrical, Induction furnaces- Energy saving measures. (7-Hrs)

Unit-III: Thermal Systems: Fans, Blowers and HVAC:
Energy conservation in Pumps, Fans (flow control) and blowers, Pumps and Pumping systems - Classification, Performance, Factors affecting pump performance, efficiency. Compressed Air Systems, Performance monitoring and compressed air-distribution system. Factors affecting cooling tower performance and Energy saving opportunities. Refrigeration and air conditioning systems ï Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps. Energy conservation methods. (7-Hrs)

SECTION - B

Unit-IV: Electrical Systems:
AC / DC current systems, Demand control, power factor correction, load management, Motor drives: motor efficiency testing, energy efficient motors, motor speed control, electrical distribution systems ï Transformers ï Power quality ï harmonic distortion. Reduction of losses ï Power factor. Lighting: lighting levels, efficient options. (7-Hrs)

Unit-V: Energy auditing:
Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering. (7Hrs)

Unit-VI: Energy Management and Economics:
Energy resource management ï Energy Management information systems (EMIS) ï Energy Monitoring and Targeting: Defining monitoring & targeting, elements of monitoring & targeting.
Energy economics ï discount rate, payback period, internal rate of Return, life cycle costing ï Financing energy conservation Projects. (7-Hrs)

BOOKS RECOMMENDED:

Text Books:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, Industrial Energy Management and Utilisation, Hemisphere Publ, Washington, 1988.
2. O. Callaghn, P.W. Design and Management for Energy Conservation, Pergamon Press, Oxford, 1981.
3. IDryden, I.G.C. The Efficient Use of Energy, Butterworths, London, 1982.

Reference Books:

1. Turner, W.C. Energy Management Hand Book, Wiley, New York, 1982.
2. 4Murphy, W.R. and Mc KAY, G. Energy Management, Butterworths, London 1987.
3. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press .
4. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press.
5. Trivedi, P.R, Jolka K.R., Energy Management, Commonwealth Publication, New Delhi,1997.

8ME03 PROFESSIONAL ELECTIVE – III
(ii) RODUCTION PLANNING AND CONTROL

Course Learning Objectives (CLOs);
1. To understand the importance of production planning and control, its functions, advantages.
2. To apply the skills of calculating for sales forecasts using various forecasting methods.
3. To remember concept of machine capacity, loading of machines and man machine activity charts.
4. To study the concept of inventory control & various cases of inventory system and modern techniques/philosophies of management like CIM, JIT, MRP-I and MRP-II.

Course Outcomes (COs):
1. Understand the importance of production planning and control, its functions, advantages.
2. Apply the skills of calculating for sales forecasts using various forecasting methods.
3. Remember concept of machine capacity, loading of machines and man machine activity charts.
4. Understand concept of inventory control & various cases of inventory system and modern techniques/philosophies of management like CIM, JIT, MRP-I and MRP-II.

SECTION – A

Unit I :- INTRODUCTION:
Objectives and Advantages of PPC, Production procedure, functions of PPC, production consumptions cycle, centralized & decentralized PPC, Pre-requisite of PPC. (7-Hrs)

Unit II :- PRODUCTION FORCASTING :-
Introduction, definition and importance of forecasts, Qualitative model: Delphi techniques, Quantitative models :- Simple movingaverage, weighted moving average, simple experimental smoothing.
Forecasing error and selection of forecasting model. Types of forecaste: Constant, linear cycle forecaster, Verification and conrolling, The moving range chart, Average MR, out of control conditions. (8-Hrs)

Unit III: PRODUCTION PLANNING : - The production order, Procedure for formulating Production order, masier Program, Basic problems in production planning, Quantities in batch production, criteria for batch, size determination, minimum cost batch size, productionrange, Maximum profit Batch size, Maximum return, Rate ofreturn,Economic Batch size. (7-Hrs)

SECTION – B

Unit IV : MACHINE OUTPUT :
Machine output, multi machine supervision by one operator,
Machine interference, Ashcroft labels, average number of consecutive servicing task, the Ashcraft Number. (7-Hrs)

Unit V: ANALYTICAL STRUCTURE OF INVENTORY:- Definition of inventory, Types of inventory and the classification, structureof inventory problems and its analysis, the relevant cost, objectives of carrying inventories, selective inventory analysis. Static Model :- General characteristic, incremental analysis, opportunity cost, cost of risk, decision criteria under uncertaincy. (7-Hrs)

Unit VI: A) DYNAMIC MODEL :- CERTAINITY CASE ;- General characteristic, optimum lot size model win constant demand,quntity discounts. Risk Case :- General characteritics, P-system and Q-system.

B) Material Requirment planning (MRP) :- Introduction to MRP, Manufacturing Resource Planning (MRP-IT), just in time (JIT), comparison of MRP, MRP-II, Entrepreneurship Resource Planning (ERP). (8 Hrs.)

BOOKS RECOMMENDED:

Text Books:

1. Elements of Production Planning and Control by Simuel Eilon ï Universal Publishing Corporation ltd. Mumbai
2. Production Control ï John E.Biegal- Prentice Hall of India.
3. Inventory Control, Theory & Practice- Start & Miller.

Reference Books:

1. Production Planning and control and Management:- K.C.Jain &L.N.Agrawal.
2. Production & Operation Mgmt.;- E.E.Adam, Jr.R.J.Ether, Prentics Hallof India.
3. Industrial Engineering and Production Management- M.Mahajan-Dhanpat Rai.

8ME03 PROFESSIONAL ELECTIVE–III
(iii) PRODUCT DESIGN & DEVELOPMENT

Course Learning Objectives:
This course aims at introducing the students to the basic concepts of engineering design and product development with focus on the front-end processes. At the end of this course the student is expected to demonstrate an understanding of the overview of all the product development processes and knowledge of concept generation and selection tools.

Course Outcomes:
After successfully completion of this course students will be able to:

1. Manage the development of an idea from concept through to production.
2. Employ research and analysis methodologies as it pertains to the product design process, meaning, and user experience.
3. Apply creative process techniques in synthesizing information, problem-solving and critical thinking.
4. Demonstrate, apply, explain, and recognize basic engineering, mechanical, and technical principles for decision making
5. Use sustainable materials and manufacturing processes & Carry out cost and benefit analysis through various cost models.

SECTION-A

UNIT I: Introduction to product design: The morphology of design, Primary design phases & flowcharting, Role of allowance, Process capability and tolerance in detailed design and assembly, detailed design phase. (6-Hrs)

UNIT II: Product design practices:
Product strategies, time to market, analysis of the product, the Three Sôs, standardization, Renard series, Simplification, Designer and his role, Basic design consideration, Procedures and problems faced by industrial designer, Role of aesthetics in product design, functional design practice. (6-Hrs)

UNIT III: Product design consideration:
Principal stress trajectories, balanced design, criteria and objectives of design, material toughness: resilience, designing for uniform strength, tension vis-à-vis compression.
Pure struts and pure columns, mapping of principal stresses, buckling and instability, theory of long columns, hollow columns, plastic design, practical ideas for material saving in design, ribs, corrugation, laminated, membranes. (6-Hrs)

SECTION-B

UNIT IV Design for production:
Producibility requirement, forging design, pressed component design, casting design, design for machining ease, the role of process engineer, ease of location and clamping, die casting and special casting, design of powder metallurgical parts, expanded metal and wire forms.
Introduction, properties & classification of plastics, phenol formaldehyde and urea formaldehyde resin products, compression moulding, transfer moulding, injection moulding, high-pressure laminates, forming and drawing of plastic sheets, design of plastic parts, natural & artificial rubber, engineering properties of rubber, Glass & ceramics. Plastic bush bearings, gears & fasteners in plastic, Design recommendation for rubber parts, Distortion in rubber, dimensional effects and tolerances, design factors for ceramics and glass parts, Wood. (6-Hrs)

UNIT V: Optimization & Economics in Design:
Siddalôs classification of design approach, Optimization by differential calculus, Language multipliers, Linear programming, geometric programming, Johnsonôs method of optimum design. Product value, design for safety, reliability and environmental considerations, manufacturing operations in relation to design, economic analysis, profit & competitiveness, break-even analysis, economics of a new product design. (6-Hrs)

UNIT VI: Human engineering, value engineering & role of computer in product design:
Human being vas applicator of forces, Anthropometry, design of controls& displays, man/machine information exchange, workplace layout from ergonomic consideration, noise, heating and ventilating, lighting.

Introduction to value, maximum value, normal degree of value, importance of value, creativity, steps to problem solving and value analysis, value analysis tests, value engineering idea generation check-list, cost reduction through value engineering, material and process selection in value engineering.

Introduction to product cycle & CAD/CAM, role of computers in manufacturing and design, creation of a manufacturing database, CIM, communication networks, GT, production flow analysis, MRP, FMS, JIT. **(7-Hrs)**
BOOKS RECOMMENDED:

Text Books:

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, ñProduct Design and Development ñ, 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9.
2. Clive L. Dym, Patrick Little, ñEngineering Design: A Project-based Introductionò, 3rd Edition, John Wiley & Sons, 2009, ISBN 978-0-470-22596-7

Reference Books:

1. George E.Dieter, Linda C.Schmidt, ñEngineering Designò, McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9.

2. Kevin Otto, Kristin Wood, ñProduct Designò, Indian Reprint 2004, Pearson Education, ISBN 9788177588217.

3. Yousef Haik, T. M. M. Shahin, ñEngineering Design Processò, 2nd Edition Reprint, Cengage Learning, 2010, ISBN 0495668141.

8ME03 PROFESSINAL ELECTIVE-III
(iv) ARTIFICIAL INTELLIGENCE

Course Learning Objectives (CLOs):

1. To understand the basic concepts of Artificial Intelligence.
2. To understand the basic concepts of Expert System.
3. To study the methods of knowledge representation.
4. To understand the Expert system Tools, knowledge base editors, procedure oriented methods, object-oriented methods, logic-based methods, access-oriented methods.
5. To study the methods of Building an expert system.
6. To understand the concept of Fuzzy Engineering & applications of fuzzy expert systems for design of industrial controllers.

Course Outcomes (COs):

1. Understand the concept of knowledge and knowledge base.
2. Apply the skills of development of expert system for industrial problems.
3. Remember the design pre-requisites and design procedure of expert system.
4. Understand the concept of fuzzy logic and will try to implement in project work.

SECTION – A

Unit-I : Introduction to Artificial Intelligence (AI): Overview of AI,definition and importance of knowledge based systems, representation of knowledge, knowledge organization, knowledgemanipulation, acquisition of knowledge. (6 Hours)

Unit II: Introduction to Expert Systems - Features of expert systems, knowledge engineering, basis expert system terminology, human experts and artificial experts, algorithmic nd heuristic methods, difference between conventional programs and expert systems,Architecture of expert systems. (8 Hrs.)

Unit III : Knowledge Representation ï Rule based methods, rule execution, forward chaining and backward chaning, knowledge representation using semantic nets, structure of semantic nets, Frame-based methods . (8 Hours)

SECTION – B

Unit IV : Expert system Tools – Types of tools for expert system building,system building aids, support facilities, debugging aids, I/O facilities, explanation facilities, knowledge base editors, stagesin the development of expert system tools, procedure oriented methods, object-oriented methods, logic-based methods, access-oriented methods. (7 Hours)

Unit V : Building an expert system ï Development phased in expert system building, development constraints, reliability, maintainability, examples of expert systems, difficulties in development of expert systems. (7 Hours)

Unit VI: Fuzzy Engineering - Fuzzy logic, fuzzy expert systems, fuzzy sets,membership functions, fuzzy rules for approximate reasoning, fuzzy inference generation, deffufication, development of rules matrix, applications of fuzzy expert systems for design of industrial controllers. (7 Hours)

RECOMMENDED BOOKS:

Text Books:

1. A guide to Expert Systems by Donald a. Waterman, Pearson
2. Introduction to Artificial intelligence & Expert Systems by DanW. Peterson, PHI
3. Fuzzy Logic by John Yen, Reza Langari, Pearson

Reference Books:

1) Expert Systems ï Theory & Practice, By Ermine, Jean Louis, PHI.
2) Expert systems in Engineering , By D.T.Pham.JFS Pub.
3) Expert system application by Sumit Vadera,Sigma press
4) Artificial Intelligence by Winston P.H.,Pearson.

8ME04 PROFESSIONAL ELECTIVE – IV
(i) REFRIGERATION & AIR CONDITIOING

Course Learning Objectives (CLOs):

1. Illustrate the fundamental principles and applications of refrigeration and air conditioning system Learning the fundamental principles and different methods of refrigeration and air conditioning.
2. Comparative study of different refrigerants with respect to properties, applications and environmental issues. Study the numbering system of Refrigerants and its classification.
3. Identify the basic components of a refrigeration cycle.Study of various refrigeration cycles and evaluate performance using P-H chart, Mollier charts and/ or refrigerant property tables. Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems
4. Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning. Operate and analyze the refrigeration and air conditioning systems.
5. Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems.

Course Outcomes:

1. Understand the fundamental basics of simple vapour compression system, types of refrigerant used in refrigeration system.
2. Understand the multistage pressure system, its types and elementary treatment of refrigeration system.
3. Apply the knowledge of refrigeration system and its controls, defrosting.
4. Apply the concept air conditioning system as winter, summer air conditioning system applications and its related issues.

SECTION–A

Unit I : **Introduction to automotive air conditioning-** Vapour compression system:- Analysis of simple vapour compression system. Use of pressure enthalpy. Temperature entropy charts. Effect of operating conditions such as evaporation and condesion pressure, superheating and sub cooling Actual vapour compression system, Refrigerants :- classification: primary & secondaryrefrigerants, desirable properties of refrigerants; merits& demerits of commonly used refrigerants such as Ammonia R-12, R-22 and their selections and eco friendlyrefrigeration 134 a,HFC. (8- Hours)

Unit II: **Multi stage pressure systems-** multistage compression: choiceof intermediate pressure, complete multi-stage compressions. Multi evaporator systems; single compression individual expansion value, single compression multi expansion valve, individual compressor multi expansion valves, cascade systems,its applications to cryogenics Air liquefaction processes- Linde- Hampson (No numerical treatment to air liquefaction system) (7- Hours)

Unit III : **Refrigeration systems components & controls**:- brief study of refrigerants compressor, condensers, evaporators, expansion valves, drier, fillers, selection criteria for the components of vapours compression systems Flow controls, temperature controls, pressure controls and safety devices. Defrosting systems, testing & charging of refrigeration systems, leak detection. (No analytical treatment is expected) (7- Hours)

SECTION– B

Unit IV : Psychromeric properties of moisair psychrometric chart, concept of thermodynamic wet ï bulb temperature, representations of Psychromeric process on Psychromeric charts, mixing of air, evaporating cooling, air washers. Human comfort:- metabolism of human body, factors influencing comfort, concept of effectivetemperature, optimum effective temperature & comfort charts. (7 Hours)

Unit V : **Classification of air conditioning systems & applications**. Unitarysystem package, window type & split type air conditioning. Central system:-System components, types:- direct expansion system, all water system & all air system. Water, summers & year round air conditioning. Transmission & distribution. Types of supply air ducts, consideration for selection & location of outlet,distribution partners of outlet, location of return air opening &introduction to duct design.
(*No numerical treatment is expected*). (7 Hours)

Unit VI : Load calculation & applied Psychromety-basic consideration at heat gains/losses sensible & latent , heat due to occupancy lightening, appliances, products, process, air conditioning systems, safety factor cooling load estimates, heating load estimates. Sensible heat factor by pass factor, apparatus dew point, effective sensible heat factor. (7 Hours)

BOOKS RECOMMENDED:

Text Books:

1. Refrigeration & air conditioning; C.P.Arora; Tata Mcgraw HillPublication.
2. Refrigeration & air conditioning; Arora, Domkundwar; Dhanpat Rai Publication.

Reference Books:

1. Principles of Refrigeration; J.Dossat; Pearson Education, Asiapublication

2. Refrigeration & air conditioning- P.L.Balaney

3. Refrigeration & air conditioning- Manohar Prasad.

8ME04 PROFESSIONAL ELECTIVE – IV
(ii) FINITE ELEMENT ANALYSIS

Course Learning Objectives (CLOS):

1. To study the concept of FEM and various methods in it.
2. To understand the knowledge of application of Matrix Algebra & Gausian Elimination.
3. To study the finite element modeling approaches and understand the concept of boundary conditions.
4. To study 2D problems for Constant strain triangle, temperature effects, problem modeling and boundary conditions.
5. To study the concept of heat transfer and fluid flow.

Course Outcomes:

1. Apply the knowledge of principal of FEA, its types, governing equation, fundamental concept of solid mechanics.
2. Remember the mathematical understanding required for FEA and finite difference techniques.
3. Understand the knowledge of application of FEA such as related to stress on beams, three dimensional frames, heat transfer.
4. Apply the knowledge of FEA in project work.

SECTION-A

Unit I : Introduction : Application, Advantages, Steps of FEM, Stress and Equilibrium, Boundary conditions, Strain Displacement Relations, Stress-strain Relations, Von mises stress, Temperature effect, Potential Energy & Equilibrium, Gelerkinœ Method, stiffness (Displacement) Method. (7Hrs)

Unit II: **Matrix Algebra & Gausian Elimination :** Matrix Multiplication,Transposition, Diagonal Matrix, Symetric Matrix, Upper Triangular Matrix, Determinant of Matrix, Matrix Inversion Eligen values & Elgenvectors, Gaussian elimination. (7 Hrs)

Unit III: **ID Problems :** Finite Element modeling, coordinate Shapefunction, The potential Energy approah, The GalerkinœApproach, assemblies of the global stiffness matrix and loacvectors, Properties of stiffness Matrix, Treatment of boundaryconditions, quadratic Shape Functions, Temperature Effects. (7 Hrs)

SECTION – B

Unit IV : **2D Problems for CST :** Constant strain triangle, isoperimetric Representation , potential Energy energy approach, element stiffness, galaerkinœ approach, temperature effects, problem modeling and boundary conditions. (7 Hrs)

Unit V : **Development of equations:** Truss equations, derivation of the stiffness, matrix for a bar element in local coordinate, global stiffness matrix, beam equation. Beam stiffness, example assemblage of beam stiffness matrix, plain stress & plain stress stiffness equations, basic concept of plain stress and plain strain, derivation of the CST stiffness matrix and equations Treatment of body and surface forces. (7 Hrs)

Unit VI : **Heat Transfer :** Derivation of the basic differential equations, Heat transfer with conduction, radiation, ID Formulation usingvariational method.
Fluid Flow : Derivation of the basic differential equations, Id Finite Element formulation, Computer Implementation (prepossessing, post processing, input data file, mesh generation) (7 Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Introduction to Finite Element Engineering ï T.R.Chandrupatla,Belegunda; PHI
2. A First course in Finite Element Method- Darya Logon, ThompsonLearning (TL Publisher)

Reference Books:

1. The Finite Element Method in Engineering- S.S.Rao, Elsveir Pub., 4^{th} Edition.
2. Fundamentals of Finite Element Method analysis ï D.V.Huttan, TataMc-graw Hill
3. Concept & Applications of Finite Element Analysis ï Robert D.Cook
4. Finite & Boundary Element Method in Engineering ï O.P.Gupta
5. An Introduction to Finite Element Method- J.N.Reddy, Tata Mc-graw Hill, 2^{nd} Edition, 2005.

8ME04 PROFESSIONAL ELECTIVE – IV

(iii) ROBOTICS & INDUSTRIAL APPLICATIONS

Course Learning Objectives :

1. To understand basics of robotics, evolution of robots and their role in industrial automation.
2. To study the Robot's anatomy, joints types, wrist construction, robot standard configurations and their work spaces..
3. To study the construction and working of different types of end Effectors.
4. To study various robot drives, robot motion control and its levels.
5. To understand various methods of teaching and programming the robots.
6. To study principle of working and applications of different types of robot sensors.
7. To study robot kinematics viz. forward, reverse and homogeneous transformation.
8. To study different applications of robots in manufacturing and to understand importance of robot features for a particular application.
9. To study different Quantitative methods to perform economic evaluation of robot project.

Course Outcomes:

1. Understand the concept of robotics, its history.
2. Remember robot anatomy and various configurations for different industrial applications.
3. Understand the concept of kinematic analysis of robots.
4. Remember the concept robot programming, its methods and programming languages.

SECTION – A

Unit I : Fundamentals of Robotics- Introduction, Automation & Robotics- robot applications robotic systems, robot anatomy and robot configurations, Joint types used in robots, robot wrists, joint notation schemes, work value for various robot anatomies, robotSpecifications**.** (8 Hrs.)

Unit II : Robots end-effectors-classification of end-effectors, mechanicalgrippers, hooking or Lifting grippers, grippers for molten metal ,plastics, vacuum cups, magnetic grippers Electrostatic grippers,multiple grippers, internal & external grippers, drive systems for gripers, active & passive grippers. Design consideration in gripper, gripper analysis. (7 Hrs.)

Unit III: Robot drives & control-pneumatic power drives, hydraulic systems, electric drives, robot controllers- servo and non servo systems, motion control of robots, point to point and continuouspath control, teaching of robots, robot programming methods. (7 Hrs.)

SECTION – B

Unit IV: Robot Sensors: Features, Contact type sensors:- wrist force sensor, binary & analog touch sensor,

Artificial skins, force, torque, encoders, position, velocity sensors, Non contact type sensors;- vision sensor, proximity, range sensors, safety measures in robot. (7 Hrs.)

Unit V: Robot Kinematics- Forward & reverse kinematics, forward andreverse transformation of two DOF & three DOF 2-D manipulator,homogeneous transformations. (6-Hrs)

Unit VI: Quantitative Techniques for economic performance of robots- Robot investment coats, robot operating expenses. Methods of economic evaluation, method of pay-back period, return on investment method, discounted cash flow method. VAL Command: robot programming in Val & RAIL. (7 Hrs.)

RECOMMENDED BOOKS:

Text Books:

1) Robotics Technology & Flexible Automation by S.RDeb, Tata McGrawHill.
2) Industrial Robotics by M.P.Groover, McGraw Hill.

Reference Books:

1. Robotics for Engineering, Korean Yoram, McGraw Hill.
2. Robots & Manufacturing automation by Asfahal, C.Ray, John Wiley.
3. Robotic Engineering by Richard D.Klafter, PHI.

8ME04 PROFESSIONAL ELECTIVE- IV

(iv) RAPID PROTOTYPING

Course Learning Objectives (CLOS):

1. Understand the fundamentals of Rapid Prototyping Techniques.
2. Understand the methodology for processing of RP Cad models.
3. Selection of appropriate RP fabrication techniques for the prototyping.
4. Study of prototyping techniques for Reverse engineering.
5. To acquire the necessary knowledge regarding RP softwares.

Course Outcomes (CO):

1. **Create** and develop overall awareness for design of Rapid prototype.
2. **Apply** fundamentals of RP techniques.
3. **Design and develop** the RP Toolings for using suitable rapid prototyping technique.
4. **Synthesis** of RP techniques for reverse engineering.

SECTION-A

Unit-I: Introduction to Product Design: Design definitions; Brief history of Industrial designs. Industrial Design chronology, stages in Product development. Cost associated in various stages of Product development.
Prototyping: What is Prototype?, Types of Prototype, Principles of Prototyping, Prototyping Technologies. (7-Hrs)

Unit-II: Basics of Rapid Prototyping: Rapid Prototyping: Working Principles and types of Rapid Prototyping machines. Input devices, Contact and non-contact type digitizers such as Coordinate measuring machines, Laser and White light scanners. **Fields of Application of RP**: Industrial, medical, etc. (7-Hrs)

Unit-III.RP Process: Photo polymerization (Stereo lithography (SL), Micro-stereo lithography), Powder Bed Fusion (Selective laser Sintering (SLS), Electron Beam melting (EBM)), Extrusion-Based RP Systems (Fused Deposition Modeling (FDM)), 3D Printing, Sheet Lamination (Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC)), Beam Deposition (Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD)). (8-Hrs)

SECTION-B

Unit-IV: Physics of RP Process:
Process Physics, Tooling, Process Analysis, Material and technological aspects, Applications, limitations and comparison of various rapid manufacturing processes. Classification of RP Methods.
Pre and Post processing: Pre-processing for RP, Post-processing of RP parts, Errors in RP parts, Part building errors in FDM, STL,LOM, SLS Parts. (6 Hrs.)

Unit-V: Rapid Tooling: What is Rapid tooling?, Types of Rapid toolings. Benifits of Rapid tooling.
Silicon rubber tooling, Aluminium filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, etc. Direct Rapid Tooling Direct. AIM. Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling. (6 Hrs.)

Unit-VI: Overview of RP Software: STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools. . (6-Hrs)

BOOKS RECOMMENDED:

Text Books:

1. Rapid Prototyping by Amitabha Ghosh , affiliated East ï west press pvt. ltd., New Delhi.
2. Rapid Prototyping by Adithan M. Edition 2018, Atlantic Publishers & distributer pvt.ltd.
3. Additive Manufacturing by C.P.Paul & A.N. Jinoop McGraw Hill 1st Edition 2021
4. Product Design & Development by Karl T.Ulrich & Steven D. Eppinger.,Tata McGraw Hill Publishing.
5. Rapid Prototyping Data Formats by V.V. Prathibha Bharathi. Notion press publishing.

Reference Books:

1. CAD & Rapid Prototyping for product design, Dauglas Bryden, Laurence King Publishing.
2. Rapid Prototyping (Principle and Application), Rafiq Noorani by Wiley Publishing.

8ME05 I.C.ENGINES - LAB.

Course Learning Objectives (CLOs):

1. To study basic of engines, Air standard cycles ,Fuel air cycle, actual cycle and review of other losses in IC engines.
2. To
3. To Evaluate performance of Engines by using heat balance sheet, excess air calculation and determination of friction power, effect of supercharging.
4. To study Emission from Engines, EURO emission norms and Recent trends in Engines.

Course Outcomes (COs):

1. Remember fundamentals of I.C. engines, their types and cycle analysis.
2. Apply the knowledge of a multi-cylinder petrol engine.
3. Evaluate performance of Engines by using heat balance sheet
4. Study of fuel injection pump and injectors.

List of Experiments (Any Six):

Any six of the following practical should be performed and Performance test on a single cylinder diesel engine.

1. Performance test on a single cylinder petrol engine.
2. Evaluation of the heat balance for single cylinder diesel engine.
3. Performance test on a multi-cylinder petrol engine.
4. Mors test on multi-cylinder petrol engine.
5. Trial on petrol/ diesel engine to plot p-0 and p-V diagram.
6. Measurement of exhaust gas emission from S.I.engine
7. Measurement of smoke density of CI engine exhaust.
8. Study of Bosch type single plunger fuel pump.
9. Study of various types of fuel injectors and nozzles.

***It shall consist of viva-voce based on term work and syllabus.**

8ME06 PROFESSIONAL ELECTIVES -IV
(i) REFRIGERATION & AIR CONDITIONING- LAB.

Course Learning Objectives (CLOs):

1. Illustrate the fundamental principles and applications of refrigeration and air conditioning system Learning the fundamental principles and different methods of refrigeration and air conditioning.
2. Identify the basic components of a refrigeration cycle. Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems
3. Study of various types of refrigeration systems for various applications like ice plant, water cooler etc.
4. Understand the basic air conditioning processes.
5. Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems.

Course Outcomes (CO):

1. Understand the fundamental basics of simple vapour compression system, types of refrigerant used in refrigeration system.
2. Apply the knowledge of different applications of refrigeration systems.
3. Apply the knowledge of refrigeration system and its controls, defrosting.
4. Apply the concept air conditioning system.

List of Practicals:-

Any **six** of the following should be conducted and a report thereof should be submitted.

1. Trial on Vapour compression system.
2. Trial on Air-conditioning system.
3. Study of Electrolux system.
4. Study of Water cooler.
5. Study of window Air conditioner.
6. Study of household refrigerator.
7. Study of desert cooler.
8. Study of cold storage plant.
9. Testing and changing of refrigeration system.
10. Study of defrosting system.
11. Study/trial of ice plant.
12. Study of various refrigeration and air-conditioning controls.

***Practical Examination: shall consist of viva-voce based on term work report and syllabus.**

8ME06 PROFESSIONAL ELECTIVE- IV
(ii) FINITE ELEMENT ANALYSIS-LAB.

Course Learning Objectives (CLOS):

1. To understand the knowledge of application of Matrix Algebra & Gausian Elimination.
2. Design of finite element modeling approaches and understand the concept of boundary conditions.
3. Formulation of 2D problems for Constant strain triangle, temperature effects, problem modeling and boundary conditions.
4. Understand concept FEA applied for heat transfer and fluid flow.

Course Outcomes:

1. Apply the knowledge of principal of FEA, its types, governing equation, fundamental concept of solid mechanics.
2. Remember the mathematical understanding required for FEA and finite difference techniques.
3. Application of FEA such as related to stress on beams, three dimensional frames.
4. Apply the knowledge of FEA in heat transfer and fluid flow.

List of Practicals (Any-5):

1. Study of a FEA modeling & FEA packages.
2. Stress Analysis of bars having
   i) Constant cross section area
   ii) Tapered cross section area
   iii) Stepped bar.
3. Stress Analysis of beam (Simply supported or Cantilever) carrying point load and uniformly distributed load.
4. Solve any one 2D problem on CST element.
5. Solve any one problem on truss element.
6. Solve any one problem on axi-symmetric element
7. Solve any one problem on steady state heat condition.

***Practical Examination:** shall consist of viva-voce based on term work report and syllabus.

8ME06 PROFESSIONAL ELECTIVE-IV

(iii) ROBOTICS & INDUSTRIAL APPLICATIONS-LAB.

Course Learning Objectives:

1) To understand the basic concepts associated with the robot functioning and applications of Robots.
2) To study about the robot motion analysis of robot.
3) To study about the drives and control system used in Robots.
4) To understand the concepts of end effectors, sensors and vision system used in robots
5) To learn about robot programming.

Course Outcomes:

After successfully completion of this course students will be able to:
1) To know about fundamental knowledge about the robot
2) To know about robot motion analysis.
3) To know about drives and control system used in robots.
4) To know about end effectors, sensors and vision system.
5) To know about robot programming methods and languages.

List of Prcticals : (Any-5)

1. Study of components of a real Robot & its DH Parameters.
2. Demonstration of Robot with 2DOF,3DOF,4DOF,etc.
3. Study of positioning and orientation of Robot arm.
4. Programming of the Robot for Industrial Application (actual trial on robot ,if available or trial on simulation software).
5. Robotic Control Experiment demonstration using available hardware or software.
6. Integration of assorted sensors (IR, Potentiometer, staring gadges, etc.) micro controllers & ROS (Robot Operating System) in a Robotic system.
7. Industrial Robot application (Any one Mini project)
8. Study of Robot Simulation Software (on any one application).

***Practical Examination shall consist of viva voce based on above term work.**

8ME06 PROFESSIONAL ELECTIVE- IV
(iv) RAPID PROTOTYPING- LAB.

Course Learning Objectives (CLOS):

1- Study the fundamentals of Rapid Prototyping Techniques.
2- Understand the use of techniques for processing of Cad models for RP.
3- Use of suitable RP fabrication techniques for prototyping.
4-Use of prototyping techniques for reverse engineering.
5- To get the introduction regarding RP software.

Course Outcomes (CO):
1- Create and develop overall awareness for design of Rapid prototype.
2- Apply fundamentals of RP techniques.
3- Selection of appropriate tooling for rapid prototyping process.
4- Synthesis of RP techniques for reverse engineering.

List of Practical (Any-5):
1-To create a 3-D model of a machine component for RP
2- Generation of a Process Plan for fabrication of a product on the basis of CAD Model.
3- Fabrication of part on available RP setup.
4- Post processing of fabricated Additive Manufactured product/prototype.
5- Inspection of fabricated product/prototype for dimensional accuracy and defects.
6- Post processing of CAD model and generation of .stl file using suitable software.
7- Study of principles of various pixel generation techniques and forms of raw materials in RP.

***Practical Examination:-**shall consist of viva-voce based on term work report and syllabus.

8ME07 : PROJECT

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NOTIFICATION

No. 89/2020 Date : 26/10//2020

Subject : Implementation of new Syllabi of Semester III & IV of B.E. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum…

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester III & IV of B.E./B.Text. E./B.Tech. (Chem.Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2020-21 & onwards as per "**Appendix – A**" as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

"**Appendix – A**"

SYLLABI OF B.E. SEM. III & IV (CIVIL ENGINEERING) [C.B.C.S.]

THIRD SEMESTER

3CE01 MATHEMATICS III

Objectives:-

- Find general solutions of linear differential equations with constant coefficients using the roots of the auxiliary equation.
- Calculate the Laplace Transform of basic functions using the definition.
- Compute the partial Differential Equations.
- Understand the computational details behind certain numerical methods.
- Compute the Analytic function.
- Compute and interpret the correlation coefficient.

Course Outcomes:
After successfully completing the course, the students will be able to:

1. Demonstrate the knowledge of differential equations and partial differential equations, applied to electrical engineering systems.
2. Apply Laplace transform to solve differential equations.
3. Demonstrate the use of Partial Differential Equations.
4. Compute different Numerical Methods.
5. Apply the knowledge of Complex Analysis.
6. Demonstrate the basic concepts of probability and statistics.

SECTION-A

Unit I : Ordinary Differential Equations :

Complete solution, Operator D, rules for finding the complementry function, the inverse operator, Rules for finding particular integral. Method of variation of parameters, Cauchy's and Legendre's Linear Differential equations. Simultaneous linear differential equations with constant coefficients Applications to civil engineering. (7)

Unit II: Laplace transforms:

Definition and elementry properties, Inverse L.T. by various methods, Convolution theorem, Solution of ordinary differential equation using Laplace transform of periodic functions. Application to problems of beams and fluids. (7)

Unit III : Partial Differential Equations :

P.D.E. of first order and first degree of types i) $f(p,q) = O$ ii) $f(p,q,z)=0$, iii) $f(p,q,x,y)=O$ iv) $f(p,q,x,y,z)=O$ i.e. (a) Lagrange's form $Pp + Qq = R$ (b) Clairtut's form $z=px+qy+f(p,q)$ v) Equations reducible to above standard types linear Homogeneous P.D.E. of nth order with constant co-efficients. (7)

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SECTION-B

Unit IV: **Numerical Methods :-** (i) Solution of Algebraic and transcendal Equations by Newton Raphson method and by method of False Position.

(ii) Solution of system of linear equations by Grout's method, Gauss Seidal method and Relaxation Method.

Numerical solution of differential equations by Picard's method, Taylor's series method, Euler's method, modified Euler's method and Rungekutta forth order method. (7)

Unit V : Complex variable :

Analytic functions, C.R.conditions, Harmonic functions. harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation) (7)

Unit VI : Statistics :

Probability : Axioms, conditional probability, Baye's theorem, Mathematical Expectation and probability distributions (Binomial, Poisson and Normal). Curve fitting by method of least square only for line and parabola, Correlation, regression. (7)

TEXT BOOKS:

1. Elements of Applied Mathematics by P. N. Wartikar and J. N. Wartikar. Poona Vidhyarthi Publisher
2. Higher Engineering Mathematics by B.S.Grewal. Khanna Publishers
3. Introduction to method of Numerical Analysis- S. S. Shastry, 2ND Edition, PHI Pvt. Ltd.,New Delhi.

REFERENCES:

1. A Mathematical Companion for Science and Engineering Students – Brettenbach, Oxford University Press, 2008
2. Advancing Engg. Mathematics, E.K.Kreyzig, John Wiley
3. Numerical Method for Mathematics Science and Engineering, John H. Mathew, PHI 4. Numerical Methods - Principles, Analysis & Algorithms Pal, Oxford.

3CE02 – STRENGTH OF MATERIALS

Learning Objectives of Subject:

1. To determine theMechanica lbehavior of the body and construction materials bydetermining the stresses, strains produced by the application of loads.
2. To apply the fundamentals of simple stresses and strains.
3. To make one understand the concept of bending and its theoretical analysis.
4. To apply fundamental concepts related to deformation, moment of inertia, load carrying capacity, shear forces, bending moments, torsional moments, principal stresses and strains, slopes and deflection.

Course outcomes:

At the end of the subject the students will be able -

1. To understand the basics of material properties, stress and strain.
2. To apply knowledge of mathematics, science, for engineering applications
3. To identify, formulate, and solve engineering & real life problems
4. To design and conduct experiments, as well as to analyze and interpret action and reaction data.
5. To understand specific requirement from the component to meet desired needs within realistic constraints of safety.

SECTION – A

Unit I: Mechanical properties: Concept of direct and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit II: Axial force, shear force & bending moment diagrams: Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear forces, bending moment and loading intensity.

Unit III: Stresses in beams (Bending, Shear), i) Bending: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section. ii) Shear: Distribution of shear stresses on beam cross sections, impact loads and instantaneous stresses.

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SECTION – B

Unit IV: Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load. Thin cylinders subjected to internal pressures.

Unit V: Principal stresses: Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses, principal strains. Combined direct & bending stresses.

Unit VI: Slope & deflection of beams: Slope & deflection in statically determinate beams subjected to point loads, uniformly distributed loads, moments by Macauley's method. Theory of long columns, Euler, Rankin's formula.

Books Recommended:

1. E. P. Popov, "Mechanics of Materials", Prentice Hall of India, New Delhi.
2. S.Timoshenko and O. H. Young, 'Elements of Strength of Materials', East West Press Private Ltd., New Delhi.
3. Ferdinard L. Singer, 'Strength of Materials', Harper and Row, New York.
4. Shames, I. H., 'Introduction to Solid Mechanics', Prentice Hall of India, New Delhi.
5. R. K. Bansal, Strength of materials, Laxmi Publications Pvt Ltd.
6. Junnarkar, S. B., Mechanics of materials.
7. Mubeen, A., Mechanics of solids, Pearson education (Singapore) Pvt. Ltd.
8. Beer and Johston, Mechanics of materials, Mc-Graw Hill.
9. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Co Pvt Ltd.

3CE03 – BUILDING CONSTRUCTION & ENGINEERING GEOLOGY

Learning Objectives of Subject:

1. To understand various types and components of civil structure.
2. To learn about the type of infilling material, its features and construction methodology.
3. To understand various levels in building – floor, sill, lintel, roof levels and their need.
4. To understand the need and type of vertical and horizontal circulation.
5. To make aware of knowledge and importance of rock, soil and its impact for site selection.
6. To help one to understand the reason for Earthquake and its impact on soil / rock properties.

Course outcomes:

At the end of the subject the students will be able -

1. To understand Load bearing and Frame structure.
2. To recognize various types of construction material and its suitability
3. To recognize the various levels in building and its need.
4. To know types of staircase, doors, windows and other related fixtures.
5. To recognize types of rock and minerals and its construction properties.
6. To know reason for earthquake and seismic waves.

SECTION - A

Unit I: Introduction: Definition, types of buildings as per national building code, components of buildings and their functions, Types of structure – load bearing & framed structures. Foundation: Definition and necessity, loads of foundation, Bearing Capacity soil, field methods of improving bearing capacity. Types of foundation – shallow foundation and Types of Shallow foundation.Causes of failure of foundations and precautions to be taken.

Unit II: Masonry: Classification of bricks, manufacturing of bricks, tests on bricks, properties of burnt bricks, fly ash bricks, ALC Blocks. Brick masonry construction – Technical terms, general principles, commonly used types of bonds such as stretcher, header, English bond and Flemish bond, their suitability. Formwork: Different types, their relative merits, demerits, period for removal of formwork for different members. Earthquake resistant bands in masonry- Types, location and application.

Unit III: Floors: Types of Floors – Basement floor, ground floor and upper floors, Floorfinishes – Types of flooring material, different types of floor finishes, suitability, method of construction, criteria for selection. Roofs – Flat, pitched roof, steel roof trusses – types and suitability, types of roof covering. Arches, lintels – Types and their suitability, details of R.C.C. lintels.; chajja, precast lintels arches.

SECTION - B

Unit IV: Doors: Purpose, criteria for location, size of door, door frames.; its types, methods of fixing, Types of door shutters and their suitability, Windows – Purpose, criteria for location, no., sizes; shapes of Windows, types of windows; their suitability. Ventilators – Types and their suitability. Fixtures & fastening for doors and windows. Stairs – Function, technical terms, criteria for location, types of staircases, their suitability, principle of stair layout design.

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Unit V: Plastering - Necessity, types, processes of different types of plastering, defects inplastered work. Scaffolding – Purpose, types and suitability. Special Aspects of Construction – Damp proofing – causes of dampness, its effects, various methods of damp proofing.Fire proof construction –Fire protection requirements for a multistoried building. Sound proof Construction – Sound absorbents and their characteristic. Expansion & construction joints in building.

Unit VI: Introduction - Different branches of Geology and importance of Geology in CivilEngineering.Folds, faults, joints in Geology. Geological studies related to site selection for dams and reservoirs. Petrology - rock cycle, rock weathering and soil formation, study of common rock types. Earthquake Engineering - earthquake waves, causes and effects, magnitudeand intensity, earthquake zones of India.

Books Recommended:

1. Mackay W.B.: Building Construction, Vol. I, II, III, Longmans.
2. Sushil Kumar: Building Construction, Standard Publishers Distributors.
3. Singh Parbin: General & Engineering Geology.
4. Mukherjee: A Text Book of Geology.
5. TuyrellG.W.: The Principle of Petrology.
6. WadiaD.N. : Geology of India.
7. Sane L.S.: Construction Engg. ManakTalas, Mumbai.
8. National Building Code of India, 2016.
9. Punmia B.C.: Building Construction.
10. A Manual of Earthquake Resistant, Non-Engineered Construction Indian Society of Earthquake Tech.

3CE04 – TRANSPORTATION ENGINEERING

Learning Objectives of Subject:

1. To learn about basics of Road construction like surveys, alignment principles, types of roads.
2. To study and understand various road studies for safe road design principles and essential geometry.
3. To learn about various road pavements its construction and maintenance procedure.
4. To learn about railway transportation and terms related to it.
5. To learn about construction concepts of Airport runway, Apron layout , various survey and terms related to Airport Transportation.
6. To learn about Tunnels and Bridges components types and related transportation study.

Course outcomes:

At the end of the subject the students will be able –

1. To identify type of roads and its utility.
2. To understand the application of various road studies at time of survey and actual construction.
3. To design the various types of road pavements.
4. To understand rules regulations, signals , type of gauges and railway sleepers density.
5. To recognize the Airport features and design concept of components for Aero plains movement.
6. To identify types and components of Tunnels and bridges and its design components.

SECTION-A

Unit-I Highway: Road Transport characteristics, classification of Roads, Road Patterns, Alignment principles, Survey for highway.

Unit-II Geometric Design: Cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, PIEV Theory, stopping sight distance, overtaking sight distance, Horizontal alignment, curves, superelevation.

Unit-III Pavement Design and Traffic Engineering: Components of Flexible and Rigid pavement, Design factor, Traffic Characteristics, Traffic Studies, Construction and Maintenance – WBM Surface dressing, bituminous roads and construction procedure. Road parking system, traffic control devicesand 3 E's of traffic

SECTION-B

Unit-IV:Railway: Railway transportation, track sections, embankment & cutting. Points and crossing Left &right hand turnouts. Objects, Permanent way, gauges, coning of wheels, components of permanent way, Sleeper density, Rail fixtures & fastening. Rail types and functions.

Unit-V: Airport: Agencies controlling national & international aviation, various surveys to be conducted, airport site selection, Aero plane component parts, Aircraft characteristics. Airport obstructions: Zoning laws, wind rose diagram. Basic runway length and corrections, Apron layout, Aircraft parking & parking system.

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Unit-VI: Tunnel and Bridges: Tunnels- necessity, types, tunnel alignment, Size and shape of tunnels, and Tunnel lining. Tunnel drainage, ventilation & lighting of tunnels. Bridge Engineering-Components, classification and identification, data collection, site selection, economic span, Estimation of flood discharge, water way, scour depth, depth of foundation, Afflux, clearance and free board, different structural form – culverts, types of foundation, abutments, piers and wing wall.

Books Recommended:

1) Khanna S.K. & Justo C.E. : Highway Engineering
2) Rao G.V. : Principles of Transportation& Highway Engg.
3) Dr.KadiyaliL.R. : Traffic Engg. & Transport Planning.
4) BindraS.P. : Principles & Practice of Bridge Engg.
5) Saxena &Arora : Railway Engineering.
6) Agrawal M.M. : Railway Engineering.
7) Khanna S.K., Arora M.G., Jain S.S. : Airport Planning & Design,
8) Srinivasan: Tunnel Engineering.
9) Shrarma S.K. : Principles, Practice & Design of Highway Engg.
10) Duggal A.K. &Puri V.P. : Laboratory Mannual in Highway Engg.

3CE05 – CONCRETE TECHNOLOGY & RCC

Learning Objectives of Subject:

1. To understand basic construction material - Cement, its property and suitability tests.
2. To learn about meaning of concrete, strength of concrete, mixing proportion and suitability test.
3. To understand meaning of RCC and its need.
4. To learn various properties of concrete and use of different admixtures.
5. To learn about special concrete materials and methods.
6. To be able to perform mix design of concrete

Course outcomes:

At the end of the subject the students will be able -

1. To know need and composition of binding material, cement.
2. To recognize concrete and RCC and will be able to perform desired test for suitability,
3. To analyze RCC Components like slab and lintels.
4. To decide and utilize the admixtures as per the need of Concrete.
5. To understand importance of mix design.

SECTION-A

Unit I: Cement: Physical properties of Portland cement, laboratory tests on cement, types of cements. Aggregate: Classification of aggregate, physical properties, bulking and moisture content, specific gravity, bulk density.

Unit II: Properties of fresh concrete: Workability of concrete, methods of measuring workability, nominal mix, mixing, centering & formwork, placing, compaction and curing of concrete. Properties of hardened concrete: Grades of concrete, properties of concrete, compressive, tensile, and shear strength, modulus of elasticity, creep, shrinkage.Durability of concrete,laboratory tests on concrete.

Unit III: Basic elastic theory and concept of reinforced concrete, types of reinforcement, Analysis of rectangular sections by working stress method, modes of failure, design of singly reinforced beams, one-way slabs (simply supported), lintels, andchajjas.

SECTION-B

Unit IV: Pozzolana and Admixtures: Plasticizer, retarders, accelerators, water proofing agents, mineral admixtures, IS code provisions. Construction chemicals: concrete curing compounds, polymer bonding agent, surface retarders, bond aid for plastering, protective and decorative coating.

Unit V: Special concrete: Ready Mix Concrete Light weight concrete, fiber reinforced concrete, Roller compacted concrete, self-compacted concrete, high strength concrete, high performance concrete, high volume fly ash concrete. Special concreting techniques: Guniting, grouting and shotcrete concrete, introduction & application of Ferrocement.

Unit VI: Introduction of mix design, factors governing mix design, IS Code method of mix design (IS: 10262 – 2019) and Ambuja method.

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Books Recommended:

1. Lea, F. M. The Chemistry of Cement and Concrete, Edward Arnold (Publishers) ltd.
2. Neville, A. M.: Properties of Concrete, Pitman Publishing Company.
3. Neville, Brooks: Concrete Technology, ELBS
4. Gambhir, M. L. : Concrete Technology, Dhanpat Rai and Sons
5. Orchard D. F.: Concrete Technology, Applied Science Pub Ltd.
6. Shetty, M. S.: Concrete Technology, S. Chand
7. Varshney, R. S.: Concrete Technology, Oxford Pub. house.
8. IS: 456 – 2000,
9. IS: 10262 – 2019,,
10. Krishna Raju: Design of Concrete Mixes, Mc – Graw Hill.
11. Ambuja Cement Concrete Mix Design- Ambuja Technical Literature series 79.

3CE06 – STRENGTH OF MATERIALS – LAB

List of Practical's in Strength of Material Lab (Minimum any eight practical from the list should be performed)

1. Tension test on metals.
2. Compression test on metals.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Buckling of columns.
10. Deflection of springs.

3CE07 BUILDING CONSTRUCTION & ENGINEERING GEOLOGY – LAB

List of Practical's in Building Construction & Engineering GeologyLab (Minimum any eight practical from the list should be performed)

1. Drawing of following building elements on A-2 size sheet.
   a) Paneled door, flush door, and glazed window.
   b) Steel truss with details of joints, details & support, details of fixing of roof covering.
2. Planning & drawing of a staircase for the given data. [On A-2 size sheet, Design calculations, plan & section.]
3. Preparation of foundation plan from the given line plan of a two room building [On a A-2 size sheet.]
4. Layout of the above, in field.
5. Fields visits to building under construction and its report writing including material of construction, construction processes, Human recourses required, and construction details.
6. Sketch book containing Free hand sketches of following:

Different types of foundations, Bonds in brick masonry, Types of floors. [Sections] Types of stairs. [Plans and side view], Line sketches of different types of steel roof trusses, Details of expansion joints, Details of damp proofing for basement, Fixtures & fastenings of doors & windows.

7. To determine shape and size of supplied bricks.
8. Field visit for different types of roof structures.
9. Field visit for studying building component in Load bearing and framed structure.
10. Megascopic study of silicate and non-silicate mineral, with special reference to physical properties of minerals and uses.
11. Megascopic study of the common igneous, sedimentary and metamorphic rocks, with special reference to engineering properties of rock and uses.

3CE08 TRANSPORTATION ENGINEERING – LAB

List of practicals in Transportation Engineering-Lab (Minimum eight experiments from the list should be performed)

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1. Determination of Los Angeles value
2. Determination of Abrasion value of Aggregates by the use of devil machine
3. Determination of Aggregate Impact value
4. Determination of Aggregate Crushing value
5. Determination of Flakiness and Elongation Index of Aggregate.
6. Determination of Viscosity of Bituminous material
7. Determination of softening point of bituminous material.
8. Determination of ductility of bitumen.
9. Determination of marshal stability value

3CE09 CONCRETE TECHNOLOGY & RCC – LAB

List of Practicals in Concrete Technology & RCC Lab (Minimum eight practical from the list should be performed) :

1. Mix Design (Compulsory) by IS method.
2. Compulsory site visit and submission of site visit report.
3. Fineness of cement
4. Soundness of cement
5. Consistency and setting time of the cement
6. Compressive strength of cement
7. Sieve analysis of aggregate.
8. Bulking of sand (fine aggregate).
9. Silting of sand.
10. Workability by slump cone test compaction factor test
11. Admixture: Density, Compatibility Test
12. Workability by flow table method.
13. Compressive & Tensile strength of concrete.

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FOURTH SEMESTER

4CE01 BUILDING PLANNING DESIGNING & CAD

Learning Objectives of Subject:

1. To understand need of engineering drawings and methods to draw it.
2. To learn about various planning principles and able to apply on residential buildings.
3. To understand seasonal and climatic condition and corresponding provisions in structure.
4. To know regional rules regulation related to building construction.
5. To learn various types of plan – Block , Site , Line , Detail , Section etc.
6. To learn about smart buildings.

Course outcomes:

At the end of the subject the students will be able -

1. To make engineering drawings by First angle and Third angle method.
2. To apple building planning principles practically while developing projects.
3. To study the climatic conditions and decide the corresponding provision in structure.
4. To know about Bylaws, Town development authority rules and terms.
5. To draw various plans manually and computationally.

SECTION-A

Unit I: Importance of building drawing for Civil Engineering in construction & industry, estimation, Selection of scales for various drawings. Types of line and theirapplication. Methods of dimensioning in architectural drawing. Abbreviations and graphical symbols used in Civil Engineering Drawing as per IS: 962. Compare first angle and third angle method of projection. Layout of sheet for civil engineering drawing. Requirements of drawing and documents as per plan sanctioning authorities. Define FSI and TDR.

Unit II: Planning of residential building. Introduction, general principles of planning viz. aspect, prospect, roominess, privacy, grouping, circulation, ventilation, furniture requirement.

Climate of Indian and its influence on Building planning: Solar radiation, air temperature, wind, humidity, precipitation, earth & its motion, directions to their characteristics. Orientation of buildings: factors affecting orientation, sun, wind, rain. Requirement of the owner. Alternatives of building types viz. individual bungalows, semidetached houses, row houses, apartments. Provision of mezzanine floor, balconies and porches in the building. Common utilities such as parking, security, water supply, sanitation, etc. for apartments. Criteria for earthquake resistant planning of building.

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Concepts of Digitized / Smart Buildings, Internet of Things (IOT) in buildings and Green Buildings, Industrialized Buildings

SECTION -B

Unit-III: Building Bye-laws and Development Control Rules for D Class Municipal Corporations in the Maharashtra State under the provisions of the Maharashtra Regional & Town Planning Act, 1966. Conversion of land to non-agricultural lands, layout for a housing project.Types of public building and their requirements, planning of public building.

Preparing line plans of different public buildings such as schools, commercial market, primary health center, workshop, college building, post-office. Free hand sketching of components of buildings and elevation features of building such as balconies, chajjas, etc.,Staircase planning & drawing.

Unit IV: Concept of line plan, working and submission drawings of the building. Details to be incorporated in the working drawing. Necessity and use of working and submission drawing. Concept of site plan, block plan and layout plan. Importance and details to be incorporated. Concept of foundation plan, importance and use. Developing working and submission drawings for load bearing and framed structures building from the given line plan(Develop plan, elevation, LHSV, RHSV, back side view, section, foundation plan, site plan and their detail). Plumbing ramp, Electric plan.

Books Recommended :

1. Shah, Kale &Patki, Building Planning & Drawing, Tata McGraw-Hill plubication
2. Dr. Kumar Swamy& Rao Swamy, Charotar publications
3. CheryR , Auto cad Pocket reference, BPB Publication.

4CE02 - HYDROLOGY & WATER RESOURCE ENGINEERING

Learning Objectives of Subject:

1. To study the different hydrological parameters.
2. To understand hydrological statistics and design.
3. To characterize and mitigate natural and man-made hazard.
4. To understand the various irrigation systems and its design.

Course outcomes:

At the end of the subject the students will be able -

1. Explain the hydrology and hydrological data.
2. To analyze the hydrological methods for runoff.
3. Evaluate the ground water hydrological problems.
4. Explain the need of irrigation systems and its alternatives.

SECTION – A

Unit I: Introduction - Hydrologic cycle, applications in engineering, sources of data. Precipitation- Forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area- duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP).

Unit II: Abstractions from precipitation - evaporation process, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modeling infiltration capacity, classification of infiltration capacities, infiltration indices.

Unit III: Runoff - runoff volume, methods of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph. Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

SECTION – B

Unit IV: Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler, pipeline distribution network(PDN) and trickle / drip irrigation.

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Unit V: Distribution systems - canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Lining of canals, types of lining. Water logging problems, causes, effects and remedies.

Unit VI: Dams and spillways – Earthen dams: Classification, design considerations, selection of suitable site. Estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Economic height of dam, Spillways: components of spillways, types of gates for spillway.

Books Recommended:

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
3. G L Asawa, Irrigation Engineering, Wiley Eastern

4CE03 SURVEYING

Learning Objectives of Subject:

1. To learn about the term surveying, various instruments and possible error.
2. To learn Linear Measurement methods and way of conduction.
3. To learn about the measurement at elevation and of Directions , contour development process.
4. To understand and learn performing Plane table surveying.

Course Outcomes:

At the end of the course the student will be able to:

1. Define principles of Surveying, Remote Sensing and Geomatics.
2. Describe different instruments, tools, applications and techniques to determine the positions on the surface of the earth, change detection.
3. To perform Liner measurement methods of surveying.
4. Differentiate the techniques for setting out alignments, curves, other layouts, modern survey systems etc.
5. To perform survey at elevation and conduct Plane Table survey.

SECTION-A

Unit I: INTRODUCTION: Geo-informatics- definition, disciplines covered, importance. Field Surveying- definition & objectives; concept of Geoids and reference spheroids, coordinate systems, plane and geodetic surveys. Methods of location of a point- classification of surveys; principles of surveying Errors in measurements- sources, types of errors and their treatment. Random error distribution, accuracy, precision and uncertainty. Surveying instruments- temporary and permanent adjustment concept, principle of reversal. Maps- types, importance, scales/CI, conventional symbols, and generalization; topographic maps projection systems, sheet numbering systems, map layout.

Unit II:LINEAR MEASUREMENTS: Direct and indirect methods; Chain and tape measurements- corrections to tape measurements; Optical methods- tachometers, sub tense bar; Electronic methods- EDMs, total stations.

Unit III: MEASUREMENT OF ELEVATIONS :Various terms; Methods of height determination; Spirit leveling- different types of levels and staves; booking and reduction of data, classification and permissible closing error; profile leveling and cross sectioning; curvature & refraction and collimation errors; reciprocal leveling. Contours- characteristics, uses and methods of contouring.

SECTION – B

UnitIV:MEASUREMENT OF DIRECTIONS: Bearings and angles; Compass surveying- magnetic bearings, declination, local attraction errors and adjustments.

Unit V: TRAVERSING: Purpose and classification of each; Compass and theodolite traverses, theodolites- different types, uses, methods of observation and booking of data, balancing of traverses, computation of coordinates, omitted measurements Gale's traverse table.

Unit VI: PLANE TABLING: Merits and demerits, accessories; orientation and resection; methods of plane tabling; three point problem and solutions; errors in plane tabling, least square principle, Engineering project surveys- requirements and specifications, various stages of survey.

Books Recommended:

1. D. Clarke: Plane and Geodatic Surveying, Volume I & II
2. T.P. Kanetkar& Kulkarni: Surveying & Levelling, Part I & II.
3. B.C. Punmia : Surveying I & II.
4. N.N. Basak : Surveying & Levelling.

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4CE04 - GEOTECHNICAL ENGINEERING –I

Learning Objectives of Subject:

1. To understand the various types of soil and its classification.
2. To learn about the Index and Engineering properties of soil.
3. To make one understand the mechanics of compaction and factors affecting the compaction.
4. To understand the concept of permeability and factors affecting to it.
5. To learn about the concept of seepage discharge and effective, neutral and total stress in soil mass.
6. To make one understand the stress distribution in soil mass& its engineering applications.

Course Outcomes:

At the end of the subject the students will be able –

1. To determine the Index properties and Atterberg limits for soil classification.
2. To understand the mechanics of compaction and quality control in field.
3. To explain permeability of soil and methods of dewatering.
4. To calculate the seepage discharge and design the graded filter.
5. To understand the concept of consolidation and stress distribution in soil mass.
   To calculate the shear strength of different soil.

SECTION - A

Unit- I History of development of soil mechanics, formation of soil, its significance to the field problems. Soilproperties and its classification, system: Definition of soil, soil as a three phase system, weight – volume relationship Index properties of coarse and fine grained soil BIS classification of fine grained & coarse grained soil.

Unit-II Concept of clay mineral, major soil minerals, their structural formation and properties. Mechanics of compaction, factors affecting compaction, Standard and modified Proctor test, their field Determination, zero air void line, concept of wet of optimum, and dry of optimum, different structures of soil, field compaction & their control. CBR test and CBR value for soak and unsoaked conditions.

Unit-III Absorbed water, surface tension, capillarity and its effect on Soil properties permeability of soil, Darcy's law and validity, Discharge and seepage velocity, factors affection Permeability, determination of coefficient of permeability laboratory and field methods. Permeability for stratified deposits. Drainage and dewatering of soil and it's various methods.

SECTION – B

Unit-IV Laplace equation, its derivation in Cartesian co-ordinate system, its application for the computation of discharge seepage, seepage pressure, quick sand condition, concepts flow net, method to draw flow nets, characteristics and use of flow net, preliminary problem of discharge, estimation of discharge through homogenous earthen embankment, concept of effective neutral and total stress in soil mass, method of arresting seepage, design Terzaghi's criteria for graded filter, concept of piping and criteria of stability against piping.

Unit-V A physical concept of shear strength, Introduction of Mohr's stress diagram, Mohr's failure criteria, Mohr-Coulomb's theory and development of failure envelopes, Unconfined compression test, Laboratory measurement of shear strength for different drainage, conditions by direct shear test, Triaxial test for various drainage conditions, Merits and demerits of various shear strength tests. Concept of pore pressure coefficient shear characteristics of sand, NC and OC clays and partially saturated soil, Influence of soil structure and strain rate on shear strength.

Unit-VI State of stress at a point, stress distribution in soil mass, Boussinesq's theory and its applications, point load, uniformly loaded rectangular and circular area New-mark's chart, its preparation and use, equivalent point load Compression of laterally confined soil, concept of consolidation spring analogy, Terzaghi's theory of one-dimensional consolidation. e-p curve, compression index, swelling index, coefficient of compressibility, Consoledometer-test, determination of Cv Cassagrande's method for determination of pre-consolidation pressure.

Books Recommended:

1) Craig R.F.: Soil Mechanics,
2) Lambe T.W. & Whiteman R.V.: Soil Mechanics, John Wiley and Sons, 1969.
3) Terzaghi K. & Peck R.B.: Soil Mechanics in Engg. Practice, John Wiley & Sons, 1967.
4) Gulhati S.K.: Engg. Properties of Soils, Tata McGraw Hill, New Delhi, 1978.
5) Singh A.: Soil Engg. in Theory and Practice, Asia Publishing House, Mumbai.
6) Venkataramiah C.: Soil Mechanics and Foundation Engineering.
7) B. M. Das, Advanced Soil Mechanics.
8) S. K. Garg: Soil Mechanics and Foundation Engineering.

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4CE05 - STRUCTURAL ANALYSIS- I

Learning Objectives of Subject:

1. To understand the action and corresponding displacement in various type of structural elements.
2. To learn about statically determinate and indeterminate structures.
3. To analyze continuous, cantilever and propped cantilever beams.
4. To learn different analysis methods for analysis of beam, frames and trusses.
5. To learn analysis of 2 Hinge and 3 Hinge arches.

Course outcomes:

At the end of the subject the students will be able -

1. To decide what is required to be analyzed depending upon type of structural element.
2. To know about degree of freedom, Condition of equilibrium and determinacy of element.
3. To understand reason for failure and permissible limits for safety.
4. To apply the knowledge of beam analysis for practical analysis and design purpose.
5. To make application of various analysis methods for actual structural member analysis and design.
6. To know merits for utilization of suspension, 2 hinged and 3 hinged arches.

SECTION – A

Unit-I : 1. Classification of Structures, Concept of statically indeterminate Structures, Analysis of fixed beam and propped cantilever, Rotation and sinking of support.

2. Analysis of Continuous beam by theorem of three moments, sinking of support.

Unit-II : 1. Castigliano's theorem I, Unit load method, slope and deflection in determinate beams and portals.

2. Deflection in determinate trusses.

Unit-III : Influence line diagrams for reactions, bending moment and shear force for determinate beams. Rolling loads on simply supported beams concentrated and uniformly distributed loads, maximum shear force and bending moment, focal length.

SECTION - B

Unit IV : 1. Analysis of Cables Suspension Bridge under Concentrated Load and UDL for Cables over pulleys and Cable provided with saddles.

2. Two & Three hinged arches subjected to static loads, Bending moment, radial shear and axial thrust.

Unit V: Slope deflection method: 1. Analysis of continuous beams with and without sinking of support.

2. Analysis of portal frames without side sway.

Unit VI : Moment Distribution method: 1. Analysis of continuous beams with and without sinking of support.

2. Analysis of portal frames without side sway.

Books Recommended:

1. Junnarkar, S. B., Mechanics of Structure, Volume I and II.
2. Jain and Arya, Theory and Analysis of Structures .
3. Reddy. C. S., Basic Structural Analysis, Tata – McGraw hill
4. Wang, C. K., Elementary Analysis of Structures
5. Norris and Wilbur, Elementary Structural analysis.

4CE06 BUILDING PLANNING DESIGNING & CAD – LAB

A. SKETCH BOOK :

1. Draw various types of lines, Graphical symbols for materials, doors, windows, sanitary and water supply installations, electrical installations, Abbreviations as per IS 962:1989, Location for bed, sofa, dining table with chairs, wardrobe, kitchen furniture, etc. Free hand sketches of Verandah, lobby, passage, corridor and balconies. Building layout plan with setback lines, sanitary and water supply lines. Loft and Mezzanine floor.

2. Collect one readymade drawing for residential building (1 BHKD or 2BHKD) Read various details shown on drawing. write summary of observations on the drawing itself such as orientation of rooms, placement of doors and windows, wall thicknesses, flooring in rooms and sanitary block, skirting, dado, kitchen platform-size, height etc; room height, chajja projections, staircase-rise, tread, landing etc. Attach these drawings with the sketch book.

3. Draw line plans for five Residential Buildings with minimum three rooms and staircase in each with WC and Bath.

4. Draw line plans for five Public Building- School Building, Primary Health Centre, Hospital Building, Bank, Post Office, Hostel, Canteen and Shopping Complex. Bar & Restaurant and Hotels, Saloon, Bus Station.

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B. FULL IMPERIAL SIZE SHEET (A1)

AUTOCAD: Understanding basic concepts such as Absolute, relative & world Co-ordinates, Drawing units, drawing limits, extend, layers, line types, object snapping, and filter.

Drawing entities in AutoCAD/Felix CAD, various drawing commands, use of object snaps & filters, Editing the drawing different editing commands, Dimensioning commands, Text commands, Hatching commands viewing the drawing different views, view ports, zooming in & out, panning, saving & printing in different scales.

Draw sheet no. 1, 2 and 3 drawing in Auto-CAD or similar software.Prepare sheet no. 3 in Pre-DCR software.

1. SHEET NO. 1 : Submission drawing, **to the scale 1:100,** of single storied Load Bearing Residential Building (4 Room) with Flat Roof and staircase showing developed plan, elevation, section passing through Stair or W.C. and Bath, site plan (1:200), **foundation plan and section (1:50),** area statement, schedule of openings , construction notes.

2. SHEET NO. 2 : Submission drawing, to the scale 1:100, of (G+1) Residential Building Framed Structure (2 BHKD) with attached toilet to 1 bedroom showing the position of European type WC pan) showing developed plan, elevation, section passing through staircase, site plan (1:200), foundation plan **and section** (1:50), area statement, schedule of openings. (Also Show the place for Washing machine, WHB, Pooja, store, bed, dining table with chairs, sofa, wardrobe etc.)

3. SHEET NO. 3: Submission drawing of Apartment / Multi storeyed building to the scale 1:100, showing developed plan, elevation, section passing through staircase or W.C. and Bath and Component Drawing of RCC Lintel and Chajjas. Shows detailed enlarge section.

Note: No identical plans and every student must have his/her own plans and drawings.

4CE07 - HYDROLOGY & WATER RESOURCE ENGINEERING - LAB

TERM WORK: Five problems from the following to be worked out by the students, whenever necessary scale drawing on half empirical size must be drawn:

Practical examination shall consist of viva – voce.
1. Fixing control levels of Reservoir from given data.
2. Cross section, plan, L-section of Earth dam showing all components.
3. Drawing of elementary and practical profile of gravity dam.
4. Drawing of diversion weir on permeable foundation.
5. Drawing of ogee spillway with energy dissipaters.
6. Computer Aided design of unlined and lined canal.
7. Drawing of any four canal structure (No design)
8. Technical Field visit.

4CE08 SURVEYING– Lab

List of Practical's in Surveying Lab (Minimum eight practical from the list should be performed)

1. Distance measurement by chain tape and EDM.
2. Finding RL of given point.
3. Profile and cross section leveling for road.
4. Measurement of bearings with prismatic compass.
5. Chain and compass traversing.
6. Local attraction detection- correction of bearings.
7. Measurement of Horizontal and Vertical angles using Theodolite.
8. Theodolite Traversing.
9. Plane table surveying- Radiation, Intersection and Resection method.
10. Engineering Project Surveys.

4CE9 GEOTECHNICAL ENGINEERING I – LAB

List of Practical's in Geotechnical Engineering- I Lab (minimum eight practical from the list should be performed)

Experiments:

1. Determination of specific gravity of soil solids by Pyconometer, density bottle.
2. Determination of moisture content by ovendrying method.

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3. Determination of field density of the soil by sand replacement / core cutter method.
4. Determination of grain size distribution by mechanical sieve analysis.
5. Determination of Atterbergs limits (LL, PL and SL)
6. Determination of Compaction properties (Standard Proctor Test)
7. Determination of permeability of soil by using falling head test
8. Determination of shear strength parameters by direct shear test
9. Determination of unconfined compressive strength of soil.
10. Determination of shear strength parameters by Triaxial list of UU type
11. C.B.R. test. Determination of C.B.R. value by conducting CBR test on soaked sample.
12. Determination of Coefficient of consolidation by conducting consolidation.

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SYLLABUS OF B.E. [MECH.] SEM. III & IV {C.B.C.S.}

Semester-III

3ME01 MATHEMATICS-III

Course Learning Objectives :

1. To provide the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. To understand the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. To provide knowledge to apply False Position, Newton Raphson method to solve nonlinear & polynomial equations, Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. To understand the Gradient, divergent and curl of vector point functions. To find the directional derivatives of scalar point functions. To discuss the Irrotational and solenoidal vector fields. To define line surface and volume integrals.

Course Outcomes :

Students will be able to -

1. Demonstrate the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. Define the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. Apply False Position, Newton Raphson method to solve nonlinear & polynomial equations Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. Define Gradient, divergent and curl of vector point functions. Finds the directional derivatives of scalar point functions. Discuss the Irrotational and solenoidal vector fields. Define line surface and volume integrals

SECTION-A

UNIT-I : Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (10 Hrs)

UNIT-II: Laplace transforms : Definition, standard forms, properties of Laplace transform, inverse Laplace transform, initial and final value theorem, convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function. Solution of Linear differential equations. (10 Hrs)

UNIT-III :a) Partial differential equation of first order of following form- (i) $f(p,q)=0$; (ii) $f(p,q,z)=0$; (iii) $f(x,p)=g(y,q)$; (iv) $Pp+Qq=R$ (Lagranges form); (v) $z=px+qy+f(p,q)$ (Clairaut form)

b) Statistics : Curve fitting by method of least squares (Straight and parabola only), Correlation, Regression.

c) Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (10 Hrs.)

SECTION-B

UNIT-IV: Complex Analysis :- Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation), singular points, expansion of function in Tayler's and Laurent's series. Cauchy's integral theorem and formula, Residue theorem. (12 Hrs.)

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NOTIFICATION

No. 135 /2021 Date : 2/12/2021

Subject :- Implementation of new syllabi of Semester V & VI of B.E. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum from the session 2021-2022 & onwards.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabi of **V & VI** of various branches of B.E. in Civil, Mechanical, Computer Science & Engg., Computer Engg., Information Technology, Electrical Engg., Electrical (Electronics & Power) and Electrical & Electronics Engg. (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2021-2022 and onwards in phase wise manner as per **Appendix – A** :

Sd/-
(Dr.T.R.Deshmukh)
Registrar
Sant Gadge Baba Amravati University

Appendix – A

Syllabus Prescribed for V & VI Semester of B.E (Civil Engineering)

SEMESTER V

5CE01 : Design Of Reinforced & Prestressed Concrete Structures

Learning Objectives of Subject:

- To understand basic concept of limit state method.
- To understand behavior of slab under external loading.
- To understand behavior of staircase and retaining wall.
- To understand behavior of column and footing.
- To learn concept of grid slab and earthquake resistant construction.
- To introduce basic concept of prestressed concrete.

Course outcomes:

At the end of the subject the students will be able -

- To analyze and design of rectangular section.
- To analyze and design of slab.
- To analyze and design of staircase and retaining wall.
- To analyze and design of column and footing.
- To understand grid slab and ductile detailing.
- Explain the general behavior of PC sections under external load.

SECTION-A

Unit I:

1) Introduction to limit state method, basic concept and design of singly and doubly reinforced rectangular sections.
2) Analysis and design of flanged sections.

Unit II:

1) Analysis and design of one way continuous slabs
2) Analysis and design of two way slab.

Unit III:

1) Design of Dog legged staircase.
2) Design of cantilever retaining walls (Horizontal backfill only).

SECTION-B

Unit IV:

1) Analysis and design of columns for axial load, uniaxial and biaxial bending.
2) Design of isolated footings: square and rectangular subjected to axial load and uniaxial bending moment only (with uniform depth only).

Unit V:

1) Design of Grid Slab by I.S. code method.
2) Detailing for earthquake resistant construction. Introduction, Cyclic behavior of concrete and reinforcement, significance of Ductility, Ductile detailing for beams, columns, beam-column joint and footing.

Unit VI: 1. Introduction to Prestressed concrete: Materials and their characteristics, types of prestressing, Methods and various prestressing systems, Losses of prestress.
2. Analysis of Rectangular and flanged beams.

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Notes:

1) Students should use IS 456:2000, IS 1343:2012, IS 1893:2016, IS 13920:2016.
2) Field visit on any RCC framed structure & report of the same.
3) Students must be shown video CD, slides, transparencies, and photograph of actual structures.

Books Recommended:

1. Ashok K Jain : Reinforced Concrete Limit state Design (Nem Chand & Bros Roorkee)
2. S.K.Sinha: Reinforced Concrete Design (M C Graw Hill Education India Pvt Ltd)
3. Devdas Menon, S. UnnikrishnaPillai :Reinforced concrete Design ;Third Edition; McGraw Hill Education
4. Dr.Shah V.L. &Karve S.R. : Limit State Theory & designof Reinforced concrete IS 456:2000(Structurs Publication)
5. Neelam Sharma :Reinforced Cement Concrete design (S.K.Kataria& Sons)
6. S.S.Bhavikatti :Design of R.C.C. Structural Element (R.C.C. Vol. I)(New Age International Publishers)
7. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
8. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi

5CE02: SURVEYING & GEOMATICS

Learning Objectives of Subject:

- To prepare the student to understand applications of curves.
- To enable the students to establish accurate control for photogrammetric survey and to determine accurate locations of points in engineering works
- To equip the candidate with the art, science and technology of cartography and applications of GIS in Mapping Resources.
- To develop the skills in surveying and thematic mapping.

Course Outcomes:

At the end of the course students will be able to

- Understand the use of different types of curves and their field implications.
- Understand the triangulation adjustment.
- Understand the hydrographic survey.
- Acquire skills in handling spatial data base warehousing and mining.
- Understand the surveying with advance instrument like remote sensing, GPS and GIS.

SECTION- A

Unit-I: Curves: Classification, degree of curve, elements of circular and compound curves, theory and methods of setting out simple curves, Instrumental method of setting out compound curves.

Unit-II: Triangulation: principles, classification of triangulation system, triangulation figures, their choice of station, phase of signals, towers, satellite station, reduction to center, field work, reconnaissance, Inter-visibility, angular measurements. Basenet, extension of Basenet.

Unit-III: Hydrographic surveying: necessity, controls, shore line surveys, gauges, sounding equipment s and procedure of taking soundings, methods of location of sounding, three-point problem in hydrographic surveying, analytical and graphical methods. Underground Surveying: surface alignment, correlation of surface and underground surveys; Weisbach triangle, transferring levels and alignment underground.

SECTION – B

Unit-IV: Elements of photogrammetry: Basic definitions, terrestrial and aerial photography, scale of vertical photograph, Relief and relief displacements, heights from parallel measurements, flight planning, photographs required.

Unit-V:1.Remote sensing: Introduction, definitions, remote sensing systems, advantages over conventional system, energy interaction in the atmosphere, Indian remote sensing satellite series and their characteristics 2. GPS: Global positioning system (GPS) introduction, definitions, GPS receivers, antenna, advantages of GPS.

Unit-VI: 1. Geographical Information System: Definition and history, Components of GIS, Data structure and formats, Spatial data models Raster and vector, Data base design- editing and topology creation in GIS, Linkage between spatial and non-spatial data, Introduction to QGIS software. 2. GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning.

Books Recommended:

1. D. Clark.: Plane and Geodetic Surveying Vol II, CBS Publishers & Distributors Pvt. Ltd,
2.T.P. Kanetkar & S.V.Kulkarni: Surveying and Leveling Part II, Pune Vidyapetth GrahaPrakashan.
3. B.C.Punmia: Surveying Vol. II and III, Tata McGraw-Hill Publishing Company Limited,
4. Kang-tsung Chang: Introduction to Geographic Information Systems, McGraw-Hill Book Company, 2006.
5. B.C. Punmia, Ashok Jain, Arun k. Jain: Higher surveying, Laxmi publications (P), Ltd,
6. Dr. S. Kumar: Basics of remote sensing and GIS, Laxmi publications (P), Ltd

5CE03: NUMERICAL METHODS AND COMPUTER PROGRAMMING

Learning Objectives of Subject:

- To learn the basics of spreadsheets.
- To learn the basic concepts of computing.
- To know the methodology of problem solving.
- To develop skills in programming using C language.

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Course outcomes:

At the end of subject the students will able -

- To use spreadsheet software for solving civil engineering problems.
- To impart knowledge to analyze, solve, design and code numerical method problems using C language.
- To impart knowledge to analyze, solve, design and code civil engineering problems using C language.

SECTION – A

Unit-I:
Spreadsheet software basics, Expressions, Mathematical Functions, Conditional Execution Functions like IF, COUNT, COUNTIF, SUM, SUMIF, AVERAGE, AVERAGEIF, LOOKUP, HLOOKUP. Application to the Civil Engineering Problems.

Unit-II:
1. Basic structure of C program, use of library functions, input output statements, flowchart.
2. Decision Control structures and loop Control structures conditional loop and unconditional loop: WHILE, DOWHILE, FOR, IF, IFELSE, NESTEDIF, LADDER IFELSE etc.

Unit-III :
1. Type casting, single dimensional and multi-dimensional array, subscripted variables
2. Functions in C

SECTION-B

Computer Programming using C:

Unit-IV:
1. Matrix operations such as:
   a. Addition and subtraction
   b. Multiplication
   c. Transpose
   d. Testing summary etc.
2. Fourth order, Runge - Kutta method for solution of first order, second order differential equations and two simultaneous equations.

Unit-V:
1. Solution of quadratic equation
2. Numerical integral using Trapezoidal and Simpson rule
3. Finding root of equation f (x) = 0 by Newton Raphson , Regula -Falsi and Bisection method.

Unit VI:
1. Centre of gravity, moment of inertia & radius of gyration of Tee section.
2. Bending moment and shear force ordinates for simply supported beam subjected to point and uniformly distributed load only.
3. Design of singly reinforced beam by limit state method.
4. Determination of coefficient of permeability in parallel and perpendicular direction of bedding plane
5. Reduce level by height of instrument method.
6. Determination of Chezy s constant.

BOOKS RECOMMENDED :

1.E Balagurusamy, Programming in ANSI C
2.Yashavant P. Kanetkar, Let Us C
3. Pradeep Dey & Manas Ghosh Computer Fundamentals &Programming in C Oxford University Press 2006.
4. Herbert Schildt - C Complete Reference (Tata-McGraw Hill)
5. Gottfried Problem Solving in C (Schaum Outline Series- McGrawHill)
6. Noel Kalicharan - C by Example (Cambridge University Press)

5CE04 : (PROFFESSINAL ELECTIVE - I) (I) HIGHWAY CONSTRUCTION AND MANAGEMENT

Learning Objectives of Subject:

- To know the development of transport, various road development plans and policies in India and test procedures for highway materials.
- To understand the principles of highway geometric design as per IRC standards.
- To study the different types of pavement its construction, maintenance & design by different methods.
- To understand the Traffic engineering & different types of traffic control devices.
- To study the causes, preventions, better planning & design of highway to prevent accidents.
- To study various types of equipments, their working principles & limitations for flexible and rigid pavement.

Course outcomes:

At the end of the subject the students will be able

- Explain the basic concepts about highway engineering
- To design geometric elements of the highway.
- To design the various types of road pavements with construction and maintenance of highway.
- To carry out traffic studies and implement traffic regulation and control measures and intersection design.
- To apply the knowledge to prevent the road accidents.

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SECTION A

Unit I: Highway: Development and Planning, Road Transport characteristics, classification of Roads, Road development plans & Salient features, Road pattern, Alignment principles, Egg. Survey for highway. Material and Testing. Various properties of aggregates and bituminous materials and Test, IRC, IS Specifications, bituminous mix design.

Unit II: Geometric Design : cross sectional elements, Right of way, Camber, Gradient, Typical Highway cross section in embankment and in cutting, PIEV Theory, stopping sight distance, Overtaking sight distance, Horizontal alignment - curves, super elevation, Extra widening, transition curves, vertical alignment, Design of summit and valley curves, IRC Standards for Geometric design.

Unit III: Pavement Design: Components of Flexible and Rigid pavement, Design factors, ESWL, Flexible pavement design by C.B.R. Method. Westergards analysis for wheel load & Temperature stresses in rigid pavement, Rigid pavement by IRC method (As per IRC-37), Combination of stresses, Joints in Rigid Pavement, Construction And Maintenance WBM Surface dressing, Bituminous roads, cement concrete Pavement, construction procedure, construction of roads in expansive soil .

SECTION B

Unit IV: Traffic Control Devices: Traffic signs, markings, islands and signals. Different methods of signal design; redesign of existing signal including case studies. Signal system and co-ordination. Evaluation and design of road lighting.

Unit V: Road Safety: Road accidents, Causes, scientific investigations and data collection. Safety in Road Design Accident prevention through better planning and design of roads planning road networks by land use planning. Traffic calming techniques and innovative ideas in road safety.

Unit VI: Equipment in Highway Construction: Various types of equipment for excavation, grading and compaction - their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

Books Recommended:

1. Kadiyali L.R., Principles & Practice of Highway Engineering Khanna Publisher
2. Highway Engineering , Khanna & Justo, (Nem Chand & Poros, Roorkee.1997)
3. E.J. Yoder, Principles of Pavement Design, John Wiley & Sons lnc., New York
4. Chakroborty P Das Principles & Practice of Highway Engineering (Khanna Publisher 2000)

REFERENCE BOOKS:

1. Highway Material Testing S K Khanna- C.E.G. Justo, Nemchand Bros- Rookee, 2000
2. S.K.Khanna & Justo C.E.G., Highway Material Testing Manual
3. A.K. Duggal and Vijay P.Puri, Laboratory Manual in Highway Engineering, .

5CE04: (II) REPAIRS & REHABILITATION OF STRUCTURES

Learning Objectives of Subject:

- To learn various distress and damages to concrete and masonry structures
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To assess the damage to structures using various tests
- To learn the importance and methods of substrate preparation
- To learn various repair techniques of damaged structures, corroded structures

Course outcomes

At the end of the subject the students will be able

- Various distress and damages to concrete and masonry structures
- The importance of maintenance of structures, types and properties of repair materials etc
- Assessing damage to structures and various repair techniques

SECTION A

Unit I : Introduction: General Consideration, Distresses monitoring, Causes of distresses, Quality assurance, Defects due to climate, chemicals, wear and erosion, inspection, Structural appraisal, Economic appraisal Structural Health, factors affecting health of structures, effect of leakage, age, creep, corrosion, fatigue on life of structure.

Unit II: Structural health monitoring, various measures, regular maintenance, structural safety in alteration. Quality control & assurance of materials of structure, durability of concrete, Factors affecting durability of concrete, Corrosion in structures, Testing and prevention of corrosion, fire safety.

Unit III : Structural Audit, Assessment of health of structure, study of structural drawings, nature of distress, visual observations, Collapse and investigation, limitations of investigator, tools for investigation, Various NDT Methods for assessing strength of distressed materials, investigation management, review of assimilated information, interviews and statements, evaluation and reporting, presentation of report, communication gap among client, architect, consulting engineer & contractor.

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SECTION B

Unit IV: Retrofitting of Structures, parameters for assessment of restoration strategies, selection of construction chemicals during restoration, Specification for important items of work in restoration, Structural detailing for restoration, and various techniques of retrofitting. Waterproofing of RCC water retaining structures.

Unit V: Safety during construction, formwork and staging, material handling, Existing methods of formwork, Modular formwork, Structural aspects for formwork in buildings & bridges.

Unit VI: Demolition of Structure, study of structural system and structural drawings, need and importance for demolition, outline of various demolition methods and their evaluation, partial and controlled demolition, role of safety measures, temporary support structures in demolition. Recycling of demolished materials

Books Recommended:

1. Deananmmer: Handbook of Material Management ; McGraw Hills.
2. Gopalkrishnan: Fundamentals of Material Management ; Tata McGraw Hills.
3. M Y Khan and Jain: Financial Management ; Tata McGraw Hills
4. A M Neville: Properties of Concrete ; Longman
5. R N. Raikar: Durable Structures , R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
6. R.N. Raikar: Learning from Failures , R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
7. R.N. Raikar: Diagnosis and treatment of structures in Distress , R & D Centre, (SDCPL), RaikarBhavan, Sector 17, Vashi, Navi Mumbai.
8. Hanbook on Seismic Retrofit of building , Central public works Department & Indian Building Congress In Association with IIT - Madras

5CE04 : (III) SUSTAINABLE CONSTRUCTION METHODS

SECTION A

Learning Objectives of Subject:

- Student should learn about the present demand supply gap of various construction resources and resource forecasting.
- Student should be able to understand various pollutions and its impact, rules and regulation related to pollution control.
- Student should be able to understand the concept of Sustainability , strategy to achieve it .
- Student should turn aware about various organizations working for implementing sustainability, Green rating agency and process to achieve it.
- Student should be able to determine use of waste material by proper process and percentage.
- Student should learn about sustainable construction like Green roofs, Green walls etc.
- Student should be able to understand thermo resistive property of construction material and its effect on utilization.
- Student should learn about sustainable Illumination, ventilation techniques.
- Student should know to manage domestic water resources.

Course outcomes:

At the end of the subject the students will be able -

- To understand present condition and need for replacement of non renewable resources.
- To understand concept of sustainability and strategy to achieve it.
- To understand various criteria s and considerations to achieve sustainable construction according to Green Rating Agencies.
- To decide application of sustainable methods in construction for Roof, Wall, thermo resistivity etc.
- To reduce water need and reuse of house hold waste water.

SECTION A

Unit I: Role of Construction sector in Global Resource Consumption, Resource like sand , water , aggregates , cement etc. demand supply gap analysis. Construction & Demolition waste. Environmental pollution related terms like Global warming, Carbon credit, Resource exploitation, Land pollution, Urban Heat Island, Air and water Pollution. Rules and Act related to waste management and pollution mitigation.

Unit II: Concept of Sustainability, Its origin, Legislation related to Sustainable construction , Reduce Reuse Recycle (3 R) Strategy , Various Green Rating Agency worldwide, Detail study of criteria s and process under GRIHA (Green Rating for Integrated Habitat Assessment), IGBC (Indian Green Building Council), LEED, India (Leadership in Energy and Environmental Design).

Unit III: Concept of Manufacturing cost, operational cost and life time cost, Payback Period. Thermo resistive property of construction materials and its importance. Implementation of Waste and recycled materials in construction Case study of some projects like Use of Plastic in Road construction, recycled aggregate utilization and similar to this. Various types of Renewable Energy and its application.

SECTION B

Unit IV: Concept of Green/ Sustainable Roofs, Its types, geometry, material, methodology and Limitations. Concept, material & methodology and limitation of Green walls, various methods like implementation of Cavity wall, Rattrap bond wall, thermo resistive material wall, Green vegetative wall etc.

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Unit V: Sick Room, Need and types of windows & ventilations, active and passive ventilation concept, Role of opening location and dimension in Ventilation and air circulation. Sustainable ventilation techniques.

Unit VI: Illumination terms :- Glare , Glare Index ,dark room, comfortable illumination , Lux value for various rooms as per utilization as in latest Building Code of India , Role of Solar direction, season and location for direction and provision of openings. Sustainable Illumination Techniques (Natural & Artificial methods) ,
Water Management – Re Use of domestic water, Grey water Concept and some Grey water treatment units example, Ground water recharging techniques, Rain water harvesting.

Books Recommended:

1. Moore F: Environmental Control System McGraw Hill, Inc., 1994.
2. K S Jagadish, B V Venkataramana Reddy, K. S. NanjundaRao : Alternative Buildings Materials and Technologies, New Age International Publishers, New Delhi, 2007
3. "Construction Materials, Methods & techniques" (3e) by William P Spence, Yesdee Publication 2012, pvt.ltd, Chennai, India
4. "Concrete Structure Properties & Materials" by mehataP.K&MantreioP.J.M, Prentice hall.
5. "Building Materials" ny M. L. Gambhir, NeaJamwal, Tata McGraw Hill Publication.
6. Building Reuse ,Sustainability preservation and value of life by Kathrin Rogers Mrilino.
7. Sustainable Construction Engineering & Management by Dr. S.K.Deshmukh & Dr. Abhinandan R.Gupta, LAP academic Publishing Mauritius
8. Energy Efficient Construction Materials, Key Engineering Material, Elsevier by Dr. S.K. Deshmukh & Dr. Abhinandan R.Gupta
9. Handbook of GRIHA for Green Rating
10. Handbook of LEED , India for Green Rating.

5CE04 :(IV) WATERSHED ENGINEERING AND MANAGEMENT

Learning Objectives of Subject:

- To study the different hydrological parameters.
- To understand hydrological statistics and design.
- To characterize and mitigate natural and man-made hazards.

Course Outcome: Student shall be able to

- Explain the hydrology and hydrological data.
- Analyze the hydrological methods for runoff.
- Evaluate the ground water hydrological problems.

SECTION - A

UNIT I: Introduction: Watershed, Definitions, Concept of watershed development, objectives of watershed development, and need for watershed development, Integrated and multidisciplinary approach for watershed management.
UNIT-II: Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.
UNIT-III: Hydrology in water resources development, statistical analysis of rainfall and runoff, different distributions methods, Estimation of Unit Hydrograph-flood flow formulae, Storm hydrograph, Storage and regulation of runoff-safe yield of streams

SECTION - B

UNIT-IV: Hydrology of ground water : Common aquifers-Exploration for ground water, hydraulics of ground water flow- Measurement of permeability of formations, flow nets and their constructions, Boundary conditions Unconfined and Confined, steady and unsteady flow into wells, Method of images Types, design, construction and maintenance of wells and infiltration galleries, Development of wells well strainer functions and selections, Ground water recharge
UNIT-V: Practice of watershed management: rehabilitation, protection and enhancement, non-point sources of pollution: the legal basis, the process of non point source pollution control, best management practices principles, Applications of Geographical Information System and Remote Sensing in Watershed Management
UNIT-VI: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation. Drought assessment and classification, drought analysis techniques, drought mitigation planning. Water conservation by recycle and reuse .

Books Recommended:

1. Watershed Hydrology by Peter E. Black.
2. Water Resources Systems, Planning and Management by R. N. Chaturvedi.

5CE05 (OPEN ELECTIVE) (I) BASICS OF BUILDING CONSTRUCTION

Learning Objectives of Subject:

- To understand the basic concepts of structures and types of foundation of civil structure.
- To learn about the different type of masonry, types of bonds and construction methodology.
- To understand various levels in building Types of floorings and floors,
- To understand the type and need of openings for access and circulation.
- To make aware of knowledge and importance of stairs, plastering and painting of structures.
- To understand the aspects of construction.

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Course outcomes:

At the end of the subject the students will be able -

- To understand Load bearing and Frame structure with their foundations.
- To recognize various types of construction material and its suitability
- To recognize the various levels in building and its need.
- To know types of openings, doors, windows and other related fixtures.
- To recognize types of rock and minerals and its construction properties.
- To understand the basic concepts of DPC, fireproof, soundproof and expansion joints in structure.

SECTION –A

Unit I: Introduction: Definition of building as per national building code, components of buildings and their function , Types of structure-load bearing structure and frame structures, their relative advantages and disadvantages, load bearing walls and partition walls. Types of foundation- Definition and necessity and types of foundations, precautions to be taken against failure of foundations

Unit II: Stone Masonry- Technical term, general principles to be observed during construction, selection of stone masonry. Brick Masonry Construction- Technical term, general principles to be observed during construction, commonly used types of bonds such as Stretcher, Header, English bond Flemish bond and their suitability.

Unit III: Floors- Types of floors-Basement floor, ground floor and upper floor. Types of upper floors-R.C.C. slab floor, R.C.C. slab and beam floor, R.C.C. grid floor, R.C.C. flat slab floor. Floor Finishes Types of flooring material, Shahabad , Kota, Granite, Ceramic tiles, Plain tiles, mosaic tiles glazed tiles ,different types of floor finishes , their suitability. Method of construction, criteria of selection. Roofs-Flat and pitched roof, steel roof trusses-types and suitability ,fixing details at supports ,types of roof covering, AC and GI sheets, acrylic sheets, fixing details of roof covering.

SECTION –B

Unit IV: Door Purpose, criteria for location, size of door, door frames and its types, method of fixing Windows-Purpose, criteria for location, size and shapes of windows, types of windows and their suitability. Ventilators Types and their suitability. Fixtures and Fastening for doors and windows. Glass- Types of glass and their suitability. Arches and Lintels - Types and their suitability. Details of R.C.C. lintels and chajja, precast lintels and arches.

Unit V: Stairs- Function, technical terms, criteria for location, types of staircases and their suitability. Painting and Coloring Necessity, types, processes of painting and coloring to the wall surface, wooden surfaces, iron and steel surfaces, types of paints and their uses Scaffolding- Purposes, types, suitability.

Unit VI: Special Aspects of Construction, Damp proofing-causes of dampness, its effects, various methods of damp proofing, material used for damp proofing. Fire proof construction- Points to be observed during planning and construction. Fire protection requirement for a multistoried building, Sound proof construction Sound absorbents and their characteristic. Joints Expansion and construction joints necessity, details of expansion joint at foundation level and roof level of load bearing structure and framed structure, Provision of construction joints in slabs, beams and columns.

Books Recommended:

1. Deshpande R.S... And Vartak C.V.: A Treatise on Building Construction.
2. Sharma S.K. Kaul and B.K.:A.T.B. Building Construction, S Chand and co.
3. Sane L.S.: Construction Engineering, Manak Talas, Mumbai
4. Chudley R.: Construction Technology, Volume I.II.III. And IV, Longmans Group Ltd.
5. Basics of Civil Engineering, Vol. I by Dr A.R.Gupta , Google book publishers ltd.
6. Gurucharan Sing: Building Construction Engineering, Standard Book House, Delhi-06
7. Sushilkumar :Building construction ,Standard publisher distributors.
8. B.C.Punmia ,A.K. Jain,: Building construction. ISE National Building code of India, 1970

5CE05 : (II) DISASTER MANAGEMENT

Learning Objectives of Subject:

- Student should learn about the term Disaster and definitions associated with it.
- Student should know various types , reasons for happening and preventive measures for Natural Disasters .
- Student should know various types , reasons for happening and preventive measures for Artificial Disasters
- Student should know about Impact and mitigation measures against disasters.
- Student should know about Disaster Risk Reduction and its utility practices.
- Learner should know about various Government and NG organization working for Disaster Management.
- Student should know role and responsibility of individual and group for managing Disaster.

Course outcomes:

At the end of the subject the students will be able -

- To understand concept and terms related to Disaster.
- To understand various types of Natural and Artificial Disaster .
- To decide and take actions to mitigate impact of disaster.
- To know roles and responsibility of organizations public and private, individual and group to manage disaster.

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SECTION A

Unit I: Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks severity, frequency and details, capacity, impact, prevention, mitigation. Study about natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.);

Unit II: Study about manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit III: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

SECTION B

Unit IV: Disaster Risk Reduction (DRR) - Disaster management cycle its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures, vulnerability and capacity assessment; early warning systems, Post disaster environmental response.

Unit V: Institutional mechanism for Disaster Management, Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, Disaster Management Policy Environment and local Action, Funding for Disaster Management, Capacity Building, Disaster Management Act 2005.

Unit VI:. Disaster Management practices at working and residential places. Key responsibility of engineers in disaster reduction techniques, medical preparedness aspect of disaster, plan to counter, threats to water supply.

Books Recommended:

1. Cuny, Fred C; Disasters and management, oxford Uni. Press.
2. Alexander, David; Principles of emergency planning and management, Terra publishing, ISBN 1-903544-10-
3. National Disaster Management Authority, Govt. of India, Report.
4. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994

5CE05 :(III) SOFT SKILLS AND INTERPERSONAL COMMUNICATION

Learning Objectives of Subject:

- Student should learn about the methods and measures to develop the interaction skills.
- Student should be able to have strong decision making and lateral thinking skills.
- Should know the do s and don ts for being good leader.
- Should be able to understand about conflict and be able to manage it.
- Should understand need of Negotiation and strategy to handle it wisely.
- Should be able to recognize the type, ways and barriers in Communication so as to develop it.
- Should be able to conduct effective correspondence process and shall have knowledge of documentation and formal writing skills.

Course outcomes:

At the end of the subject the students will be able -

- Interact in developed way so as to handle the situations .
- To take analyzed decisions over the problem and will effectively carry out wok in time.
- To handle task with developed leadership skills.
- To determine the reasons and solutions over conflict and will be able to manage it.
- To understand need for negotiation and strategy negotiate things.
- To have strong communication.
- To carry out formal documentation process and will have proper guideline for writing formal basic documents.

SECTION A

Unit I : Individual s Basic Interaction Skills Within family, Society Personal and interpersonal intrapersonal skills . Types of skills; conceptual, supervisory, technical, managerial and decision making skills. Problem Solving, Lateral Thinking. Self Awareness and Self Esteem Group Influence on Interaction Skills Human relations examples through role play and cases.

Unit II : Leadership Skills Working individually and in a team Leadership skills Leadership Lessons through Literature Team work & Team building . Interpersonal skills Conversation, Feedback, Feed forward Interpersonal skills Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team work. Conflict Management Types of conflicts, how to cope with them Small cases including role plays will be used as teaching methodology.

Unit III : Negotiation Skills (To be Taught through Role Plays and Cases) Types of Negotiation Negotiation Strategies Selling skills Selling to customers Selling to Superiors Selling to peer groups, team mates & subordinates Conceptual selling, Strategic selling Selling skills Body language

SECTION B

Unit IV : Introduction, Need for Communication, Process of Communication - Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication - Inter-cultural, Intra-cultural, Cross-cultural and International communication - Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication.

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Unit V : Barriers to Communication Improving Communication Skills -Preparation of Promotional Material -Non-verbal communication -Body language -Postures and gestures -Value of time -Organizational body language -Importance of Listening -Emotional Intelligence.

Unit VI : -Business Cases and Presentations, Letters within the Organizations, Letters from Top Management, Circulars and Memos - Business Presentations to Customers and other stakeholders, Presenting a Positive Image through Verbal and Non-verbal Cues, Preparing and Delivering the Presentations, Use of Audio-visual Aids .

Book Recommended:

1. Personality Development & Soft Skills by Barun K. Mitra.
2. Soft Skills and Interpersonal Communication by S. Balsubhramanium.

5CE06 : DESIGN OF REINFORCED & PRESTRESSED CONCRETE STRUCTURES - LAB

Practicals:

1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any RCC framed structure & report of the same.

5CE07: SURVEYING & GEOMATICS – LAB

Following is the list of practical to be conducted. Minimum 8 practical out of the given should be carried out. Practical examination shall consist of field exercise and viva-voce examination based on theory & practical.

List of Practicals: (Any Eight)

1. Ranging circular curve by offset from long chord.
2. Ranging circular curve by offset from tangent.
3. Ranging circular curve by offset from chord produced.
4. Ranging circular curve by Rankine s method.
5. Triangulation by satellite station.
6. Base line measurement in triangulation system.
7. To Find horizontal distance and difference in elevation between two points by using Total station.
8. To plot a layout using Total station.
9. Study on Stereoscope.
10. Application of GPS Distance and Coordinate Measurement using GPS tool.

5CE08 : NUMERICAL METHODS AND COMPUTER PROGRAMMING -LAB

Practicals: Preparation and execution of at least **six** computer programs using C language. Solution of at least **two** civil engineering problems using spreadsheet software. A journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

5CE09 : (I) HIGHWAY CONSTRUCTION AND MANAGEMENT –LAB.

List of Practicals :-

Any **Five** of the following should be conducted and a report there of should be submitted:

1. Field CBR Test.
2. Pavement Evaluation by Benkelman Beam Method.
3. Road Unevenness Measurement by Bump-Integrator.
4. Valuation of Pavement Roughness by Roughometer / Profilometer.
5. Design of Flexible Pavements for Highway.
6. Design of Flexible Pavements for Runway.
7. Design of Rigid Pavements For Highway.
8. Design of Rigid Pavements For Runway
9. Design of Overlays.
10. Marshal Stability Test
11. Transportation management (**field studies)**
12. Parking management (**field studies)**
13. Road accident studies (**field studies)**
14. Rotary design

Field Visit:

1. Hot mix plant visit,
2. Road construction site visit: Earth work construction procedure and bituminous mix laying, spreading and rolling procedure.

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5CE09 :(II) REPAIRS & REHABILITATION OF STRUCTURES – LAB

List of Experiments: (Any Three)

1. To perform a non-destructive and semi-destructive testing on the cast specimens of the beams using set up of Rebound hammer, UPSV, Core drilling etc. and there by prepare a report on the interpretation of the strength i.e quality of concrete based on NDT test results.
2. Take up Conditional Assessment of 5 different structures including Residential, Commercial, Industrial, and Government buildings, Private structures (old & new construction both). Prepare Rapid visual inspection data sheets of the same.
3. Prepare a report of the buildings surveyed, to highlight all the defects/deterioration seen through proper resolution photographs. The report must clearly indicate the distress its source and symptoms.
4. Perform experiment to evaluate the Compatibility between the substrate material concrete and any repair material. (For instance comparing the Bond strength of Polymer modified mortar and Conventional Mortar with Concrete).
5. Experimental investigation to carry out the efficacy of repair material/ technique of enhancing the strength of concrete beam post cracking. (For instance, Cast a RCC beam, simulate cracking and then filling the crack with repair material and check the post-repair strength results).

Major Equipment: Compression Testing Machine, Concrete Mixture, NDT equipment like USPV, Rebound Hammer, Corrosion Meter, Rebar Locator, Engineer s inspection Kit.

5CE09 : (III) SUSTAINABLE CONSTRUCTION METHODS – LAB.

1. Experimentation to check the corresponding strength of material by mixing waste material for Concrete work : Casting of 2 sets of specimen only with each set of 3 cubes , for percentage replacement of concrete elements with any suitable waste material like Recycled aggregate, waste vehicle tire etc.
2. Experimentation to check the corresponding strength of material by mixing waste material for Brick work : Study of cavity wall and rattrap wall for thermo resistive property.
3. Student can work out and prepare report on installation plan , process ,budget, payback period and maintenance required for renewable energy source like solar / wind for small residential house of around 5 rooms.
4. Study and Preparation of Isolux mapping for room using Lux meter, for understanding illumination area and pattern.
5. Case Study : Students should visit to nearby sustainable construction like old existing monumental structure like Palace, religious place, well , fort **or** any Green rated structure by valid Rating agency like GRIHA , LEED India etc. **or** any undergoing sustainable project in vicinity for better understanding and needs to prepare the short report over learning s.

5CE09:(iv) Watershed Engineering And Management – Lab.

Minimum 8 practical s out of the given should be performed. The Site visit is compulsory. The Graphs and sheets are to be drawn whenever are necessary. The practical examination shall consist of viva-voce based on theory and Practical.

List of Experiments:

1. Study of watershed management technologies.
2. Watershed planning and development.
3. Surveying and preparation of watershed map.
4. Analysis of hydrologic data for planning of watershed development.
5. Water budgeting of watersheds.
6. Grid survey of watershed area.
7. Study of Aquifer (Working, Types, Flow net)
8. Study of infiltration galleries. (Types, Design, Construction, Maintenance)
9. Study of unit hydrograph, Storm hydrograph
10. Design of storm water drainage system.
11. Visit to watershed development project.

SEMESTER SIXTH

6CE01: DESIGN OF STEEL STRUCTURES

Learning Objectives of Subject:

- To introduce steel structures and its basic components
- To understand methods of design of steel structure.
- To introduce structural steel fasteners like welding and bolting
- To introduce design method of tension & compression members.
- To introduce design method of beams, Column, Base Plate.
- To introduce design load on a typical steel roof trusses.

Course outcomes:

At the end of the subject the students will be able -

- To explain the methods of design of steel structure.
- To design bolted and welded connection.
- To identify the different failure modes of bolted and welded connections, and determine their design strengths.
- To design the Tension and compression member.
- To identify and compute the design loads on a typical steel roof trusses.
- To design basic elements of steel structure like beams, column and bases.

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(By Limit State Method IS 800:2007)

SECTION – A

Unit I:
- Introduction to WSM, LSM & Plastic analysis of steel structure, plastic hinge, plastic moment capacity, shape factor, plastic section modulus.
- Design of bolted & welded connections subjected to axial and eccentric loading (In the plane of group of Bolts & Weld).

Unit II:
- Design of Compression & Tension member.
- Design of Industrial shed.

SECTION – B

Unit III:
- Design of simple & compound columns for axial loading.
- Design of column bases (Slab base & Gusseted base) subjected to axial load.

Unit IV:
- Design of simple Beams (laterally supported).
- Design of compound Beams (laterally supported).

Books Recommended:
1. Duggal, S. K., Design of Steel Structures, Tata McGraw Hill Pub. Company Ltd.
2. N. Subrramanyam, Design of Steel Structures, Oxford University Press, 2008.
3. V L Shah & Veena Gore: Limit State Design of steel structures IS 800-2007
4. M. R. Shiyekar, Limit state design in Structural Steel (Second Edition); PHI Learning Pvt. Ltd.
5. Bhavikatti, Design of Steel Structures: By Limit State Method as Per IS: 800 2007; I K International Publishing House Pvt. Ltd.
6. M. L. Gambhir, Fundamentals of Structural Steel Design ; McGraw Hill Education.

6CE02: ENVIRONMENTAL ENGINEERING – I

Learning Objectives of Subject:
- To make the students conversant with sources and its demand of water
- To understand the basic characteristics of water and its determination
- To expose the students to understand the design of water supply lines
- To provide adequate knowledge about the water treatment processes and its design
- To have adequate knowledge on operation and maintenance of water supply

Course Outcomes: -
At the end of the subject the students will be able -
- Define and explain the significance of terms and parameters frequently used in water supply engineering.
- Evaluate the influence of the different parameter in design and treatment of water treatment plant (water quality parameters).
- Basic methodology for water treatment (viz., sedimentation, coagulation, flocculation, filtration, disinfection and water softening.)
- An understanding of water quality criteria and standards, and their relation to public health.

SECTION – A

Unit-I : Quantity Estimation of water: Demand of water. Consumption for various purposes. Fire Demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population.
Sources: Surface sources, ground water sources, Infiltration Galleries, Relative merits of sources, assessment & suitability, selection.

Unit-II :Water quality: Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis- physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Flow diagrams and layouts of different water treatment works. Intakes- type, location, requirement & features.

Unit-III: Aeration: Purpose, types of gravity aerators & spray aerators.
Sedimentation: Plain and with coagulation, different coagulants used, dose of coagulant, Jar test, Flocculation, clarrifloculator. Design criteria for sedimentation tanks, surface loading, simple problems on design of sedimentation tanks.

SECTION – B

Unit-IV: Filtration: - Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process. Control system, Negative head, operating difficulties, pressure filter; Simple design problems on rapid sand filters.

Unit V: Disinfection: - Requirement of good disinfectant, methods of disinfection. Chlorination: Methods, prechlorination, post chlorination. Break point chlorination and super chlorination, forms of chlorine. Use of bleaching powder - Simple problems. Introduction to tertiary treatments-Softening and Defloridation.

Unit-VI: Distribution system: - Types of supply: Continuous, and intermittent. Types of system: Gravity, Pumping and combined gravity and pumping, Layouts of distributions system. Maintenance of distribution system. Equalizing storage, Type of storage reservoirs, capacity. Types of conduits, joints, appurtenances. Pipe laying and testing.

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Books Recommended:

1. Steel E. W., Water Supply and Sewerage , Mc-Graw Hill.
2. Kshirsagar S. R., Water Supply Engineering , Roorkee Pub house, Roorkee.
3. Birde G. S. , Water Supply and Sanitary Engineering , Dhanpat Rai and Sons, Delhi.
4. Punmia B. C. water Supply Engineering . Laxmi publication.
5. Garg S.K. Water Supply Engineering, Khanna Publishers.

6CE03: FLUID MECHANICS

Learning Objectives of Subject:

1. To study the basic behavior of fluids and fluid system and the laws governing this behavior
2. To understand and apply the basic concepts Mechanics to carry out professional engineering activities in the field of fluids.
3. To apply scientific strategies to analyze qualitatively and quantitatively the problems and give solutions.

Course Outcomes:

At the end of the subject the students will be able -

1. Describe basic properties of fluid flow.
2. Apply the knowledge to fluid flow problems.
3. Analyze the type of flow by using basic of mathematical principle.
4. Solve and modeling the pipe flow problems.

SECTION - A

Unit I: Properties of fluids: Introduction, properties of fluids, viscosity, surface tension, & capillarity, related problems.
Pressure and its measurement: Fluid pressure at a point, Pascal s Law, pressure variation in a fluid at rest, absolute gauge, atmospheric & vacuum pressures, measurement of pressure, simple manometers, differential manometers, related problems.

Unit II: Hydrostatic forces on surfaces: Introduction, total pressure & centre of pressure, vertical, horizontal plane surface submerged in liquid, related problems.
Buoyancy & floatation**:** Introduction, buoyancy, centre of buoyancy, metacentre, metacentric height, analytical method of metacentric height, conditions of equilibrium of a floating & submerged bodies, related problems.

Unit III: Kinematics of flow :Introduction, methods of describing fluid motion, types of fluid flows, continuity equation in three dimensions, velocity & acceleration, velocity potential function & stream function, related problems.
Dynamics of fluid flow: Introduction equation of motion, Euler s equation of motion, Bernoulli s equation from Euler s equation, its assumptions, related problems.

SECTION - B

Unit IV: Measurement of fluid flow, Horizontal venturimeter, V and Rectangular Notches, Darcy s equation (no proof), major and minor losses in pipes, pipes in series and parallel, pipe network. Momentum equation and its application to horizontal pipe bends.

Unit V: Dimensional Analysis; Buckingham s Pie theorem, it s application, similitude, Dimensionless numbers, Re, Fr, We, Predominant forces & their ratio, Model Analysis - Geometrically similar models, Reynolds law, Froudes law, Model study of spillways.

Unit VI: Uniform flow, Open channel flow, Types of flow, geometric elements of rectangular & trapezoidal sections, Chezy s &Mannings equations, most efficient rectangular & trapezoidal section, Energy & momentum principles, Normal & critical depth, specific energy diagram, discharge diagram.

Books Recommended:

1) Modi P.N. & Seth S.M.: Hydraulics & Fluid Mechanics, SI Edition, Standard book house.
2) Dr. Jain A.K.: Fluid Mechanics, Khanna publication.
3) Subramanya K.: Fluid Mechanics, Tata Mc-Graw Hill.
4) Streeter: Fluid Mechanics, Mc-Graw Hill.
5) Fluid mechanics by R.K.Bansal, Laxmi publication.
6) Garde&Mirajgaonkar: Fluid Mechanics, Scitech publication.

6CE04: PROFESSIONAL ELECTIVE – II (I) ADVANCED CONSTRUCTION MATERIALS

Learning Objectives of Subject:

- To understand the special type of concrete and supplementary cementatious materials.
- To learn about the different type of metals and new alloy steels.
- To learn different composite materials and Thermal and Sound insulating materials.
- To understand different types of construction chemicals and wastes.
- To learn different types of shoring and formwork materials.
- To understand the concept of smart materials.

Course outcomes:

At the end of the subject the students will be able -

- To understand special type of concrete and supplementary cementitious materials.
- To recognize various types of metals and new alloy steels.
- To understand Thermal and Sound insulating materials.
- To know types of construction chemicals and wastes.
- To recognize types of shoring and formwork materials.
- To understand the elementary concept of smart materials.

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SECTION A

UNIT I: Cement, Mortar And Concrete Ceramic Materials
Study of Special Purpose Cement, Mortar, Concrete - High Strength And High Performance Concrete, Self Compacting Concrete, supplementary cementitious material - Fly Ash, Red Mud, Gypsum, Various Types of Finishes & Treatments, Engineering Grouts, Mortar plaster, Gypsum, Glass. GGBS, micro silica etc. Replacement of aggregates; stone dust, light weight aggregates, recycled aggregate.

UNIT II: Metals
Steels - HYSD, TMT, Tendons, Light Gauge Steel, Steel Fastenings, New Alloy Steels Aluminum and Its Products, Protective Coatings to Reinforcement.

UNIT III: Composites
Polymer and its composites, Ceramic and its composite, FRC, Ferro cement etc., Timber, bamboo, veneer, Laminates, Particle boards, Thermal and Sound insulating materials.

SECTION B

UNIT IV: Construction Chemicals and Waste: Chemical Admixtures and Adhesives, Water Proofing Compounds Non Weathering Materials, GeoSynthetics, Geo-Membranes,, Asphalt, Tar & Bituminous Materials, Agro Waste Materials, Industrial Waste Materials, Disposable Materials.

UNIT V: Shoring & Formwork Materials : Materials, Accessories and Proprietary Products - Lumber - Types - Finish - Plywood -Types and grades, Reconstituted wood -Steel -Aluminum Form lining materials, Design Considerations, Building and Erecting the formwork, Causes of Failure of Formwork.

UNIT VI: Elementary Concept Of Smart Material :
Smart and Intelligent Materials-Piezoelectric Materials, Shape Memory Alloys & Polymers, Magnetostrictive Materials, Temperature Responsive Polymer, Halo chromic Materials, Smart Hydrogels, Chromomeric Systems, Photomechanical Materials, Self Healing Materials, Dielectric Elastomers. Bio cement, Phase change material.

Text Book: Building Materials, P.C. Varghese, Prentice-Hall India, 2555.

Reference Books:

1. Materials Science and Engineering: An introduction, W.D. Callister, John Wiley, 1994.
2. Materials Science and Engineering, V. Raghavan, Prentice Hall, 1990.
3. Properties of Engineering Materials, R.A. Higgins, Industrial Press, 1994.
4. Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J. Domone, 3rd ed., Spon Press, 2551.
5. The Science and Technology of Civil Engineering Materials, J.F. Young, S. Mindess, R.J. Gray & A. Bentur, Prentice Hall, 1998.
6. Engineering Materials 1: An introduction to their properties & applications, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann, 2553.
7. The Science and Design of Engineering Materials, J.P. Schaffer, A. Saxena, S.D. Antolovich, T.H. Sanders and S.B. Warner, Irwin, 1995.
8. Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill, 2556.
9. Properties of concrete, A.M. Neville, Pearson, 2554.
10. Materials for Civil and Construction engineers by Michael S. Mamlouk, John P. Zaniewski, Pearson Publication

6CE04 :(II) GEOGRAPHIC INFORMATION SYSTEM & SCIENCE

Learning Objectives of Subject:
- To prepare the student to understand remote sensing, it s techniques and interpretations.
- To introduce the concepts of image processing and basic analytical methods to be used in image processing
- To familiarize students with image enhancement, restoration techniques, and to understand different image compression techniques.
- To gain a basic, practical understanding of GIS concepts, techniques and real-world applications

Course Outcomes:
At the end of the course students will be able to
- Explain and communicate quantitative remote-sensing principles and integrate different tools for remote sensing data analysis
- Perform image corrections, enhancements and generate high-level remote sensing products.
- Apply basic graphic and data visualization concepts such as colour theory, symbolization, and use of white space.
- Demonstrate proficiency in the use of GIS tools to create maps that are fit-for-purpose and effectively convey the information they are intended to.
- Apply mathematical concepts, including statistical methods, to data to be used in geospatial analysis.
- Review the fundamental concepts of a digital image processing system.

SECTION – A

Unit I: Definition and scope of remote sensing: electromagnetic energy and its wavelengths. Remote sensing systems, sensors and scanners, resolution of sensors, multi-spectral, thermal and radar scanners, radiometers spectral response curve and spectral signatures.

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Unit II: Elements of sensing system: Terrestrial, airborne and space borne platforms, Sun-synchronous and geo-stationary satellites, advantages and disadvantages. Various earth Resources satellites, Indian remote sensing program. Remote sensing data products and their types: analogues and digital data formats, Thermal and radar imageries.

Unit III: Interpretation techniques: Elements of interpretation and methods, interpretation key, interpretation instruments. Relief displacement, image parallax and vertical exaggeration, Determination and calculation of elevation from RS data.

SECTION - B

Unit IV: Digital image processing: image rectification and restoration, image enhancement-contrast manipulations, spatial feature manipulation, multi-image manipulation, image classification supervised and unsupervised classification, accuracy assessments and data merging.

Unit V: Applications: Integrated approach of RS and GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning. Application in civil engineering projects damns and bridges, site investigations, landslide studies.

Unit VI: Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers.

Books Recommended:

1. Remote sensing Geology: Ravi P Gupta, Springer publication
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Remote Sensing: Sabins, Floyd F
4. Higher surveying volume III: Dr. B C Punmia.

6CE04 PROFESSIONAL ELECTIVE – II (III) MASONRY STRUCTURES

Learning Objectives of Subject:

This course will enable students to

- Understand properties of masonry units, strength and factor affecting strength
- Understand design criteria of various types of walls subjected to different loads system
- Impart the culture of following the codes, for strength, serviceability and durability as an ethics.
- Provide knowledge in analysis and design of masonry elements for the success in competitive examination

Course Outcomes:

At the end of the subject the students will be able -

- Explain engineering properties and use of masonry units defect and cracks in masonry and its remedial measures
- Summaries various formulas for finding compressive strength of masonry units.
- Explain permissible stress and design criteria as per IS: 1905 and SP-20.
- Design different types of masonry walls for different load considerations.

SECTION A

Unit -I :- Masonry unit materials, types and masonry construction : brick, stone and block masonry unit- strain, modulus of elasticity and water absorption of masonry materials, classification and properties of Mortar. Defect and errors in masonry construction- cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and stability: strength and stability of axially loaded masonry walls, effects of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of aging, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

Unit II:-Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and Lateral load, permissible tensile stress and shear stresses.

Design consideration: Effective height of wall and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. problems on design considerations for solid walls, cavity walls, walls with pillar.

Unit – III : Load consideration and design of Masonry walls subjected to axial loads: - Design criteria, Design of wall subjected to concentrated axial loads: - Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers,

SECTION B

Unit – IV: Design examples of walls under UDL, Solid walls ,cavity walls ,solid walls supported at the end by cross walls, walls with piers .

Unit – V : Design of wall subjected to eccentric loads: - Design criteria - stress distribution under eccentric loads -problems on eccentrically loaded solid walls, cavity walls, walls with piers.

Design of laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of compound walls.

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Unit –VI: Confined Masonry
Confined masonry construction, difference between confined masonry and RC frame construction. Earthquake resistance of confined masonry Structures. Earthquake-Resistant Confined Masonry Construction guidelines

TEXT BOOKS:
1. Dayaratnam P, Brick and Reinforced Brick Structures, Scientific International Pvt. Ltd.
2. M. L. Gambhir, Building and Construction Materials, McGraw Hill education Pvt. Ltd.
3. Anand S. Arya, Masonry and Timber Structures Including Earthquake Resistant Design Published by Nem Chand and Bros.
4. Svetlana Brzev , Earthquake-Resistant Confined Masonry construction , National Information center of earthquake engineering Indian Institute of technology Kanpur.

REFERENCE BOOKS:
1. Materials for Civil and Construction engineers by Michael S. Mamlouk, John P. Zaniewski, Pearson Publication
2. Design of Masonry Structures By A.W. Hendry, B.P. Sinha, S.R. Davies
3. Design of Reinforced Masonry Structures, Second Edition, Narendra Taly, McGraw Hill education Pvt. Ltd

6CE04 :(IV) SOLID AND HAZARDOUS WASTE MANAGEMENT

Learning Objectives of Subject:
- To provide an overview of waste generation, waste characterization and waste management processes.
- To impart knowledge on solid waste management with particular emphasis on municipal solid waste management which includes different waste processing options such as pyrolysis, composting, and incineration; designing and operating sanitary landfill.
- To enrich knowledge about characteristics of hazardous wastes and their management.
- To impart knowledge on industry specific solid waste management practices.
- To provide an overview about the concept of land degradation and land reclamation

Course Outcomes:
At the end of the subject the students will be able -
- To identify and interpret the criteria for the classification of a substance as a solid/hazardous wastes.
- An ability to recognize waste minimization and source reduction, assess and describe the procedure for solid and hazardous waste identification and characterization and various waste processing options.
- Define and elucidate the management, treatment and disposal of hazardous wastes.
- Skill to assess and develop physical/chemical/biological treatment techniques for the control of hazardous wastes.
- Skill to address and describe solid waste management including landfill operation.
- Ability to design and execute land reclamation projects.

SECTION A

Unit I: Municipal solid waste: Definition, Sources and types of solid waste, composition and its determinants of Solid waste-factors influencing generation, quantity assessment of solid wastes, methods of sampling and characterization.

Unit II: Collection and Transfer Collection: Collection of Solid waste, collection services , collection system, equipments, time and frequency of collection. Transfer and Transport: Need for transfer operation, transport means and methods, Optimization of Transport Cost.

Unit III: Disposal of Solid Wastes Refuse disposal : various methods, incinerations, principle features of an incinerator, site selection and plant layout of an incinerator, sanitary landfill- methods of operation, advantages and disadvantages of sanitary land fill, site selection, reactions accruing in completed landfills, gas and leachate movement and control, equipments necessary, Energy Recovery.

SECTION B

Unit IV: Introduction: Definition, Need for hazardous waste management, Sources of hazardous wastes, Effects on community, terminology and classification. Storage and collection of hazardous wastes, Problems in developing countries, Protection of public health and the environment.

Unit V: Management of hazardous wastes: Identifying a hazardous waste, methods, Quantities of hazardous waste generated, Components of a hazardous waste management plan, Hazardous waste minimization, Disposal practices in Indian Industries, Future challenges.

Unit VI: Nuclear wastes and E-waste: Characteristics, Types, Health and environmental effects, Audit of E-Waste. Biomedical and chemical wastes: Biomedical wastes, Types, Management and handling, control of biomedical wastes & Chemical wastes.

Books Recommended:
1) George Techobanoglous et al, Integrated Solid Waste Management McGraw - Hill, 1993.
2) Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.
3) R.E.Landreth and P.A.Rebers, Municipal Solid Wastes-Problems & Solutions . CRC press.
4) J. Glynn Henry and Gary. W. Heinke, Environmental Science and Engineering , Pearson publication.
5) A. D.Bhide and B.B.Sundaresan, Solid Waste Management Collection, Processing and disposal Mudrashilpa Offset Printers, Nagpur, 2001.
6) Biomedical waste (Management and Handling) Rules, 1998.

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6CE04 :(V) TRAFFIC ENGINEERING & MANAGEMENT

Learning Objectives of Subject:
1. To understand traffic planning & characteristics for urban roads.
2. To understand different surveys and methods of traffic volume study.
3. To understand the design of different intersections and use visual aids
4. To understand the Traffic safety & control devices to prevent road accidents.
5. To understand the traffic system management.
6. To know advanced technology used in traffic engineering.

Course outcomes:
At the end of the subject the students will be able
1. To explain the road characteristics & traffic planning.
2. To analyze traffic capacity of roads & intersection by different methods.
3. To design different types of road intersections & use of visual aids for roads.
4. To use knowledge of traffics safety & environmental hazards.
5. To recommend suitable traffic management system and traffic regularity measures.
6. To apply the knowledge of Intelligent Transportation System to traffic management system.

SECTION A

Unit I: Traffic Planning & Characteristics:
Road Characteristics Road User Characteristics PIEV theory vehicle Performance Characteristics Fundamental of traffic flow Urban Traffic problems in India Integrated planning of town, country, regional and all urban infrastructure towards sustainable approach Land use & transport and model integration.

Unit II : Traffic surveys:
Traffic surveys Speed, Journey time and delay surveys vehicles volume survey including non-motarized transport methods and interpretation origin destination survey accident analyses methods , interpretation and presentation statistical applications in traffic studies and traffic forecasting level of service concept, application and significance.

Unit III : Traffic design and visual aids:
Intersection Design channelization, Rotary intersection design signal design coordination of signals grade separation traffic signs including VMS and road markings significant roles of traffic control personnel networking pedestrian facilities & cycle tracks.

SECTION B

Unit IV: Traffic Safety and Environment :
Road Accident Causes, effects, prevention, and cost street lighting traffic and environment hazards air and noise pollution, causes, abatement measures promotion and integration of public transportation Promotion of non-motorized transport.

Unit V: Traffic Management:
Area Traffic management system traffic system management (TSM) with IRC standards _ Traffic Regulatory Measures Travel Demand Management (TDM) Direct and Indirect Methods - congestion and parking pricing all segregation methods coordination among different agencies

Unit VI : ITS : Intelligent transport system for traffic management, enforcement and education, Application of ITS to Traffic Management System- Public Transportation Management System.

(Open Elective II)
6CE05 : (i)Environmental Management

Learning Objectives of Subject:
The objective of the course is to provide skills and an improved understanding of how firms and organisations work with sustainability issues such as environmental and natural resource management in order to protect our eco system.

Course Outcomes:

At the end of the course the student will be
- Aware of different environmental problems, their causes and effects.
- Have knowledge regarding different environmental policies & management plans.
- Have thorough knowledge about Environmental Legislation and Acts.
- Acquire information about various agencies for Environmental Managements in India.
- Have knowledge regarding different systems working for Environmental Management.

SECTION – A

Unit I: Different environmental problems - Energy and the environment, Agriculture and the environment, the atmosphere and human activities, etc. Need for environmental management, the nature, scope and components of environmental management.

Unit II: Environmental policy analysis- micro level and macro level, methods of policy analysis, steps involved. : Operational methods, quantitative methods, statical analysis public policy analysis resource allocation, environmental economics etc.

Unit III: Environmental management plan (EMP): components of Environmental Management Plan, Preparation of Environmental Management Plan.

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SECTION – B

Unit IV: Environmental Legislation and Acts: Water (prevention and control of pollution) Act1974,Air (prevention and control of pollution) Act 1981, environmental protection Act (EPA) 986, Hazardous waste rules1989, Factory Act 1984 amendments in 1987, Environmental Management System: ISO 14000(EMS) Environmental Audits: methods, components and preparation.

Unit V: Various agencies for Environmental Managements in India: Ministry of environment and forest, central pollution control boards, state pollution control boards, local bodies, - their scopes, organizational and functional issues, their working etc.

Unit VI: Basics of Data Base Management System (DBMS), Geographic Information System (GIS) and remote sensing in Environmental Management.

Books Recommended:
1. Environmental Impact Analysis- a decision Making Tool: By R KJain, McGraw Hill.
2. Theory and Practice of Environmental Impact Assessment: By Abbasi and Ramesh, Discovery publishing house pvt. ltd.

6CE05 :(II) HUMAN RESOURCE DEVELOPMENT & ORGANIZATIONAL BEHAVIOR

Learning Objectives of Subject:
- Student should learn about concept of Management and its utility.
- Student should learn about various types of Organization and its structure.
- Learner should be able to understand the concept of Human Resource Management .
- Learner should understand self development process and its fixity for Organizational need .
- Student should be able to understand and develop skills of Leadership , Team Work , Professional behavior , Job analysis and ethics .
- Student should be able to analyze job , opportunities and growth criteria s.

Course outcomes:
At the end of the subject the students will be able -
- To understand the concept of Management and Organization.
- To understand types of Organization and Its structure.
- To develop himself/ herself as per the need and requirement of work and self updation.
- To develop better skills related to leadership, team behavior, ethics at working place .
- To analyze job opportunity and future in it .
- To understand expectations for job evaluation , assessment of work and growth in the field.

SECTION A

UNIT I:- Understanding the Term Management and Organization. Learning about various types of Organizations and Organizational chart. Concept and need for Human Resource Management (HRM) and Human Resource Development (HRD) . Concept, Origin and Need, for HRD as a Total System; Approaches to HRD; Human Development and HRD; Introduction to Organizational Behavior (OB) .

Unit II :- Knowing and Managing Yourself Individual Behaviour: MARS model of individual behaviour Values: Values across cultures (Hofstede s framework); Personality: Big five model; MBTI; Use of personality tests; Personality attributes influencing OB Emotions: Understanding emotions; Emotional labour; Emotional Intelligence Attitudes: Attitudes v/s values; Job Satisfaction; Organizational Commitment Perception: Factors influencing perception; Perceptual errors; Self-fulfilling prophecy; Know yourself: Johari window

Unit III :- Motivation in the workplace , What is motivation; Types of Motives; Theories of Maslow; Herzberg, McGregor, Alderfers, Porter and Lawler s Model; Job Enlargement, Job Enrichment, Behaviour Modification.

SECTION B

Unit IV :- Communication What is communication; Organizational communication: Formal networks and Grapevine; Electronic communications; Barriers to effective communication; non- verbal communication; Improving Interpersonal communication: Empathy and Active listening

Unit V :- Leadership Difference between managers and leaders; Perspectives of leadership: Trait, Behavioural, Contingency; Inspirational leadership: Transactional, Transformational, Charismatic; NGO leadership

Unit VI :- Job Analysis, Job description; Job Specification; Job Evaluation, Recruitment, Selection, Orientation Sources of recruitment: Internal and external; Steps in selection process; Performance Management , What is performance appraisal; Purposes, Process and Uses.
Compensation Management Need, Objectives and factors determining compensation; Developing pay structures, Executive remuneration; components of compensation; Incentives

Prescribed Books :
1. Nadler, Leonard : Corporat Human Resource Development, Van Nostrand Reinhold, ASTD, New York .
2. Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi , 2005.
3. Rao, T.V: Readings in HRD, Oxford IBH Pub. Pvt. Ltd., New Delhi, 2004.
4. Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi.

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5. Rao, T.V.(et.al): HRD in the New Economic Environment, Tata McGraw-Hill Pub.Pvt, Ltd., New Delhi , 2003.
6. Management & Organisation , Dr A. R Gupta , Google book Publishers.
7. ILO, Teaching and Training Methods for Management Development Hand Book, McGraw-Hill, New York .
8. Rao, T.V: Human Resource Development, Sage Publications, New Delhi.
9. Kapur, Sashi: Human Resource Development and Training in Practice, Beacon Books, New Delhi.
10. Lynton, Rolf. P and Pareek, Udai: Training for Development, Vastaar Publishers, New Delhi
11. Viramani, B.R and Rao, Kala: Economic Restructuring, Technology Transfer and Human Resource Development, Response Books, New Delhi .
12. Jaya Gopakl, R: Human Resource Development : Conceptual analysis and Strategies, Sterling Publishing Pvt. Ltd., New Delhi .
13. Truelove, Steve. A: hand book of Training and Development, Beacon Books, New Delhi . 14. Goldstein, Irwin : Training in Organisations, Cole Publishing Co., California .

6CE05 : (III) INTRODUCTION TO EARTHQUAKE ENGINEERING

Learning Objectives of Subject:
This course will cover the basics of seismology and Earthquake engineering. Students will learn
1. Basic seismology, earthquake phenomenon and its characteristic.
2. Earthquake resistant concept.
3. Use of earthquake bands in masonry structure.
4. Behavior of buildings during earthquakes.

Course outcomes:
At the end of the subject the students will be able to -
1. Identify type of earthquake, its properties
2. Earthquake resistance planning
3. Apply knowledge of seismic bands in masonry structure construction
4. Solve engineering problems in the context of Earthquake Engineering.

SECTION A

Unit I: Interior of earth, engineering geology of earthquakes, plate tectonics, Seismicity of the world, tectonics features of India, Faults, and Propagation of earthquake waves.

Unit II: Quantification of earthquake (magnitude, energy, intensity of earthquake), Measurements of earthquake (accelerograph, accelerogram recording), Determination of magnitude, Epicenter distance, Ground motion and their characteristics, Factors affecting ground motions.

Unit III: Guidelines for achieving efficient seismic resistant planning, selection of sites, importance of architectural features in earthquake resistant buildings.

SECTION B

Unit IV: Projections & suspended parts, special construction features like separation of adjoining structure, crumble section, stair case etc., twisting of building, seismic effects on structures, inertia forces, horizontal & vertical shaking.

Unit V: Behavior of masonry structure during earthquake, bands & reinforcement in masonry building opening in walls, importance of flexible structures.

Unit VI: Behavior of R.C. building in past earthquakes. Concept of earthquake Resistant design, Introduction to IS: 1893.

Books Recommended:

1. Duggal S. K., Earthquake Resistant Design of Structures, Oxford University Press 2007
2. Amita Sinvhal; Understanding Earthquake Disasters, Tata McGraw Hill
3. P. N. Agraval; Engineering Seismology Oxford & IBH Publishing
4. C.V.R. Murty; Earthquake Tips National Information Centre of Earthquake Engineering IIT Kanpur
5. Pankaj Agrawal & Manish Shrikhande ; Earthquake Resistant Designof Structures Prentice- Hall of India

6CE06 : DESIGN OF STEEL STRUCTURE– LAB

List of Experiments:
1. Candidates are required to prepare at least **two** designs of steel structures based on theoretical course detailed working drawings are necessary.
2. A compulsory **site visit** for studying the various aspect and prepare a report. A Journal/report on experiments conducted shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.

6CE07: ENVIRONMENTAL ENGINEERING LAB – I

Minimum Eight (8) practicals out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Graphs are to be drawn wherever necessary.

List of Experiments:
1. Determination of Turbidity of water sample
2. Determination of Electrical Conductivity water sample
3. Determination of pH of water sample
4. Analysis of Dissolved, Suspended and Total solids

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5. Analysis of Volatile and Fixed solids
7. Optimum coagulant dose
8. Determination of Temporary and Permanent Hardness of water sample
9. Determination of Acidity & Alkalinity of water sample
10. Determination of Iron and Manganese
11. Determination of residual chlorine in the given water sample
12. Total Count of Bacteria Test.

6CE08 : FLUID MECHANICS – LAB

Suggested Fluid Practicals :
Minimum 8 practical out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Graphs are to be drawn wherever necessary.

1. Verification of Bernoulli s theorem.
2. Determination of coefficient of discharge for Venturimeter.
3. Verification of Reynold s Number with respect to type of flow.
4. Determination of metacentric height.
5. Determination of friction factor for GI pipe.
6. Determination of coefficient of discharge for rectangular notch.
7. Determination of coefficient of discharge for triangular notch.
8. Determination of Chezy s coefficient.
9. Determination of coefficient of discharge of Venturiflume.
10. Verification of momentum equation.
11. Study of hydraulic jump, calculations of height of jump, length & energy loss.

6CE09: MINI PROJECT

Any one Group Project in details:
1) Irrigation Project
2) Rehabilitation of Village / Town
3) Water Supply Project
4) Sewerage System
5) Bridge on River
6) Flood Relief Structures
Students should conduct a detailed survey in a seven day camp.
Data Analysis, Design & Submit Report & Drawing sheets.

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SYLLABUS PRESCRIBED FOR SEMESTER V & VI OF B.E. (MECHANICAL ENGG.)

SEMESTER – V

5ME01 HEAT TRANSFER

Course Learning Objectives (CLOs):
1. To provide details of heat transfer involving conduction, convention and radiation mechanisms.
2. To carry out heat transfer analysis and to demonstrate different techniques used in solving a heat transfer problem.
3. To impart basics of designing heat transfer equipment.

Course Outcome (COs) :
At the end of Heat Transfer course the student will be able to:

1. Solve steady state heat transfer problems of 1-D heat conduction with and without internal heat generation.
2. Design and to analyze the performance of extended surfaces.
3. Apply Lumped heat capacity method for analysis of unsteady state heat transfer.
4. Explain the laws of radiation and its applications.
5. Predict heat transfer coefficients for forced and free convection heat transfer applied to internal and external flow conditions.
6. Design and analyze the performance of heat exchangers using NTU and LMTD methods.

UNIT - I: Introduction, heat transfer in engineering, modes of heat transfer, basic laws of heat transfer and their basic equations. Conduction-thermal conductivity and thermal diffusivity effect of phase &temperature on thermal conductivity, one dimensional steady state heat conduction through slab, cylinder & sphere-simple and composite. Combined conduction- convection, overall heattransfer coefficient. General heat conduction differential equation. One dimensional steady state conduction with internal heat generation for infinite slab, wire & cylinder. (8 Hrs)

UNIT II : Insulations, critical radius of insulation, Conduction through extended surfaces, analysis of a uniform C.S. fin, fin efficiency, fin effectiveness, Biot number. Introduction to unsteady state heat conduction, Newton s law of cooling, lumped heat capacityanalysis. **(8 Hrs)**

UNIT III : Radiation-general concepts and definitions, black body & greybody concept. Laws of radiation - Kirchoff s Plank s, Stefan- Boltzman s, Wien s law. Concept of shape factor, emissivity factor and radiation heat transfer equation. (No numericals).Radiation errors in temperature, measurement, radiation shield. (7 Hrs)

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NOTIFICATION

No. 66/2022 Date : 18/06/2022

Subject : Implementation of new Syllabi of Semester VII & VIII of B.E.(Civil Engineering)(C.B.C.S.) as per A.I.C.T.E. Model Curriculum…

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester VII & VIII of B.E. (Civil Engineering) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2022-23 onwards as per **Appendix – A** as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

Appendix A

SYLLABUS OF B.E. SEM. VII & VIII (CIVIL ENGINEERING) [C.B.C.S.]

SEMESTER SEVENTH

7CE01: STRUCTURAL ANALYSIS – II

Learning Objectives of Subject:

- To understand the action and corresponding displacement in various type of structural elements.
- To learn about statically determinate and indeterminate structures.
- To analyze frames subjected to sway.
- To learn different analysis methods for analysis of beam and frames.
- To learn analysis of Plane truss, Space truss.

Course outcomes: At the end of the subject the students will be able -

- To decide what is required to be analyzed depending upon type of structural element.
- To know about degree of freedom, Condition of equilibrium and determinacy of element.
- To understand reason for failure and permissible limits for safety.
- To apply the knowledge of beam analysis for practical analysis and design purpose.
- To make application of various analysis methods for actual structural member analysis and design.

SECTION - A

Unit-I: 1. Moment distribution method, application to portal frames with sway. Multibay, multistoried, symmetrical frames subjected to symmetric loads only.

2. Slope deflection method: Application to portal frames with side sway.

Unit-II: 1. Kani's method: Continuous beams and single bay single storey portal frames with side sway.

2. Multi- bay, multi storeyed frames subjected to symmetric loads.

Unit-III: 1. Castigliano's second theorem, principle of least work, Analysis of redundant frames. (up to two degree redundancy).

2. Analysis of redundant trusses (up to second degree of redundancy).

SECTION – B

Unit-IV: 1. Muller - Breslau's principle, Influence line diagrams for continuous beams, upto two spanwith simple end supports.

2. Tension coefficient method & its applications to simple space trusses.

Unit-V: 1. Flexibility method, static redundancy, flexibility coefficients, compatibility condition application to beams.

Unit-VI: Stiffness method, kinematic redundancy, stiffness coefficients, direct stiffness approach, application to continuous beams and single - bay, single - storey portal frame.

Books Recommended:

1. Meghre A.S. and Deshmukh S.K., Matrix Methods of Structural Analysis, Charotar Publishing, Anand, India 2003.
2. Junnarkar, S. B., Mechanics of Structure, Volume I and II, Charotar Publishing House Pvt. Ltd., 2017
3. Jain and Arya, Theory and Analysis of Structures, Nem Chand & Bros.
4. Reddy. C. S., Basic Structural Analysis, Tata McGraw Hill
5. Norris and Wilbur, Elementary Structural Analysis
6. Bhavikatti, S. S, Structural Analysis Vol I and II, Vikas Publishing
7. Ramamrutham., S and Narayan R., Theory of Structures 9th Edition, Dhanpat Rai Books

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7CE02: GEOTECHNICAL ENGINEERING – II

Learning Objectives of Subject:
- To learn the methods of exploration, objectives and its field application along with data interpretation.
- To understand the bearing capacity of shallow foundation.
- To study the earth pressure on retaining wall.
- To learn the pile foundation and well foundation.
- To understand the settlement evaluation of different types of foundation.
- To know the various ground improvement techniques.

Course Outcomes: At the end of the subject the students will be able
- To select the appropriate soil investigation method and get true sub soil parameters used for selection of type of foundation.
- To determine the bearing capacity of shallow foundation.
- To calculate the lateral earth pressure on retaining wall
- To find bearing capacity of well foundation and design of pile foundation.
- To evaluate the settlement of different types of foundation.
- To suggest the suitable method o ground improvement.

SECTION – A

Unit I: Exploratory Programme : Field exploration, objectives and methods of exploration planning of exploration programme soil boring , hand augers, percussion boring, rotary wash boring, collection of sample, split spoon sampler, disturbed and undisturbed samples and their criteria SPT test, field vane shear test, geophysical methods, electrical resistivity and soil refraction methods. Soil log bore presentation and interpretation exploration data.

Unit II : Bearing Capacity of Shallow foundation :- Concept of local and general shear failure, Different theories: Terzaghi s Skempton s, Meyerhof s, BIS method for bearing capacity , determination bearing capacity of granular soils based on SPT value. Concept of raft foundation and floating foundation. In situ methods of evaluation of bearing capacity, plate load test, static cone penetrometer, pressure meter test, contact pressure distribution diagram below the base of footing.

Unit III : Earth pressure: Earth pressure at rest, & plastic equilibrium of soil, Rankine s and Coulomb s theory of active and passive earth pressure on retaining wall. Influence of surcharge, water table, Rebhann s and Culmann s simple graphical methods. Introduction to sheet pile and bulkhead and their classifications,(No design criteria) Cofferdam purpose, various types and their suitability.

SECTION – B

Unit IV : Pile foundation : Classification of piles and their uses, static analysis, formula for determination of pile capacity for driven and bored pile in sandy and in clayey soil , dynamic pile formula Negative skin friction, factors affecting it, piles in group and their capacity, group efficiency, factors affecting group efficiency, behavior of group of pile in sandy and in clayey soil, pile load test, effect of pile cap. Criteria for spacing and depth of piles. BISdesign criterion for undereamed Pile in clays and sands.

Unit V: Settlement Evaluation: Immediate, primary and secondary settlement for footing resting on homogenous isotropic, cohesive and cohesion less soils related to single footing, combined footing, & raft foundation etc., concept of differential settlement factors and causes for differential settlement, BIS requirement for total as well as differential settlement, service loads, proportioning of footing for uniform settlement, Computation of total and differential settlement of a single pile and group of piles in sandy and clayey soil.

Unit VI: Well foundation: Component & their function, sinking of well, types of force system, and their computation, design criteria for various components of wells, tilting and shifting Bearing capacity of well as per BIS.

Ground Improvement: Methods of soil stabilization use of admixture (lime, cement, fly ash) in stabilization) Mechanism of reinforced soil, use of Geo synthetics material and it s function, vibroflotation, sand drain and preloading techniques.

Books Recommended:

1. C. Venkatramaiah, Geotechnical Engineering, New Age International publishers, 2012
2. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International Publishers, 2012.
3. K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers, 2011
4. P.Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.
5. Alam Singh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi
6. Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai

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7. V. N. S. Murthy; Soil Mechanics & Foundation Engineering; CRS Press, Taylor & Francis Group, New York
8. Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.
9. Joseph E. Bowles, Foundation analysis and design, Mcgraw-hill international book company, Inc., Singapore.
10. Ralph B. Peck, Walter E. Hanson, Thomas H. Thornburn , Foundation Engineering, 2nd Edition, ISBN-13: 978-0471675853, ISBN-10: 0471675857.

7CE03 : HYDRAULICS ENGINEERING

Course Objectives:

- To understand the flow pattern in the open channels.
- To understand the criteria for formation hydraulics jump.
- Study different types of GVF profiles and apply various methods to determine the length of GVF profiles.

Course Outcomes: Student shall be able to-

- Illustrate the flow pattern in the open channels, criteria for formation hydraulics jump.
- Identify different types of GVF profiles and methods.
- Compute of water hammer pressures in pipe.
- Design penstocks and surge tanks, understand causes of water hammer.

SECTION A

Unit I : Types of open channel flows, Computation of uniform flow, Chezys and Manning s equation, most efficient rectangular and trapezoidal section, specific energy diagram, discharge diagram related problems.

Unit II : Theory of gradually varied flow, dynamic equation of GVF with proof ,Analysis of surface profile of gradually varied flow.

Unit III : Rapidly varied flow, Theory of Hydraulic jump, hydraulic jump in horizontal rectangular channel, elements of hydraulic jump, relation between conjugate depths.

SECTION B

Unit IV: Turbulent flow through pipes, Nikuradses experiments on artificially rough pipes, hydro dynamically smooth and rough pipes, Moodys diagram, velocity distribution laws.

Unit V :computation of water hammer pressure of frictionless flow in horizontal pipe for sudden and slow closer of valve, Application of Allievi s method and charts, approximate pressure.

Unit VI : Function of surge tank and different type of surge tanks. Equation governing the flow inthe simple surge tank system. Analysis of flow in a simple surge tank system.

Text Books:

1 K. G. Ranga Raju, Flow through open Channel , Wiley Eastern Limited(New Delhi), 2nd Edition, 1992.
2. VenTe Chow, Open Channel hydraulics , Wiley Eastern Limited (New Delhi),13th Edition, 2009.
3. K. Subramanya, Flow in open Channels , Wiley Eastern Limited (New Delhi),3rd.
4. Modi P.N. & Seth S.M.: Hydraulics & Fluid Mechanics, SI Edition, Standard book house.

7CE04: ENVIRONMENTAL ENGINEERING – II

Course Objectives: -

- To learn the basics of sewage composition and its characteristics.
- To depict the information about various sewage treatment processes.
- To provide the adequate information on various disposal standards for industrial effluents.
- To study the information about air pollution and its effects.
- To understand the knowledge about solid waste generation and disposal methods.

Course Outcomes: -

- Define and explain the significance of terms and parameters frequently used in wastewater Treatment.
- Evaluate the influence of the different parameter in design and treatment of wastewater treatment plant (wastewater characteristics).
- Basic methodology for wastewater treatment (screening, grit chambers,sedimentation, biological treatment and chemical treatment)

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- Appreciate the advantages, disadvantages and limitations of the technologies and new developments.
- An ability to identify and interpret the criteria for the classification of a substance as a solid/hazardous wastes.
- Ability to identify air pollution problems and interpret criteria air quality data.
- Evaluate the engineering solutions for industrial and vehicular air pollution problems.
- The candidate at the end of the experimental exercise would be able to perform field-oriented testing of wastewater.

SECTION –A

Unit-I : Quantity of storm water, DWF, variation of sewage, flow systems of sewerage - separate combined and partially combined, layouts of sewerage system, capacity of sewers design of sewers Laying out of circular sewers-Boning rod and sight rail method, Testing & maintenance of sewers.

Unit-II : Waste water characteristic, sampling of sewage, physical chemical and biological examinations, B.O.D. and C.O.D., B.O.D. equation, problems on B.O.D Pollution due to domestic and industrial waste. Treatment of sewage - purpose of treatment, preliminary treatment, primary treatment and secondary treatment. Flow diagram for conventional sewage treatment plant. Preliminary Treatment:- Screening, Grit chamber, Detritus tank. Primary Treatment:- Sedimentation of sewage.

Unit-III : Biological treatment: Trickling filters, low rate & high rate tricking filters, construction details, Re-circulation Modification of trickling filters Activated sludge process - Process description, Methods of aeration, loading rates, Different modified forms of A.S.P.,MLSS& SVI, F/M.

SECTION –B

Unit-IV : Low cost waste treatments - Oxidation ponds, Aerated Lagoon, Treatment and Disposal of sludge - Digestion of sludge, sludge disposal Septic tank, working and design, Disposal of septic tank effluent Disposal of sewage on land and in stream. Effluent standards for disposal on land, into stream and into sewers. MINAS. Self purification capacity of stream

Unit-V : Characteristics of solid waste:- Physical, chemical, biological analysis. Collection of solid waste:- Types of collection system and services, frequency of collection, methodology involved in setting up collection bins. Disposal of solid wastes:- Different methods, sanitary land fill, composting, incineration.

Unit-VI :Air pollution: Introduction to air pollution, various pollutants their sources and their effects on man and material, prevention or air pollution at sources, introduction to control devices electrostatic precipitator & cyclones only human tolerance level Introduction to EIA and Environmental Audit.

Books Recommended:

1) Kshirsagar S.R. : Sewerage and Sewage Treatment, Roorkee Pub House, Roorkee.
2) Steel E.W. : Water Supply & Sewerage, McGraw Hill Book Co.
3) Birdie G.S. : Water Supply and Sanitary Engineering, Dhanpat Rai & Son s.
4) Garg S.K. : Waste Water Engineering, Khanna Publishers.
5) Dr. Bhide A.D., Sunderson B.B.: Solid Waste Management in Developing Countries, INSDC publication.
6) Rao M.N., Rao H.V.N. : Air Pollution, Tata McGraw Hill.
7) Stern, Wohlers, Boobel, Lowry: Fundamentals of Air Pollution, Academic Press, 1973.

7CE05 : (PROFESSIONAL ELECTIVE III)
(i) ANALYSIS AND DESIGN OF STRUCTURES FOR EARTHQUAKE AND WIND

Course Learning Objectives:
This course will cover the basics of seismology and Earthquake engineering. Students will learn

- Basic seismology, earthquake phenomenon and its characteristic.
- Earthquake resistant concept
- Use of earthquake bands in masonry structure
- Behavior of buildings during earthquakes
- Earthquake resistant design concept
- IS code procedure to find earthquake forces on structure
- Wind load Calculation for Multy-story Building

Course outcomes: At the end of the subject the students will be able to -

- Identify type of earthquake, its properties
- Do earthquake resistance planning
- Apply knowledge of seismic bands in masonry structure construction.
- To analyze and design buildings to resist seismic and wind forces
- Solve engineering problems in the context of Earthquake Engineering.

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SECTION-A

Unit I: Interior of earth, Engineering geology of earthquakes, plate tectonics, Seismicity of the world, tectonics features of India, Faults, Propagation of earthquake waves, Quantification of earthquake (magnitude, energy, intensity of earthquake), Measurements of earthquake (accelerograph, accelerogram recording), Determination of magnitude, Epicentre distance, focal depth, etc. Ground motion and their characteristics, Factors affecting ground motions, Inertia forces, horizontal & vertical shaking.

Unit-II: Guidelines for achieving efficient seismic resistant planning, selection of sites, importance of architectural features in earthquake resistant buildings, continuity of construction, projection & suspended parts, special construction features like separation of adjoining structure, stair case etc, twisting of building, seismic design philosophy for building.

Unit-III: Importance of flexible and ductile structures, Effect of earthquake on RCC Building, How Beam, Column & Beam Column joint resist earthquake, Effect of open ground story, Effect of short column, Use of shear wall, latest technique used to reduce earthquake effect on building (Base Isolation). Behaviour of R.C. building in past earthquakes.

SECTION-B

Unit-IV: Introduction to IS:1893 (2016),Concept of earthquake Resistant design, design philosophy. Design Horizontal Acceleration, Zone factor, Importance factor, Response Reduction Factor, Natural Time Period, Base Shear, Earthquake eccentricity, Earthquake load combination, Diaphragm, Centre of mass & rigidity, Seismic mass & weight, P- Effect, Calculation of nodal loads due to earthquake using Equivalent lateral force method.

Unit-V: Ductility and its important in earthquake resistant design, Factors affecting ductility, Ductile detailing considerations as per IS:13920 (2016) for flexural member, axial member and joints of frame. Earthquake resistant design of RCC Columns, beams.

Unit-VI: Wind load Calculation for Multy-story Building as per IS 875-Part-3 : 2015.

[**Note:** Students should use IS 1893:2016, IS 13920:2016, IS 875-Part-3: 2015.]

Books Recommended:

1. Duggal S.K. Earthquake Resistant Design of Structures , Oxford University Press
2. Pankaj Agrawal, Manish Shrikhande Earthquake resistant design of Structures, Prentice Hall India

7CE05 : PROFESSIONAL ELECTIVE III
(ii) ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE

Course Objectives:

The course aims to introduce the concepts, procedures and methodology of Environmental Impact Assessment (EIA) in order to develop a critical awareness of factors that will be helpful in the use of EIA as part of project management in the legislative and regulatory context of recently-industrialized or less -industrialized countries that would eventually expose the students to the need for environmental impact assessments and would be help them in the preparation of various documents required for legal procedures.

Course Objectives: At the end of the course the student will :

1. Understand the concept and basic process of environmental impact assessment.
2. Have knowledge regarding Impact assessment methodologies and Components of EIA.
3. Be able to perform environmental auditing.
4. Have knowledge regarding Sustainable development & environmental management.

SECTION A

Unit I: Environmental impact assessment (EIA): Definition of EIA and EIS, Concepts, scope and objectives of EIA; National Environmental Policy Act (NEPA, 1969); EIA guidelines1994 (Notification of Government of India).Screening and Scoping in EIA.

Unit II: Impact assessment methodologies: Definition and concept of impact; Types of impacts (Negative & Positive: Primary & Secondary; Reversible and Irreversible); Impact identification; Methods for impact identification: Matrices, networks and checklists, Advantage & disadvantages of EIA methodologies.

Unit III: Components of EIA: Baseline data; Prediction and evaluation of impacts; Environmental management plan and monitoring, Baseline information, Prediction, evaluation and mitigation of impacts on socioeconomic, air water, soil and noise environment.

Public participation in EIA: Decision making, public participation in environmental decision making, Objectives and techniques for public participation, Advantages and disadvantages of public participation.

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SECTION B

Unit IV: Preparation and writing of EIA: For water resources, Dams and irrigation projects; Mining and Infrastructural projects etc., eco labelling eco-marks, ecotourism, eco-feminism, Eco-regulation, eco-accountability, green management, green products, green claims, and eco wars.

Unit V: Environmental auditing: Notification and guidelines for Environmental audit; Scope, applicability and objective of environmental audit; procedure of environmental auditing ;Cost Benefit analysis, Designing and implementation of audit tools

Pre audit activities on site activities post audit activities Environmental statement benefits of environmental audit EA scenario in India submission of Environmental Audit report in MoEF format .Life cycle Assessment, Resource Balance, Energy Balance and Management Review.

Unit VI: Sustainable development & environmental management, Natural Resource Conservation, Conservation of Energy, Pollution Prevention, disposal of treated effluents and solid waste, Environmental Management in India.

Books Recommended:

1. Environment Impact Assessment: Larry W. Canter, Mc-Graw Hill Inc., New York (1996).
2. Introduction of Environmental Impact Assessment: John Glassion, Rikay Therival and A. Chadwick, UGC Press Ltd., London (1994).
3. Methods of Environmental Impact Assessment: Peter Morris, Ricky Therivel, UGC Press Limited, London (1994).
4. Environmental Impact assessment: N.S.Raman, A.R.Gajbhiye, Dreamtech publication.

7CE05 (PROFESSIONAL ELECTIVE - III)
(iii) PAVEMENT DESIGN

Learning Objectives of Subject:

- To understand types of pavement for highway & airport.
- Perform analysis of flexible pavement by various methods.
- Perform design of flexible pavement by various methods.
- Perform analysis of rigid pavement by various methods.
- Perform design of rigid pavement by various methods.
- To understand design, maintenance, repair & rehabilitation of pavement as per
- IRC standards.

Course outcomes: At the end of the subject the students will be able

- To explain basics of highway & airport pavement.
- To carry out analysis of flexible pavement by various methods.
- To carry out design of flexible pavement by various methods.
- To carry out analysis of rigid pavement by various methods.
- To carry out design of rigid pavement by various methods.
- To apply IRC design parameters in design, maintenance, repair & rehabilitation
- for different types of pavement.

SECTION A

Unit I: Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements. Stresses and deflection in flexible pavements.

Unit II: Stresses and deflections in homogeneous masses. Burmister's two layer theory, three layer and multi-layer theories; wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels. Repeated loads and EWL factors; sustained loads. Pavement behaviour under transient traffic loads.

Unit III: Flexible Pavement Design Methods For Highways and Airports: Empirical, semi-empirical and theoretical approaches, development, principle, design steps, advantages; design of flexible pavements as per IRC;

SECTION B

Unit IV: Stresses in Rigid Pavements: Types of stresses and causes, factors influencing the stresses; general considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.

Unit V: Rigid Pavement Design: Types of joints in cement concrete pavements and their functions, joint spacing; design of CC pavement for roads and runways as per IRC, design of joint details for longitudinal joints, contraction joints and expansion joints.

Unit VI: IRC method of design by stress ratio method. Design of continuously reinforced concrete pavements; Maintenance, repair and rehabilitation of pavements including design of bituminous and concrete overlays as per IRC.

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7CE05 : (PROFESSIONAL ELECTIVE - III)
(iv) WATER POWER ENGINEERING

Course Objectives:
1. To understand necessity and importance of sources of energy
2. To learn about different types of hydropower plants
3. To study various power canals and design of power canal structures

Course Outcome: Student shall be able to:
1. Describe the various sources of energy systems.
2. Classify the different power plants.
3. Identify the problems related to hydraulic pressure.

SECTION A

Unit I: Water Power: Introduction, sources of energy, importance of water power, estimation of water power potential, primary and secondary power, load factor, pondage and pondagefactor, load curve, numericals. Type of hydropower plants:- low and high head, run of river, valley dam, diversion canal, high head diversion, pumped storage underground, general description, layout, topographical requirements of each of above.

Unit-II: Penstocks: general classification, design criteria, economical dia, anchorages and accessories. Water hammer: - meaning, rigid and elastic water column theory, Allievi's charts, numerical.

Unit-III: Surge tanks: Necessity, types, function, location, effect of sudden load change, Hydraulic design of simple surge tanks, stability of surge tanks, numerical.

SECTION – B

Unit-IV: Intakes: types, locations, requirements, trashrack and other components, control gates, emergency gates, Air Entrainment.

Unit-V: Hydel Channel:- power canal and forebay, general principles of alignment and capacity, balancing tank. Turbines:-types, hydraulic features, size, general description of components and layout, specific speed, choice and selection of turbines, approximate costs, numericals on specific speed only.

Unit-VI : Power house:- types, general layout and approximate dimensions, advantages and disadvantages of underground power stations. Non-conventional sources of energy: - tidal power, wind power, geothermal power, solar power, elementary principles and description, application of water power in drilling and blasting of rocks. Note : Technical visit to nearby hydro power station is compulsory.

Books Recommended:
1) Dandekar M.M. &Sharma : Water Power Engineering, Vikas Pub. House, Delhi.
2) Brown J.G., Blackie and Practice : Hydro Electric Engg., Vol. I, II & III, W. Sons, London.
3) Mosonyi E. : Water Power Development, Hungarian Academic Sciences, Budapest.
4) Deshmukh M.M. : Water Power Engineering.
5) Davin C. and Sorenson K.C. : Hand Book of Applied Hydraulics, McGraw Hill.
6) Barrows H.K., Water Power Engineering, McGraw Hill.

7CE06 COMPUTATIONAL STRUCTURE ANALYSIS - LAB.

1) Analysis of simple structures (2D) like portal frames, Beams (1D) with different support conditions. Correlations of the same manually as well as by readymade software like STAAD Pro., SAP, ETABS, ANSYS etc.
2) Calculation of deflection and stresses in truss by using readymade software like STAAD Pro., SAP, ETABS, ANSYS etc.
3) Analysis and design of 3D (G+2) structure by using software like STAAD Pro., SAP, ETABS, ANSYS etc.

7CE07: GEOTECHNICAL ENGINEERING- II– LAB.

List Of Experiments: **(Any six)**
1. To determine the shear strength by conducting Field Vane shear test.
2. To identify the subsoil strata by conducting soil resistivity / seismic refractivity method
3. To determine the soil characteristics by conducting standard penetration test
4. To determine the bearing capacity of soil by conducting standard penetration test
5. To determine the soil properties by conducting the static cone penetration test.
6. Computation of bearing capacity by analytical approach to verify with field test.
7. To determine the soil characteristic with respect to soil log bore

Compulsory: Introduction to Geotechnical Software, determination of bearing capacity , earth pressure etc. professional this software.

7CE08 : ENVIRONMENTAL ENGINEERING II – LAB.

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Minimum 8 practicals out of the list given should be carried out. The practical examination shall consist of viva voce based on theory & practical. Field visit & report is compulsory.

List of Experiments:

1. Chemical Oxygen Demand (COD)
2. Dissolved Oxygen (D.O) and Biochemical Oxygen Demand (BOD)
3. Determination of Chloride concentration
4. Determination of Sulphate concentration
5. Colour measurement
6. Odour Measurement
7. Sludge volume index (SVI) determination
8. Physical characteristic of solid waste
9. Analysis of SPM by using sampler
10. Ambient noise measurement
11. Sketches on sewer appurtenances
12. Report of Field visit to Municipal wastewater treatment plant/Industrial effluent treatment plant.

SEMESTER VIII

8CE01: CONSTRUCTION PROJECT MANAGEMENT

Learning Objectives of Subject:

- Students should be able to understand meaning of project and Project Management .
- Students should be able to understand Project Life Cycle and Project Development Steps.
- Learner should know the process and various planning tools and their Limitation.
- Student should be able to carry out project planning using tools like BAR chart, Networking methods like CPM, PERT etc.
- Student should know the method of controlling using Baseline Plans and process of updating it.
- Student should know optimizing process of Project and way to carry out it by method of Network Crashing.
- Student should know process and need of Resource Smoothening / Leveling.
- Student should be able to develop planning s using Project Planner software.
- Students should know the various management skills related to Quality, Safety and Inventory and Risk Handling.

Course outcomes: At the end of the subject the students will be able –

- To understand meaning of Project and Project Management.
- To understand the phases of Project Life Cycle and process of developing it.
- To use and apply various planning tools like BAR chart, Milestone Chart, Networking Methods like CPM , PERT .
- To compare and control the project at the time of execution.
- To update projects and review the status of work.
- To optimize project using Network crashing method
- To understand the concept of Project Smoothening/ leveling.
- To plan and develop the project using Project Planner software s.
- To understand importance and application of various management like Quality , Safety , Risk handling and Inventory .
- To turn good manager at individual and organizational level.

SECTION – A

Unit I: Basic Element of Construction Management:
Stakeholders of Construction Project, Meaning of terms Project, Management and need of Construction Management. Life cycle of Project.
Learning of project elements like Activity & its types, Events, Work Breakdown Structure, Resources, Scheduling, and Resource Allocation.

Unit II: Planning Tools : Detail steps of planning, Concept, Limitation &**Numerical** over Planning Tool BAR CHART, MILESTONE CHART.
Introduction to Networking Development using Critical Path Method, Programme Evaluation & Review Technique, Concept of Line of Balance Method.

Unit III: Total Project Duration, Float/ Slack calculation Geometrical and Numbering Rules for Network Development.
Numerical to find out Total duration, critical path and Float/ Slack of a project by CPM & PERT method.

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SECTION – B

Unit IV: Project Controlling: Concept and **numerical** over both Network Updating of Project and Project optimization by Network crashing method. Concept of Resource Smoothening / Leveling.

Unit V :- Project Review & Planning using Management software:
Importance of Documentation, Daily, Weekly, Monthly Progress report. Project Review process and documentation. Concept of Project associated Risk & Risk handling strategies.
Introduction to Illustration for project development using software like of MS Project and Primavera. Developing one small construction project using project planning software.

Unit VI- Organization & Management : Concept & Types of Organization, Feyol s Principals of Management, Need and Concept of Quality Management, Safety Management, Inventory Management. Learning EOQ Analysis.

Text Book: Kumar NeerajJha, Construction Project Management- Theory and Practice , Pearson Education, New Delhi ,17.

Reference Books:
1. K. K. Chitkara, Construction Project Management- Planning, schedule and controlling , second edition , Tata McGraw Hill Education pvt. Ltd, New Delhi.
2. John M. Nicholas and Herman steven, Project management for engineers, business and technology , fourth edition, Routledge Publication, New York.
3. Prasanna Chandra, Projects Planning, analysis, selection, financing, implementation and review , 7th edition, McGraw Hill Education India Pvt. Ltd., New Delhi.
4. Harold Kerzner, Project Management system approach to planning, scheduling and controlling, second.

8 CE02: CONSTRUCTION ECONOMICS & ESTIMATING – COSTING

Learning Objectives of Subject:
- Student should be able to understand the concept of Estimation and construction Economics.
- Student should be able to understand and apply various estimation methods.
- Student should be able to understand need , concept and types of Specification.
- Student should be able to understand various cost estimation related terms and Rate Analysis.
- Student should be able to carry out Rate analysis of basic construction materials.
- Student should know the application of Current Schedule of Rate .
- Student should be able to carry out estimation of Residential and Commercial structures.
- Student should be able to carry out estimation of various road types like Rigid , Flexible and Hilly roads.
- Student should be able to understand concept , need and process of valuation of construction projects.
- Students should be able to understand and practice the Bidding and Tendering process.

Course outcomes: At the end of the subject the students will be able -
- Determine need and basics of Estimation and Construction Economics.
- Carry of estimation by various methods.
- Write and understand specification of materials and items of construction.
- Carry out rate analysis of basic construction material and apply calculation logic for other construction materials.
- Use of CSR for Estimation work and carry out estimation of residential , Commercial building, Flexible and Rigid Roads, Water Tank , Septic tank etc.
- Understand need, purpose and process of valuation .
- Understand and carry out Bidding and tendering process .

SECTION A

Unit I: Basics of Construction Economics & Estimations Concept of Construction Economics, Stakeholders of Construction Project, Need of Estimation , Units of Measurement as per IS1200 , various approximate and details method of Estimation. Specification Purpose and Principles of Specification Writing, Types of Specification Writing.

Unit II: Introduction to Schedule of rates in Cost estimates, Factors affecting analysis of rates, Fixed, Variable, Prime, Supplementary cost , Overhead cost and its allocation. Rate analysis concept and explanatory calculations of Some materials like Cement, Steel, Bricks, aggregates & Timber. Bar Bending Schedule Process of development.

Unit III: Current Schedule Rates (CSR) understanding & Utilization, Developing Cost & Quantity Estimates for the Residential block, Commercial building, House hold water tank, Septic tank, Staircase and Lift duct.

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SECTION B

Unit IV: - Developing Cost & Quantity Estimates for Road works example for Rigid & Flexible Pavemen Earthwork Estimation in Hill roads and for earthen dams.

Unit V: - Valuation Purpose and types of Valuation, Market value, Potential value, Sentimental values , scrap Value etc. Tenure of Land, free hold and lease hold property, sinking fund, deprecation and capitalized value and annualized value of old building. Consideration of Building Life and Structural Stability Report at the time of valuation. Valuation validity period.

Unit VI: **-** Public organizations and various stake holders in construction Industry, Contract and its types, Detail process of Tendering & Bidding Concept of E Tendering, Tender Notice, Process of Filling the Tender, Process of Submission of Tender, Acceptance of tender, Tender Awarding. Land acquisition Act, Leal aspects of contract provision.

Books Recommended:

1. R.H. Namavati. : Estimating and Valuation.
2. D.N.Datta : Estimating & Costing Datta Lucknow.
3. Vazirani: C.E.Estimating & Costing, Chandola Khanna Publisher Delhi.
4. B.S.Patil: Estimating Costing Orient Longmans.
5. P.W. & H.Deptt. Govt. of Maharashtra: Standard Specification
6. Rangawala: Valuation, Charotar Book Stall
7. Dhanpat Rai: Text book of Estimates Costing Anand & Sons, Delhi.
8. B.C.Chakraborty: Principles of Estimation & Costing.
9. Indian Contract Act.

8CE03 : PROFESSIONAL ELECTIVE - IV
(i) ADVANCED DESIGN OF STEEL STRUCTURES

Learning Objectives of Subject:

- To introduce the concept of foot bridge.
- To understand the behavior of transmission tower.
- To understand the behavior of steel chimney
- To introduce the concept of truss bridge.
- To understand the behavior of plate girder.
- To understand the behavior of lattice girder and steel tanks.

Course outcomes: At the end of the subject the students will be able

- To explain the methods of design of foot bridge.
- To design transmission tower line.
- To design steel chimney and its foundation.
- To design the truss bridge.
- To design the plate girder.
- To design lattice girder and steel tanks.

SECTION – A
(By Limit State Method IS 800:2007)

Unit-I : (a) Design of foot bridge (N-Truss or Pratt)
(b) Analysis and design for transmission tower lines
Unit-II :(a) Design of self-supporting steel chimney and its foundation.
(b) Design of through type truss bridge member for dead load and equivalent live load including top, bottom bracings and open web girder bridges of Pratt trusses and portal bracing for railway broad gauge single main line.

SECTION – B

Unit-III : Design of Plate girder.
Unit-IV : a) Design of north light trusses and lattice girder.
b) Design of elevated, square pressed steel tanks and staging

Books Recommended:

1. Ramchandra, Design of Steel Structure, Volume - I and II. Scientific Publishers Journals Dept
2. Arya, Ajmani, Design of Steel Structures. Nem Chand
3. Duggal S. K., Limit State Design of Steel Structures ; McGraw Hill Education.
4. N. Subramanian, Steel Structures: Design and Practice: Theory and Practice; Oxford University Press, 2008

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8CE03: PROFESSIONAL ELECTIVE - IV
(ii) ADVANCED PRESTRESS CONCRETE STRUCTURES

Learning Objectives of Subject:
1. To introduce the need for Prestressing as well as the methods
2. To introduce the general behavior of PC sections under external load.
3. To introduce the design of PC flexural members.
4. To introduce the design of shear in PC members.
5. To introduce the design for deflection and crack control of Prestress concrete members.

Course outcomes: At the end of the subject the students will be able
1. Explain the general behavior of PC sections under external load.
2. Explain behavior of Prestress concrete members and Losses in Prestress steel.
3. Analyze & Design of Prestress concrete flexural members.
4. Analyze & Design of Prestress concrete for shear
5. Analyze & Design of Prestress concrete Water Tank.

SECTION-A

Unit I: Introduction to Pre-stressed concrete: Pre-stress concrete concept, Materials and their characteristics as per IS code, Advantaged & Disadvantaged, Application, Differences of Pre-stressed concrete over Reinforced Concrete. Principle of Pre-stressing, Methods of Pre-stressing (Pre-Tension & Post-Tension), Tensioning Devices, Nature of concrete-Steel Interface (Bonded & Unbonded) various Pre-stressing systems. Losses of Pre-stress.

Unit-II: Analysis of Pre-stressed concrete beams for flexure, at different stages, under working load for Rectangular and flanged sections. Permissible stress at different stages as per IS 1343:2012 code.

SECTION-B

Unit-III: Introduction to Limit state Design (Serviceability & Collapse). Basic Design of rectangular sections for flexure by limit state method, Design of one way single span slabs.
Analysis and design of end block, anchorage zone reinforcement, Check for transfer bond length in pre-tensioned beams.

Unit-IV: Design of Pre-stressed concrete circular water tanks by IS code method. Analysis and design of Poles.
Note: 1) Students should use IS 456:2000, IS 1343:2012, IS 875 (Part III) : 2015.

Books Recommended:
1. Edward G. Nawy Prestressed Concrete- A fundamental Approach , Prentice Hall.
2. Lin, T. Y. and Burns N. H., Design of Prestressed Concrete Structures, John Wiley and Sons.
3. Krishna Raju, N.; Prestressed Concrete Structures; TMH; Delhi).
4. P. Dayaratnam, Prestressed Concrete Structures, Oxford & IBH 5.

8CE03 : PROFESSIONAL ELECTIVE - IV
(iii) ADVANCED WATER TREATMENT

Course Objectives:
1. To educate the students on the principles and process designs of various treatment systems for water.
2. To impart knowledge about the advanced treatment for water.
3. Explain and design of various treatment process.
4. To use the fundamental principles of mass balance, chemical kinetics and equilibrium to design water reactors to achieve a desirable treatment goal.

Course Outcomes:
On completion of the course, student will be able to:
1. In-depth knowledge of physical chemical unit processes for advanced water treatment.
2. consider the application of this in research projects, and to contribute to the development of new theories and methods in the field.
3. Select or construct appropriate treatment schemes to remove certain pollutants present in water or waste water.
4. Developed conceptual schematics required for the treatment of water.
5. Translate pertinent forcing criteria into physical and chemical treatment system.
6. Provide recommendations of appropriate treatment processes for upgrading water and treatment efficiency

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SECTION-A

Unit - I: water treatment facilities flow diagram, different unit operations and unit processes. Coordination of unit operations. Common attributes of water affected by conventional unit operations and processes. Aeration: rate of gas absorption and desorption, objectives of aeration, gravity aerators and spray aerators, design of aerators.

Unit-II: Coagulation& Flocculation: Coagulation Process ,concept of surface charge, coagulating effects of electrolytes, zeta potential, coagulants and coagulant aids, factors affecting coagulation. flocculation - Objectives of flocculation, mixing and stirring devices, flash mixing flocculators, construction and operation of flocculators, problems on design of flocculators.

Unit-III: Sedimentation: objectives, theory of sedimentation discrete settling and hindered settling, settling of flocculants suspension. Ideal settling basin and its efficiency. Design, construction and operation of sedimentation tanks. Inlet and outlet hydraulics, sludge, removal and disposal, tube and plate settlers. Problems on design of sedimentation tanks.

SECTION-B

Unit-IV: Filtration: Filtration Process, Principal Mechanisms of Filtration, Design of rapid and slow sand filters, filtering sand & their performance. Fluidization & bed expansion in backwashing, Under drainage systems with design, operation problem .Scour intensification, high rate, declined rate, upflow biflow, dual media, diatomaceous earth filters.

Unit-V: Disinfection: objectives, different disinfectants, chemical disinfection, theory, factors governing, and kinetics. Non Chemical Methods for Disinfection: Ozonation, UV radiation. Chemical Disinfection by chlorine, Types of Chlorination and other uses of chlorine, manageable variables.

Unit-VI: Miscellaneous methods of treatment : Water softening: lime soda and zeolite process, split treatment problems on calculation of dose of lime and soda ash. Iron and Manganese Removal : Fluoridation and Defluoridation. Theory & Methods of Desalination.

Books Recommended:

1) Fiar, Geyer &Okun : Water and Waste Water Engg., John Wiley & Sons.
2) Mark J. Hammer : Water and Waste Water Technology, John Wiley & Sons.
3) Steel E.W. & Ghee M.C. : Water Supply & Sewerage, McGraw Hill Co.
4) B.C.Punmia A.K.Jain: Water supply engineering, Laxmi publication.

8CE03 : PROFESSIONAL ELECTIVE - IV
(iv) Industrial Waste Water Treatment

Course Objectives:

1. Enrich the knowledge on sources and characteristics of industrial wastewater.
2. Discuss the different methods of waste water treatment such as de-nitrification, membrane separation, air stripping, etc.
3. Understand the characteristics and composition of wastewater generated from industrial processes.
4. Design and operate effluent treatment plants for joint treatment of raw industrial wastewater and domestic sewerage.
5. To impart knowledge on the concept and application of Industrial pollution prevention, cleaner technologies, industrial wastewater treatment and residue management.
6. Understand principles of various processes applicable to industrial wastewater treatment.
7. Identify the best applicable technologies for wastewater treatment from the perspective of yield production.

Course Outcomes:

On completion of the course, students will be able to:

1. Distinguish between the quality of domestic and industrial water requirements and Wastewater quantity generation.
2. Understand the industrial process, water utilization and waste water generation.
3. Acquire the knowledge on operational problems of common effluent treatment plants.
4. Impart knowledge on selection of treatment methods for industrial wastewater.
5. Specify design criteria for physical, chemical, and biological unit operations.
6. Define the Principles of pollution prevention and mechanism of oxidation processes.
7. Suggest the suitable technologies for the treatment of wastewater.
8. Discuss about the wastewater characteristics.
9. Design the treatment systems.

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SECTION A

Unit I: Problem of Industrial Waste Water: Variation in quality and quantity of industrial wastewater. Effects of discharge of industrial waste water on streams; land and municipal sewers. Benefits of water pollution control by doing treatment of industrial waste.

Unit II: Indian Standards for discharge of treated wastewater on land, into municipal sewer and natural water courses. Sampling Procedure. Industrial waste survey; Stream sanitation, Stream sampling, Types of sampling, Stream survey, Sampling analysis.

Unit III: Approaches to Minimization of problem of industrial waste water, Good housekeeping, equalization, neutralization, precipitation, mixing of different effluent streams, recycle of effluent streams, process modifications in terms of raw materials or chemicals used general approach to planning of industrial waste water treatment and disposal.

SECTION B

Unit IV: General Approach for handling and treatment of industrial wastewater with following special characteristics. Shock Loads, presence of colours, toxic metal/ions, refractory substances, e.g. A B S and other detergents, growth inhibiting substances such as insecticides, waste rich in nutrients (N.P.K. etc.), waste rich in oil & grease, high suspended solids, high BOD, high temperature, acidity, alkalinity etc.

Unit V: Process Line Diagrams, characteristics and treatment of industrial waste of: - Pulp and paper, textile, tannery, food, Cannings, sugar mill, distillery, dairy, pharmaceutical, electroplating etc. industries. Design of Effluent Treatment Plant.

Unit VI: Advanced industrial wastewater treatment: Principles of tertiary treatment, Reuse and resource recovery. Recent trends in industrial waste management, Cleaner technologies

Recommended Books:

1. Waste Water Treatment, Disposal and Reuse, Mctcalf and Eddy, Tata McGraw Hill Publishing Co.Ltd, 1995
2. Pollution Control in Process Industries, S. P. Mahajan, Tata McGraw-Hill, 1985.
3. Liquid Waste of Industry Theory, Practices and Treatment, Nemcrow, Addison- Wesley,1971.
4. Industrial Water Pollution Control, W.W. Eckenfelder, McGraw-Hill, 1989.M.Tech Environmental Engineering Curriculum w.e.f. Aug 2019 Page 28
5. Natural Systems for Waste Management and Treatment, S.C. Reed, E.J.
6. Middlebrooks and R.W. Crites, McGraw-Hill, 1988.
7. Biological Treatment of Waste Waters: W.W. Eckenfelder, Pergamon Press, 1961.

8CE03: PROFESSIONAL ELECTIVE - IV
(v) STRUCTURAL ANALYSIS BY MATRIX METHOD

Learning Objectives of Subject:

1. To introduce students, matrix-based approach for linear elastic analysis of skeletal structure by using stiffness method/ flexibility method.
2. To form the bridge form basic subject like structural analysis to more advanced analysis subjects such as finite element method/analysis
3. To enable the student to have a good grasp of all the fundamental issues in structural analysis, besides enjoying the learning process, and developing analytical and intuitive skills.

Course outcomes: At the end of this course students will be able to-

1. Analyze simple structure using flexibility method,
2. Analyze simple structure using stiffness method (structure approach)
3. Analyze structure (truss, continuous beam, plane frame etc.) using stiffness method (member approach)
4. Understand basic programming/ flowchart aspects of structural analysis programs.

SECTION A

Unit I: Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility coefficients, stiffness coefficient, flexibility and stiffness matrices of beam and plane truss elements.

Unit II: Flexibility method, Advantages, Disadvantages, basic determinate structure, redundant, alternate choices of redundant and corresponding primary structures, matrix formulation, Analysis using flexibility method of simple problem on truss, beams, frames, up to two unknown.

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Unit III: Stiffness method(structural approach), unknown joint displacements for various structures, joint equilibrium equations, Analysis of simple problems of beams, frames, trusses up to three unknowns using Stiffness method (structural approach).

SECTION B

Unit IV: Stiffness method (member approach), Formation of member stiffness matrix, Transformation of load vector and displacement vector, Formation of global stiffness matrix, Solution of equations, member end forces, Analysis of plane trusses.

Unit V: Stiffness method (member approach), Formation of member stiffness matrix, Transformation of load vector and displacement vector, Formation of global stiffness matrix, Solution of equations, member end forces, Analysis of beams and plane frames.

Unit VI: Special analysis procedures static condensation, Analysis of beams and plane frames. Programming aspects, flow charts. Introduction to FEM

Reference Books:

1. Pandit G.S. and Gupta S.P., Structural Analysis A matrix approach, Tata Mc Graw Hill, New Delhi 1986
2. Gere J.M. and W.Weaver, Analysis of framed Structures, D.Van Nostrand com. Inc.,Affiliated East West Press, 1965
3. Meghre A.S. and Deshmukh S.K., Matrix Methods of Structural Analysis, Charotar Publishing, Anand, India 2003.

8CE04 : PROFESSIONAL ELECTIVE - V
(i) ADVANCED GEOTECHNICAL ENGINEERING

Learning Objectives of Subject:

- To study the clay mineralogy in detail.
- To learn about the concept of seepage discharge in anisotropic medium.
- To know the concept of three dimensional consolidation of soil.
- To understand the behavior of expansive soil.
- To study the stability of infinite and finite slope.
- To understand the concept of soil stabilization and to know the use of geosynthetics material.

Course Outcomes: At the end of the subject the students will be able

- To explain the structure of different clay mineral groups and their physical properties.
- To calculate the seepage discharge in anisotropic medium.
- To compute the degree of consolidation of soil.
- To recommend suitable type of foundation for expansive soils.
- To analyze the stability of infinite and finite slope.
- To suggest the suitable method of soil stabilization and to recognize the major geo-synthetics applications and
- their significance.

SECTION-A

Unit I : Clay mineralogy: Introduction, atomic bonds, classification and nomenclature, structure of clay mineral, Kaolinite. Illite and Montmorillonite groups, physical properties, clay-water relations, diffused double layer, thixotropy, base exchange capacity formation of different structure in soil deposites, electrical effects, electro osmosis, electrophoresis, stemming potential, zeta potential, clay mineral identification, DTA analysis, X ray diffraction method.

Unit II: Seepage : Flow net for anisotropic soil media, construction of flow net for hydraulic structure on non-homogenous soil, directional variation of permeability in aniosotropic medium. Numerical analysis of seepage in layered soil computation of seepage force, seepage through earthen dam resting on confined and unconfined medium entrance discharge and Transfer condition of line of seepage through earth dam.

Unit-III: Three dimensional consolidation. Equation, solution of 3dimensional consolidation equation, consolidation by vertical sand drain and its design aspect, free strain consolidation with no smear, effect of smear zone on radial consolidation. Calculation of the degree of consolidation with radial drains and solutions of problems based on this.

SECTION – B

Unit IV: Expansive soils: orgin of soil, intensification of expansive soil, swelling potential, factors affecting the swelling, different systems of classification, concept of swelling pressure and its measurements in the laboratory, special constructional measures adopted for the construction on expansive soils, special foundations adopted for the construction in expansive soils, concept of cohesive non-swelling techniques and its effect on expansive soil.

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Unit V: Stability analysis : Stability analysis of infinite and finite slope, causes of failure of slopes, Stability analysis of infinite and finite slope in cohesive and non cohesive soils, Taylor s stability number, Friction circle method and Swedish circle method.
Soil stabilization concept of mechanical stabilization, physical and chemical stabilization with organic and inorganic material like line, cement, lime, fly ash and mechanisms, various factors affecting stabilization.

Unit VI: Geosynthetics: types, specifications, functions and various applications in the field of Geotechnical engineering. Reinforced earth, mechanism of reinforced earth, various constructional methods and its effect towards altering, the properties of soil, field situations for application of this techniques.

Books Recommended:

1) Scoth R.F. : Principles of Soil Mechanics.
2) Das B.M. : Advanced Soil Mechanics.
3) Terzaghi : Theoretical Soil Mechanics.
4) Proceedings of Indian Geotechnical Conference, Dec. 22-24, 2013, Roorkee.
5) Proceedings of first Indian Geotextile Conference, Dec. 08-09, 1988, IIT, Bombay.

8CE04: PROFESSIONAL ELECTIVE V
(ii) ADVANCED STRUCTURAL ANALYSIS

Course Learning Objectives:
This course will cover the theory of structural response to dynamic loads. Students will learn

- To mathematically describe the response of SDOF systems with and without damping
- To mathematically describe the response of SDOF systems subjected to free vibration, harmonic, and arbitrary excitations.
- To prepare lumped mass systems including modal analysis of MDOF systems.
- To understand fundamental of elastic foundation and have an insight on soil-structure interaction problems.
- To aware students regarding nomenclature of stress-strain coordinate system and its associated relationship.

Course outcomes: At the end of the subject the students will be able to -

- Formulate the equation of motion for dynamics analysis of structures
- Demonstrate an understanding the assumptions and limitations of the structural dynamics theories.
- Find the response of SDOF systems with and without damping
- Find the response of SDOF systems subjected to free vibration, harmonic, and arbitrary excitations.
- Solve engineering problems in the context of structural dynamics.
- Students will be able to differentiate, analyze structures on firm base and elastic base foundations.
- By virtue of stress-strain relationship, advance aspects of stress-strain resultants allied with plates and shell can be understood.

SECTION - A

Unit I: Equation of Motion, Mass, Stiffness, and Damping. Ground Excitation and Rotational Motion. Free Vibration Single Degree of Freedom Systems (with and without damping). Definition of natural frequency/period. Simple harmonic motion. Effect of damping.

Unit II: Harmonic and Periodic Excitation of SDOF systems (with and without damping). Dynamic Response Factors. Resonance. Transmissibility

Unit III: Response to Arbitrary, Step, and Pulse Excitations of SDOF systems (with and without damping) for Unit impulse, Arbitrary Force and Pulse Excitations. Duhamal Method.
Numerical Evaluation of Dynamic Response of SDOF system using Newmark s Method.

SECTION - B

Unit IV: Earthquake Response of Structures. Concept of Response Spectrum. Free vibration, Modal analysis, Response of Linear systems and Earthquake analysis of linear systems for Multiple Degree of Freedom Systems.

Unit V: 1) Response spectrum Analysis as per IS 1893:2016
2) Introduction to plastic analysis of steel structure, shape factor, plastic section modulus, Redistribution of moment, upper and lower bound theorems, collapse loads for beams, single bay, single storey portals. Application of the concept in steel structures.

Unit VI: 1) Infinite & Semi-infinite beams resting on elastic foundation subjected to general loading condition.
2) Introduction to theory of elasticity - (treatment in Cartesian co-ordinates), state of stress at a point, stress equilibrium equations, strain-components, stress -strain relations, generalized Hooke s law, strain plane stress and plane conditions, stress and compatibility for 2D.

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Books Recommended:

1. Chopra A. K. , Dynamic of Structures, Theory and Applications to Earthquake Engineering , 3rd edition (2007), Prentice Hill (on reserve)
2. Duggal S.K. Earthquake Resistant Design of Structures , Oxford University Press 2007
3. PankajAgrawal , Manish Shrikhande Earthquake resistant design of Structures, Prentice Hall India
4. Timoshenko & Goodier, Theory of Elasticity.
5. Vazirani & Ratwani : Advanced Theory of Structures.

8CE04 : PROFESSIONAL ELECTIVE V
(iii) ADVANCED DESIGN OF R. C. C. STRUCTURES

Learning Objectives of Subject:

- To understand behavior of Flat slab under external loading.
- To understand behavior of retaining wall.
- To understand behavior of combined footing under external loading.
- To understand behavior of simple structure under external loading.
- To learn behavior of portal frame under external loading.
- To introduce basic concept of water tank.

Course outcomes: At the end of the subject the students will be able -

- To analyze and design of Flat slab.
- To analyze and design retaining wall.
- To analyze and design of combined footing.
- To analyze and design of simple structure.
- To analyze and design of portal frame.
- To analyze and design of water tank.

SECTION - A

Unit I:

1. Design of flat slab.
2. Design of Counter fort retaining wall.

Unit II:

1. Design of combined footing.
2. Complete design of simple, small structures like Canopies & Parking shed.

SECTION – B

Unit III:

1) Design of Portal frame up to two bay two storied symmetrical frame for symmetrical loading.
2) Design of circular slab for uniformly distributed load only.

Unit IV:

1. Design of circular tanks with rigid and flexible base resting on firm ground by working stress method. (By IS code Method, IS 3370-2021)
2. Design of circular tanks with rigid base resting on firm ground by Limit State method. (By IS code Method, IS 3370-2021)

Notes:

1) Students should use IS 456:2000, IS 3370-2021.
2) Field visit on any RCC framed structure & foundation, report of the same.
3) Students must be shown video CD, slides, transparencies, and photograph of actual structures.

Books Recommended:

1. Sushil Kumar, Treasure of R. C. C. Design ; STANDARD BOOK HOUSE SINCE 1960.
2. Ashok K Jain : Reinforced Concrete (Limit state Design) (Nem Chand & Bros Roorkee)
3. Dr.Shah V.L. & Karve S.R.: Limit State Theory & design of Reinforced concrete IS 456:2000 (Structures Publication)
4. N. Krishna Raju, Advanced R. C. C. Design; 3rd Edition; CBS PUBLISHERS AND DISTRIBUTOR PVT. LTD.
5. Rajgopalan, K., Storage Structures Hardcover Import; Aa Balkema
6. P.C.Varghese : Advanced reinforced concrete Design (PHI Publication)

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8CE04 : PROFESSIONAL ELECTIVE V
(iv) ADVANCED WASTEWATER ENGINEERING

Course Objectives:
The objective of advanced wastewater engineering is to extract pollutants, remove toxicants, neutralize coarse particles, kill pathogens so that quality of discharged water is improved to reach the permissible level of water to be discharged into water bodies or for agricultural land.

Course Outcomes: At the end of the course students will:
1. Have knowledge regarding different types and sources of wastewater.
2. Apply advanced technologies in Wastewater treatment.
3. Select the most appropriates types of membrane processes for tertiary treatment of wastewater.
4. Apply advanced oxidation processes to treat concentrated non biodegradable wastewater.
5. Learn sludge handling and disposal processes.

SECTION A

Unit I: Water Pollution and Treatment: Types and Sources, quality of water, various stages of treatment of Water treatment process: aeration, Sedimentation, Filtration: slow and rapid sand filters.

Unit II: Biological nutrient removal: Nitrogen removal: nitrification, denitrification, processes for biological nitrogen removal, phosphorous removal mechanism; application of phostrip, bardenpho and phoredox process.

Unit III: Membrane Separation: Membrane process terminology & classification, Materials, membrane configuration, membrane operation, ultra filtration, reverse osmosis, microfiltration, Nanofiltration: Applicability, limitations, advantages and disadvantages, membrane fouling, electro dialysis, membrane bioreactors.

SECTION B

Unit IV: Adsorption: Types of adsorbents, fundamentals of adsorption, adsorption isotherm, activated carbon adsorption kinetics, activated carbon treatment.
Ion Exchange: Fundamentals of ion exchange, types of ion exchange resins, general characterization of ion exchange resins, theory and application of ion exchange.

Unit V: Advanced Oxidation Process: Theory of advanced oxidation, technologies used to produce hydroxyl radicals, applications.

Unit VI: Sludge handling and disposal: Sludge processing steps- Preliminary operations, thickening, stabilization, conditioning, dewatering and heat drying and thermal reduction. Aerobic and anaerobic sludge digestion microbiology and design, land application of sludge and design consideration. Sludge storage, land application of domestic sewage and ground water recharge.

BOOKS RECOMMENDED:
1. Wastewater Engineering: Treatment, disposal, Reuse (4th ed.) - Metcalf & Eddy Inc. Tata McGraw-Hill, New Delhi, 2003.
2. Wastewater Treatment for Pollution Control (2nd ed.) - SJArceivala, Tata McGraw-Hill, 1998.
3. Wastewater Treatment Plants: Planning, Design and Operation Holt - SR Qasim, Rinehart & Winston, NY, 1985
4. Wastewater Treatment DW Sunderstorm and HE Klei, Prentice-Hall, Englewood Cliffs, NJ, 1979.
5. Biological Wastewater Treatment: Theory and Application - CLP Grady, and HC Lim, Marcel Dikker, NY, 1980.
6. Punmia B. C. Wastewater Engineering . Laxmi publication.

8 CE04 : PROFESSIONAL ELECTIVE V
(v) CONSTRUCTION EQUIPMENT AND MACHINERY

Learning Objectives of Subject:
- Student should learn about the basic terms related to construction machinery and equipments.
- Student should understand use of various equipments and tools in sequence of Project Life cycle.
- Student should be able to know the application of Survey tool and basic construction minor tools.
- Student should know about various equipment and machinery related to excavation and dumping work like excavator, Machine Shovel , Hoe etc.
- Learner should know about various material mixing machinery like Rotating drum concrete mixer, transit mixer etc.
- Learner should study about compacting machine and tools like various vibrators and rollers.
- Student should know about various material movement equipment like crane , hoist and lifts etc.

Course outcomes: At the end of the subject the students will be able -
- To recognize the various terms related to the tools that are required for any construction work.
- To decide which machine or tool can be implemented as per the project life cycle stage.
- To understand the survey process with help of Total station and will be able to analyze the performance of basic minor tools and machinery
- To understand various equipments like excavators, shovels, mixers, compactors , crane , hoist , lift etc.

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SECTION A

Unit I: Basics of Construction Equipment and Machinery History of Construction Equipments and Tools, Need of utilizing equipments and Machinery in Construction work. Understanding Terms like operating time, Idle time, Capacity, Efficiency of Machine, depreciation and obsolesce cost of machines and equipments. Purchase, Rent and Lease considerations while using Machine or Equipments. Factors affecting selection of Machinery, General Safety rules and measures while using equipments, tools and machinery at time of construction.

Unit II : Land Survey Equipments and essential Tools- Need for survey equipments , Application of Total Station for land survey and layout work. Introduction to Drone surveying and mapping method. Tools like Hoe, Head pan, Masonry Trowel , Wheel barrow , Wooden Float , Plumb Bob , Line Level etc.

Unit III : Excavating & Dumping Machines :- Components , Capacity , Working method of Excavator , Front Shovel , Loaders and Back Hoe.

SECTION B

Unit IV : Mixers - Components , Capacity , Working method of Batch mixers, Drum Types Mixer, Tilting drum mixers, Non-tilting drum mixer, Reversing drum mixer, Pan Type Mixer , Concept & Types of Continuous Concrete Mixer Transit Mix trucks/ Ready mixed Concrete Mixers.

Unit V: Compacting Equipments, Tools & Machinery:
Vibrator Its need and types Internal/ needle, surface, vibrating table & surface vibrating machine. Details of Rollers and its types Sheep Foot, Tamping , Smooth drum vibratory soil compactors , Pneumatic- tired rollers.

Unit VI: Material handling Equipments, Tools & Machinery: Components , Capacity , Working method of various Cranes Tower , Mobile, Truck mounted Rough Terrain, Overhead .
Components, Capacity, Working method of Loader, Conveyors, Lifts , Hoist & Forklift.

8CE04 : PROFESSIONAL ELECTIVE - V
(vi) FINITE ELEMENT METHOD

Course Learning Objective:
The aim of the course is to provide the students an overview on Finite Element Method, Material models, and Applications in Civil Engineering.

Course outcomes: At the end of the subject the students will be able to -
1. Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer.
2. Formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric and plate bending problems.
4. Implement and solve the finite element formulations using software.

SECTION – A

Unit I: Introduction to Finite Element Method, its application, Steps in Finite Element Analysis, Advantage/ Disadvantages, Virtual Work and Variation Principle, : Galerkin Method, Displacement Approach, Stiffness Matrix and Boundary Conditions.

Unit II: Finite Element and Interpolation Functions/shape function, One dimensional Element (Line, Quadratic, cubic, Lagrangian form, higher order), Two dimensional Element (Triangular element- linear / quadratic, Rectangular element, Isoparametric, Serendipity element), Three dimensional Element (Tetrahedral element, Prismatic element)

Unit III: One dimensional Finite Element Analysis; Linear spring, Truss element, one dimensional fluid flow thro porous media, steady state heat conduction, solutions of simple engineering 1D problems.

SECTION – B

Unit IV: One dimensional Finite Element Analysis; 1) Beam Element, review of beam theory, FE formulation of beam element, solutions of engineering problems. 2) Analysis of plane frame, Transformation Matrix, solutions of engineering problems

Unit V: Two dimensional Finite Element Analysis; 2D Continuum Structures: Plane stress and plane strain analysis by constant strain triangle (CST), rectangular element, Isoparametric Elements, development of element stiffness matrices, load vectors and solution.

Unit VI: Three dimensional Finite Element Analysis; Development of element stiffness matrices and load vectors using Axi-symmetric solids, tetrahedron, eight node brick element, Isoparametric Elements. Introduction to FEMsoftware s STAAD, RAM Product, NISA, MSC Nastron, ANSYS, ABAQUS, MIDAS, CRISP, PLAXIS etc.

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Books Recommended:

1. Introduction to Finite Elements in Engineering, Chandragupta T. R. and Belegundu A. D., 3rd Edition, Prentice Hall, 2002.

2. Finite Element Method in Structural Analysis, A.S.Meghre and Ms. K.N.Kadam, First Edition, Khanna Publishers, 2014.

3. Finite Element Analysis: Theory and Programming: C. S. Krishnamurthi Second Edition, Tata McGraw Hill Publishing Company Limited, 1994

4. O. C. Zienkiewicz., R. L. Taylor & J. Z. Zhu., The Finite Element Method Its Basis & Fundamentals , Elsivier Publications, 2007

8 CE05: CONSTRUCTION ECONOMICS & ESTIMATING – COSTING – LAB.

1. Writing specification for 5 items that includes Building Work, Road work, Irrigation work etc.
2. Rate Analysis of 6 items like Cement, Sand, Steel, Brick, Paver and Timber etc.
3. Preparation of BAR bending Schedule.
4. Manual & Software Application for detail estimate of Residential Block with 4 rooms only.
5. Quantity & Rate Estimate of small Commercial building.
6. Quantity & Rate Estimate of Rigid/ Flexible Pavement Road for stretch of 1 km only.
7. Valuation of small building/ flat for any existing structure.

Note: **-** Faculty should carry out Mock exercise for Tendering & Bidding Process among the concern class students.

8 CE06 : P.E. IV (i) ADVANCE DESIGN OF STEEL STRUCTURE- LAB.

Practicals:

1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any Steel framed structure & report of the same.

8CE06: P.E. - IV (ii) ADVANCED PRESTRESS CONCRETE STRUCTURES-LAB.

Practicals:

1. Candidates are required to prepare at least two designs based on theoretical course detailed working drawings are necessary.
2. A journal/report on design shall be submitted by each student. Practical examination shall be viva-voce based on above practical and the syllabus of the course.
3. Field visit on any Prestressed structure & report of the same.

8CE06 P.E. - IV (iii) ADVANCED WATER TREATMENT- LAB.

List of Experiments: Minimum 8 practicals out of the given should be performed. The site visit is compulsory.

1. Determination of Turbidity of water sample.
2. Determination of pH of water sample.
3. Determination of Electrical Conductivity of water sample.
4. Determination of Chlorides.
5. Determination of suspended, settleable, volatile & fixed solids.
6. Determination of hardness of water sample.
7. Determination of Optimum Coagulant dosage.
8. Determination Dissolved oxygen and BOD for the given sample.
9. Determination of COD for given sample.
10. Report of Field visit to Municipal Water Treatment Plant.

8CE06: P.E. - IV (iv) INDUSTRIAL WASTE WATER TREATMENT- LAB.

List of Experiments: Minimum 8 practical s out of the given should be performed. The site visit is compulsory.

1. Determination of Alkalinity and Acidity
2. Determination of Dissolved oxygen
3. Determination of Biochemical Oxygen Demand
4. Determination of Chemical Oxygen Demand
5. Determination of suspended, settleable, volatile & fixed solids.
6. Determination of Oil & Grease.
7. Determination of Phosphates and Sulphates.
8. Determination of SVI of Biological sludge
9. Metal analysis from Industrial Wastewater a) Arsenic b) Nickel c) Chromium
10. Report of Field visit to Industrial Waste Water Treatment Plant.

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8CE06 : P.E. - IV (v) STRUCTURAL ANALYSIS BY MATRIX METHODS – LAB.

(Any five)

1. Analysis of axially loaded member/ problem using stiffness method/ flexibility method and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
2. Analysis of Continuous beam problem using structural approach and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
3. Analysis of Continuous beam problem using member approach and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
4. Analysis of Truss problem using member approach and Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
5. Analysis of Plane frame problem using member approach hand Compare the output obtained through the structural analysis using software/ computer program/ excel program with the solution.
6. Prepare computer program for Matrix addition, subtraction, multiplication, inverse using C/FORTRAN language.

Prepare computer program to form Stiffness matrix for 1) Truss element, 2) Beam Element, 3) Plane frame Element using C/FORTRAN language

8 CE07 : PROJECT & SEMINAR

As per the details in the scheme of B.E (Civil Engineering).

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C. WATER CONSERVATION

1. Rainwater Harvesting System

To sustain the ground water availability the Institution has adopted rain water harvesting system. The systematic rainwater harvesting is to collect the rainwater from terrace is implemented. For improvement of ground water level, all buildings are provided with roof water harvesting.

This rain water harvesting system is design to collect terrace water using rainwater pipes. The collected water is discharge to the soak pits which work for earth and well recharge. Nearly 70% of terrace area water is discharge through the pipes.

Institute created the rainwater harvesting pit of size 5* 5* 5 feet near well in order to recharge the well. Rainwater Pit is of rectangular shape which is filled with pebbles or stones or aggregates or broken bricks to 5 ft depth. Then a layer of smaller stones or aggregates (Jelli) for a depth of 6 inches over the pebbles is added. Similarly pit is filled completely. This soak pit works for ground recharging as well as discharge the water to the well through its bed. In each soak pit a filter media is provided.

Frugal use of water has ensured constant supply of water for the stakeholders in the institute. The institute has reduce its water consumption by significant amount with the help of rain water harvesting system, open well recharge system and awareness among the students and staff members about water conservation.

Rain Water Harvesting Pit

Rain Water harvesting Pipe arrangement

Rain Water harvesting Pipe arrangement


PANKAJ LADDHAD
ITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, BUL
COMPUTER SOCIETY OF INDIA
ESTD. 1965
COMPUTER SOCIETY
INDIA


PANKAJ LADDHAD
INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, BULDHANA
COMPUTER SOCIETY OF INDIA
COMPUTER SOCIETY OF INDIA
ESTD. 1965


PANKAJ LADDHAD
INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, BULDHANA
COMPUTER SOCIETY OF INDIA
COMPUTER SOCIETY OF INDIA
ESTD. 1965


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OF TECHNOLOGY AND MANAGEMENT STUDIES, BULDHANA
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STUDENT BRANCH


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MANAGEMENT STUDIES, BULDHANA
SOCIETY OF INDIA
COMPUTER SOCIETY OF INDIA


KAJ LADDHAD
ECHNOLOGY AND MANAGEMENT STUDIES, BULDHANA
STUDENT BRANCH

B. MANAGEMENT OF THE FOLLOWING TYPES OF THE DEGRADABLE & NON DEGRADABLE WASTE

1. Solid Waste Management: -

Pankaj Laddhad Institute of Technology & Management Studies, Buldhana generates the solid waste from various sources, including academic building, hostels, canteen and the garden. The management of solid waste is crucial to ensure the safety and well being of students , staff and the environment.

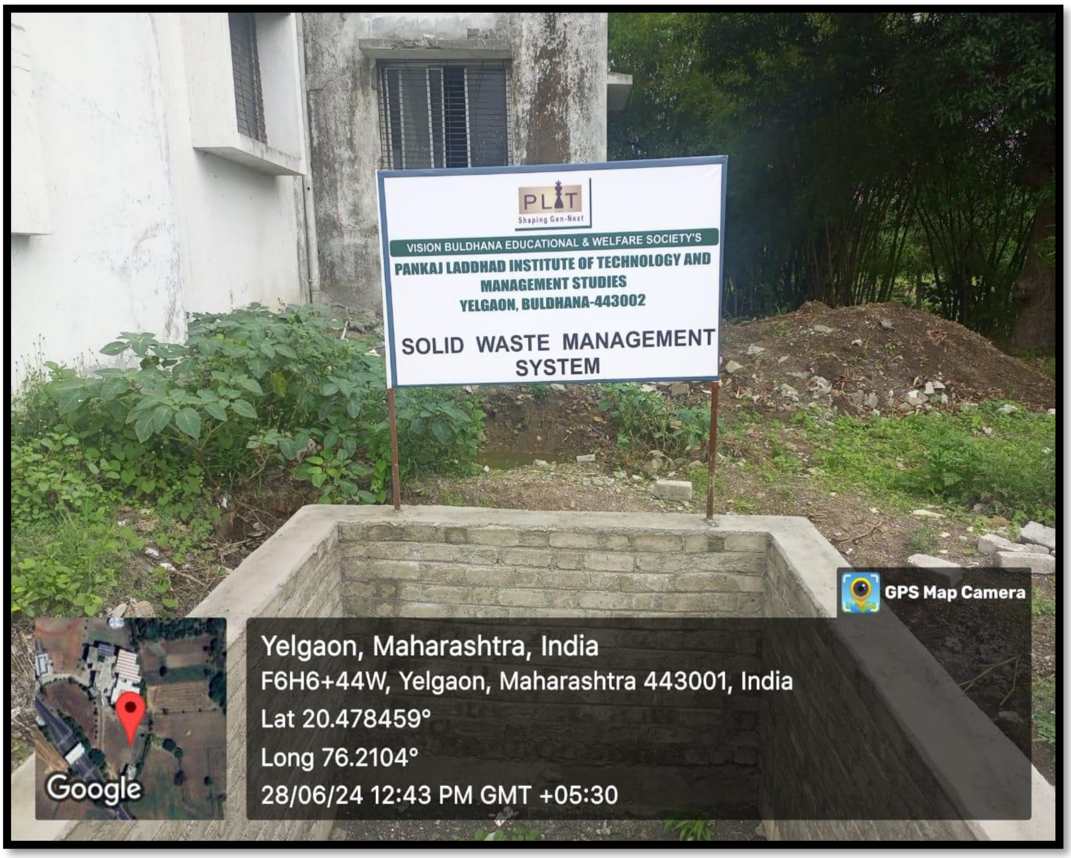
Institute creates the Solid Wastes Dumping System where all waste is dumped every day. This solid waste management pit having size of 10 * 10* 10 feet located at backside of the institute.

Dustbins are placed at different location of the institute such as corridor, cafeteria, classroom and laboratories for collection and disposal of waste.

Every day , the college worker collects the solid waste from different location of the Institute. After that waste is segregated and dumped in to the solid waste pit. Non degradable waste is handover the local vender for shredding purpose.

Then waste is left for decomposition and then it is used as compost for trees and plants planted in the campus. Layer of loose soil is spread on solid waste daily.

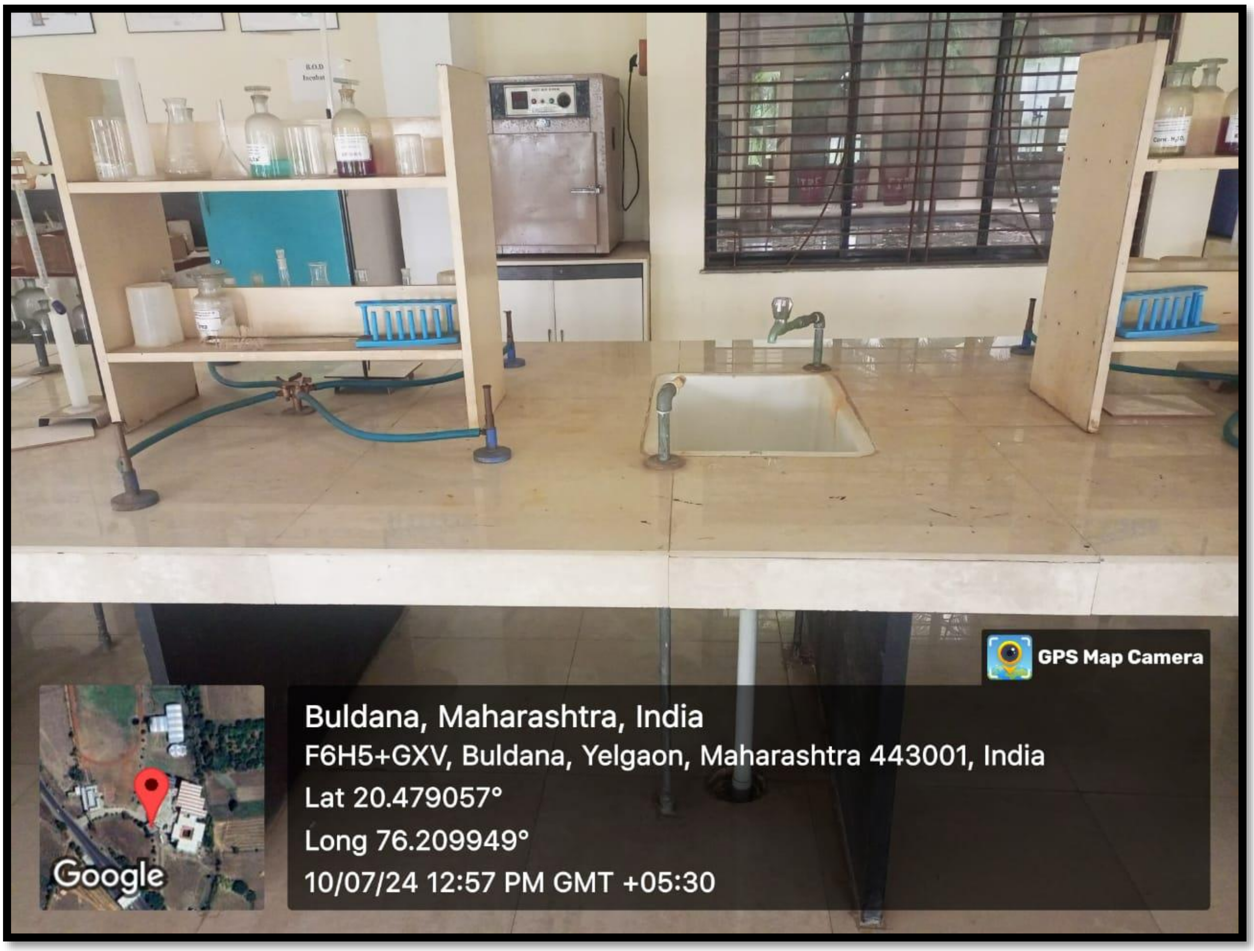
Dustbin for collection of Waste at Various Location



Solid waste Management Pit

2. Liquid Waste Management: -

The Institution follows the systematic procedure for proper management and disposal of liquid waste. A suitable drainage system setup have been provided near Chemistry laboratories for liquid waste management It is essential to ensure proper disposal of all the liquid waste generated in the campus. Generally chemistry laboratory having requirement of different types of liquid and as per requirement of each semester, chemical is being purchased and it is consumed during the academic session itself. The solutions which are left during practical sessions are drained into the sink under running tap water as the chemicals may contaminate the water bodies and there are no consequences on the environment. Liquid waste from the points of generation like the canteen and toilet etc. is let out as effluent into a proper drainage facility and to avoid stagnation.



Liquid Waste Management System in Chemistry Laboratory

3. E-Waste Management: -

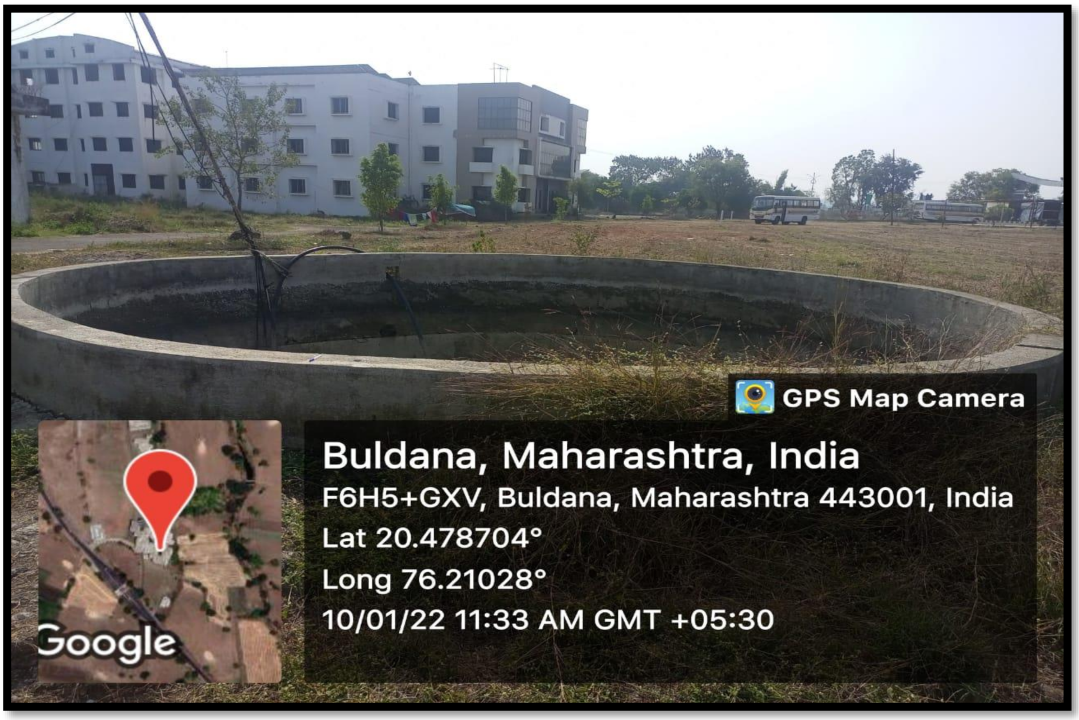
Pankaj Laddhad Institute of Technology & Management Studies takes significant steps to manage electronic waste. College ensure that less amount of production of e-waste can be done in premises.

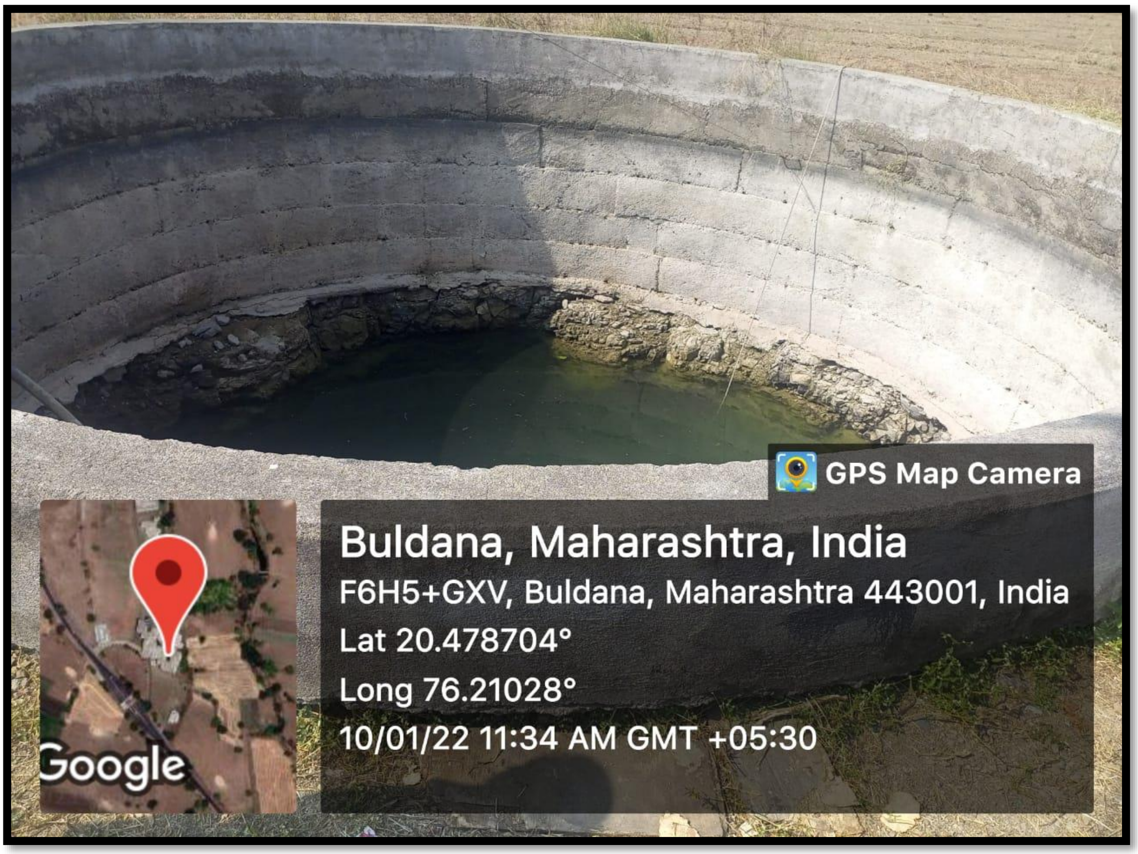
- Electronic goods are put to optimum use, the minor repairs are set right by the staff and the Laboratory assistants; and the major repairs, by the professional technicians, and then they are reused.
- The parts of obsolete computer system are reused whenever there is requirement of it with existing computer system.
- The institution allow and motivate he final year students to reuse the old invalid project components such as useful parts of electronic gadgets like resistors, capacitors, inductors, diodes, transistors, thermostats to their project. This will help to students learn and experiment with existing components.

Rain Water harvesting Pipe arrangement

2. Open Well recharge

Open well recharge is very effective method of rain water harvesting. The open wells on campus is used to replenish rainwater. The water level rises when the open wells are recharged. As a part of water conservation facilities that are available in the institute, the open well facilities are available in the campus. As the water crisis continues to become severe, there is a dire need of reform in water management system and revival of traditional systems.





Open Well Recharge

INVOICE

SOLAR SHAKTI 17-18 PATNI COM COMPLEX SHOP NO 20 WASHIM Mo No 9422193162,8421586422 E-Mail : solarshakti123@gmail.com	Invoice No. **R011**	Dated **29-Jun-2017**
	Delivery Note	Mode/Terms of Payment
	Supplier's Ref.	Other Reference(s)
Buyer Code : **VISION BULDANA EDUCATUION SOC,BULDANA**	Buyer's Order No.	Dated
	Despatch Document No.	Delivery Note Date
	Despatched through	Destination
	Terms of Delivery	

Sl No.	Description of Goods	GST%	Qnty	Rate	Sceam.%	CD. %	Amount
1	**SOLAR ROOF TOP SYSTEM 25 KW**		1	15,25,000.00/No			**15,25,000.00**
						Total	**₹ 15,25,000.00**

Amount Chargeable (in words)

E. & O.E

INR Fifteen Lakh Twenty Five Thousand Only

Company's Bank Details
Bank Name : **ALLAHABAD BANK Br Washim**
A/c No. : **50245850774**
Branch & IFS Code : **Washim & ALLA0213204**

Declaration
We declare that this invoice shows the actual price of the goods described and that all particulars are true and correct.

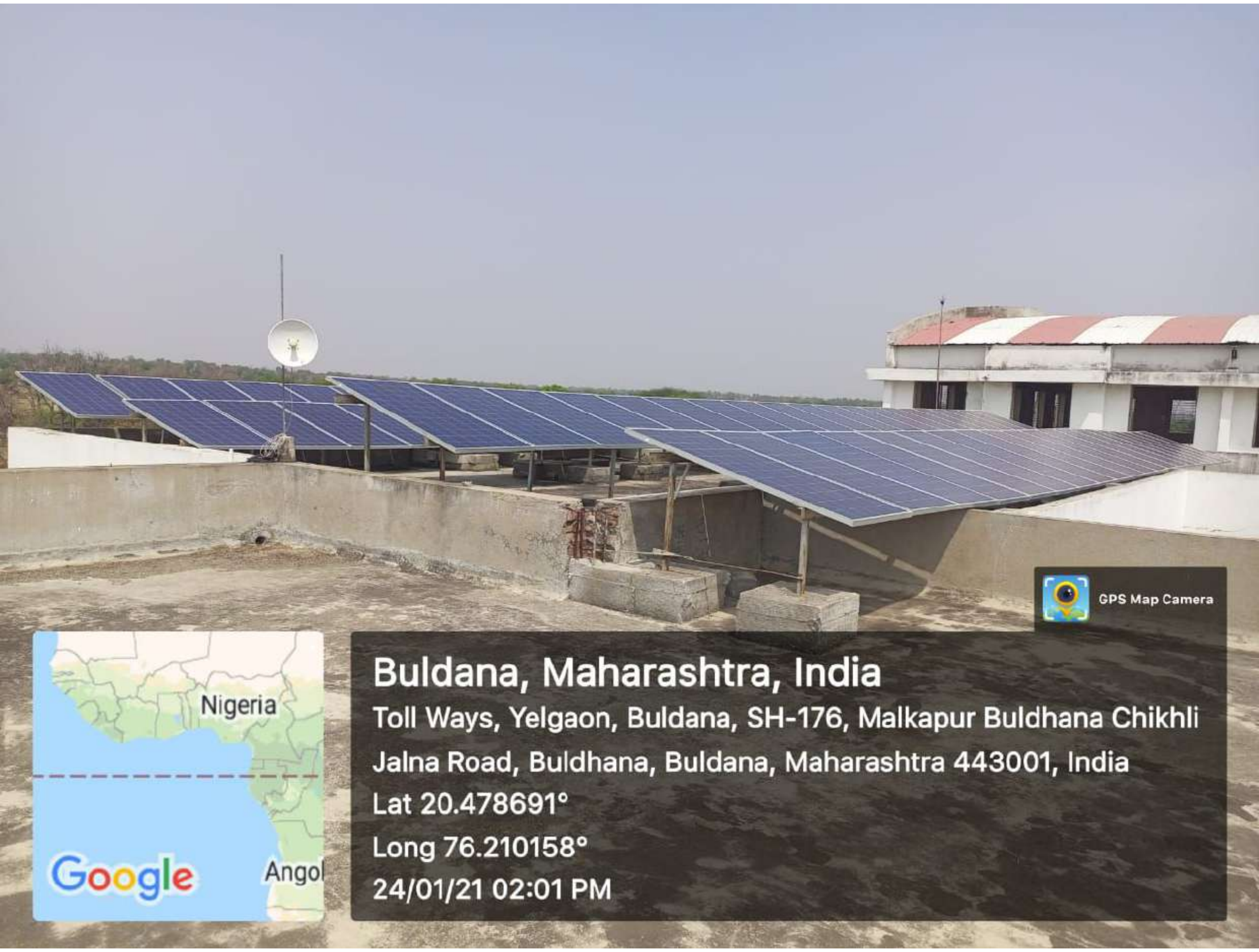
for SOLAR SHAKTI 17-18

V.Joshi

Authorised Signatory

SUBJECT TO WASHIM JURISDICTION

This is a Computer Generated Invoice


GPS Map Camera
Nigeria
Google
Angol
Buldana, Maharashtra, India
Toll Ways, Yelgaon, Buldana, SH-176, Malkapur Buldhana Chikhli
Jalna Road, Buldhana, Buldana, Maharashtra 443001, India
Lat 20.478691°
Long 76.210158°
24/01/21 02:01 PM


AC Distribution Box
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GPS Map Camera
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Nigeria
Google
Buldana, Maharashtra, India
Toll Ways, Yelgaon, Buldana, SH-176, Malkapur Buldhana
Chikhli Jalna Road, Buldhana, Buldana, Maharashtra
443001, India
Lat 20.47869°
Long 76.210156°
24/03/21 03:17 PM


GPS Map Camera
Mali
Nigeria
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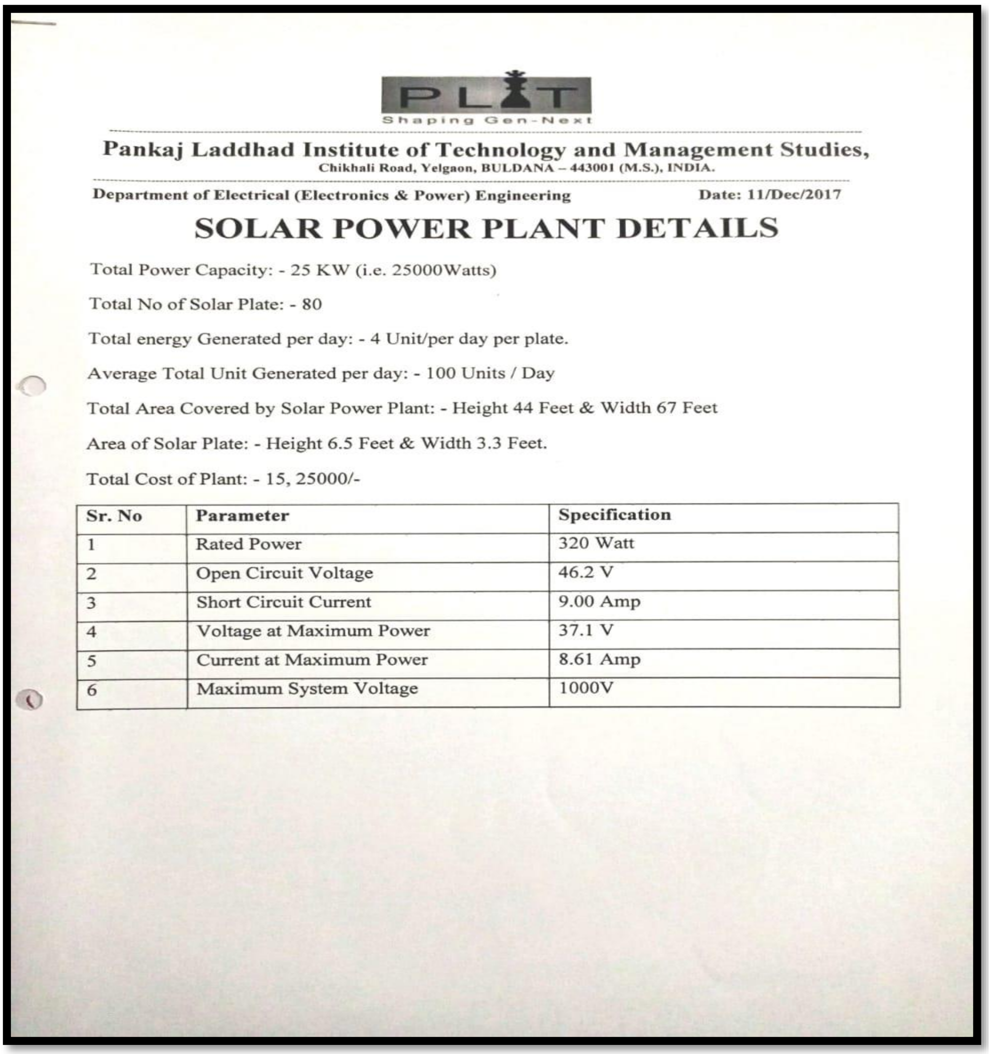
Buldana, Maharashtra, India
Toll Ways, Yelgaon, Buldana, SH-176, Malkapur Buldhana Chikhli Jalna Road, Buldhana, Buldana, Maharashtra 443001, India
Lat 20.47869°
Long 76.210156°
24/03/21 03:17 PM

A. THE INSTITUTE HAS FACILITIES FOR ALTERNATE SOURCES OF ENERGY AND ENERGY CONSERVATION MEASURES

1. Solar Energy

The Installation of Solar Power Plant on roof top is a great example of how renewable energy can be utilized to provide clean energy and reduce the greenhouse gas effect. The grid tied solar power plant installed in the institute has a capacity of 25kilowatt which generate approximately 28800 units of electricity every year. Maximum power requirement of a college is 30KW. Every year 70 to 80 percentage of power requirements of college is met by this renewable energy source.



PLIT
Shaping Gen-Next

Pankaj Laddhad Institute of Technology and Management Studies,
Chikhali Road, Yelgaon, BULDANA – 443001 (M.S.), INDIA.

Department of Electrical (Electronics & Power) Engineering Date: 11/Dec/2017

SOLAR POWER PLANT DETAILS

Total Power Capacity: - 25 KW (i.e. 25000Watts)

Total No of Solar Plate: - 80

Total energy Generated per day: - 4 Unit/per day per plate.

Average Total Unit Generated per day: - 100 Units / Day

Total Area Covered by Solar Power Plant: - Height 44 Feet & Width 67 Feet

Area of Solar Plate: - Height 6.5 Feet & Width 3.3 Feet.

Total Cost of Plant: - 15, 25000/-

Sr. No	Parameter	Specification
1	Rated Power	320 Watt
2	Open Circuit Voltage	46.2 V
3	Short Circuit Current	9.00 Amp
4	Voltage at Maximum Power	37.1 V
5	Current at Maximum Power	8.61 Amp
6	Maximum System Voltage	1000V

Solar Power Plant Details

25 KW Solar Power Plant installed at Pankaj Laddhad Institute of Technology & Management Studies, Buldhana

25 KW Solar Inverter System

INVOICE

SOLAR SHAKTI 17-18
PATNI COM COMPLEX
SHOP NO 20
WASHIM
Mo No 9422193162,8421586422
E-Mail : solarshakti123@gmail.com

Invoice No. R011
Dated 29-Jun-2017
Delivery Note
Mode/Terms of Payment
Supplier's Ref.
Other Reference(s)
Buyer's Order No.
Dated
Despatch Document No.
Delivery Note Date
Despatched through
Destination
Terms of Delivery

Buyer Code :
VISION BULDANA EDUCATUION SOC,BULDANA

Sl No.	Description of Goods	GST%	Qnty	Rate	Sceam.%	CD. %	Amount
1	SOLAR ROOF TOP SYSTEM 25 KW		1	15,25,000.00/No			15,25,000.00
						Total	₹ 15,25,000.00

E. & O.E

Amount Chargeable (in words)
INR Fifteen Lakh Twenty Five Thousand Only

Company's Bank Details
Bank Name : ALLAHABAD BANK Br Washim
A/c No. : 50245850774
Branch & IFS Code : Washim & ALLA0213204

Declaration
We declare that this invoice shows the actual price of the goods described and that all particulars are true and correct.

for SOLAR SHAKTI 17-18
Authorised Signatory

SUBJECT TO WASHIM JURISDICTION
This is a Computer Generated Invoice

Bills of Roof Top Solar Power Plant

Tax Invoice *(ORIGINAL FOR RECIPIENT)*

Chirayu Power Pvt. Ltd., Khamgaon 23-24
M.I.D.C., Khamgaon
GSTIN/UIN: 27AAGCC3581P1Z3
State Name : Maharashtra, Code : 27
Contact : 07263-277477
Fax : 07263-277024
E-Mail : karan@chirayupower.com

Consignee (Ship to)
Pankaj Laddhad Institute of Technology
Buldhana , Maharashtra
State Name : Maharashtra, Code : 27
Contact : 9881851852

Buyer (Bill to)
Pankaj Laddhad Institute of Technology
Buldhana , Maharashtra
State Name : Maharashtra, Code : 27
Contact : 9881851852

Invoice No. 24-25/Pr-60 e-Way Bill No.	Dated 22-May-24
Delivery Note 4961	Mode/Terms of Payment
Reference No. & Date.	Other References
Buyer's Order No.	Dated
Dispatch Doc No. 4961	Delivery Note Date 22-May-24
Dispatched through Road	Destination Buldhana
Terms of Delivery	

Sl No.	Description of Goods and Services	Quantity	Rate	per	Amount
1	**Invertor Growwatt** *Growatt 3ph 25KW Inverter*	1 nos	89,000.00	nos	89,000.00
2	**Installation and Commissioning**	1 nos	3,000.00	nos	3,000.00
3	**Transportation Expenses**				2,000.00
					94,000.00
	CGST on Sales				5,790.00
	SGST on Sales				5,790.00
	Total	2 nos			₹ 1,05,580.00

Amount Chargeable (in words) *E. & O.E*
Indian Rupees One Lakh Five Thousand Five Hundred Eighty Only

HSN/SAC	Taxable Value	CGST Rate	CGST Amount	SGST/UTGST Rate	SGST/UTGST Amount	Total Tax Amount
854140	89,000.00	6%	5,340.00	6%	5,340.00	10,680.00
854140	5,000.00	9%	450.00	9%	450.00	900.00
Total	94,000.00		5,790.00		5,790.00	11,580.00

Tax Amount (in words) : **Indian Rupees Eleven Thousand Five Hundred Eighty Only**

Company's Bank Details
A/c Holder's Name : Chirayu Power Pvt. Ltd., Khamgaon
Bank Name : State Bank of India CC A/c 38205848281
A/c No. : 3 8 2 0 5 8 4 8 2 8 1
Branch & IFS Code : Main Br., Khamgaon & SBIN0063821
SWIFT Code :

Company's PAN : AAGCC3581P

Declaration
Certified that particulars given above are true and correct.

for Chirayu Power Pvt. Ltd., Khamgaon 23-24

Authorised Signatory

SUBJECT TO KHAMGAON JURISDICTION

This is a Computer Generated Invoice

Bills of Inverter used for solar power plant

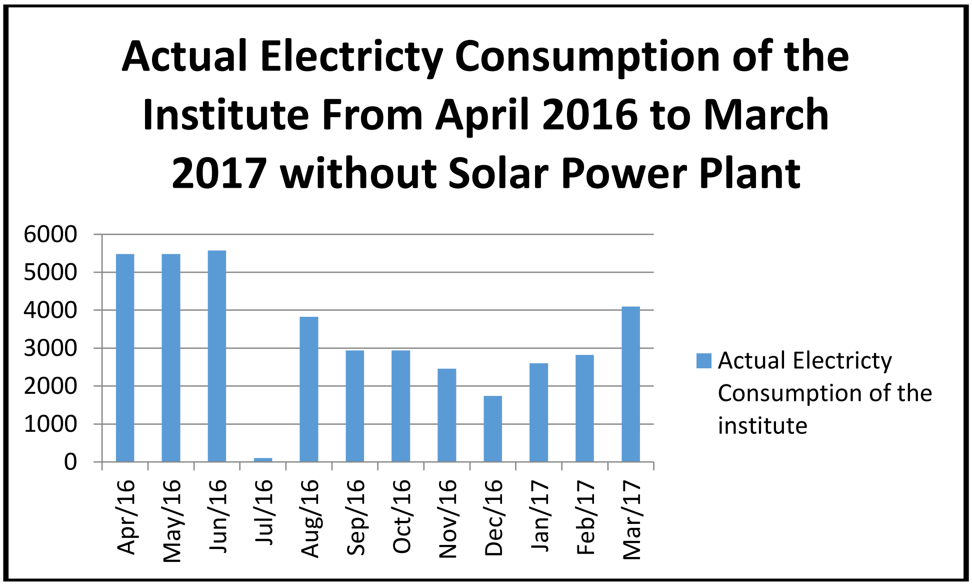
2. Wheeling to the grid

25 KW Solar Power Plant installed at roof top of the institute which generates 80Units of electricity in an average per day. The Installed solar power plant is connected to online grid system through net metering system which exports the excess of electrical energy to the grid. Near about 500 to 600 units of electricity are export to the grid per month.

SAVING OF ELECTRICAL ENERGY IN UNITS

A. Electricity Consumption of Pankaj Laddhad Institute of Technology & Management Studies, Buldhana from April 2016 to March 2017 without Solar Power Plant.

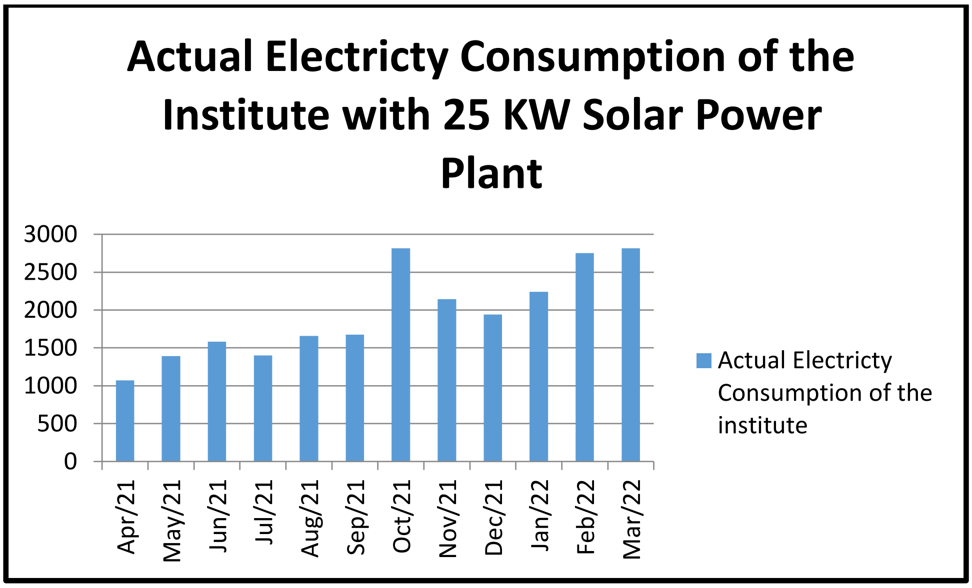
Sr. No	Month (A)	Actual Electricity Consumption of the institute during the given month
1	Apr-16	5478
2	May-16	5479
3	Jun-16	5577
4	Jul-16	100
5	Aug-16	3822
6	Sep-16	2942
7	Oct-16	2942
8	Nov-16	2456
9	Dec-16	1738
10	Jan-17	2601
11	Feb-17	2824
12	Mar-17	4097
Total	**12 Months**	**40056 Units**



Link of Electricity Bills from April 2016 to March 2017.
https://drive.google.com/file/d/1anHyFaJZcM1aOK3I6mf__u-LZGHVx_RE/view?usp=drive_link

B. Electricity Consumption of Pankaj Laddhad Institute of Technology & Management Studies, Buldhana from April 2021 to March 2022 with 25KW Solar Power Plant.

Sr. No	Month (A)	Actual Electricity Consumption of the institute
1	Apr-21	1073
2	May-21	1394
3	Jun-21	1584
4	Jul-21	1399
5	Aug-21	1656
6	Sep-21	1677
7	Oct-21	2814
8	Nov-21	2145
9	Dec-21	1939
10	Jan-22	2241
11	Feb-22	2752
12	Mar-22	2815
Total	**12 Months**	**23410 Units**



Link of Electricity Bills from April 2021 to March 2022.

https://drive.google.com/file/d/13N_o3F-R6jPoIbtfqz75Qk30uP78YCK8/view?usp=drive_link

D. Electricity Bill Record from April 2021 to March 2022

Sr. No	Month (A)	Actual Electricity Consumption of the institute (B)	Offset (Solar Units which are deducted from Actual Electricity Consumption) (C)	Total Electricity Consumption of the Institute (D) = (B) - (C)	Solar Generated Units Current Bank (E)	Solar Generated Units Previous Bank(F)	Total Solar Units Generation (G)
1	Apr-21	1073	139	934	387	0	1463
2	May-21	1394	29	1364	785	387	1762
3	Jun-21	1584	209	1376	1235	785	2399
4	Jul-21	1399	306	1093	1812	1235	2250
5	Aug-21	1656	343	1314	2467	1812	2361
6	Sep-21	1677	283	1394	3127	2467	2445
7	Oct-21	2814	91	2723	3586	3127	3436
8	Nov-21	2145	185	1960	3986	3586	2791
9	Dec-21	1939	364	1575	5274	3986	2767
10	Jan-22	2241	213	2029	5939	5274	3057
11	Feb-22	2752	97	2655	**6533**	5939	3408
12	Mar-22	2815	91	2725	7051	**6533**	3770
Total	**12 Months**	**23410**	**2906**	**21581**	**6533**		**33740**

Note:-

- Offset:- It is the Electricity Unit generated by Solar Power Plant which is deducted from actual Consumption of the institute.
- Export **:- (Current Bank) 6533 + 2906 (Offset) = 9439 Solar Generated Units** are send to Maharashtra State Electricity Distribution Company Limited through Net Metering.
- Consumption of the Institute:- From April 2021 to March 2022 Actual Consumption of Institute is **23410 Units** whereas due to solar Power Plant we have generated electrical units and sent back to MSEDCL company which is deducted in the form of Offset and then Total Consumption of institute is **21581 Units**. Total saving **23410-21581= 2906 Units.**


व्हिजन बुलडाणा एज्युकेशन अॅन्ड वेलफेअर सोसायटी द्वारा संचालित
पंकज लध्दड इन्स्टीटयुट ऑफ टेक्नोलॉजी ॲन्ड मॅनेजमेंट स्टडीज, येळगांव, बुलडाणा
राष्ट्रीय सेवा योजना
GPS Map Camera
Buldana, Maharashtra, India
F6H5+GXV, Buldana, Yelgaon, Maharashtra 443001, India
Lat 20.478683°
Long 76.209933°
01/10/23 10:46 AM GMT +05:30
Google


राष्ट्रीय सेवा योजना
GPS Map Camera
Buldana, Maharashtra, India
F6H5+GXV, Buldana, Yelgaon, Maharashtra 443001, India
Lat 20.47862°
Long 76.209955°
01/10/23 10:44 AM GMT +05:30
Google


GPS Map Camera
Buldana, Maharashtra, India
F6H5+GXV, Buldana, Yelgaon, Maharashtra 443001, India
Lat 20.478642°
Long 76.209935°
01/10/23 10:44 AM GMT +05:30
Google
राष्ट्रीय सेवा योजना


TECHNOLOGY
LDANA.
GPS Map Camera
Buldana, Maharashtra, India
F6H5+GXV, Buldana, Yelgaon, Maharashtra 443001, India
Lat 20.47863°
Long 76.209877°
01/10/23 10:42 AM GMT +05:30
Google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a long way
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अॅन्ड मॅनेजमेंट स्टडीज, येळगांव,
बुलडाणा
राष्ट्रीय सेवा योजना
I Am A
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GPS Map Camera
Yelgaon, Maharashtra, India
Chikhali Rd, Yelgaon, Sakhali Bk., Maharashtra 443001, India
Lat 20.471488°
Long 76.21188°
04/12/23 03:35 PM GMT +05:30
Google


GPS Map Camera
Yelgaon, Maharashtra, India
Chikhali Rd, Yelgaon, Sakhali Bk., Maharashtra 443001, India
Lat 20.471488°
Long 76.21188°
04/12/23 03:33 PM GMT +05:30
Google
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योजना


"Having a positive mental attitude is asking how something can be done rather than saying it can't be done."
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ॲन्ड मॅनेजमेंट स्टडीज, येळगांव,
बुलडाणा


Having a positive mental attitude is asking how something can be done rather than saying it can't be done.
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ॲन्ड मॅनेजमेंट स्टडीज, येळगांव.
बुलढाणा
राष्ट्रीय सेवा योजना


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बुलढाणा
राष्ट्रीय सेवा योजना


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ॲन्ड मॅनेजमेंट स्टडीज, येळगांव,
बुलढाणा
राष्ट्रीय सेवा योजना


PARIVARTAN
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of kindness
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a long way
BLOOD
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DRIVE
राष्ट्रीय सेवा योजना


SWACHH BHARAT

A Brief Report on

Swachhta Pakhwada

(16th January 2020 to 31st January 2020)

Organized by

National Service Scheme (NSS)

at

Shaping Gen-Next

Pankaj Laddhad Institute of Technology & Management Studies,

Buldana-443002, Maharashtra, India.

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Swachhta Pledge

Name of the Event : Swachhta Pledge

Date and time: 16th January 2020, 12.40 pm.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the pledge program for Swachhta. The "Swachhta Pledge" was started on 16th of January 2020 at 12.40 p.m.in the presence of Principal Honorable Dr. P. M. Jawandhiya and the entire student including NSS Volunteers & other were involved in the program. The complete event was organized by National Service Scheme under supervision of NSS Coordinator Prof.A. V. Deshmukh & NSS Lady Faculty Advisor Prof. P. S. Kharche.

PHOTOS OF THE SWACHHTA PLEDGE

Plantation of Saplings

Name of the Event : Plantation of Saplings

Date and time: 17th January 2020, 11a.m.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldanaorganized the“ Plantation of Saplings” program under Swachhta Pakhwada. The Program was started on 17th of January 2020 at 11.00 a.m.in the presence of Principal Honorable Dr. P. M. Jawandhiya and the student of National Services Scheme were involved in Program. The complete event was organized by National Service Scheme under supervision of NSS Coordinator Prof.A.V.Deshmukh & NSS Lady Faculty Advisor Prof.P.S.Kharche.

PHOTO OF PLANTATION OF SAPLINGS

Presentation of Innovative Technologies for Waste Recycling & Energy Conservation

Name of the Event: Presentation of Innovative Technologies for Waste Recycling & Energy Conservation

Date and time: 18th January 2020, 3.30p.m.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the "Presentation of Innovative Technologies for Waste Recycling & Energy Conservation" program under SwachhtaPakhwada. The program was started on 18th of January 2020 at 3.30p.m.in the presence of Dr. Amit A.Bhusari and the student of National Services Scheme were involved inprogram.

In this program students represented the different techniques for waste recycling and energy conservation. The event was organized byNational Service Scheme & Indian Society for Technical Education (ISTE Student Chapter) under supervision of NSS Coordinator Prof.A.V.Deshmukh, NSS Lady Faculty Advisor Prof.P.S.Kharche & Prof. S. S. Jayalwal.

PHOTO OF PRESENTATION OF INNOVATIVE TECHNOLOGIES FOR WASTE RECYCLING & ENERGY CONSERVATION

Competition on Swachhta :Slogan Writing

Name of the Event : Slogan Writing Competition

Date and time: 20th January 2020, 3.30p.m.

Event Description

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the "Slogan Writing Competition" under Swachhta Pakhwada.The Program was started on 20th of January 2020 at 3.30p.m.in the presence of NSS Coordinator Prof.A.V.Deshmukh & NSS Lady Faculty Advisor Prof.P.S.Kharche.

In this competition students written different slogan related to Swachhta. The competition was judged by Prof M.O. Sharma HOD of Electrical (Electronics & Power) Engineering Department. The event was organized byNational Service Scheme & Indian Society for Technical Education (ISTE Student Chapter) under supervision of NSS Coordinator Prof.A.V.Deshmukh, Lady Faculty Advisor Prof.P.S.Kharche and Prof. S. S. Jayalwal.

PHOTO OF SLOGAN COMPETION

Cleanliness Drive in Campus

Name of the Event: Cleanliness Drive in Campus

Date and time: 21st January 2020, 3.30p.m.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the "Cleanliness Drive in Campus" under SwachhtaPakhwada. The program was started on 21th of January 2020 at 3.30p.m.in the presence of NSS Coordinator Prof.A.V.Deshmukh& NSS Lady Faculty Advisor Prof.P.S.Kharche & other faculties & supporting staff.

In this drive students collected the all waste material in the campus and pour some waste in the pit.The complete event was organized by National Service Scheme under supervision of NSS Coordinator Prof.A.V.Deshmukh & NSS Lady Faculty Advisor Prof.P.S.Kharche.

PHOTOSOF CLEANLINESS DRIVE IN CAMPUS

Competition on Water Conservation: Poster Making

Name of the Event : Poster Making

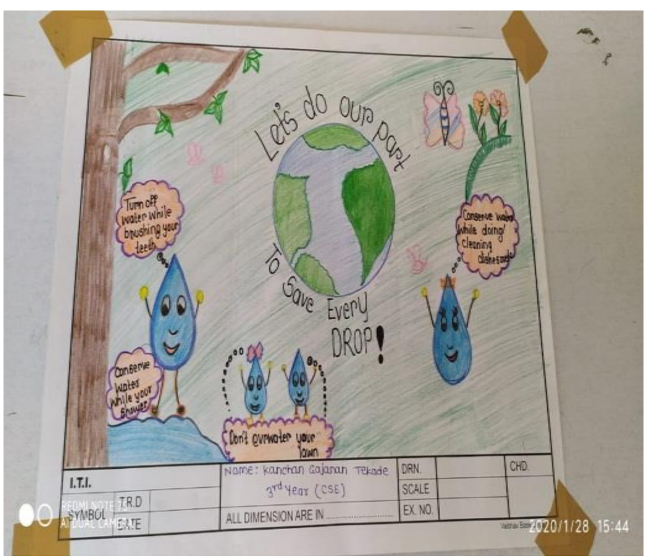
Date and time: 22nd January 2020, 3.30p.m.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the “Competition on Water Conservation” under Swachhta Pakhwada. The program was started on 22nd of January 2020 at 3.30p.m.in the presence of Principal Honorable Dr. P. M. Jawandhiya.

In this competition studentspresented the different poster related to Water Conservation. The event was organized by National Service Scheme & Indian Society for Technical Education (ISTE Student Chapter) under supervision of NSS Coordinator Prof.A.V.Deshmukh & NSS Lady Faculty Advisor Prof.P.S.Kharche.

PHOTOS OF WATER CONSERVATION COMPETITION POSTER MAKING



Talk Show on Swachhta & Water Conservation

Name of the Event : Guest Lecture on Swachhta & Water Conservation

Date and time: 23rd January 2020, 11a.m.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the "Guest Lecture on Swachhta & Water Conservation" under Swachhta Pakhwada. The Expert Lecture delivered by Dr. P. O. Modani. The Program was started on 23rd of January 2020 at 11a.m.in the presence of Principal Honorable Dr. P. M. Jawandhiya.

Dr. P. O. Modani in his expert talk focuses on different aspects of Swachhta and also elaborated the current scenario of water at National & International Level along with statistics and given stress on different techniques for Water Conservation. The event was organized by National Service Scheme under supervision of NSS Coordinator Prof.A.V.Deshmukh & NSS Lady Faculty Advisor Prof.P.S.Kharche.

PHOTOSOF SWACHHTA AND WATER CONSERVATION TALK

Competition on Forest Conservation: Slogan Writing

Name of the Event: Slogan writing competition on Forest Conservation

Date and time: 24^{th} January 2020, 3.30p.m.

Event Description

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the "Slogan Writing Competition" under Swachhta Pakhwada. The program was started on 20^{th} of January 2020 at 3.30p.m.in the presence of NSS Coordinator Prof. A. V. Deshmukh & NSS Lady Faculty Advisor Prof.P.S.Kharche.

In this competition students written different slogan related to Forest Conservation. The competition was judged by Prof M.O. Sharma HOD of Electrical (Electronics & Power) Engineering Department. The event was organized byNational Service Scheme & Indian Society for Technical Education (ISTE Student Chapter) under supervision of NSS Coordinator Prof.A.V.Deshmukh, NSS Lady Faculty Advisor Prof.P. S.Kharche & Prof. S.S. Jayalwal.

PHOTO OF SLOGAN WRITING COMPETITION ON FOREST CONSERVATION

Cleanliness Drive in Hostel

Name of the Event: Cleanliness Drive in Hostel

Date and time: 25th January 2020, 3.30p.m.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the "Cleanliness Drive in Hostel" under swachhta Pakhwada. The program was started on 25th of January 2020 at 3.30p.m.in presence of NSS Coordinator Prof.A.V.Deshmukh & NSS Lady Faculty Advisor Prof.P.S.Kharche, other Faculties & Supporting staff.

In this drive students collected the all waste material in the hostel campus and pour some waste in the pit as well as disposed the remaining material.The event was organized by National Service Scheme under supervision of NSS Coordinator Prof.A.V.Deshmukh & NSS Lady Faculty Advisor Prof.P.S.Kharche.

PHOTO OF CLEANLINESS DRIVE IN HOSTEL

Competition on Best out of Waste

Name of the Event: "Best out of Waste"

Date and time: 27th January 2020, 3.30p.m.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the "Best out of waste competition" under Swachhta Pakhwada. The program was started on 27th of January 2020 at 3.30p.m.in the presence of Principal Honorable Dr. P. M. Jawandhiya.

In this competition students presented the different items made up by waste material such as waste bangles, newspaper etc. The competition was judgeed by Dr. P. M. Jawandhiya. The event was organized byNational Service Scheme & Indian Society for Technical Education (ISTE Student Chapter) under supervision of NSS Coordinator Prof.A.V.Deshmukh, NSS Lady Faculty Advisor Prof.P.S.Kharche and Prof. S. S. Jayalwal.

PHOTOS OF COMPETITION ON BEST OUT OF WASTE

Drive on Water Conservation

Name of the Event: “Dam Visit”

Date and time: 28^{th} January 2020, 3.30p.m.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the “**Visit for Water Conservation**” under Swachhta Pakhwada to show the water conservation to the students. For this, they visited the Yelgoan dam near by the college with some faculties and supporting staff.

In this visit students learned about the different aspect related to water conservation. The visit was organized by National Service Scheme under supervision of NSS Coordinator Prof.A.V.Deshmukh Faculty from Civil Engineering Department.

PHOTO OF DAM VISIT FOR WATER CONSERVATION

Village Activities

Name of the Event: “Village Camp”

Date and time: 29th January 2020, 11a.m.

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the “**Village Camp in the Antri Tele**” under Swachhta Pakhwada.

In this visit students perform the different activities to spread the awareness regarding cleanliness through road show, some skit, songs and display of banner etc. The program was inaugurated by Principal Dr. P. M. Jawandhiya. The visit was organized by National Service Scheme under supervision of NSS Coordinator Prof.A.V.Deshmukh.

PHOTO OF VILLAGE CAMP

Road Show: Jan Jagruti Rally

Presentation of Report on Village Visit

Name of the Event: "Camp Report"

Date: 30th January 2020

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the "**Camp in the Antri Tele**" under Swachhta Pakhwada.

In this visit students perform the different activities to spread the awareness regarding cleanliness through road show, some skit, songs &display of banner etc. The report was presented to students, faculties and supporting staff by NSS Coordinator Prof.A.V.Deshmukh.

PHOTOS OF VILLAGE VISIT AND ACTIVITIES

Prize Distribution Ceremony

Name of the Event: “Prize Distribution”

Date: 31st January 2020

Event Description:

Pankaj Laddhad Institute of Technology and Management Studies, Buldana organized the “**Prize Distribution Ceremony**”for the different competition held during Swachhta Pakhawada .

Following students emerged winners in various competitions:

Sr. No.	Name of Student	Event	Position
1	Neha S.Yawatkar & Rohini B. Wagh	Presentation on water recycling techniques	First
2	Priyanka B. Chavan	Slogan writing on Swachhta	First
3	Neha S.Yawatkar	Slogan writing on Forest Conservation	First
4	Poonam V. Chavan	Poster Making	First
5	Shubham Khunare & Snehal Tarmale	Poster Making	Second
6	Rashmi N. Kukade	Best Out of Waste	First
7	Priyanka B Chavan	Best Out of Waste	Second

A BRIEF REPORT ON INDUCTION PROGRAM @PLITMS

PLITMS, BULDANA

22nd November, 2022

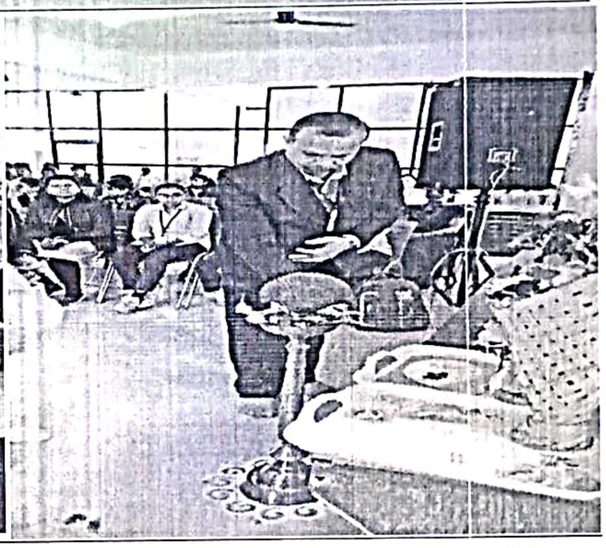
Induction program for first year engineering and Direct second year engineering student was organized at Pankaj Laddhad institute of technology and management studies Buldana, on 22nd November, 2022 to welcome and aware the students and parents about the schemes, disciplines and rules of engineering.

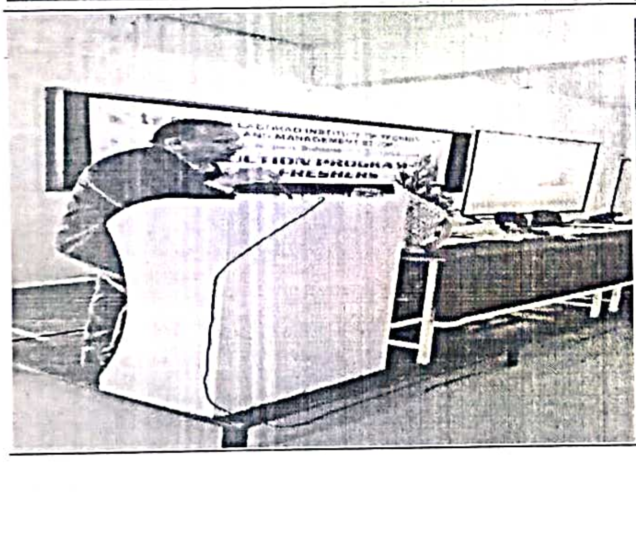
The inaugural function was graced by the hands of Hon'ble Deepakji Laddhad, President of Vision Buldana Educational and Welfare Society, Buldana, Dr. P.M.Jawandhiya, Principal and all Head of Departments, PLITMS, Buldana.

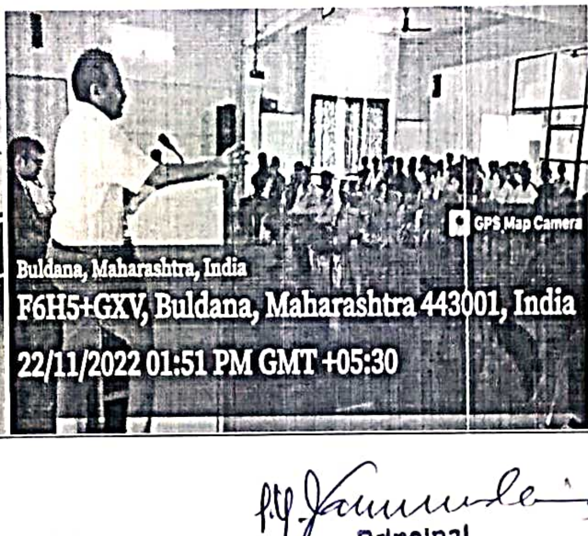
Induction program has its own significance as it stands throughout as first memory of every college students in their life.

- Program was started with playing "Vidyapeeth geet" followed by lightening of lamp and welcoming of the guest.
- Students along with parents were welcomed by the dignitaries by blossoms of roses.
- Dr. Deepakji Laddhad in his Presidential speech asked students to put their good impression in the field of engineering and research. He also told students that this is very important day in the life of every student as they are entering in the new world of imagination and challenges.
- Hon'ble Principal Dr. P.M.Jawandhiya, in his well arranged presentation focused on the syllabus of First year engineering, teaching Scheme, different curricular and co curricular activities. Hon'ble principal sir asked student to maintain the attendance above 75% as per the guidance by SGBAU Amravati. Also they briefed about the mechanism of internal assessment, Best Student award. In his inspirational words of wisdom, he advised students to take advantage of this learning environment and make these days fruitful to be a successful engineer. The program witnessed by Shri Tushar Dodiya, Prof. S.M.Dandge, Prof. V.P.Narkhade, Prof.S.A.Deshmukh, and other staff members.
- Prof.V.P.Mangle, Prof.J.V.Chavan, Prof.V.M.Nawale, Shri.S.S.Khadse faculties, Mr.A.D.Bhalerao, Mr.Abhijeet Bhalearo & Staff from first year engineering carried out special efforts for successful organization of the program.
- Prof. J.V.Chavan performed the anchoring and Vote of thanks was given by the first year in charge Prof.S.V.Raut.
- The program was concluded by National anthem.
- Afterwards the breakfast and high tea was served

- *Photo Gallery:*







Principal
Pankaj Laddhad Institute of Technology
Management Studies, Buldana

Media Coverage:

The event was covered by major news papers (Daily Tarun Bharat, Good Evening City etc)

लढ्ढड अभियांत्रिकी महाविद्यालयात विद्यार्थी प्रेरण कार्यक्रमास सुरुवात

बुलडाणा, २४ नोव्हेंबर (गुड इव्हिनिंग सिटी) : लढ्ढड अभियांत्रिकी महाविद्यालयात दिनांक २२ नोव्हेंबर २०२२ रोजी प्रथम वर्ष अभियांत्रिकी वर्षाच्या विद्यार्थ्यांसाठी विद्यार्थी प्रेरण कार्यक्रमाची आजपासून सुरुवात झाली. कार्यक्रमाची सुरवात संत गाडगेबाबा विद्यापीठ गीताने झाली. यानंतर मान्यवरांच्या व पालकांच्या हस्ते दीपप्रज्वलन करून विद्धेची देवता माता सरस्वती व पंकजजी लढ्ढड यांच्या प्रतिमेचे पूजन करण्यात आले. कार्यक्रमाचे अध्यक्ष म्हणून संस्थेचे अध्यक्ष डॉ दीपक लढ्ढड, संस्थेचे सचिव डॉ. संगीता लढ्ढड, संस्थेचे सहसचिव रविंद्र लढ्ढड, संस्थेचे कोषाध्यक्ष अर्चना लढ्ढड तसेच महाविद्यालयाचे प्राचार्य डॉ. पी. एम. जावंधिया, प्रमुख पाहुणे माननीय तुषार डोडिया, सर्व विभाग प्रमुख, प्राध्यापक वृंद, विद्यार्थी व पालक उपस्थित होते. यावेळी संस्थेचे अध्यक्ष डॉ दीपक लढ्ढड,यांनी आपले मनोगत व्यक्त करताना सांगितले कि महाविद्यालयाचा पहिला दिवस हा विद्यार्थीच नव्हे तर पालकांसाठी पण तेवढाच महत्वाचा असतो. इंजिनिअरिंग हे असे क्षेत्र आहे ज्यामध्ये आजरोजी भरपूर रोजगार उपलब्ध आहेत. यामध्ये आपण आपला नवीन ठसा उमटवू शकतो त्यासाठी नवनवीन तंत्रज्ञानाचे शोध लावून समाजकार्य करण्याचे काम हा अभियंता करत असतो. यावेळी कार्यक्रमाचे प्रमुख पाहुणे तुषार डोडिया यांनी विद्यार्थ्यांना सकारात्मक विचारसरणी किती महत्वाची असते हे पटवून सांगितले. याप्रसंगी महाविद्यालयाचे प्राचार्य डॉ. पी. एम. जावंधिया यांनी महाविद्यालयाची सविस्तर माहिती दिली तसेच महाविद्यालयाचे नवनवीन उपक्रम, चार वर्ष अभ्यासक्रम या अध्यापन पद्धती विषयी सविस्तर माहिती दिली. यानंतर विध्यार्थी व पालकांचे उपस्थित मान्यवरांच्या हस्ते गुलाबपुष्प देऊन स्वागत करण्यात आले.

तंत्रज्ञानाचा शोध लावून विद्यार्थ्यांनी समाजकार्य करावे

डॉ. दीपक लढ्ढड यांचे आवाहन

◆ बुलढाणा, २३ नोव्हेंबर

महाविद्यालयाचा पहिला दिवस हा विद्यार्थीच नव्हे तर पालकासाठी पण तेवढाच महत्त्वाचा असतो. अभियंता हे असे क्षेत्र आहे. ज्यामध्ये भरपूर रोजगार उपलब्ध आहेत. यामध्ये आपण आपला नवीन ठसा उमटवू शकतो त्यासाठी नवनवीन तंत्रज्ञानाचे शोध लावून समाजकार्य करण्याचे काम हा अभियंता करत असतो असे प्रतिपादन डॉ. दीपक लढ्ढड यांनी केले.

लढ्ढड अभियांत्रिकी महाविद्यालयात २२ नोव्हेंबर रोजी प्रथम वर्ष अभियांत्रिकी वर्षाच्या विद्यार्थ्यांसाठी विद्यार्थी प्रेरणा कार्यक्रमाची आजपासून सुरुवात झाली. कार्यक्रमाची सुरवात संत गाडगेबाबा विद्यापीठ गीताने झाली.

विद्यार्थी प्रेरणा कार्यक्रमात बोलताना डॉ. दीपक लढ्ढड. व्यासपीठावर प्राचार्य डॉ. जावंधिया, तुषार डोडिया

यानंतर मान्यवरांच्या व पालकांच्या हस्ते दीपप्रज्वलन करून विद्येची देवता माता सरस्वती व पंकज लढ्ढड यांच्या प्रतिमेचे पूजन करण्यात आले.

कार्यक्रमाचे अध्यक्ष संस्थेचे अध्यक्ष डॉ. दीपक लढ्ढड, संस्थेचे सचिव डॉ. संगीता लढ्ढड, संस्थेचे सहसचिव रवींद्र लढ्ढड, संस्थेचे कोषाध्यक्ष अर्चना लढ्ढड, प्राचार्य डॉ. पी. एम. जावंधिया, प्रमुख पाहुणे तुषार डोडिया, विभाग प्रमुख, प्राध्यापक वृंद, विद्यार्थी व पालक उपस्थित होते यावेळी तुषार डोडिया यांनी विद्यार्थ्यांना सकारात्मक विचारसरणी किती महत्वाची असते हे पटवून सांगितले प्राचार्य जावंधिया यांनी महाविद्यालयाची माहिती दिली तसेच महाविद्यालयाचे नवनवीन उपक्रम, चार वर्ष अभ्यासक्रम या अध्यापन पद्धती विषयी सविस्तर माहिती दिली. कार्यक्रमाचे संचालन प्रा. जागृती चव्हाण यांनी केले व आभार प्रदर्शन प्रा. एस व्ही राऊत यांनी केले. ◆(तभा वृत्तसेवा)

Prof.S.V.Raut
I/C First Year

Dr.P.M.Jawandhiya
Principal

Principal
Pankaj Laddhad Institute of Technology
Management Studies,Buldana

D. GREEN CAMPUS INITIATIVES

1. **Use of Bicycles/ Battery powered and avoid use of two wheeler**

Students, Staff and Faculties are encouraged to come to college by bicycles or battery powered vehicle. To encourage this concerned day is fixed in a month, on that day every stakeholders comes to college by using bicycle i.e. **'No Vehicle Day'**. On this day, students, teaching, and non-teaching staff use bicycle or public transportation Switching from a two wheeler to a bicycle saves 150 g of CO2 per kilometre. Each 7 km by bicycle will save an emission of 1 kilogram of CO2 as compared to the same distance covered by car.

Also most of the students and staff members are use public transportation facilities instead of individual motor cycles.

Use of Bicycle on "No Vehicle day"

2. **Ban use of plastic**

Institute celebrates World Environment Day on 5th June. On this occasion awareness program is carried out by organizing different activities. Single-use plastic items such as plastic

E. THE INSTITUTE HAS DISABLED FRIENDLY BARRIER FREE ENVIRONMENT

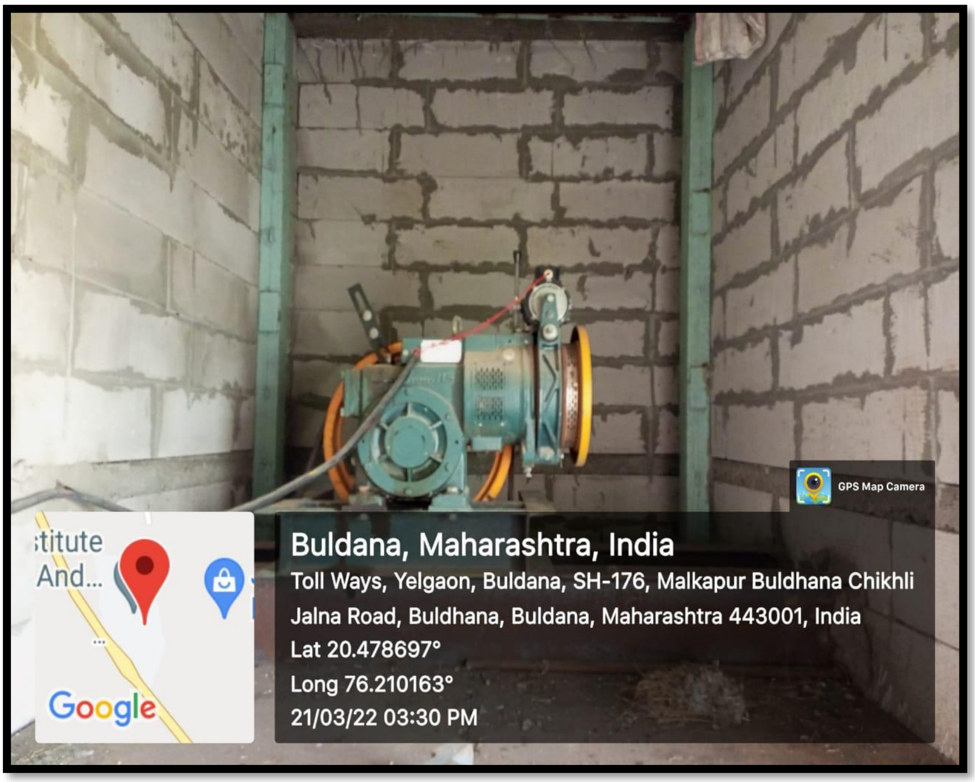
Pankaj Laddhad Institute of Technology & Management Studies provides barrier-free environment where people with disabilities can move about safely and freely and use the facilities within the built environment. The environment supports the independent functioning of individuals so that they can participate without assistance in everyday activities within the campus. Buildings / places / transportation systems are made barrier free.

3. Ramp

Ramp-Rails, an inclined plane, are built in addition to staircases in the ground floor. The ramps are carefully designed as per specifications to be used by the differently abled people. Wheelchair facility is also available in the institute.

4. Elevator

College buildings have provision of lift for barrier free access for students, staff, visitors and differently abled people.



Elevators System

7. Reception Counter & Personal Assistance

The Reception Counter provides all the needed information to the differently-abled and all stakeholders.

Reception Counter

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PANKAJ LADDHAD INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES , BULDHANA

(AICTE Approved vide letter F.No.-06/07/Ms-Engg/2009/04 dated June 05, 2009)
(Affiliated to Sant Gadge Baba Amravati University, Amravati)

Dr. Deepak S. Laddhad
President

Dr. Pradip M. Jawandhiya
Principal

No. PLIT/ 24-25 / 44-C

Date:- 15/07/2024

Notification

SUBJECT: ESTABLISHMENT OF GRIEVANCE REDRESSAL COMMITTEE
(Session 2024-25)

Further to office order No. **PLIT/2024-25/44-C** dated **19/07/2024** notifying herewith the establishment of the Grievance Redressal Committeeas mentioned belowwith reference toNotification UGC Letter No.233 dated 11 April 2023:

Sr. No.	Name	Designation	Representation	Mobile No.
01	Dr. Pradip M Jawandhiya	Principal	Chairman	9422880399
02	Mr. Ashish V. Harkut	Head of Department Electronics & Tele-Communications	Member	9420562870
03	Dr. Kruti R. Wohra	Assistant Professor Humanities and Science Department	Member	8719891706
04	Mr. Shubham S. Rokade	Assistant Professor Master of Business Administration Department	Member	8999946689
05	Ms. Megha S. Sarode	Lecturer(Diploma in Engineering)	Member	8554828883
06	Mr. Akash R. Ujjainkar	Nominated Students Representative	Member	9307423509
07	Mr. Sachin V. Raut	Head of Department, Applied Sciences & Humanities	Member Secretary	9763428458

P.M.Jawandhiya

Principal

Principal
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Management Studies,Buldana

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Dr. Deepak S. Laddhad
President

Dr. Pradip M. Jawandhiya
Principal

No. PLIT/ 24-25/44-D

Date:- 19/07/2024

Notification

SUBJECT: ESTABLISHMENT OF INTERNAL COMPLAINT COMMITTEE (ICC)

(Session 2024-25)

Further to office order No. **PLIT/2024-25/44-D** dated **19/07/2024** notifying herewith the establishment of the Internal Committee (IC) as per Section 4 All India Council for Technical Education (Gender Sensitization, Prevention and prohibition of Sexual Harassment of Women Employees and Student and Redressal of grievances in Technical Institutions) Regulations, 2016 vide No. F. AICTE /WH/ 2016/ 01 dated 10th June,2016:

Sr. No.	Name	Designation	Representation	Gender,	Mobile No.	Remark
01	Dr. Kruti R. Wohra	Assistant Professor Applied Science & Humanities	Presiding Officer	Female	8719891706	Women Faculty, Nominated by the Executive Authority
02	Mr. Abhishek U. Deshmukh	Assistant Professor, Electrical (E&P) Engineering	Member	Male	8600209216	Two Teaching Faculty Members, Nominated by the Executive Authority
03	Mr. Swapnil A. Deshmukh	Assistant Professor, Civil Engineering	Member	Male	8668902957	
04	Ms. Priyanka R. Rajput	Accountant	Member	Female	7350676456	Two Non Teaching Employees, Nominated by the Executive Authority
05	Ms. Sneha V. Shirbhate	Clerk	Member	Female	8446165068	
06	Ms. Arti R. Dhoran	Student Representative, Computer Science & Engineering	Member	Female	9579682714	Three Student members (comprising of one girl) from Pre-final year
07	Mr. Pavan P. Paithane	Student Representative , Civil Engineering	Member	Male	8668415196	
08	Mr. Lalit K. Patil	Student Representative, Diploma Computer Science & Engineering	Member	Male	7666875979	
09	Mr. Prabhakar M. Waghmare	Secretary, S. S. M., Educated Unemployed Cooperative Society, Buldana	Member-Non Government Organization (NGO)	Male	9604112797	One member from amongst non government organizations, nominated by the Executive Authority
10	Ms. Madhuri A. Shejol	Assistant Professor, Mechanical Engineering	Member Secretary	Female	8830337649	Women Faculty, Nominated by the Executive Authority

P.M. Jawandhiya
Principal

Principal
Pankaj Laddhad Institute of Technology
Management Studies Buldana

Opp. Toll Booth, Chikhali Road, Yelgaon, Buldhana-443002 Toll Free No. 1800 270 1130
Cell: 9422880399, 9422180463, 9422926757 email.:-plitprincipal@gmail.com, website: www.plit.ac.in

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(AICTE Approved vide letter F.No.-06/07/Ms-Engg/2009/04 dated June 05, 2009)
(Affiliated to Sant Gadge Baba Amravati University, Amravati)

Dr. Deepak S. Laddhad
President

Dr. Pradip M. Jawandhiya
Principal

No. PLIT/ 24-25/44B

Date:- 19/07/2024

Notification

SUBJECT: CONSTITUTION OF SC/ST AND RESERVATION CELL
(Session 2024-25)

Further to office order No. **PLIT/2024-25/44-B** dated **19/07/2024** notifying herewith the constitution of the Reservation Cell of the Institute is hereby constituted as follows:

SC/ST CELL

Sr. No.	Name	Designation	Representation	Gender	Category	Mobile No.
01	Dr. Pradip M. Jawandhiya	Principal	Chairman	Male	Open	9422880399
02	Mr. Shubham S. Rokade	Assistant Professor, MBA Department	Member	Male	SC	8999946689
03	Ms. Sneha V. Shirbhate	Clerk	Member	Female	SC	8446165068
04	Mr. Swapnil A. Deshmukh	Assistant Professor, Civil Engineering	Liaison officer / Secretary	Male	OBC	8668902957

MINORITY, OBC, VJ, NT CELL

Sr. No.	Name	Designation	Representation	Gender	Category	Mobile No.
01	Dr. Pradip M. Jawandhiya	Principal	Chairman	Male	Open	9422880399
02	Mr. Faheem R. Sheikh	Assistant Professor Mechanical Engineering	Member	Male	Minority	9623672834
03	Ms. Sneha V. Shirbhate	Clerk	Member	Female	SC	8446165068
04	Mr. Harshan G. Jadhao	Final Year Student, Computer Science and Engineering	Member	Male	VJ	9307856573
05	Ms. Dhanshree S. Sonune	Third Year Student, Computer Science and Engineering	Member	Female	SC	9921368859
06	Ms. Sanika V. Naphade	Third Year Electronics & Telecommunication Engineering	Member	Female	OBC	7218869166
07	Mr. Absaar Khan Athar Khan	Third Year Student, Computer Science and Engineering	Member	Male	Minority	7666161134
08	Mr. Lalit K. Patil	Second Year Diploma Computer Science & Engg	Member	Male	OBC	7666875979
09	Mr. Swapnil A. Deshmukh	Assistant Professor, Civil Engineering	Liaison officer / Secretary	Male	OBC	8668902957

P.M. Jawandhiya

Principal

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(AICTE Approved vide letter F.No.-06/07/Ms-Engg/2009/04 dated June 05, 2009)
(Affiliated to Sant Gadge Baba Amravati University, Amravati)

Dr. Deepak S. Laddhad
President

Dr. Pradip M. Jawandhiya
Principal

No. PLIT/ 24-25/44-A

Date:- 19/07/2024

Notification

SUBJECT: ESTABLISHMENT OF ANTI-RAGGING CELL & ANTI-RAGGING SQUAD
(Session 2024-25)

Further to office order No. **PLIT/2024-25/44-A** dated **19-07-2024**notifying herewith the establishment of the Anti-Ragging Cell &Anti_Ragging Squad complying with the directives of the Hon'ble Supreme Court of India, the Institute for overseeing the implementation of the provisions of the verdict with immediate effect.

ANTI-RAGGING CELL

Sr. No.	Name	Designation	Representation	Mobile No.
01	Dr. Pradip M. Jawandhiya	Principal	Chairman	9422880399
02	Nominee, API, Women Safety Cell, SP Office Buldhana	API, Women Safety Cell, SP office, Buldana	Member-Police Representation	07262-242400
03	Mr. Prabhakar M. Waghmare	Secretary, S. S. M., Educated Unemployed Cooperative Society, Buldana	Member- Non Government Organization (NGO)	9604112797
04	Mr. Nitin Shirsat	Local Correspondent Tarun Bharat	Member- Local Media	9881717828
05	Ms. Apurva S. Padghan	Lecturer (Diploma in Engineering)	Member Teaching	8080851726
0	Mr. Ashish V. Harkut	Head, Internal Quality Assurance Cell	Member - Teaching	9420562870
06	Mr. Suresh N. Gawai	Parent Representative	Member - Parent	9421468632
07	Mr. Anil Pachpande	Parent Representative	Member- Parent	8805478433
08	Mr. Priyanka R. Rajput	Accountant	Member – Non Teaching	7350676456
09	Mr. Ganesh Raut	Student Representative	Member – Student	9765616865
10	Ms. Lochan P. Hiwarkar	Student, Third Year Electronics and Tele Communication Engineering	Member- Student Representative	7447847752
11	Mr. Sachin V. Raut	Assistant Professor, Applied Science & Humanities	Member Secretary	9763428458

ANTI-RAGGING SQUAD

Sr. No.	Name	Designation	Representation	Mobile No.
01	Dr. Pradip M. Jawandhiya	Principal	Chairman	9422880399
02	Ms. Prachita A Wange	Assistant Professor, Electronics and Tele Communication Engineering	Member	7720974476
03	Ms. Priyanka S. Kharche	Assistant Professor, Computer Science & Engineering	Member	7775052633
04	Mr. Abhishek U. Deshmukh	Assistant Professor, Electrical (Electronics & Power) Engineering	Member	8600209216
05	Mr. Yogesh S. Bhawar	Assistant Professor, Mechanical Engineering	Member	9850441220
06	Mr. Vinayak N. Magar	Lecturer (Diploma in Engineering)	Member	9096998683
07	Priyanka S. Pusadkar	Clerk	Member	9765691518
08	Mr. Sachin V. Raut	Assistant Professor, Applied Science & Humanities	Member Secretary	9763428458

P.M.Jawandhiya

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No. PLIT/ 24-25/44E

Date:- 19/07/2024

Notification

SUBJECT: RTI ACT INFORMATION OFFICER AND GRIEVANCE

(Session 2024-25)

Further to office order No. **PLIT/2024-25/44-E** dated **19/07/2024** notifying herewith the establishment of the Students Counselor as mentioned below:

Sr. No.	Name	Designation	Representation	Mobile No.
01	Mr. Shubham S. Rokade	Assistant Professor	RTI ACT INFORMATION OFFICER	+91-8999946689

P.M. Jawandhiya

Principal

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Pankaj Laddhad Institute of Technology and Management Studies,
Chikhali Road, Yelgaon, BULDANA – 443002 (M.S.), INDIA.
url:plit.ac.in, Mail id: plitprincipal@gmail.com, Contact:+918080237640

COLLEGE COUNCIL COMMITTEE

Sr. No.	Name	Designation	Profession
01	Dr. Pradip. M. Jawandhiya	Chairman	Educationalist
02	Mr. Sachin V. Raut	Member	Educationalist
03	Mr. Ashish V. Harkut	Member	Educationalist
04	Mr. Vaibhav P. Narkhade	Member	Educationalist
05	Mr. Swapnil A. Deshmukh	Member	Educationalist
06	Mr. Parag R. Jawale	Member	Educationalist
07	Mr. Bharat G. Pawar	Member	Educationalist
08	Mr. Ashutosh S. Mhaske	Member	Educationalist
09	Mr. Amit P. Patole	Member	Educationalist
10	Mr. Sachin M. Dandage	Member Secretary	Educationalist

P.M. Jawandhiya

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COLLEGE DEVELOPMENT COMMITTEE

Sr. No.	Name	Designation	Profession
01	Dr. Deepak. S. Laddhad	Chairman	Medical Practitioner
02	Dr. Sangeeta D. Laddhad	Member	Medical Practitioner
03	Mr. Sachin V. Raut	Member Teaching	Educationalist
04	Mr. Nilesh A. Ingle	Member Teaching	Educationalist
05	Mr. Sachin M. Dandage	Member Teaching	Educationalist
06	Mr. Swapnil A. Deshmukh	Member Teaching	Educationalist
07	Ms. Priyanka R. Rajput	Member Nonteaching	Accountant
08	Dr. Nilesh N. Kasat	Member , Education	Educationalist , Professor, Department of Electronics & Telecommunication Engineering, Sipna College of Engineering , Amravati
09	Shri Vijay. G. Bhattad	Member , Industrialist	Managing Director, Advance Micro Devices, Akola - Member
10	Dr. Prashant O.Modani	Member, Research	Educationalist
11	Mr. Akash A. Chhajad	Member, Alumina	Business
12	Mr. Ghanshyam J. Sontakke	Member, Alumina	Service
13	Mr. Ashish V. Harkut	Member, Teaching	Co-coordinator, IQAC
14	Ms. Vijaya S. Tarmale	Member, Students	---------------
15	Mr. Sumaydh Shrinagare	Member, Students	---------------
16	Dr. Pradip. M. Jawandhiya	Member Secretary	Educationalist

P.M. Jawandhiya

Principal

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url:plit.ac.in, Mail id: plitprincipal@gmail.com, Contact:+918080237640

BOARD OF GOVERNERS (BOG) / GOVERNING BODY

Sr. No.	Name	Designation	Profession
01	Dr. Deepak. S. Laddhad	Chairman	Medical Practitioner
02	Shri. Ravindra S. Laddhad	Vice Chairman -Member	Business
03	Dr. Sangeeta D. Laddhad	Secretary - Member	Medical Practitioner
04	Dr. Dhruv D. Laddhad	Joint Secretary - Member	Medical Practitioner
05	Mrs. Archana R. Laddhad	Treasurer -Member	Business
06	Shri Abhay Y. Rathi	Member	Business
07	Shri Abhaykumar K. Bhutada	Member	Business
08	Nominee of Affiliating University –Ex-Officio	Nominee of Affiliating University-Ex-Officio	Educationalist
09	Nominee of All India Council of Technical Education (AICTE) –Ex-Officio	Nominee of All India Council of Technical Education (AICTE) –Ex-Officio	Educationalist
10	Nominee of State Government , Directorate of Technical Education (DTE)-Ex-Officio	Nominee of State Government , Directorate of Technical Education (DTE)-Ex-Officio	Educationalist
11	Dr. Nilesh N. Kasat	Member , Education	Educationalist , Professor, Department of Electronics & Telecommunication Engineering, Sipna College of Engineering , Amravati
12	Shri. Vijay. G. Bhattad	Managing Director, Advance Micro Devices, Akola -Member	Technologist
13	Mr. Sachin V. Raut	Assistant Professor - Member	Educationalist
14	Dr. Prashant O. Modani	Assistant Professor - Member	Educationalist
15	Dr. Pradip. M. Jawandhiya	Principal -- Member Secretary	Educationalist

P.M. Jawandhiya
Principal

Principal
Pankaj Laddhad Institute of Technology
Management Studies,Buldana

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url:plit.ac.in, Mail id: plitprincipal@gmail.com, Contact:+918080237640

STUDENT'S DEVELOPMENT CELL

Sr. No.	Name	Designation	Profession
01	Dr. Pradip. M. Jawandhiya	Chairman	Educationalist
02	Mr. Sachin M. Dandage	Member	Educationalist
03	Mr. Swapnil A. Deshmukh	Member Teaching	Educationalist
04	Mr. Ashutosh S. Mhaske	Member Teaching	Educationalist
05	Mr. Prabhakar M. Waghmare	Secretary, S. S. M., Educated Unemployed Cooperative Society, Buldana	Member- Non Government Organization (NGO)
06	Mr. Anshuman M. Gaikwad	Students Representative	--------------
07	Ms. Pragati M. Mhaisagar	Students Representative	--------------
08	Mr. Sudhir R. Jadhav	Students Representative	--------------
09	Mr. Sachin V. Raut	Member Secretary	Educationalist

P.M.Jawandhiya

Principal

Principal
Pankaj Laddhad Institute of Technology
Management Studies,Buldana

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