VINAYAKA MISSION'S RESEARCH FOUNDATION, SALEM (Deemed to be University)

FACULTY OF ENGINEERING AND TECHNOLOGY

REGULATIONS-2015

CHOICE BASED CREDIT SYSTEM

CURRICULUM FROM I TO VIII SEMESTERS FOR B.E-MECHATRONICS (REGULAR)

SEMESTER –I

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Calculus for Engineers	Mathematics	3	1	0	4
2.		English for Engineers	English	3	0	0	3
3.		Physics for Engineers	Physics	3	0	0	3
4.		Essentials of Computer Science and Engineering.	CSE	3	0	0	3
5.		Essentials of Civil and Mechanical Engineering.	Civil/Mechanical	3	0	0	3
	PRACTICAL						
6.		Physics Lab	Physics	0	0	3	2
7.		Computer Lab	CSE	0	0	3	2
8.		Workshop Practices	Mechanical	0	0	3	2
9.		Yoga And Meditation	Yoga	0	0	3	2
		TOTAL		**15**	**1**	**12**	**24**

SEMESTER -II

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Transforms & Matrices	Mathematics	3	1	0	4
2.		Business English	English	3	0	0	3
3.		Chemistry for Engineers	Chemistry	3	0	0	3
4.		C-Programming	CSE	3	0	0	3
5.		Electronic Devices	ECE	3	0	0	3
	PRACTICAL						
6.		Engineering Chemistry Lab	Chemistry	0	0	3	2
7.		C-Programming Lab	CSE	0	0	3	2
8.		Engineering Graphics Lab	Mechanical	0	0	3	2
9.		Electronic Devices Lab	ECE	0	0	3	2

TOTAL		**15**	**1**	**12**	**24**

SEMESTER –III

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		PDE Applications and Complex Analysis	Mathematics	3	1	0	4
2.		Fluid Mechanics and Strength of Materials	Civil	3	1	0	4
3.		Kinematics of Machines	Mechanical	3	1	0	4
4.		Electric Circuit Analysis	EEE	3	1	0	4
5.		Electrical Machinery	EEE	3	0	0	3
6.		Engineering Mechanics	Mechanical	3	1	0	4
	PRACTICAL						
7.		Fluid Mechanics and Strength of Materials Lab	Mechanical	0	0	3	2
8.		Electrical Machinery Lab	EEE	0	0	3	2
9.		Electric Circuits & Devices Lab	EEE	0	0	3	2
TOTAL				**18**	**5**	**9**	**29**

SEMESTER -IV

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Numerical Methods	Mathematics	3	1	0	4
2.		Dynamics of Machines	Mechanical	3	1	0	4
3.		Control Systems	EEE	3	1	0	4
4.		Digital Electronics	ECE	3	1	0	4
5.		Manufacturing Engineering	Mechanical	3	0	0	3
6.		Environmental Science and Engineering	Chemistry	3	0	0	3
	PRACTICAL						
7.		Digital Electronics Lab	ECE	0	0	3	2
8.		Manufacturing Engineering Lab	Mechanical	0	0	3	2
9.		Dynamics Lab	Mechanical	0	0	3	2
TOTAL				**18**	**4**	**9**	**28**

SEMESTER -V

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Design of Machine Elements	Mechanical	3	1	0	4
2.		Engineering Metrology and Measurement	Mechanical	3	0	0	3
3.		Power Electronics and Drives	EEE	3	0	0	3
4.		Sensors and Electronic Measurements	MECT	3	0	0	3
5.		Digital Signal Processing	ECE	3	1	0	4
6.		Elective – I		3	0	0	3
	PRACTICAL						
7.		Power Electronics and Drives Lab	EEE	0	0	3	2
8.		CAD Lab	Mechanical	0	0	3	2
9.		Sensors and Electronic Measurements Lab	MECT	0	0	3	2
		TOTAL		**18**	**2**	**9**	**26**

SEMESTER -VI

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Microcontroller & Applications	ECE	3	0	0	3
2.		Programmable Logic Controller	MECT	3	0	0	3
3.		Robotics and Automation	MECT	3	0	0	3
4.		Computer Integrated Manufacturing	Mechanical	3	0	0	3
5.		Design of Mechatronics systems	MECT	3	0	0	3
6.		Elective-II		3	0	0	3
	PRACTICAL						
7.		Programmable Logic Controller and Mechatronics Lab	MECT	0	0	3	2
8.		Microcontroller Lab	ECE	0	0	3	2
9.		Robotics Lab	MECT	0	0	3	2
		TOTAL		**18**	**0**	**9**	**24**

SEMESTER -VII

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Disaster Mitigation & Management	Civil	3	0	0	3
2.		Finite Element Analysis	Mechanical	3	1	0	4
3.		Embedded Systems	EEE	3	0	0	3
4.		Hydraulics and Pneumatic Systems	Mechanical	3	0	0	3
5.		Professional Ethics and Human Values	Management	3	0	0	3
6.		Elective-III		3	0	0	3
	PRACTICAL						
7.		Hydraulics and Pneumatic Systems and CAM Lab	Mechanical	0	0	3	2
8.		Creative and Innovative Project	MECT	0	0	3	2
9.		Comprehension	MECT	0	0	3	2
		TOTAL		**18**	**1**	**9**	**25**

SEMESTER –VIII

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
	THEORY						
1.		Elective –IV		3	0	0	3
2.		Elective-V		3	0	0	3
3.		Elective-VI		3	0	0	3
	PRACTICAL						
4.		Project Work & Viva Voce	MECT	0	0	12	6
		TOTAL		**9**	**0**	**12**	**15**

TOTAL CREDITS: 195

ELECTIVES

Sl.No	Course Code	Course Title	Dept. Offering the course	L	T	P	C
THEORY							
1.		Analog & Digital Communication	ECE	3	0	0	3
2.		Avionics	EEE	3	0	0	3
3.		Biomedical Instrumentation	ECE	3	0	0	3
4.		Computer Architecture	CSE	3	0	0	3
5.		Computer Communication	ECE	3	0	0	3
6.		Cryptography and Network Security	CSE	3	0	0	3
7.		Cyber Security	CSE	3	0	0	3
8.		Design and Analysis of Algorithm	CSE	3	0	0	3
9.		Design for Manufacture	Mechanical	3	0	0	3
10.		Grid Computing	CSE	3	0	0	3
11.		Industrial Tribology	Mechanical	3	0	0	3
12.		Intelligent Controllers	EEE	3	0	0	3
13.		Internet Programming	CSE	3	0	0	3
14.		Linear Integrated Circuits	ECE	3	0	0	3
15.		Medical Informatics	ECE	3	0	0	3
16.		MEMS	EEE	3	0	0	3
17.		Nano Electronics	EEE	3	0	0	3
18.		Nano Materials	Physics	3	0	0	3
19.		Soft Computing	CSE	3	0	0	3
20.		Engineering Thermodynamics	Mechanical	3	0	0	3
21.		Unconventional Manufacturing Process	Mechanical	3	0	0	3
22.		Vibration and Noise Control	Mechanical	3	0	0	3
23.		Virtual Instrumentation	EEE	3	0	0	3
24.		VLSI Design	ECE	3	0	0	3
INDUSTRIAL ELECTIVES							
25.		Learning IT Essentials by doing	Infosys	3	0	0	3
26.		Business Intelligence and its Applications	Infosys	3	0	0	3

YEAR	SEMESTER	TITLE OF PAPER	L	T	P	C
II	III	PDE APPLICATIONS AND COMPLEX ANALYSIS (Common to BE-CIVIL,EEE,MECHAT& EIE B.TECH-Solar and Alternate Energy)	3	1	0	4

Aim:

To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

Objective:

- To provide the students with the concept and an understanding of Differential equations.
- To orient the students to know about the application of Harmonic analysis.
- To teach the students about the solutions of wave and heat equations.
- To motivate the students to know about the applications of Fourier Series
- To provide the students about the basic concepts of the complex variables.
- To provides the students about the concept of analytic functions and complex integration

.

OUTCOMES:

- Relate the properties of Fourier series with their engineering subjects during their course of study
- Apply the knowledge gathered in the subject to Signal processing
- Gain the knowledge in vibrations of stretched strings.
- Develop the fundamental ideas of D Alembert's solution of the wave equation
- Understand the concepts of Steady state conditions
- Understand the main properties and examples of analytic functions and be able to compute and manipulate series expansions for analytic functions;
- Use the major integral theorems; and able to identify and classify zeroes and poles of
- functions and find their residues.
- Analyze the spectral characteristics of continuous time periodic and periodic signals using Fourier series.

UNIT – I: PARTIAL DIFFERENTIAL EQUATIONS 12

Formation - Solutions of standard types f(p,q)=0, clairauts form, f(z,p,q)=0,f(p,x)=g(q,y) of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT – II : FOURIER SERIES 12

Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity – Harmonic Analysis.

UNIT – III : BOUNDARY VALUE PROBLEMS 12

Classification of second order linear partial differential equations - Solutions of one - dimensional wave

equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates.

UNIT – IV : ANALYTIC FUNCTIONS 12

Function of a complex variable – Analytic function – Necessary conditions - Cauchy Riemann equations – Sufficient conditions (excluding proof) – Harmonic conjugate–Constructions of analytic functions-conformal mapping($w=z+c, w=z^2, w=1/z$)-bilinear transformation

UNIT - V : COMPLEX ANALYSIS 12

Statement and application of Cauchy‟s integral theorem and integral formula – Taylor‟s and Laurent‟s expansions –Residues – Cauchy‟s residue theorem-contour integration over unit circle.

Lecture Hours : 45
Tutorial Hours : 15
Total Hours : 60

TEXT BOOK:

1. A.Singaravelu,”Transforms and Partial Differential Equations”, Meenakshi Agencies, Chennai
2. Kandasamy .P.,Thilagavathy. K., and Gunavathy. K., “Engineering Mathematics”, Volumes I & II (4th edition), S.Chand& Co., New Delhi.

REFERENCES:

1. T.Veerarajan, “Engineering Mathematics” (for semester III), Third Edition Tata McGraw- Hill Publishing Company limited.
2. Grewal, B.S., “Higher Engineering Mathematics” (35th Edition), KhannaPublishers,Delhi 2000.
3 .Kreyszig, E., “Advanced Engineering Mathematics” (8th Edition), John Wiley and Sons,(Asia) Pte Ltd.,Singapore, 2000.

YEAR	II	FLUID MECHANICS AND STRENGTH OF MATERIALS	L	T	P	C
SEMESTER	III		3	1	0	4

(Common to AUTO & MECHT)

Aim	*The aim of the subject is to provide a fundamental knowledge in fluid mechanics and strength of materials.*
Objective	*1. To learn basics of stresses and strains* *2. To learn basics of different types of beams and their loading.* *3. To learn the fundamentals about the deflection of beams* *4. To understand the kinematics of the fluid flow.* *5. To understand the fluid flow concepts*
Outcome	*The students would be able to understand the basics of fluid mechanics and strength of materials.*

.UNIT – I : STRESS- STRAIN AND DEFORMATION OF SOLIDS

Properties of material, Concept of Stress and Strain, Hook's Law, Stress Strain Diagram for structural steel and Non-ferrous materials. Poisson's Ratio & principles of superposition, Total elongation of tapering bars of circular and rectangular cross-sections. Elongation due to self-weight, Volumetric strain. Expression for Volumetric strain, Elastic constants, relationship among elastic constants, compound bars Rigid and Deformable bodies – Strength- Stiffness and Stability – Stresses; Tensile- Compressive and Shear – Elastic constants – Strain energy and unit strain energy– Strain energy in uniaxial loads.

UNIT - II : BEAMS - LOADS AND STRESSES 9

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever- Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Shear stresses in beams.

UNIT – III : DEFLECTION OF BEAMS 9

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope : Double integration method- Macaulay Method- and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns – Introduction to curved beams.

UNIT – IV: FLUID PROPERTY AND FLOW CHARACTERISTICS 9

Surface tension – Capillarity – Viscosity – Newton's law – Fluid pressure and pressure head - Fluid velocity – Uniform and steady flow – Reynolds number - Classification as laminar and turbulent flow – Continuity equation.

UNIT - V : FLOW DYNAMICS AND MEASUREMENT IN PIPE NETWORKS 9

Euler's and Bernoulli's Equations – Manometer, Venturi meter and orifice meter - Pressure losses along the flow – Categorisation into minor losses - Flow through circular pipes – Statement of Darcy – Weisbach equation – Friction factor – Pipes in series and parallel - Hydraulic gradient

Lecture Hours : 45
Tutorial Hours : 15
Total Hours : 60

TEXT BOOKS:

1. R. K. Rajput, 'Strength of Materials (Mechanics of Solids)', S. Chand & Company Ltd., 2003.
2. R.K., Bansal, A text book on Fluid Mechanics & Hydraulic Mechanics,- M/s. Lakshmi Publications (P) Ltd, 2004.

REFERENCES :

1.Ryder G.H- "Strength of Materials"- Macmillan India Ltd.- Third Edition- 2007
2. K. L. Kumar, 'Engineering Fluid Mechanics', S. Chand & Company Ltd., 2002.

YEAR	II	KINEMATICS OF MACHINES	L	T	P	C
SEMESTER	III		3	1	0	4

(Common to MECH & MECHAT)

Aim	*The aim of the subject is to provide a fundamental knowledge in kinematics of machines*
Objective	1. *To learn the basic mechanisms of kinematics.* 2. *To learn to calculate the velocity and acceleration of links using graphical and vectorial approach.* 3. *To study about Cams and to draw their profiles.* 4. *To learn about Gear terminology and types of gear trains* 5. *To study about effect of friction in Transmission devices*
Outcome	*The students would understand the basic link mechanisms and would draw cam profiles*

UNIT – I : BASICS OF MECHANISMS **9**

Terminology and Definitions-Degree of Freedom -Mobility-Kutzbach criterion-Grashoff's law-Kinematic Inversions of 4-bar chain and slider crank chains-Mechanical Advantage-Transmission angle-Description of common Mechanisms-Single - Double and offset slider mechanisms - Quick return mechanisms - Ratchets and escapements - Indexing Mechanisms - Rocking Mechanisms - Straight line generators - Design of Crank-rocker Mechanisms.

UNIT – II : KINEMATICS OF LINKS **9**

Displacement- velocity and acceleration - analysis in simple mechanisms - Graphical Method-velocity and acceleration polygons - Vector Approach- Computer applications in the kinematic analysis of simple mechanisms-Coincident points- Coriolis Acceleration.

UNIT – III : KINEMATICS OF CAM **9**

Classifications - Displacement diagrams-parabolic- Simple harmonic and Cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion - Pressure angle and undercutting.

UNIT - IV : GEARS **9**

Spur gear Terminology and definitions - Fundamental Law of toothed gearing and involute gearing-Interchangeable gears - Gear tooth action – Terminology - Interference and undercutting-Non standard gear teeth- Helical- Bevel- Worm- Rack and Pinion gears (Basics only)-Gear Trains: Simple gear trains, Compound gear trains, Epicyclic gear trains, Algebraic method & Tabular method, Problems on gear trains.

UNIT - V : FRICTION **9**

Surface contacts-Sliding and Rolling friction - Friction drives – Friction in screw threads - Friction clutches - Belt and rope drives- Friction aspects in Brakes – Friction in vehicle propulsion and braking

Total Hours : 45

TEXT BOOKS

1. Rattan S.S, "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2009.
2. Khurmi.R.S. - Gupta, "Theory of Machines".S.Chand & Co., 2011

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 2005.
2. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi.

3 Shigley J.E and Vickes J.J, "Theory of Machines & Mechanism", McGraw Hill, 2009.

STANDARDS

1. IS 2458: 2001- Vocabulary of Gear Terms – Definitions Related to Geometry.
2. IS 3756: 2002- Method of Gear correction – Addendum modifications for External Cylindrical Gears with Parallel Axes.
3. IS 5267 : 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.
4. IS 12328 : Part 1: 1988 Bevel Gear Systems Part – 1 Straight Bevel Gears.
5. IS 12328 : Part 2: 1988 Bevel Gear Systems Part – 2 Spiral Bevel Gears.

YEAR	II	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C
SEMESTER	III		3	1	0	4

(COMMON TO EEE, B.Tech – Solar and Alternate Energy & MECHT)

AIM:

To study concepts of basic circuits, Network theorems, resonance and coupled circuits, balanced and unbalanced circuits and transient analysis of circuits.

OBJECTIVE:

- To understand basic circuit concepts.
- To study networks and solution of DC and AC circuits.
- To understand series and parallel resonance concepts and analysis of coupled circuits.
- To study protection of balanced and unbalanced loads and measurement of power and power factor in three phase circuits.
- To understand transient analysis of RL, RC and RLC circuits with DC and sinusoidal excitations.

OUTCOMES :

- To understand basic circuit concepts.
- To study networks and solution of DC and AC circuits.
- To understand series and parallel resonance concepts and analysis of coupled circuits.
- To study protection of balanced and unbalanced loads and measurement of power and power factor in three phase circuits.
- To understand transient analysis of RL, RC and RLC circuits with DC and sinusoidal excitations.

UNIT – I : BASIC CIRCUIT CONCEPTS 9

Review of basic concepts- DC & AC circuits - R, L, and C elements phasor diagrams-Complex impedance - Real & Reactive power- Series & Parallel circuits– Formation of matrix equations and analysis of complex circuits using mesh- Current and nodal - Voltage methods.

UNIT - II : NETWORK THEOREMS AND TRANSFORMATIONS. 9

Voltage – Current – Source transformation. Star Delta transformation - Superposition theorem – Reciprocity theorem – Substitution theorem – Maximum Power Transfer theorems – Thevenin's theorem – Norton's theorem and Millman's theorem with applications.

UNIT - III : RESONANCE AND COUPLED CIRCUITS 9

Series resonance and parallel resonance – Bandwidth and Q factor. Inductively coupled circuits - Coeffiecient of coupling - Dot convention - Multi winding coupled circuits - Analysis of coupled circuits

UNIT - IV : THREE PHASE CIRCUITS 9

Analysis of three phase 3 wire and 4 wire circuits with star and delta connected balanced and unbalanced loads- phasor diagram of Voltages and Currents – Measurement of power and power factor in three phase circuits

UNIT - V : TRANSIENT ANALYSIS 9

Transient response-Natural Response Force Response – DC Response of RL, RC, RLC Circuits – Sinusoidal Response of RL, RC, RLC Circuits.

Lecture Hours : 45
Tutorial Hours : 15
Total Hours : 60

TEXT BOOKS

1. Dr.S. Arumugam, Premkumar, Circuit Theory - Khanna publishers,1991
2. Sudhakar, A. and Shyam Mohan S.P.,'Circuits and Network Analysis and Synthesis', Tata McGraw-Hill Publishing C.Ltd., New Delhi, 2006.

REFERENCES:

1. Prof.T.Nageswara Rao,"Electric circuit analysis" A.R.Publications.
2. Hyatt, W.H. Jr and Kemmerly, J.E., 'Engineering Circuits Analusis', McGraw-Hill International Editions, 2002.
3. Edminister, J.A., 'Theory and Problems of Electric Circuits', Schaum's outline series McGraw Hill Book Company, 5th Edition, 2011.

YEAR	II	ELECTRICAL MACHINERY	L	T	P	C
SEMESTER	III		3	0	0	3

(COMMON TO MECHT & B.Tech – Solar and Alternate Energy)

AIM:

To impart basic knowledge on Electrical machines, principles and its behavior.

OBJECTIVES:

- To study the working principles of DC machines as generator and motor, determination of their no load/load characteristics, starting and speed control of DC motors
- To familiarize the constructional details, principle of operation, performance, methods of testing of transformers and three phase transformer connections.
- To understand the principle of operation and performance of synchronous Machines.
- To gain knowledge about construction, principle of operation and performance of induction machines.
- To understand the Construction, principle of operation and performance of single phase induction motors and special machines.

OUTCOMES :

Upon the completion of the course, the student will be able to

1. Understand the constructional details and principle of operation of DC machines and Transformers.
2. Analyze the performance of the DC Machines under various operating conditions using their various characteristics.
3. Evaluate the performance of Transformers using phasor diagrams and equivalent circuits.
4. Select appropriate DC motor as well as to choose an appropriate method of speed control for any industrial application

UNIT - I : D.C. MACHINES **12**

Construction of D.C. Machines - Principle and theory of operation of D.C. generator - EMF equation - Characteristics of D.C. generators - Armature reaction – Commutation - Principle of operation of D.C. motor - Voltage equation - Torque equation - Types of D.C. motors and their characteristics –Starters - Speed control of D.C. motors - Applications.

UNIT - II : TRANSFORMERS **9**

Principle - Theory of ideal transformer - EMF equation - Construction details of shell and core type transformers - Tests on transformers - Equivalent circuit – Phasor diagram - Regulation and efficiency of a transformer - Introduction to three – phase transformer connections – All Day Efficiency

UNIT - III : SYNCHRONOUS MACHINES 8

Principle of alternators:- Construction details, Equation of induced EMF and Vector diagram – Regulation – Parallel Operation- Synchronization-Synchronous motor:- Starting methods, Torque, V curves, Speed control and Hunting.

UNIT – IV : INDUCTION MACHINES 9

Induction motor:- Construction and principle of operation, Classification of induction motor, Torque equation, Condition for maximum torque, Equivalent Circuit, Starting methods and Speed control of induction motors.

UNIT - V : SPECIAL MACHINES 7

Types of single phase motor –Double revolving field theory – Cross field theory – Capacitor start capacitor run motors – Shaded pole motor – Repulsion type motor – Universal motor – Hysteresis motor - Permanent magnet synchronous motor – Switched reluctance motor – Brushless D.C motor.

Total Hours : 45

TEXT BOOKS :

1. Nagrath, I.J., and Kothari, D.P., " Electrical Machines", Tata McGraw - Hill, 1997.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw- Hill, Singapore, 2000.

REFERENCES :

1.Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chand and Co., New Delhi, 2007.
2. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi, 1995.
3. Cotton, H., "Advanced Electrical Technology", Sir Isaac Pitman and Sons Ltd., London, 1999.

YEAR	II	ENGINEERING MECHANICS	L	T	P	C
SEMESTER	III		3	1	0	4

Aim	*The aim of the subject is to provide a fundamental knowledge in Engineering mechanics.*
Objective	1. *To learn the basics of statics of particles* 2. *To learn about the equilibrium of rigid bodies.* 3. *To study about properties of surfaces and solids.* 4. *To learn about friction* 5. *To study about dynamics of particles.*
Outcome	*The students would understand the basics of Engineering mechanics.*

UNIT - I : BASICS & STATICS OF PARTICLES 9

Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem. Parallelogram and triangular law of forces - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - Single equivalent force.

UNIT - II : EQUILIBRIUM OF RIGID BODIES 9

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Vectorialrepresentaion of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimension - Equilibrium of Rigid bodies in three dimensions.

UNIT - III : PROPERTIES OF SURFACES AND SOLIDS 9

Determination of Areas and Volumes - First moment of area the Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - second and product moments of plane area - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principle moments of inertia of plane areas - Principle axes of inertia - Mass moment of inertia.

UNIT - IV : FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9

Frictional force - Laws of Coloumb friction - simple contact friction - Rolling resistance - Belt friction. Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.

UNIT - V : DYNAMICS OF PARTICLES 9

Displacement, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's law - Work Energy equation of particles - Impulse and Momentum - Impact of elastic bodies.

Lecture Hours : 45
Tutorial Hours : 15
Total Hours : 60

TEXT BOOKS :

1. Beer & Johnson, Vector Mechanics for Engineers. Vol.I Statics and Vol. II Dynamics, McGraw Hill International Edition, 1995.
2. KottiswaranN,Engineering Mechanics-Statics &Dynamics,SriBalaji Publications,2014.
3. Meriam, Engineering Mechanics, Vol. I Statics & Vol. II Dynamics 2/e, Wiley Intl., 1998.

REFERENCE BOOKS :

1. Rajasekaran.S, and Sankara Subramanian G, "Engineering Mechanics", Vikas Publishing Co. New Delhi.
2. Irving H. Sharma, Engineering Mechanics - Statics & Dynamics, III Edition, Prentice Hall of India Pvt. Ltd., 1993.

3. K.L.Kumar, Engineering Mechanics III Edition, Tata McGraw Hill Publishing Co. Ltd., 1998

YEAR	II	FLUID MECHANICS & STRENGTH OF MATERIALS LABORATORY	L	T	P	C
SEMESTER	III		0	0	3	2

Aim	The main objective of this Study is to lab practice of fluid flows, Determination of Flow through notches, weir and orifice. The practical study of strength of materials.
Objective	1. *To understand the concepts of fluid mechanics, performances of various pumps* 2. *To understand the testing procedure for different materials and analysis of their performance*
Outcome	*The students can perform operations in hydraulic machineries, testing of various pump and testing of different materials.*

LIST OF EXPERIMENTS:

1. A comparative analysis of Coefficient of discharge using Orifice meter & venturimeter.
2. Determination of pipe loses-major & minor.
3. Demonstration of centrifugal pump/submersible pump/jet pump/reciprocating pump.
4. Determination of Tensile strength and Compression strength on a given specimen.
5. Determination of shear strength of Mild steel and Aluminium rods
6. Determination of Torsional strength of mild steel rod
7. Determination of Impact strength
8. Conduct of Hardness test on metals - Brinell and Rockwell Hardness.
9. Conduct of Deflection test on beams

.

Total Hours : 45

REFERNCES :

- Laboratory Reference Manual.

YEAR	II	ELECTRICAL MACHINERY LABORATORY	L	T	P	C
SEMESTER	III		0	0	3	2

OBJECTIVES :

To understand the operation of DC Machines, Synchronous Machines and Induction Machines by conducting the experiment.

OUTCOMES :

- Complete performance characteristics of DC machines and transformers are obtained.
- Speed control of DC shunt motor above and below rated speed is studied.
- DC motor starters and Three phase transformer connections are studied

LIST OF EXPERIMENTS

1. Load test on dc shunt motor
2. Load test on dc series motor
3. Speed control of dc shunt motor
4. Load test on single phase transformer
5. OCC & load test on DC Shunt generator
6. Swinburne's test
7. Load test on 3-phase induction motor.
8. No load and blocked rotor test on 3-phase induction motor.
9. Load test on 1-phase induction motor
10. V and inverted V curve of synchronous motors.
11. Study of induction motor starters.
12. Study of DC Starters.

Total Hours : 45

REFERNCES :

1. Laboratory Reference Manual.

YEAR	II	ELECTRIC CIRCUITS & DEVICES LABORATORY	L	T	P	C
SEMESTER	III		0	0	3	2

AIM

To verify practically, the fundamental characteristics of Electron Devices and various theorems.

OBJECTIVES

- To verify the various theorems
- To study experimentally the characteristics of diodes, BJT's and FET's.
- To verify practically, the response of various special purpose electron devices.

OUTCOMES :

Students are exposed to experimental knowledge on analysing the electric circuits and electronic devices

LIST OF EXPERIMENTS

1) Verification of Thevenin's and Norton's Theorem.
2) Verification of super position and compensation Theorem.
3) Verification of Reciprocity and Maximum Power Transfer Theorem.
4) Series and Parallel Resonance Circuits.
5) Transients in RLC Circuits.
6) Series and Parallel AC Circuits and Phasor Diagram.
7) Coupled Circuits and Tuned Circuits.
8) Characteristics of Transistor under common Emitter configuration.
9) Characteristics of Transistor under Common Base Configuration.
10) Characteristics of Transistor under Common collector configuration.
11) Characteristics of UJT and FET.
12) Characteristics of SCR, DIAC and TRIAC.

Total Hours : 45

REFERNCES :

1. Laboratory Reference Manual.

SEMESTER -IV

YEAR	II	NUMERICAL METHODS	L	T	P	C
SEMESTER	IV		3	1	0	4

(COMMON TO MECH, AERO, AUTO, MECHT, CIVIL, EIE & EEE)

AIM:

To provide students with mathematical knowledge and skills needed to support their concurrent and subsequent engineering and science studies

OBJECTIVE:

- To provide the knowledge in solving different types of equations.
- To apply appropriate numerical methods to solve a linear system of equations
- To equip the students with interpolation, numerical differentiation and numerical integration techniques.

OUTCOMES :

The students will be able to

- Relate their subject knowledge with their experiments during their course of study.
- Understand the use of numerical methods in modern scientific computing with finite precision computation.
- Solve an algebraic or transcendental equation using an appropriate numerical method.
- Solve their engineering problems using interpolation techniques.
- Understand the calculation and interpretation of errors in numerical methods.
- Identify the numerical techniques for their engineering problem.

UNIT - I : SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 12

Method of false position, Newton-Raphson method for single variable, Solutions of a linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss- Seidel methods. Inverse of a matrix by Gauss-Jordan method. Eigen value of a matrix by Power Method.

UNIT – II : INTERPOLATION AND APPROXIMATION 12

Interpolation with Newton's divided differences, Lagrange's polynomial, Newton forward and backward differences, central difference Formula (Stirling's and Bessel's).

UNIT - III : NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal and Simpson's (both $1/3^{rd}$ and $3/8^{th)}$ rules. Rombergs rule, Two and Three point Gaussian quadrature formula. Double integrals using Trapezoidal and Simpson's rule.

UNIT - IV : INITIAL VALUE PROBLEMS OF ODE 12

Solution of equations related to simple harmonic motion, Oscillations of a spring mass system, Simple pendulum, Oscillatory electrical circuit and Deflection of beams with initial conditions - using Taylor series. Euler, Modified Euler and Runge-Kutta methods.

UNIT - V : BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation (both implicit and explicit). One dimensional wave equation and two dimensional Laplace and Poisson equations.

Lecture Hours : 45

Tutorial Hours : 15

Total Hours : 60

TEXT BOOKS:

1. N.Subramanian, "Numerical Methods" ,SCM Publishers,Erode.
2. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi.

REFERENCES :

1. Sastry, S.S., "Introductory Methods of Numerical Analysis (Third Edition)", Printice Hall of India, New Delhi, 1998.
2. T.Veerarajan, T.Ramachandran, "Numerical Methods with Programs in C and C++", Tata McGraw-Hill (2004).
3. Grewal, B.S. and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, New Delhi, 1999.
4. A. Singaravelu, "Numerical Methods", Meenakshi Agency, Chennai

YEAR	II	DYNAMICS OF MACHINES	L	T	P	C
SEMESTER	IV		3	1	0	4

(COMMON TO MECH, MECHATRONICS)

Prerequisite:– ENGINEERING MECHANICS.

Aim	*The aim of the subject is to provide knowledge in various mechanisms, vibrations and balancing of masses*
Objective	*1. To study about forces acting on various parts of mechanisms.* *2. To learn static and dynamic balancing of masses.* *3. To study the characteristics of free and forced vibrations.* *4. To study and analyze various types of Governors and effect of gyroscopic forces.* *5. To learn about Cam Dynamics - velocity and displacement and acceleration.*
Outcome	*The students would be able to understand the operations of governors, cam dynamics and vibrations.*

.

UNIT - I : FORCE ANALYSIS 9

Relation between members disregarding friction. Analysis of engine mechanism, four-bar mechanism and mechanisms having more than four links. Rigid Body dynamics in general plane motion – Equations of motion - Dynamic force analysis - Inertia force and Inertia torque – D'Alemberts principle - The principle of superposition - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque - Turning moment diagrams - Fly wheels –Engine shaking Forces

UNIT - II : BALANCING 9

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines - Balancing linkages - balancing machines.

UNIT - III : FREE VIBRATIONS 9

Basic features of vibratory systems - idealized models - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration- critical speeds of simple shaft - Torsional vibration - Natural frequency of two and three rotor systems.

UNIT - IV : FORCED VIBRATIONS **9**

Response to periodic forcing – Harmonic Forcing - Forcing caused by unbalance - Support motion – Force transmissibility and amplitude transmissibility. - Vibration isolation.

UNIT - V : MECHANISMS FOR CONTROL **9**

Governors; Force analysis of Porter, Proel and spring controlled governors. Controlling force, stability, sensitiveness, effort and power of governors. Characteristics - Effect of friction.

Gyroscopic Forces: Gyroscopic couple, Effect of Gyroscopic couple on vehicle; Applicatons of Gyroscopic forces. - Ships and airplanes

Total Hours : 45

TEXT BOOKS

1. Rattan S.S, "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd. New Delhi.
2. Khurmi.R.S. - Gupta, "Theory of Machines". S.Chand & Co., 2011

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 2005.
2. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi.
3 Shigley J.E and Vickes J.J, "Theory of Machines & Mechanism", McGraw Hill, 2009

YEAR	II	CONTROL SYSTEMS	L	T	P	C
SEMESTER	IV		3	1	0	4

(COMMON TO ECE, MECHATRONICS and B.Tech – Solar and Alternate Energy)

AIM

To provide sound knowledge in the basic concepts of linear control theory and design of control system.

OBJECTIVE

- To understand the methods of representation of systems and to desire their transfer function models.
- To provide adequate knowledge in the time response of systems and steady state error analysis
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To understand the concept of stability of control system and methods of stability analysis.
- To study the three ways of designing compensation for a control system

OUTCOMES:

Upon completion of the course, students will be able to:

1. Perform time domain and frequency domain analysis of control systems required for stability analysis.
2. Design the compensation technique that can be used to stabilize control systems

UNIT - I : SYSTEMS AND THEIR REPRESENTATION 12

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT - II : TIME RESPONSE 9

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feed backcontrol.

UNIT - III : FREQUENCY RESPONSE 9

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

UNIT - IV : STABILITY OF CONTROL SYSTEM **9**

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin –Nyquist stability criterion.

.UNIT - V : COMPENSATOR DESIGN **6**

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots.

Lecture Hours : 45

Tutorial Hours : 15

Total Hours : 60

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.
2. Benjamin C. Kuo, Automatic Control systems, Pearson Education, New Delhi, 2003.

REFERENCES

1. K. Ogata, 'Modern Control Engineering', 4th edition, PHI, New Delhi, 2002.
2. Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley, New Delhi, 2007.
3. Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004
4. M. Gopal, 'Control Systems, Principles and Design', Tata McGraw Hill, New Delhi, 2002.

YEAR	II	DIGITAL ELECTRONICS	L	T	P	C
SEMESTER	IV		3	1	0	4

AIM

The Aim of this course is to develop a strong foundation in analysis and design of digital electronics.

OBJECTIVES

1. Understand the basic concepts.
2. Understand concepts of logic gates constructional features.
3. To understand the concepts of gate-level minimization & combinational logic.
4. To analyze synchronous sequential logic.

OUTCOMES:

Students will be able to:

- Analyze different methods used for simplification of Boolean expressions.
- Design and implement Combinational circuits and implement synchronous and asynchronous sequential circuits.
- Write simple HDL codes for the circuits.

UNIT – I: NUMBER SYSTEM 9

Digital System, Binary Numbers, Number-Base Conversions, Octal & Hexadecimal Numbers, Complements of Numbers, Signed Binary Numbers, Binary Codes, Binary Storage And Registers, Binary Logic

UNIT – II: BOOLEAN ALGEBRA, LOGIC GATES & GATE –LEVEL MINIMIZATION 9

Introduction, Boolean algebra, basic theorem & properties of Boolean algebra, Boolean functions, canonical & standard forms, logic operations, logic gates, integrated circuits, map method, four variable K-maps, product of sums simplification, don't care conditions, NAND & NOR implementations, Exclusive-OR Function, Hardware Description Language.

UNIT – III: COMBINATIONAL LOGIC 9

Introduction, Combinational Circuits, Analysis Procedure, Design Procedure ,Binary Adder-Subractor , Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders , Multiplexers , HDL Models Of Combinational Circuits.

UNIT – IV: SYNCHRONOUS SEQUENTIAL LOGIC, REGISTER & COUNTERS 9

Sequential circuits, storage elements: latches, flip flops, analysis of closed sequential circuits, synthesizable HDL Models of sequential circuits, state reduction assignment, design procedure, shift registers, ripple counters, synchronous counters, HDL for registers and Counters.

UNIT – V: DESIGN AT THE REGISTER TRANSFER LEVEL 9

Register Transfer Level Notation, Register Transfer Level In HDL, ASM, Sequential Binary Multiplier, Control Logic, HDL Description Of Binary Multiplier, Design With Multiplexers, Race Free Design, Latch Free Design.

Lecture Hours : 45

Tutorial Hours : 15

Total Hours : 60

TEXT BOOKS:

- Morris Mano, "Digital Design(with an introduction to the verilog HDL)", Prentice-Hall of India, (UNITS-I,II,III,IV,V)

REFERENCE BOOKS:

1. William I. Fletcher, "An Engineering Approach to Digital Design ", Prentice-Hall of India, 1980
2. Floyd T.L., "Digital Fundamentals ", Charles E. Merrill publishing Company, 1982.
3. Tokheim R.L., "Digital Electronics - Principles and Applications ", Tata McGraw Hill, 1999.
4. Jain R.P., "Modern Digital Electronics ", Tata McGraw Hill, 1999.

YEAR	II	MANUFACTURING ENGINEERING	L	T	P	C
SEMESTER	IV		3	0	0	3

(COMMON TO AUTO & MECHT)

Aim	*The aim of the subject is to provide a fundamental knowledge in manufacturing sector.*
Objective	• *To acquire the knowledge about mould making, metal melting and casting process.* • *To acquire the knowledge about various metal joining processes.* • *To acquire the knowledge about various hot and cold working processes.* • *To acquire the knowledge about various sheet metal forming processes.* • *To acquire the knowledge about various plastic processing.* • *To acquire the knowledge about various unconventional machining processes.*
Outcome	*The students would understand the basic working principle of joining and cutting operations, casting and welding process, hot and cold working processes and various unconventional manufacturing processes.*

UNIT - I : INTRODUCTION AND CASTING 9

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT - II : WELDING 9

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

UNIT - III : MACHINING 13

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

UNIT - IV : FORMING AND SHAPING OF PLASTICS 7

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods.

UNIT - V : METAL FORMING AND POWDER METALLURGY 9

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

Total Hours : 45

TEXT BOOKS :

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.

2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.

REFERENCES :

1. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", 4/e, Pearson Education, Inc. 2007.

2. Jain. R.K., and S.C. Gupta, "Production Technology", 16th Edition, Khanna Publishers, 2001.

3. "H.M.T. "Production Technology – Handbook", Tata McGraw-Hill, 2000.

YEAR	II	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
SEMESTER	IV		3	0	0	3

AIM:

To provide professional education to train students to be knowledgeable in environmental science and engineering.

OBJECTIVES:

- To create awareness on the various pollutions and their impact.
- To provide comprehensive insight in natural resources.
- To educate the ways and means to protect natural resources.
- To impart fundamental knowledge on human welfare measures.

OUTCOMES:

1. Public awareness of environment at infant stage.
2. Ignorance and incomplete knowledge has lead to misconceptions.
3. Development and improvement in standard of living has lead to serious environmental disasters.

UNIT - I : ENVIRONMENT AND NATURAL RESOURCES 9

Environment - Definition, scope & importance - Public awareness- Forest resources, mineral resources , water resources, food resources , energy resources (uses, over - exploitation & adverse effects in each case) - Scope & role of environmental engineers in conservation of natural resources - Sustainability development.

UNIT - II : ECOSYSTEMS AND BIO – DIVERSITY 9

Ecosystem - Definition, structure and function - Energy flow -Ecological succession - food chain, food web, ecological pyramids- Introduction, types, characteristics, structure and function of forest, grassland, desert and Aquatic ecosystems - Bio - Diversity :values and uses, hotspots, threats and conservation.

UNIT - III : ENVIRONMENTAL POLLUTION 9

Pollution - Definition , manmade impacts and control measures of air, water and land pollution - Water quality standards & characterization - Importance of sanitation -Nuclear hazards – Hazardous waste management : Solid waste, waste water and biomedical waste -

Prevention of pollution and role of individual – Disasters management : Floods, earthquake, cyclone and landslides - Clean technology options.

UNIT - IV : SOCIALISSUESANDENVIRONMENT 9

Urban problems related to energy - Water conservation – Resettlement and rehabilitation of people - Environmental ethics - Climate change - Global warming - Acid rain - Ozone depletion- Waste land reclamation, Environment Protection Act for air, water, wild life and forests - Pollution Control Board.

UNIT - V : HUMANPOPULATIONAND ENVIRONMENT 9

Population growth - Population explosion - Family welfare programme - Environment & human health - Human rights – Value education - Women and child welfare, Role of information technology in environment and human health.

Total Hours : 45

TEXT BOOKS :

1. Environmental Science and Engineering by Dr.A. Ravikrishnan, Sri Krishna Publications, Chennai.

REFERENCES :

1. Wager K.D. "Environmental Management", W.B. Saunders Co. Philadelphia, USA, 1998.

2. Bharucha Erach "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India

3. Trivedi R.K. " Handbook of Environmental Laws", Rules, Guidelines,Compliances and Standards Vol I & II, Enviro media.

4. Environmental Science and Engineering by Dr. J. Meenambal ,MJP Publication , Chennai Gilbert M. Masters : Introduction to Environmental Engineering and Science , Pearson Education PvtLtd., II Edition, ISBN 81-297-0277-0, 2004

5. Miller T.G. Jr Environmental Science Wadsworth Publishing Co.

6. Townsend C. Harper J. and Michael Begon, Essentials of Ecology,Blackwell Science.

YEAR	II	DIGITAL ELECTRONICS LABORATORY	L	T	P	C
SEMESTER	IV		0	0	3	2

AIM:

To provide the student with the capability to use simulation tools in digital electronic circuit analysis and design

OBJECTIVE

- To develop necessary skills to design, analyze and construct the digital circuits
- To design and simulate logic circuits using computing tools

OUTCOMES:

Students will be able to:

- Analyze different methods used for simplification of Boolean expressions.
- Design and implement Combinational circuits.
- Design and implement synchronous and asynchronous sequential circuits

LIST OF EXPERIMENTS

1. Design and implementation of Adder and Subtractor using logic gates.
2. Design and implementation of code converters using logic gates
    a. BCD to excess-3 code and vice versa
    b. Binary to gray and vice-versa.
3. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483.
4. Design and implementation of 2 bit Magnitude Comparator using logic gates 8 Bit Magnitude Comparator using IC 7485
5. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
6. Design and implementation of Multiplexer and De-multiplexer using logic gates.
7. Design and implementation of encoder and decoder using logic gates.
8. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters.
9. Design and implementation of 3-bit synchronous up/down counter.
10. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.
11. Design of experiments 1, 6, 8 and 10 using Verilog Hardware Description Language.

Total Hours : 45

REFERNCES :

1. Laboratory Reference Manual.

YEAR	II	MANUFACTURING ENGINEERING LABORATORY	L	T	P	C
SEMESTER	IV		0	0	3	2

Aim	*The aim of the subject is to provide make the students to understand the basic operations of lathe machine ,drilling machine ,shaping machine, milling machine and slotting machine.*
Objective	*To practice the various operations in lathe machine ,drilling machine ,shaping machine, milling machine and slotting machine.*
Outcome	*The students can perform operations in lathe machine ,drilling machine ,shaping machine, milling machine and slotting machine..*

LIST OF EXPERIMENTS

- Plain turning and step turning on lathe.
- Taper turning on lathe.
- Thread cutting on lathe.
- Drilling, reaming and tapping in a drilling machine.
- Plain milling.
- Making square shape job in shaping machine.
- Making Cutting key ways in a slotting machine.
- To Perform Grinding process using a grinding machine.

Total Hours : 45

REFERNCES :

1. Laboratory Reference Manual.

YEAR	II	DYNAMICS LABORATORY	L	T	P	C
SEMESTER	IV		0	0	3	2

Aim	*The aim of the subject is to provide knowledge in mechanisms related to machine dynamics.*
Objective	*To understand about governors, Gyroscopes, Speed measurement, spring mass system and compound pendulum*
Outcome	*The students would be able to understand the working principle of vibrations, balancing of masses.*

LIST OF EXPERIMENTS:

1. To perform an experiment on Watt and Porter Governor to prepare performance characteristic curves and to find stability and sensitivity.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis and determine gyroscopic couple.
4. Determine the Moment of Inertia by compound pendulum and tri-flair suspension.
5. To determine the frequency of undamped free vibration and damped forced vibration of an equivalent spring mass system.
6. To determine whirling speed of shaft theoretically and experimentally.
7. To analyse forced vibrations of a cantilever beam.
8. To determine the natural frequency of undamped torsional vibration of a single rotor shaft system.
9. To perform an experiment for static balancing on a static balancing machine.
10. To perform an experiment for dynamic balancing on a dynamic balancing machine.

Total Hours : 45

REFERNCES :

1. Laboratory Reference Manual.

SEMESTER - V

YEAR	III	DESIGN OF MACHINE ELEMENTS	L	T	P	C
SEMESTER	V		3	1	0	4

(COMMON TO MECH & MECHT)

(Use of approved Design Data Book is permitted in the University examination)

Aim	*The aim of the subject is to provide basic knowledge in designing various machine elements.*
Objective	• To understand basic design procedures, steady and variable stresses, failure Theories. • To study the design concepts of shafts and couplings. • To study the design parameters of fasteners and welded joints. • To learn the design parameters of different types of springs and levers. • To understand the design concepts of bearings and flywheel.
Outcome	*The students would be able to design any machine elements with standard procedures and formulae.*

UNIT - I : STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factor influencing machine design- Direct- Bending and torsional stress equations – Calculation of principal stresses for various load combinations- Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg- Goodman and Gerber relations

UNIT - II : DESIGN OF SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength- rigidity and critical speed – Design of rigid and flexible couplings..

UNIT - III : DESIGN OF FASTENERS AND WELDED JOINTS 9

Threaded fasteners - Design of bolted joints including eccentric loading – Design of welded Joints for pressure vessels and structures - Theory of bolted joints.

UNIT - IV : DESIGN OF SPRINGS 9

Design of helical- leaf- disc and torsional springs under constant loads and varying loads – Concentric torsion springs .

UNIT - V : DESIGN OF BEARINGS AND FLYWHEELS 9

Design of bearings – sliding contact and rolling contact types– Design of journal bearings calculation of bearing dimensions – Design of flywheels involving stresses in rim and arm.

Total Hours : 45

TEXT BOOKS

1. Shigley, Mischke, Mechanical Engineering Design, Tata Mc Graw Hill.
2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co,2003.

REFERENCES:

1. Juvinall R.C- and Marshek K.M- "Fundamentals of Machine Component Design"- John Wiley & Sons- Third Edition- 2002.
2. Norton R.L- "Design of Machinery"- Tata McGraw-Hill Book Co- 2004.
3. Orthwein W- "Machine Component Design"- Jaico Publishing Co- 2003.
4. Spotts M.F.- Shoup T.E "Design and Machine Elements" Pearson Education- 2004.
5. Md.Jalaludeen- Machine Design- Anuradha Publicatiions,Chennai.

YEAR	III	ENGINEERING METROLOGY AND MEASUREMENT	L	T	P	C
SEMESTER	V		3	0	0	3

(Common TO MECH & MECT**)**

Aim	*The aim of the subject is to provide basic knowledge in instrumentation and measurements*
Objective	• *To understand the basic measurement system.* • *To understand the various instruments used for linear and angular measurement.* • *To understand the various instruments used for form measurement and surface finish.* • *To understand the principle, applications and advancements of laser.* • *To understand the various instruments to acquire the data and store in computer*
Outcome	*The students would be able to understand the working principle of various measuring instruments.*

UNIT – I : BASIC PRINCIPLES & LINEAR / ANGULAR MEASUREMENT 9

Basic principles of measurement - generalized configuration and functional descriptions of measuring instruments - Sensitivity- Readability - Range of accuracy - Precision - Static and dynamic performance characteristics –sources of error, classification and elimination of error. Repeatability - Systematic and random errors – Correction - Calibration - Interchangeability.

Linear and angular Measurements : Vernier – micrometer - interval measurement - Slip gauges and classification - optical flats - limit gauges - Comparators: mechanical - pneumatic and electrical types – applications. -Sine bar - optical bevel protractor - Autocollimator- Angle Decker – Taper measurements.

UNIT - II : DISPLACEMENT , SPEED & ACCELERATION / VIBRATION MEASUREMENT 9

Measurement of displacement: Theory and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration Procedures. Measurement of speed**:** Mechanical tachometers, electrical tachometers, stroboscope, noncontact type of tachometer. Measurement of acceleration and vibration : Piezoelectric Accelerometer, Seismic Accelerometer , principles of seismic instruments – vibrometer.

UNIT - III : TEMPERATURE, PRESSURE AND FLOW MEASUREMENT 9

Measurement of temperature: Classification , ranges, various principles of measurement, expansion, electrical resi tance, thermistor , thermocouple, pyrometers , temperature

indicators.Measurement of pressure **:** Units, classification , different principles used., manometers, piston, bourdon , pressure gauges, bellows– diaphragm gauges. low pressure measurement, thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge, Knudsen gauge. calibration of pressure gauges. Measurement of level : Direct method – indirect methods– capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – bubler level indicators.

Measurement of flow : Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, Laser Doppler anemometer (LDA).

UNIT – IV : FORCE, TORQUE, & STRAIN MEASUREMENTS 9

Measurement of force : Load cells, cantilever beams, proving rings, differential transformers. Measurement of torque: Torsion bar dynamometer, servo controlled dynamometer, absorption dynamometers. Power Measurements. Strain Measurements**:** Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge, Rosettes. Strain gauge calibration.

UNIT - V : FORM MEASUREMENTS AND OPTICAL MEASUREMENTS 9

Form measurements : Measurement of screw threads - thread gauges - Floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish - Straightness - Flatness and roundness measurements.Optical measurements : Optical Microscope , interference microscope, tool makers microscope, profile projector, vision Systems, laser interferometer – linear and angular measurements.

Total Hours : 45

TEXTBOOKS:

1. Kumar D.S., Mechanical Measurements and Control, Tata Mc Graw Hill.
2. Jain R.K., Engineering Metrology, Khanna Publishers, 1994
3. Gupta S.C.- "Engineering Metrology"- Dhanpatrai Publications- 1984

REFERENCES;

1. Alan S. Morris- "The Essence of Measurement"- Prentice Hall of India- 1997
2. Jayal A.K- "Instrumentation and Mechanical Measurements"- Galgotia Publications 2000
3. Beckwith T.G- and N. Lewis Buck- "Mechanical Measurements"- Addison Wesley- 1991
4. Donald D Eckman- "Industrial Instrumentation"- Wiley Eastern-1985.

YEAR	III	POWER ELECTRONICS AND DRIVES	L	T	P	C
SEMESTER	V		3	0	0	3

AIM

To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.

OBJECTIVES

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and Matrix converters.

Outcomes

Students can understand various applications of electronic devices for conversion, control and conditioning of electrical power.

UNIT - I : POWER SEMI-CONDUCTOR DEVICES 9

Overview of switching devices – Driver and snubber circuit of SCR TRIAC, GTO, IGBT, MOSFET – Computer simulation of PE circuits.

UNIT - II : RECTIFIERS & CHOPPERS 9

Introduction-2 pulse / 3 pulse and 6 pulse converters – Dual converters. Basic Principles of Choppers - Stepdown and stepup chopper – Time ratio control and current limit control - Buck, Boost, Buck-Boost converters.

UNIT - III : INVERTERS & AC - AC CONVERTERS 9

Single phase and three phase [120^o & 180^o mode] inverters – PWM techniques – Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM.

Single phase AC voltage controllers – Multistage sequence control – single phase and three phase cycloconverter.

UNIT - IV : ELECTRICAL DRIVES 9

Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.

UNIT - V : SOLID STATE DRIVES (QUALITATIVE TREATMENT ONLY) 9

Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power

regulators.

Total Hours : 45

TEXT BOOKS:

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2004.
2. G.K. Dubey “Fundamental Electrical Drives” second edition 2002, Narosa Publications, Second edition, 2002.

REFERENCES:

1. Cyril.W.Lander, "Power Electronics", McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbra "Power Electronics", Khanna Publishers, third Edition 2003.
3. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004Edition.
4. N.K.De.,P.K.Sen “Electric Drives”, Prentice Hall, First edition 1999.
5. Pillai, S.K., “ A First course on Electrical Drives”, Wiley Eastern Ltd., New Delhi, 1982

YEAR	III	SENSORS AND ELECTRONIC MEASUREMENTS	L	T	P	C
SEMESTER	V		3	0	0	3

AIM:

To understand the concepts of Sensors and Electronic measurements.

OBJECTIVES:

- To familiarize the students with the concept of sensors and measurement systems.
- To understand the importance of signal generators, analyzers and signal conditioning in measurements.
- To know about measurement technique in optical domains.
- To impart knowledge on Data Acquisition, Interface Systems.

OUTCOMES

At the end of the course, the student will

- Develop an understanding of construction and working of different measuring instruments.
- Develop an ability to use measuring instruments and AC and DC bridges for measurement

UNIT - I :BASIC MEASUREMENT AND ELECTRONIC MEASUREMENT CONCEPTS 9

Basic block diagram stages of generalized measurement system, Static and dynamic characteristics, units and standards of measurements, error analysis, Zero order instrument, First order instrument, True RMS meters - Bridge measurements-Maxwell, Hay, Schering, Anderson bridge, cathode ray oscilloscope, Q meters- Vector meters.

UNIT -II : SENSORS AND PRINCIPLES 9

Resistive sensors, Potentiometer and Strain gauges, Inductive sensors- Self inductance type, Mutual inductance type, LVDT, Capacitive sensors, Piezo electric sensors, Thermocouples, Thermistors, Radiation Pyrometry, Fiber optic temperature sensor, Photo electric sensors, Pressure and Flow sensors.

UNIT - III : SIGNAL GENERATORS, ANALYSERS AND CONDITIONING 9

Function generators – RF signal generators – Sweep generators, Frequency synthesizer, Wave analyser – Hormonic distortion analyzer – Spectrum analyzer, Amplification, filtering, level conversion, linearization, buffering , Sample and hold circuit, Quantization.

UNIT - IV : DIGITAL INSTRUMENTS 9

Analog to digital converters, Digital to analog converters, digital voltmeter, multimeters, frequency counters- measurement of frequency and time interval- extension of frequency range-measurement errors.

UNIT - V :DATA ACQUISITION, INTERFACE SYSTEMS AND FIBER OPTIC MEASUREMENTS 9

Elements of data acquisition system, interfacing of transducers, computer controlled instrumentation, IEEE 488 bus, British standard interface (BS 4421) , fiber optic measurement for power and system loss, optical time domain reflectometer.

Total Hours : 45

TEXT BOOKS:

1. Albert D.Helfrick and William D.Cooper- Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 2003.
2. Rangam C.S.Sarma, G.R.Mani, V.S.V "instrumentation-devices and systems", Tata McGraw Hill publishing company LTD.1997.
3. SAWHNEY, A.K " A course in Electrical and Electronic measurements and instrumentation", Dhanpat Rai & sons, 1995.

REFERENCES:

1. Joseph J. Carr, Elements of Electronics Instrumentation and Measurement, Pearson education, 2003.
2. Doeblin, E.O Measurements systems, Tata McGraw Hill 1995.

YEAR	III	DIGITAL SIGNAL PROCESSING	L	T	P	C
SEMESTER	V		3	1	0	4

AIM :

To introduce the concepts of Digital signal processing and DSP Processor. The mathematical analysis of FIR and IIR filter design and simulation using MATLAB are dealt with in detail.

OBJECTIVES

1. Structures of Discrete time signals and systems.
2. Frequency response and design of FIR and IIR filters.
3. Finite word length effect.
4. DSP Processor- TMS320C5X.

OUTCOMES:

a. Upon completion of the course, students will be able to

1. Apply DFT for the analysis of digital signals & systems
2. Design IIR, FIR filters & Multirate Filters
3. Apply Adaptive Filters to equalization

UNIT I-REVIEW OF DISCRETE TIME SIGNALS AND SYSTEMS 12

Overview of signals and systems – DFT–FFT using DIT and DIF algorithms – Inverse DFT-FFT using DIT and DIF algorithms – Applications – Circular convolution – MATLAB programs for DFT and FFT.

UNIT II-DESIGN AND IMPLEMENTATION OF IIR FILTERS 12

Design of analog filters using Butterworth and Chebyshev approximations – IIR digital filter design from analog filter using impulse invariance technique and bilinear transformations – Matlab programs for IIR filters.

UNIT III-DESIGN AND IMPLEMENTATION OF FIR FILTERS 12

Linear phase response – Design techniques for FIR filters – Fourier series method and frequency sampling method –Design of Linear phase FIR filters using windows: Rectangular, Hanning and Hamming windows – Matlab programs for FIR filters.

UNIT IV-FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS 12

Fixed point arithmetic – effect of quantization of the input data due to Finite word length. Product round off – need for scaling – Zero input limit cycle oscillations - Limit cycle oscillations due to overflow of adders – Table look up implementation to avoid multiplications.

UNIT V-PROCESSOR FUNDAMENTALS 12

Features of DSP processors – DSP processor packaging (Embodiments) – Fixed point Vs floating point DSP processor data paths – Memory architecture of a DSP processor (Von Neumann – Harvard) – Addressing modes – pipelining – TMS320 family of DSPs (architecture of C5x).

Total Hours: 60

TEXT BOOKS

- John .G. Proakis and Dimitris C. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, Fourth edition, 2007.
- B.Venkataramani, M.Bhaskar, "Digital Signal Processors, Architecture, Programming and Application", Tata McGraw Hill, New Delhi, 2003.

REFERENCES

1. Sanjit Mitra, "Digital Signal Processing – A Computer based approach", Tata McGraw Hill, New Delhi, 2011.
2. M.H.Hayes, "Digital Signal Processing", Tata McGraw Hill, New Delhi, Edition, 2009.

YEAR	III	POWER ELECTRONICS AND DRIVES LABORATORY	L	T	P	C
SEMESTER	V		0	0	3	2

AIM

To study the characteristics of switching devices and its applications in rectifier, inverter, chopper, resonant converter and drives.

Outcomes

Students can understand various applications of electronic devices for conversion, control and conditioning of electrical power

LIST OF EXPERIMENTS:

1. Characteristics of SCR& TRIAC
2. Characteristics of MOSFET and IGBT
3. AC to DC Half & fully controlled converter
4. IGBT based choppers
5. Voltage Commutated Chopper
6. IGBT based PWM inverter
7. Resonant dc to dc converter
8. AC Voltage Controller
10. Single Phase Cyclo-converter
11. Converter fed DC Motor Drive.
12. Inverter fed Induction Motor Drive.

Total Hours : 45

REFERNCES :

1. Laboratory Reference Manual.

YEAR	III	CAD LABORATORY	L	T	P	C
SEMESTER	V		0	0	3	2

Aim	*The aim of the subject is to provide a fundamental knowledge in Drawing Softwares*
Objective	• *To study about fits and tolerances and enable students apply them in assembly of components.* • *To make students assemble simple machine components, measure and create assembly drawings on A2 Sheets using Computer Aided Drafting software.*
Outcome	*The students would be enable to learn the basic drafting procedures, allowances, 2D and 3D drawings.*

INTRODUCTION TO 3D MODELING

Creation of 3D Models - Wire Frame, Surface, Solid modeling Techniques Using CAD Packages – CSG, B-Rep Approaches in Solid Modeling - Feature Based Modeling Technique – Assembly – Detailing - Exposure to Industrial Components – Application of GD&T

1. 3D Modeling by using CAD software - Press tool Assembly
2. 3D Modeling by using CAD software - Screw Jack Assembly
3. 3D Modeling by using CAD software - Universal Coupling
4. 3D Modeling by using CAD software - Gib and Cotter Joint
5. 3D Modeling by using CAD software - Knuckle Joint

Total Hours : 45

REFERNCES :

1. Laboratory Reference Manual.

YEAR	III	SENSORS AND ELECTRONIC MEASUREMENTS LABORATORY	L	T	P	C
SEMESTER	V		0	0	3	2

AIM :

To learn about various Measuring instruments and applications

OUTCOMES

At the end of the course, the student will

- Develop an understanding of construction and working of different measuring instruments.
- Develop an ability to use measuring instruments and AC and DC bridges for measurement

List of Experiments:

1. Measurement of displacement using LVDT.
2. Measurement of speed using Inductive pick-up using Proximity Sensor.
3. Digital to Analog Converter.
4. Measurement of Temperature using RTD.
5. Measurement of temperature using Thermocouple.
6. RC Wave Shaping circuit and Wien bridge oscillator.
7. Analog to Digital converter.
8. P/I and I/P converters.
9. Measurement of capacitance using Schering bridge.
10. Measurement of Inductance using Anderson bridge.
11. Strain gauge characteristics.

Total Hours : 45

REFERNCES :

1. Laboratory Reference Manual.

SEMESTER – VI

YEAR	III	MICROCONTROLLER & APPLICATIONS	L	T	P	C
SEMESTER	VI		3	0	0	3

(Common to EEE,MECT & B.Tech – Solar and Alternate Energy)

AIM:

To provide the knowledge about the processors and controllers and its functioning

OBJECTIVES :

1. To learn the concepts of microprocessors.
2. To get knowledge in interfacing devices.
3. To know the concepts of microcontroller and its applications.
4. To develop skill in simple program writing.

OUTCOMES:

- At the end of the course, the student should be able to:
- Design and implement programs on 8086 microprocessor.
- Design I/O circuits & Memory Interfacing circuits.
- Design and implement 8051 microcontroller based systems

UNIT I – INTEL 8086 MICROCPROCESSOR 9

Architecture of 8086-Register organization – Signal Description of 8086 - 8086 Instructions set – Addressing modes – Assembler directives and operators- simple programs.

.

UNIT II – PERIPHERAL INTERFACING 9

Programmable Peripheral Interface 8255 – Programmable Communication Interface 8251 USART – Programmable Interrupt Controller 8259A - Programmable Interval Timer 8253 – Keyboard/Display Controller 8279 – A-to-D converter – D-to-A converter.

UNIT III – INTEL 8051 MICROCONTROLLER 9

Introduction to 8 bit microcontroller – architecture of 8051- Signal descriptions of 8051- Role of PC and DPTR- Flags and PSW- CPU registers- Internal RAM & ROM- Special Function Register-Counter & Timers- Serial Communication.

UNIT IV – ASSEMBLY LANGUAGE PROGRAM OF INTEL 8051 9

Interrupt- Addressing Mode- Data Transfer Instruction- Arithmetic Instruction- Logical Instruction- Jump Loop & Call Instruction- I/O Port Programming.

UNIT V – INTERFACING AND APPLICATION OF INTEL 8051 9

LCD Interfacing - A/D and D/A Interfacing- Sensor Interfacing- Relays and Optoisolators- Stepper Motor Interfacing- DC Motor Interfacing.

Lecture Hours : 45

Tutorial Hours : 15

Total Hours : 60

TEXTBOOKS

- Krishna Kant, "Microprocessors and Microcontrollers Architecture, programming and system Design using 8085, 8086, 8051 and 8096". PHI2007. (Unit I & II).
- Muhammad Ali Mazidi and Janica Gilli Mazidi, The 8051 microcontroller and embedded systems, Pearson Education, 5th Indian reprint, 2003. (Unit III to V)

REFERENCE BOOKS :

1. Rafiquzzaman M. – Microprocessors – Theory and Applications Intel and Motorola, PHI Pvt. Ltd., New Delhi 2001.
2. Douglas V.Hall – Microprocessors and Interfacing programming and hardware, Tata McGraw Hill Edition 1997.
3. A.K Roy, K.M Bhurchandi, Intel Microprocessors Architecture, Programming and Interfacing McGraw Hill International Edition – 2001

YEAR	III	PROGRAMMABLE LOGIC CONTROLLER	L	T	P	C
SEMESTER	VI		3	0	0	3

AIM

To learn about Programmable logic Controllers.

OBJECTIVES

- To study about programmble logic.
- To study about PLCs and operation of PLC
- To study about PLC programming.
- To study about Timers and counters
- To get an idea about PLC applications

OUTCOMES

At the end of the course, the student will

- Describe the function of and the relationship between the various hardware components of a programmable logic controller.
- Design logic circuits to perform industrial control functions of medium complexity.
- Develop coded programs for the programmable logic controller.

UNIT - I : PROGRAMMABLE LOGIC 9

Programmable logic introduction, Programmable logic structures ,Programmable logic arrays (PLA s). Programmable array logic (PAL s). Field Programmable gate array (FPGA s).sequential network design with Programmable logic devices. Design of sequential networks. Using ROMs and PLAs Traffic light controller using PAL.

UNIT II - : PROGRAMMABLE LOGIC CONTROLLERS (PLCS) 9

Programmable Logic Controllers (PLCs) Introduction Parts of PLC Principles of operation PLC sizes PL Chard ware components I/O section Analog I/O section Analog I/O modules, digital I/O modules CPU. Processor memory module Programming devices Diagnostics of PLCs with Computers.

UNIT - III : **PLC PROGRAMMING SIMPLE INSTRUCTIONS 9**

PLC programming Simple instructions Programming EXAMINE ON and EXAMINE OFF instructions Electromagnetic control relays Motor starters Manually operated switches Mechanically operated and Proximity switches Output control devices Latching relays PLC ladder diagram Converting simple relay ladder diagram in to PLC relay ladder diagram.

UNIT - IV : TIMERS 9

Timer instructions ON DELAY timer and OFF DELAY timer counter instructions Up/Down counters Timer and Counter applications program control instructions Data manipulating instructions math instructions.

UNIT - V : APPLICATIONS OF PLC 9

Applications of PLC Simple materials handling applications Automatic control of warehouse door- Automatic lubricating oil supplier -Conveyor belt motor control Automatic car washing machine- Bottle label detection -Process control application.

Lecture Hours : 45

Tutorial Hours : 15

Total Hours : 60

TEXT BOOKS:

1. Charles H. Roth, Jr “Fundamentals of Logic Design ", Fourth Edition, Jaico Publishing house, 1999,

2. Frank D. Petruzella " Programmable Logic Controllers ", McGraw- Hill book, company, 1989

REFERENCES:

1. William I. Fletcher “An Engineering Approach to Digital Design ", Prentice, Hall of India Ltd., New Delhi, 1999

YEAR	III	ROBOTICS AND AUTOMATION	L	T	P	C
SEMESTER	VI		3	0	0	3

AIM

To learn the fundamentals of Robotics and implementation aspects of real time concepts.

OBJECTIVES

- To learn about the Basic concepts of Robots
- To study the Sensor and Vision Systems.
- To learn the Grippers and robot dynamics.
- To know about kinematics and path planning.
- To learn about Robot Programming Languages and applications

OUTCOMES:

Upon completion of the course, the student should be able to:

- Explain the basic concepts of working of Robot
- Analyze the function of sensors in the Robot
- Write program to use a Robot for a typical application
- Use Robots in different applications

UNIT - I : BASIC CONCEPTS 9

Origin & various generation of Robots - Robot definition - Robotics system components – Robot classification- Coordinate frames - Asimov's laws of robotics – degree of freedom – work volume - Need for Automation – types of automation – fixed, programmable and flexible automation.

UNIT - II : SENSORS AND VISION SYSTEM 9

Sensing - Range, proximity, position, velocity, acceleration, Touch, Force, Torque, Optical & laser sensors.Machine vision - Introduction, Image acquisition, Illumination Techniques, Image conversion, Cameras, Image processing and analysis – image data reduction – segmentation feature extraction – Object recognition.

UNIT - III : GRIPPERS AND ROBOT DYNAMICS 9

Introduction - various types of grippers-design considerations. Construction of Manipulator Introduction to Robot - Dynamics – Lagrange formulation – Newton Euler formulation – Properties of robot dynamic equations.

UNIT - IV : KINEMATICS AND PATH PLANNING 9

Forward Kinematics – Denavit Hartenberg Representation. Inverse Kinematics – Geometric approach.

UNIT - V : PROGRAMMING LANGUAGES AND APPLICATIONS 9

Robot programming - Fixed instruction, sequence control, General programming language, Specific programming languages. Robots for welding, painting and assembly – Remote Controlled robots – Robots for nuclear, thermal and chemical plants.

Total Hours : 45

TEXT BOOKS:

1. Mikell P. Groover ,Weiss G.M. Nagel R.N. Odraj . N.G. , "Industrial Robotics", Tata Mc Graw Hill, 3rd Reprint, Edition 2008.
2. Deb.S.R. "Robotics Technology and flexible Automation", Tata Mc Graw Hill, 9th Reprint 2004.
3. K.S Fu, R C.Gonzalez, CSG Lee- "Robotics", McGraw Hill, Edition 2008.

REFERENCE BOOKS:

1. John J Craig "Introduction to Robotics Mechanics & control, Low price Edition, 7th Reprint, 2005.
2. Ghosh, "Control in Robotics and Automation : Sensor Based Integration", Allied Publishers.

YEAR	III	COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
SEMESTER	VI		3	0	0	3

(COMMON TO MECH & MECHT)

Aim	*The aim of the subject is to provide knowledge in computer integrated manufacturing*
Scope	*1. To understand the importance of CIM and business aspects* ***2.*** *To gain knowledge about GT and CAPP* ***3.*** *To enable student to learn about FMS and SFC* ***4.*** *To understand about architecture and network concepts* *5. To learn about automation protocol and database*
Outcome	*The students would be able to understand the various concepts viz. group technology, CAPP,FMS.*

UNIT I INTRODUCTION TO CAD/CAM 9

The design process Morphology of design, Product cycle Computer Aided Design, Benefits of CAD. Role of computers - principles of computer graphics - Current trends in manufacturing engineering - - Design for Manufacturing and Assembly - Sequential and concurrent engineering,-Rapid prototyping

UNIT II SOLID MODELING 9

Graphic software: coordinate representation- graphic functions, software standards. Graphical Kernel system (GKS) - Initial graphics exchange system (IGES) - Graphic packages. Geometric Modeling - Wire frame, Surface and Solid models - Constructive Solid Geometry (CSG) and Boundary Representation (B-REP) Techniques - Features of Solid Modeling Packages.

UNIT III FUNDAMENTALS OF CNC MACHINES 9

CNC Technology - Functions of CNC Control in Machine Tools - Classification of CNC systems - Contouring System - Interpolators, open loop and closed loop CNC systems - CNC Controllers, Direct Numerical Control (DNC Systems). - Work holding devices and tool holding devices - Automatic Tool changers. Feedback devices - Principles of Operation-Machining Centres - Tooling for CNC machines

Numerical control codes - Standards - Manual Programming - Canned cycles and subroutines - Computer Assisted Programming, CAD / CAM approach to NC part programming - APT language, machining from 3D models.

UNIT IV GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

Introduction to CIM and its related activities-History of group technology- role of G.T. in CAD/CAM integration - part families - classification and coding - DCLASS and MICLASS and OPITZ coding systems-facility design using G.T. - benefits of G.T. - cellular manufacturing. Process planning - role of process planning in CAD/CAM integration - approaches to computer aided process planning - variant approach and generative approaches - CAPP and CMPP process planning systems.

UNIT V SHOP FLOOR CONTROL AND INTRODUCTION OF FMS 9

Shop floor control-phases -factory data collection system -automatic identification methods- Bar code technology-automated data collection system. MS-components of FMS - types -FMS workstation -material handling and storage systems- FMS layout -computer control systems-application and benefits.

Total Hours : 45

TEXT BOOKS

- Mikell.P.Groover "Automation, Production Systems and Computer Integrated manufacturing", Pearson Education 2001.
- Radhakrishnan P, Subramanyan.S. and Raju V., "CAD/CAM/CIM", 2nd Edition New Age International (P) Ltd., New Delhi, 2000.

REFERENCES

1. Yorem koren, "Computer Integrated Manufacturing System", McGraw-Hill, 1983.
2. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International, 1986.
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe "Computer Integrated Design and Manufacturing", McGraw-Hill Inc.
4. Roger Hanman "Computer Integrated Manufacturing", Addison – Wesley, 1997.
5. Mikell.P.Groover and Emory Zimmers Jr., "CAD/CAM", Prentice Hall of India Pvt. Ltd., New Delhi-1, 1998.
6. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.

YEAR	III	DESIGN OF MECHATRONICS SYSTEM	L	T	P	C
SEMESTER	VI		3	0	0	3

AIM :

To learn about various Mechanical systems and its designs

OBJECTIVES:

The students will be exposed to design mechatronics system in Labview & Vim–Sim Environments

OUTCOMES

The students will be able to design systems in mechatronics approach using modern software Packages.

UNIT – I : ROTATIONAL DRIVES 9

Rotational drives - Pneumatic Motors: continuous and limited rotation - Hydraulic Motors: continuous and limited rotation - Brushless DC Motors - Motion convertors, fixed ratio, invariant motion profile,variators, remotely controlled couplings Hydraulic Circuits and Pneumatic Circuits.

UNIT – II : MECHANICAL SYSTEMS AND DESIGN 9

Mechanical Systems and Design - Mechatronic approach - Control program control, adaptive control and distributed systems - Design process - Types of Design - Integrated product design - Mechanisms, load conditions, Design and flexibility Structures, Load conditions, Flexibility and environmental isolation – Man machine interface, Industrial design and Ergonomics, Information transfer from machine to machine, machine to man and man to machine, Safety.

UNIT – III : REAL TIME INTERFACING 9

Real time interfacing - Introduction Elements of data acquisition and control ,Overview of I/O process - Installation of I/O card and software - Installation of application software- Over framing.

UNIT – IV :CASE STUDIES ON DATA ACQUISITION 9

Case studies on Data Acquisition - Testing of transportation bridge surface materials - Transducer calibration system for automotive applications ,Strain Gauge, weighing system - Solenoid force - Displacement calibration system - Rotary optical encoder - Inverted pendulum control - Controlling temperature of a hot/cold reservoir - Pick and place robot - Carpark barriers.

UNIT – V :CASE STUDIES ON DATA ACQUISITION AND CONTROL ` 9

Case studies on Data Acquisition and Control - Thermal cycle fatigue of a ceramic plate - pH control system –De-Icing Temperature Control System - Skip control of a CD Player – Auto focus Camera, exposure control. Case studies on Design of Mechatronic products - Motion control using D.C. Motor, A.C. Motor and Solenoids -Car engine management - Barcode reader

Total Hours: 45

TEXT BOOKS:

1) Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999.

2) Devdas shetty, Richard A. Kolk, -Mechatronics System Design,- PWS Publishing company, 1997

3) Bradley, D.Dawson, N.C. Burd and A.J. Loader, Mechatronics: Electronics in Products and Processes, Chapman and Hall, London, 1991.

REFERENCE BOOKS:

1) Brian Morriss, Automated Manufacturing Systems - Actuators, Controls, Sensors and Robotics Mc Graw Hill International Edition, 1995.

2) Gopel Sensors A comprehensive Survey Vol I & Vol VIII, BCH Publisher, New York.

YEAR	III	PROGRAMMABLE LOGIC CONTROLLER AND MECHATRONICS LABORATORY	L	T	P	C
SEMESTER	VI		0	0	3	2

Objective

To introduce and train the students to use microcontroller and PLC for actuation, control of speed

OUTCOMES:

Ability to use microcontroller and PLC to control different motor/equipment.

LIST OF EXPERIMENTS

1. DC motor speed controller Interface.

2. Stepper motor Interface using microcontroller.

3. Traffic light controller.

4. Linear actuation of hydraulic cylinder with speed control.

5. Sequential operation of pneumatic cylinders.

6. Hydrometer rotation with timer and speed control.

7. Speed control of DC motor using PLC.

8. Bottle filling system using PLC.

9. Study of Sensors and Relays using PLC.

10. Study of Dc motor speed control using PID controller.

11. Closed loop response of level process station using P, PI and PID controller.

12. Closed loop response of temperature station using P, PI and PID controller.

13. Closed loop response of flow station using P, PI and PID controller.

14. Closed loop response of pressure station using P, PI and PID controller.

Total Hours : 45

REFERENCES:

1. Laboratory Reference Manual

YEAR	III	MICROCONTROLLER LABORATORY	L	T	P	C
SEMESTER	VI		0	0	3	2

AIM

To provide the knowledge of assembly language programming of microprocessor and microcontroller and interfacing peripheral devices with microcontroller.

OBJECTIVE

1. To write the assembly language program for 8086 and 8051.
2. To write the programs for communication between microcontroller and peripheral devices.
3. To interface ADCs, DACs with microcontroller and learn the real time applications like stepper motor control, key board etc

OUTCOMES:

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

- Write ALP Programmes for fixed and Floating Point and Arithmetic
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051

LIST OF EXPERIMENTS

- 8085 & 8086 Assembly Language Program (ALP) for Arithmetic Operations.
- 8051 Assembly Language Program (ALP) for Arithmetic Operations.
- 8051 Assembly Language Program (ALP) for Logical Operations.
- 8051 Assembly Language Program (ALP) for Bit Manipulation Operations.
- 8051 Assembly Language Program (ALP) for arrange the numbers in Ascending and Descending order.
- 8051 Assembly Language Program (ALP) for Interrupt & UART Operations.
- Interfacing an ADC to 8051 Controller.
- Interfacing DAC to 8051 Controller and generate Square, Triangular & Saw-tooth waveform.
- Interfacing a Stepper motor to 8051 Controller and operate it in clockwise and anti-clockwise directions.
- Interfacing a Keyboard & Display controller (8279) to 8051 Controller.

Total Hours : 45

REFERENCES:

1. Laboratory Reference Manual

YEAR	III	ROBOTICS LABORATORY	L	T	P	C
SEMESTER	VI		0	0	4	2

AIM:

To understand the different robotic configurations and their subsystems.

OBJECTIVES:

- **To introduce different types of robotics and demonstrate them to identify differnt parts and components**
- **To write programming for simple operations like pick and place, rotoxim etc**

Outcomes

Use of Adam's software and MAT Lab software to model the different types of robots and calculate work volume for different robots

LIST OF EXPERIMENTS :

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
6. Estimation of accuracy, repeatability and resolution.
7. Robot programming exercises (Point-to-point and continuous path programming)
8. Study of vision system and use it for assembly and inspection.

Total Hours : 45

REFERENCES:

1. Laboratory Reference Manual

YEAR	IV	DISASTER MITIGATION AND MANAGEMENT	L	T	P	C
SEMESTER	VII		3	0	0	3

AIM:

To impart awareness on disasters and preparedness during disasters.

OBJECTIVES:

1. To Understand basic concepts in Disaster Management
2. To Understand Definitions and Terminologies used in Disaster Management
3. To Understand the Challenges posed by Disasters
4. To understand Impacts of Disasters

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management

UNIT I - INTRODUCTION **9**

Concept of disaster; Different approaches; Concept of Risk; Levels of disasters; Disaster phenomena and events *(Global, national and regional)*; Natural and man-made hazards

UNIT II - RISK ASSESSMENT AND VULNERABILITY ANALYSIS **9**

Response time, frequency and forewarning levels of different hazards; Characteristics and damage potential of natural hazards; hazard assessment ;Dimensions of vulnerability factors; vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards

UNIT III - DISASTER MANAGEMENT MECHANISM **9**

Concepts of risk management and crisis management -Disaster management cycle ;Response and Recovery ; Development, Prevention, Mitigation and Preparedness-Planning for relief

UNIT IV - DISASTER RESPONSE **9**

Mass media and disaster management-Disaster Response Plan; Communication, Participation, and Activation of Emergency Preparedness Plan-Logistics Management-Psychological Response-Trauma and Stress Management-Rumour and Panic Management-Minimum Standards of Relief-Managing Relief-Funding

UNIT V - DISASTER MANAGEMENT IN INDIA 9

Strategies for disaster management planning; Steps for formulating a disaster risk reduction plan; Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans

Total Hours : 45

TEXT BOOKS :

- Alexander, D. *Natural Disasters,* ULC press Ltd, London, 1993.
- Carter, W. N. *Disaster Management: A Disaster Management Handbook,* Asian Development Bank, Bangkok, 1991.
- Chakrabarty, U. K. *Industrial Disaster Management and Emergency Response,* Asian Books Pvt. Ltd., New Delhi 2007.

REFERENCES:

1. Abarquez I. & Murshed Z. *Community Based Disaster Risk Management: Field Practitioner's Handbook,* ADPC, Bangkok, 2004.
2. Goudie, A. *Geomorphological Techniques,* Unwin Hyman, London 1990.
3. Goswami, S. C. *Remote Sensing Application in North East India,* Purbanchal Prakesh, Guwahati, 1997.
4. *Manual on Natural Disaster Management in India*, NCDM, New Delhi, 2001.
5. *Disaster Management in India*, Ministry of Home Affairs, Government of India, New Delhi, 2011.
6. *National Policy on Disaster Management*, NDMA, New Delhi, 2009.
7. *Disaster Management Act. (2005),* Ministry of Home Affairs, Government of India, New Delhi, 2005.

YEAR	IV	FINITE ELEMENT ANALYSIS	L	T	P	C
SEMESTER	VII		3	1	0	4

(Common to MECH,MECT & AERO)

Aim	*The aim of the subject is to provide knowledge in finite element analysis.*
Objective	1. *To understand the basics of Finite element techniques and 1D element equation formulation* 2. *To gain knowledge about 2D problems in structural and Thermal* 3. *To enable student to learn about Natural coordinates and Iso-Parametric Elements* 4. *To understand about Elasticity concepts and Virtual work* 5. *To study about dynamic analysis*
Outcome	*The students would be able to understand the basic concepts in mathematical problem analysis.*

UNIT I: INTRODUCTION TO FINITE ELEMENT METHODS (12)

General description of Finite Element Method – Historical development – Comparison with Classical methods – General procedure of FEM - Applications of FEM – FEA software's. General Field problems, discrete and continuous models, Variational formulation in finite Elements – Ritz method - Weighted residual methods – Galerkin – sub domain – method of Least squares and collocation method - Numerical problems.

UNIT II: ONE-DIMENSION PROBLEMS (12)

Finite element modeling-coordinates and shape functions-potential energy approach-Galerkin method- Element matrices and vectors-Assembly for global equations- Boundary conditions-Higher order elements-Shapes function-Application to axial loadings of rods-Extension to plane trusses-Bending of beams-Finite element formulation of stiffness matrix and load vectors-Assembly to global equations-Boundary conditions- Solutions and post processing –Example problems

UNIT III: TWO DIMENSION SCALAR VARIABLE PROBLEMS (12)

Finite element modeling-Element equations-Load vectors and boundary condition-Assembly-Applications to scalar variable problems such as torsion, heat transfer, etc.,-Examples

UNIT IV: TWO DIMENSION VECTOR VARIABLE PROBLEMS (12)

Vector variable problems-Elasticity equations-Plane stress, Plane strain and Axissymmetric problems-CST and LST Elements-Formulation-Element matrices-Assembly-Boundary conditions and solutions-Examples

UNIT V: ISOPARAMETRIC ELEMENT FORMUALTIONS (12)

Natural coordinates-Isoparametric elements-Elements shapes functions-Element equations-Gaussian quadrature-Examples

Text Books:

- Chandrupatla & Belagundu, “Finite Elements in Engineering”, Prentice Hall of India Private Ltd., 1997.
- Rao S.S., “Finite Element Method in Engineering” , Pergamon Press, 1989

REFERENCE BOOKS:

1. Reddy J.N. “An Introduction to the Finite Element Method”, Mc Graw Hill, International Edition, 1993.
2. Segerlind L.J., “Applied Finite Element Analysis”, John Wiley, 1984.

YEAR	IV	EMBEDDED SYSTEMS	L	T	P	C
SEMESTER	VII		3	0	0	3

(COMMON TO EEE, MECHAT)

AIM:

To learn the basic concepts of embedded systems and its applications.

OBJECTIVES:

1. To introduce students to the embedded systems, its hardware and software.
2. To introduce devices and buses used for embedded networking.
3. To explain programming concepts and embedded programming in C and C++
4. To introduce the software development tools in embedded systems.
5. To introduce the concepts of Real Time Operating System.

OUTCOMES:

Upon completion of the course, students will be able to:

- Outline the concepts of embedded systems
- Use the system design techniques to develop software for embedded systems
- Model real-time applications using embedded-system concepts

UNIT I - INTRODUCTION TO EMBEDDED SYSTEMS 9

Definition –Processor Embedded into a System – Embedded Hardware Units and Devices in system –Embedded Software in a System – Examples of Embedded system –System on Chip (Soc) and Use of VLSI Design Technology – Complex Design and Processors – Design Process – Formalizations of System Design – Design Process and Design Examples – Classifications of Embedded Systems.

UNIT II - DEVICES AND BUSES FOR DEVICES NETWORK 9

Device I/O Types and Examples – Serial Communication Devices – Parallel Devices Ports – Sophisticated Interfacing Features in Devices Ports – Wireless Devices – Timer and Counting Devices – Watchdog Timer – Real Time Clock – Networked Embedded Systems – Serial Bus Communication Protocols – Parallel Bus Device Protocol – Parallel Communication Network Using ISA, PCI, PCI-X, cPCI and advanced buses.

UNIT III - PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++ 9

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler– Optimization of memory codes.

UNIT IV - SOFTWARE DEVELOPMENT AND TOOLS 9

Embedded system evolution trends. Round - Robin, robin with Interrupts, function-One-Scheduling Architecture, Algorithms. Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

UNIT V - REAL TIME OPERATING SYSTEMS 9

Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS.

Total Hours: 45

TEXT BOOKS:

- Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, Second Edition, Sixth reprint Oct. 2010
- David E Simon, "An embedded software primer ", Pearson education Asia, Eighth Impression, 2009.

REFERENCE BOOKS:

1. Steve Heath, Embedded Systems Design, Second Edition-2003, Newnes,
2. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, 2008.
3. Frank Vahid and Tony Givargis, "Embedded Systems Design – A unified Hardware /Software Introduction", John Wiley, 2006.

YEAR	IV	HYDRAULICS AND PNEUMATIC SYSTEMS	L	T	P	C
SEMESTER	VII		3	0	0	3

(COMMON TO MECH & MECHT)

Aim	*The aim of the subject is to provide knowledge about various fluid power systems*
Objective	1. *To study about basics of fluid power systems* 2. *To gain knowledge about components used in hydraulic and pneumatic systems* 3. *To learn various valves and actuators* 4. *To learn about different hydraulic circuits* 5. *To learn about different pneumatic circuits*
Outcome	*The students would be able to understand the applications of hydraulics and pneumatic systems .*

UNIT - I : FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages and Applications of fluid power system. Types of fluid power systems, Properties of fluids – General types of fluids – Fluid power symbols. Basic Laws in Fluid power system.Low cost automation.

UNIT - II : HYDRAULIC SYSTEM & PNEUMATIC SYSTEMS 9

Pump classification – Gear pump, Vane Pump,piston pump, construction and working of pumps– Variable displacement pumps.

Pneumatic Components: Compressors-types. Filter, Regulator, Lubricator Unit, Muffler– Air control valves, Quick exhaust valves.

UNIT - III : VALVES AND ACTUATORS 9

Construction of Control Components: Director control valve – 3/2 way valve ,4/2 way valve, Shuttle valve ,check valve – pressure control valve –pressure reducing valve, sequence valve-Flow control valve.

Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like Telescopic, Cushioning mechanism,
Construction of double acting cylinder.

UNIT - IV : DESIGN OF HYDRAULIC CIRCUITS 9

Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, intensifier – Intensifier circuit. Circuits: Reciprocating - Quick return – Sequencing – Synchronizing - Safety circuits - Press – Planer.

UNIT - V : DESIGN OF PNEUMATIC CIRCUITS 9

Fluid Power Circuit Design : Speed control circuits, synchronizing circuit, Pneumo-hydraulic circuit. Sequential circuit design for simple applications using cascade method.
Fluid power circuits- failure and troubleshooting.

Lecture Hours : 45

Tutorial Hours : 15

Total Hours : 60

TEXT BOOKS:

1. Hydraulicas And Pneumatic Controls, Srinivasan, TMH
2. Andrew Parr- “Hydraulics and Pneumatics (HB) "- Jaico Publishing House- 2005
3. Anthony Esposito- “Fluid Power with Applications”- Pearson Education 2008

REFERENCES:

1. Dudleyt- A. Pease and John J. Pippenger- “Basic Fluid Power "- Prentice Hall- 1987.
2. Anthony Esposite- “Fluid Power with Applications "- Prentice Hall- 1980.
3. Majumdar S.R.- “Oil Hydraulics”- Tata McGraw-Hill- 2000.
4. Majumdar S.R.- “Pneumatic systems – Principles and maintenance”- Tata McGraw Hill- 1995
5. Anthony Lal- “Oil hydraulics in the service of industry”- Allied publishers- 1982.
6. Dudelyt- A. Pease and John T. Pippenger- “Basic Fluid Power”- Prentice Hall- 1987.

YEAR	IV	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
SEMESTER	VII		3	0	0	3

(COMMON TO ECE,EEE, MECHAT)

AIM*:*

To create an awareness on Ethics and Human Values in engineering professions and to inspire moral and social values and Loyalty to appreciate the rights of others

OBJECTIVE:

After completing the course, the learner should know how to maintain code of conduct in work places and respect to each other.

OUTCOMES:

Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

UNIT – I: HUMAN VALUES

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT – II: ENGINEERING ETHICS

Senses of Engineering Ethics - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT – III: ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

UNIT – IV: SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and Chernobyl case studies.

Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT – V: GLOBAL ISSUES

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE),India, etc.

Total Hours : 45

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint).
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics: Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5. Naagarazan. R. S, A Textbook on Professional Ethics and Human Values , New Age Publications.

YEAR	IV	HYDRAULICS AND PNEUMATIC SYSTEMS & CAM LABORATORY	L	T	P	C
SEMESTER	VII		0	0	3	2

A) HYDRAULIC AND PNEUMATIC SYSTEMS LAB

Aim	*The aim of the subject is to provide basic knowledge in hydraulic and pneumatic systems.*
Objective	*1. To gain knowledge about elements of hydraulic circuits* *2. To get the hands on training in hydraulic circuits* *3. To gain knowledge about elements of pneumatic circuits* *4. To get the hands on training in pneumatic circuits*
Outcome	*The students would be able to design the hydraulic and pneumatic circuits.*

1. Design and testing of hydraulic circuits such as

i) Pressure control
ii) Flow control
iii) Direction control
iv) Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

2. Design and testing of pneumatic circuits such as

i) Pressure control
ii) Flow control
iii) Direction control
iv) Circuits with logic controls
v) Circuits with timers
vi) Circuits with multiple cylinder sequence in Pneumatic Electro pneumatic Trainer.

B) CAM LABORATORY

Aim	*The aim of the subject is to provide basic knowledge in working of CNC machines.*
Objective	*5. To gain knowledge about CNC programming* *6. To get the hands on training in CNC trainer machines* *7. To simulate various CNC maching and generate codes using CAM software*
Outcome	*The students would be able to operate CNC machine using part programming.*

Introduction:

1. Study of G and M codes
2. Manual Part Programming for CNC Machines using Stand G and M Code.
3. Machining practice on Trainer Type CNC Machines-
4. Simulation of tool path using any CAM Software

Part programming in CNC Milling:

- Point to point motions
- Linear motions
- Circular interpolations
- Contour motions
- Pocketing (Rectangular and Circular)

Programming for CNC Turning:

1. Turning and facing
2. Step turning, Taper Turning
3. Grooving
4. Fixed/Canned Cycles :
5. Thread cutting Cycles

Total Hours : 45

REFERENCES :

1) Laboratory Reference Manual.

YEAR	III	CREATIVE AND INNOVATIVE PROJECT	L	T	P	C
SEMESTER	VII		0	0	3	2

OBJECTIVES:

1. The students in batches (not exceeding three in a batch) have to take up a project in the area of their own interest related to their specialization .

2. Each batch is guided by a faculty member. The students have to select a suitable problems, design, prepare the drawings, produce the components, assemble and commission the project.

3. The students have to prepare and present a detailed project report at the end of the VI semester.

4. The evaluation will be made for the continuous internal assessment for the Project by a committee nominated by the Head of the Department.

Total Hours : 45

YEAR	IV	COMPREHENSION	L	T	P	C
SEMESTER	VII		0	0	3	2

AIM :

To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise. This will enable the students attain the confidence and competence to solve real life engineering problems.

OBJECTIVES:

- The objective of comprehension is to provide opportunity for the student to apply the Knowledge acquired during the earlier semesters to real life problems which he / she may have to face in future as an engineer.
- While learning as how to solve the real life problems, student will receive guidance from the faculty and also review various courses learnt earlier.
- Class room exercises, group discussions, case studies and topics on how the stuff works are assigned to students on an individual basis and evaluation done by a panel of teachers.
- The students work in groups and solve a variety of problems given to them.
- The problems given to the students should be of real like industrial problems Selected by a group of faculty members of the concerned department.
- A minimum of three small problems have to be solved by each group of students. The evaluation is based on continuous assessment by a group of Faculty Members constituted by the professor in-charge of the course.
- The students are required to take-up an end semester examination and obtain a minimum mark for gaining the required credit.

Total Hours : 45

SEMESTER -VIII

YEAR	IV	PROJECT WORK & VIVA VOCE	L	T	P	C
SEMESTER	VIII		0	0	12	6

OBJECTIVE

- The objective of the project work is to enable the students to form the groups of not more than 3 members on a project involving theoretical and experimental studies related to the branch of study.

- Formation of Group as follows
    - Group A : 8.5CGPA and above
    - Group B : 7 to 8.49 CGPA
    - Group C : 5 to 6.9 CGPA

      Group A Student will have a choice to take 2 students from Group B&C

- Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

- The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.

- This final report shall be typewritten form as specified in the guidelines.

- The continuous assessment shall be made as prescribed in the regulations

ELECTIVES

ELECTIVE	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

Aim:

To provide the information about different communication schemes available in real time applications

Objectives:

1. To learn the basic analog modulation schemes
2. To learn about different communication mediums
3. To learn about digital modulation schemes
4. To learn about different communication protocols
5. To learn the basics of satellite communication

OUTCOMES:

Upon completion of the course, students will be able to

1. Understand the basic concepts of analog, digital, computer and optical fiber communication.

UNIT I: BASIC MODULATION SYSTEMS 9

Time and frequency domain representation of signals, amplitude modulation and demodulation, frequency modulation and demodulation, super heterodyne radio receiver. Frequency division multiplexing. Pulse width modulation.

UNIT II: TRANSMISSION MEDIUM 9

Transmission lines – Types, equivalent circuit, losses, standing waves, impedance matching, bandwidth; radio propagation – Ground wave and space wave propagation, critical frequency, maximum usable frequency, path loss, white Gaussian noise.

UNIT III: DIGITAL COMMUNICATION 9

Pulse code modulation, time division multiplexing, digital T-carrier system. Digital radio system. Digital modulation: Frequency and phase shift keying – Modulator and demodulator, bit error rate calculation.

UNIT IV: DATA COMMUNICATION AND NETWORK PROTOCOL 9

Data Communication codes, error control. Serial and parallel interface, telephone network, data modem, ISDN, LAN, ISO-OSI seven layer architecture for WAN.

UNIT V: SATELLITE AND OPTICAL FIBRE COMMUNICATIONS 9

Orbital satellites, geostationary satellites, look angles, satellite system link models, satellite system link equations; advantages of optical fibre communication - Light propagation through fibre, fibre loss, light sources and detectors.

Total Hours : 45

TEXT BOOKS :

1. Wayne Tomasi, 'Electronic Communication Systems', Pearson Education, Third Edition, 2001.
2. Roy Blake, 'Electronic Communication Systems', Thomson Delmar, 2nd Edition, 2002.

REFERENCE BOOKS :

1. William Schweber, 'Electronic Communication Systems', Prentice Hall of India, 2002.
2. G. Kennedy, 'Electronic Communication Systems', McGraw Hill, 4th edition, 2002.
3. Miller, 'Modern Electronic Communication', Prentice Hall of India, 2003.

.

ELECTIVE	AVIONICS	L	T	P	C
		3	0	0	3

AIM

To introduce the basic concepts of navigation & communication systems of aircraft.

OBJECTIVE

1. To study the basics in avionics system.
2. To know the principles of digital system.
3. To understand the architecture of digital avionics
4. To study the control and display technologies
5. To know the utility systems in avionics.

OUTCOMES:

- The student would be able to comprehend the hardware challenges involved in the design of aircrafts and the principles involved in the design of air data systems , autopilots and navigation systems.
- The student would be capable of understanding the differences between the different practical navigation systems and the evolution of the aircraft display systems.

UNIT – I: INTRODUCTION TO AVIONICS 6

Need for Avionics in civil and military aircraft and space systems - Integrated Avionicsand Weapon system - Typical avionics sub systems - Design and Technologies.

UNIT – II: PRINCIPLES OF DIGITAL SYSTEMS 10

Digital Computers - Microprocessors – Memories

UNIT – III : DIGITAL AVIONICS ARCHITECTURE 6

Avionics system architecture-Data buses MIL-STD 1553 B-ARINC 429-ARINC 629.

UNIT – IV : FLIGHT DECK AND COCKPITS 8

Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen -Direct voice input (DVI) - Civil cockpit and military cockpit: MFDS, HUD, MFK, HOTAS

UNIT – V : INTRODUCTION TO AVIONICS SYSTEMS 15

Communication Systems - Navigation systems - Flight control systems – Radarelectronic warfare - Utility systems Reliability and maintainability - Certification.

Total Hours: 45

TEXT BOOKS :

- Malcrno A.P. and Leach, D.P., "Digital Principles and Application", Tata McGraw-Hill, 1990.
- Gaonkar, R.S., "Microprocessors Architecture - Programming and Application", Wileyand Sons Ltd., New Delhi, 1990.

REFERENCES :

1. Middleton, D.H., Ed., "Avionics Systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
2. Spitzer, C.R., "Digital Avionic Systems", Prentice Hall, Englewood Cliffs, N.J., USA., 1987.
3. Brain Kendal, "Manual of Avionics", The English Book HOuse, 3rd Edition, New Delhi, 1993.

ELECTIVE	BIO-MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

AIM

To enable the students to develop knowledge of principles, design and applications of the Biomedical Instruments.

OBJECTIVES

1. Be able to list the problems associated with the acquisition of Bio potential and list the different types of electrodes.
2. To know the various Biopotential recording methods
3. To study about various Physiological measurements methods
4. Be able to state the purpose, uses, principle of operation and maintenance of blood flow meter and blood cell counter
5. Details the various bio chemical measurements and list the different types of Biosensors

OUTCOMES :

- Ability to understand and analyze instrumentation systems and their applications to various industries.

UNIT-I: BIO PONTENTIAL ELECTRODES AND TRANSDUCERS 9

Origin of Bioelectric signals, recording electrodes-Electrode Tissue interface, Electrolyte –skin interface, Polarization, Skin contact impedance, motionartifacts. Types of electrodes- surface, Needle electrodes and Micro electrodes, Recording problems, Transducers-characteristics and types.

UNIT-II: BIOPOTENTIAL RECORDING 9

Need for Bio-amplifier, single ended bio amplifier, differential Bio amplifier, Right leg driven ECG amplifier, Band pass filtering, isolation DC amplifier & AC amplifier, chopper amplifier, Power line interface.ECG, EEG, EMG, PCG, EOG, ERG lead system and recording methods, typical waveform, frequency spectrum, abnormal waveform.

UNIT III: NON ELECTRICAL PARAMETER MEASUREMENTS 9

Respiration rate, Pulse rate, Temperature, Blood Pressure, O_2 , CO_2 measurements, Respiratory volume measurement, BMR measurement, Plethysmography technique, Impedance technique-Bipolar and Tetra polar circuits, Detection of various physiological parameters using impedance technique.

UNIT IV: BLOOD FLOW METER AND BLOOD CELL COUNTER 9

EM and ultrasonic blood flow meters, indicator dilution method, Thermo dilution method, Manual and Automatic Counting of RBC, WBC and Platelets.

UNIT V: BIO-CHEMICAL MEASUREMENTS & BIOSENSORS 9

Ph, Pc02, p02, Phco3 and electrophoresis, colorimeter, spectrophotometer, flame photometer, auto analyzer, Biosensors.

Total Hours: 45

TEXT BOOKS:

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.

REFERENCES:

- J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.

ELECTIVE	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

AIM:

To understand the organization of a computer, and the hardware-software interface.

OBJECTIVES:

- To know about the various components of a computer and their internals.
- To comprehend the importance of the hardware-software interface, and instruction set architecture.

  To understand the architectural features of superscalar processors.

OUTCOMES:

- Understand the functional units of a computers, bus structures and addressing modes
- Apply the knowledge of algorithms to solve arithmetic problems.
- Learn about single bus, multiple bus organization and pipelining concepts
- Analyze RAM, ROM, Cache memory and virtual memory concepts
- Evaluate the various I/O interfaces

UNIT – I: BASIC STRUCTURE OF COMPUTERS 9

Functional units - Basic operational concepts - Bus structures - Software performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language – Basic I/O operations – Stacks and queues.

UNIT – II : ARITHMETIC UNIT 9

Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers - Signed operand multiplication and fast multiplication – Integer division – Floating point numbers and operations.

UNIT – III: BASIC PROCESSING UNIT 9

Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Microprogrammed control - Pipelining – Basic concepts – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control consideration – Superscalar operation.

UNIT – IV : MEMORY SYSTEM 9

Basic concepts – Semiconductor RAMs - ROMs – Speed - size and cost – Cache memories - Performance consideration – Virtual memory- Memory Management requirements – Secondary storage.

UNIT – V: I/O ORGANIZATION 9

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

Total Hours: 45

TEXT BOOKS

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 5th Edition "Computer Organization", McGraw-Hill, 2002.

REFERENCES

- William Stallings, "Computer Organization and Architecture – Designing for Performance", 6th Edition, Pearson Education, 2003.
- David A.Patterson and John L.Hennessy, "Computer Organization and Design: The hardware / software interface", 2nd Edition, Morgan Kaufmann, 2002.
- John P.Hayes, "Computer Architecture and Organization", 3rd Edition, McGraw-Hill, 1998.

ELECTIVE	COMPUTER COMMUNICATION	L	T	P	C
		3	0	0	3

AIM:

To understand the architecture, recent advances, current practices and trends in computer network, analyze the networking protocols and the contemporary issues in computer networks

OBJECTIVE

1. To know about the concepts of Data communication and net-works and Physical Layer and different protocols.
2. To impart knowledge on Medium Access Layer
3. To impart knowledge on Networks Layer
4. To impart knowledge on transport protocol.
5. To impart knowledge on Application Layer.

OUTCOMES:

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

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

UNIT - I : INTRODUCTION & PHYSICAL LAYER **9**

Introduction: uses of computer networks - Network H/W, Net-work S/W, OSI reference Model, TCP/IP reference model, comparison of OSl & TCP/ IP model, Network Standardization. Physical Layer: Theoretical basics of data communication, guided trans-mission media, wireless transmission, PSTN, Mobile Telephone Systems, Cable Televisions.

UNIT - II : DATA LINK LAYER **9**

Data link layer design issues - framing, error control, flow control - Error detecting codes and Error Correcting codes, Elemen-tary data link protocols -stop-and wait protocol for error free and noisy channel - sliding window protocol - one bit, go back-N and selective repeat.

UNIT – III : NETWORK LAYER **9**

The Network Layer: Network Layer Design Issues, Routing Algorithms - optimality principle, shortest path, flooding, distance vector routing, Congestion Control Algorithms, Quality of Service, Integrated Services, internetworking, Network layer in the Internet.

UNIT – IV : TRANSPORT LAYER **9**

Transport Service, Elements of transport protocol, Congestion Control Algorithms, Internet Transport Protocol - UDP, Internet Transport Protocol - TCP, Performance issues,

UNIT – V : APPLICATION LAYER **9**

DNS-(Domain Name System), Electronic Mail, World Wide Web, Real Time Audio and Video, Content Delivery and Peer-to-peer

Total Hours : 45

TEXT BOOKS:

- Andrew S Tanenbaum, David J. Wetherall, "Computer Net-works", 5thEdition. Pearson Education/PHI/2012
- Behrouz A. Forouzan, Data Communications and Networking, 4thEdition, McGraw Hill Higher Education 2007.

REFERENCE BOOKS:

1. Michael A.Gallo, William Hancock.M, Computer Communica-tions and Networking Technologies, BROOKS/COLE/2001
2. Richard Lai and Jirachiefpattana, "Communication Protocol Specification and Verification", Kluwer Publishers, Boston, 1998.

ELECTIVE	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

AIM

To introduce the fundamentals of Cryptography and its application to Security.

OBJECTIVES

- To understand the mathematics behind Cryptography
- To understand the standard algorithms used to provide confidentiality provide integrity and authenticity.
- To get a working knowledge of network security, data base security and DS security issues in order to build secure systems.

OUTCOMES:

The student should be able to

- Identify and classify computer and security threats and develop a security model to prevent, detect and recover from attacks.
- Encrypt and decrypt messages using block ciphers.
- Demonstrate techniques to Sign and verify messages using well-known signature generation and verification algorithms.
- Develop code to implement a cryptographic algorithm or write an analysis report on any existing security product.

Understand and demonstrate the technologies to protect cipher space against security threats

UNIT - I **9**

Security trends – Attacks and services – Classical crypto systems – Different types of ciphers – LFSR sequences – Basic Number theory – Congruences – Chinese Remainder theorem – Modular exponentiation – Fermat and Euler's theorem – Legendre and Jacobi symbols – Finite fields – continued fractions

UNIT – II **9**

Simple DES – Differential cryptanalysis – DES – Modes of operation – Triple DES –AES – RC4 – RSA – Attacks – Primality test – factoring.

UNIT - III **9**

Discrete Logarithms – Computing discrete logs – Diffie-Hellman key exchange –ElGamal Public key cryptosystems – Hash functions – Secure Hash – Birthday attacks -MD5 – Digital signatures – RSA – ElGamal – DSA.

UNIT - IV **9**

Authentication applications – Kerberos, X.509, PKI – Electronic Mail security – PGP,S/MIME – IP security – Web Security – SSL, TLS, SET.

UNIT - V **9**

System security – Intruders – Malicious software – viruses – Firewalls – Security Standards.

Total Hours: 45

TEXT BOOKS

1. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", 2nd ed, Pearson, 2007.

2. William Stallings, "Cryptography and Network Security Principles and Practices", Pearson/PHI, 6th edition, 2013.

REFERENCES

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, Second Edition, 2007.

2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing Third Edition –Prentice Hall of India, 2006.

ELECTIVE	CYBER SECURITY	L	T	P	C
		3	0	0	3

AIM:

To study the critical need for ensuring Cyber Security in real time problems

OBJECTIVES :

- To understand the basics of Cyber Security
- To know the legal, ethical and professional issues in Cyber Security
- To know the various attacker techniques

OUTCOME

1. An ability to analyze a problem, and to identify and define the computing requirements appropriate to its solution.
2. An ability to design, implement and evaluate a computer-based solution to meet a given set of computing requirements in the context of the discipline.
3. An ability to communicate effectively with a range of audiences about technical information.
4. An ability to make informed judgements in computing practice based on legal and ethical principles.
5. An ability to function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables.

UNIT – I : CYBER SECURITY FUNDAMENTALS **9**

Network and security concepts – basic cryptography – Symmetric encryption – Public key Encryption – DNS – Firewalls – Virtualization – Radio Frequency Identification – Microsoft Windows security Principles.

UNIT – II : ATTACKER TECHNIQUES AND MOTIVATIONS **9**

Antiforensics – Tunneling techniques – Fraud Techniques - Threat Infrastructure.

UNIT – III : EXPLOITATION **9**

Techniques to gain a foot hold – Misdirection, Reconnaissance, and disruption methods.

UNIT - IV : MALICIOUS CODE **9**

Self Replication Malicious code – Evading Detection and Elevating privileges – Stealing Information and Exploitation.

UNIT - V : DEFENSE AND ANALYSIS TECHNIQUES **9**

Memory Forensics – Honeypots – Malicious code naming – Automated malicious code analysis systems – Intrusion detection systems – Defense special file investigation tools.

Total Hours: 45

TEXT BOOK

1. James Graham, Richard Howard and Ryan Olson, “Cyber Security Essentials”, CRC Press, Taylor & Francis Group, 2011.

REFERENCES

1. By Dan Shoemaker, Ph.D., William Arthur Conklin, Wm Arthur Conklin, “Cyber security: The Essential Body of Knowledge”, Cengage Learning, 2012.
2. Ali Jahangiri, “Live Hacking: The Ultimate Guide to hacking Techniques & Counter measures for Ethical Hackers & IT Security Experts”, 2009.

ELECTIVE	DESIGN AND ANALYSIS OF ALGORITHM	L	T	P	C
		3	0	0	3

AIM

To design and implement algorithms for various computing problems and analyze the time and space complexity of algorithms.

OBJECTIVES:

- To learn the different algorithm analysis techniques.
- To be familiar with the different algorithm design techniques.
- To understand the limitations of algorithm power
- To gain knowledge on Backtracking Algorithms
- To understand Graph Traversals

OUTCOMES

- Understand different data structures and its applications.
- Develop ability to analyze algorithms, to determine algorithm correctness and time efficiency.
- Design data structures for complex computing problems.
- Identify, model, solve and develop code for real life problems like shortest path, network flow, and minimum spanning using graphs
- Evaluate the performance of computing solutions in terms of time and space.

UNIT – I : ALGORITHM ANALYSIS 9

Time Space Tradeoff – Asymptotic Notations – Conditional asymptotic notation – Removing condition from the conditional asymptotic notation - Properties of big-Oh notation – Recurrence equations – Solving recurrence equations – Analysis of linear search.

UNIT – II : DIVIDE AND CONQUER 9

General Method – Binary Search – Finding Maximum and Minimum – Merge Sort – Greedy Algorithms: General Method – Container Loading – Knapsack Problem.

UNIT – III : DYNAMIC PROGRAMMING 9

General Method – Multistage Graphs – All-Pair shortest paths –Optimal binary search trees – 0/1 Knapsack – Travelling salesperson problem .

UNIT - IV : BACKTRACKING **9**

General Method – 8 Queens problem – sum of subsets – graph coloring –Hamiltonian problem – knapsack problem.

UNIT – V : GRAPH TRAVERSALS **9**

Connected Components – Spanning Trees – Biconnected components – Branch and Bound: General Methods (FIFO & LC) – 0/1 Knapsack problem – Introduction to NP-Hard and NP-Completeness.

Total Hours : 45

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition,Universities Press,2007.

2. K.S. Easwara Kumar, Object Oriented Data Structures using C++, Vikas Publishing House pvt. Ltd., 2000 (For Unit I)

REFERENCES :

1.T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, "Introduction to Algorithms", Second Edition,Prentice Hall of India Pvt. Ltd 2003.

2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education, 1999.

ELECTIVE	DESIGN FOR MANUFACTURE	L	T	P	C
		3	0	0	3

Aim	*The aim of the subject is to provide a fundamental knowledge in geometric analysis of part and form design of castings, weldments, assembly of parts*
Objective	➢ To gain knowledge and understanding of basic concepts design for manufacture and evaluation ➢ To impart the knowledge and understanding of geometric analysis ➢ To impart the knowledge and understanding of form desigm of castings and weldments, mechanical assembly ➢ To impart the knowledge and understanding of application of true position theory
Outcome	*The students would be enable to learn the basic concepts of geometric analysis of parts and form design of castings, weldments, assembly of parts.*

UNIT - I : METHODOLOGIES **9**

Methodologies and tools- design axioms- design for assembly and evaluation- minimum part assessment taquchi method- robustness assessment- manufacturing process rules- designer's tool kit- Computer Aided group process rules- designer's tool kit- Computer Aided group Technology- failure mode effective analysis- Value Analysis. Design for minimum number of parts- development of modular design- minimising part variations- design of parts to be multi-functional- multi-use- ease of fabrication- Poka Yoka principles.

UNIT – II : GEOMETRIC ANALYSIS **9**

Process capability- feature tolerance- geometric tolerance- surface finish- review of relationship between attainable tolerence grades and difference machining processes. Analysis of tapers- screw threads- applying probability to tolerences.

UNIT – III : FORM DESIGN OF CASTINGS AND WELDMENTS **9**

Redesign of castings based on parting line considerations- minimising core requirements- redesigning cast members using weldments- use of welding symbols.

UNIT – IV : MECHANICAL ASSEMBLY **9**

Selective assembly- deciding the number of groups- control of axial play- examples- grouped datum systems - different types- geometric analysis and applications-design features to facilitate automated assembly.

UNIT -V : TRUE POSITION THEORY **9**

Virtual size concept- floating and fixed fasterners- projected tolerance zone- assembly with gasket- zero true position tolerance- functional gauges- paper layout gauging- examples. Operation sequence for typical shaft type of components. Prepration of process drawings for different operations- tolerence worksheets and centrality analysis- examples.

Total Hours: 45

TEXT BOOKS:

1. Harry Peck- "Designing for Manufacture "- Pitman Publications- 1983.
2. Matousek- "Engineering Design- - A Systematic Approach" - Blackie & Son Ltd.- London- 1974.

REFERENCES:

1. Sports M.F..- " Dimensioning and Tolerence for Quantity Production "- Prentice Hall Inc.- 1983.
2. Oliver R. Wade- " Tolerence Control in Design and Manufacturing "- Industrial Press Inc. New York Publications- 1967
3. James G. Bralla- " Hand Book of Product Design for Manufacturing "- McGraw Hill Publications- 1983.
4. Trucks H.E.- " Design for Economic Production "- Society of Manufacturing Engineers- michigan- 2nd edition- 1987.

ELECTIVE	GRID COMPUTING	L	T	P	C
		3	0	0	3

AIM

The aim of the course is to make the students learn about grid computing.

OBJECTIVES

- To introduce the architecture of a grid.
- To learn about grid monitoring.
- To learn about the middlewares.

OUTCOMES

1. To understand the genesis of grid computing
2. To know the application of grid computing
3. To learn the technology and tool kits for facilitating grid computing

UNIT – I: CONCEPTS AND ARCHITECTURE 9

Introduction-Parallel and Distributed Computing-Cluster Computing-Grid Computing- Anatomy and Physiology of Grid-Review of Web Services-OGSA-WSRF.

UNIT – II : GRID MONITORING 9

Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems- GridICE-– JAMM -MDS-Network Weather Service-R-GMA-Other Monitoring Systems-Ganglia and GridMon

UNIT – III : GRID SECURITY AND RESOURCE MANAGEMENT 9

Grid Security-A Brief Security Primer-PKI-X509 Certificates-Grid Security-Grid Scheduling and Resource Management-Scheduling Paradigms- Working principles of Scheduling -A Review of Condor, SGE, PBS and LSF-Grid Scheduling with QoS.

UNIT – IV : DATA MANAGEMENT AND GRID PORTALS 9

Data Management-Categories and Origins of Structured Data-Data Management Challenges-Architectural Approaches-Collective Data Management Services-Federation Services-Grid Portals-First-Generation Grid Portals-Second-Generation Grid Portals.

UNIT – V : GRID MIDDLEWARE **9**

List of globally available Middlewares - Case Studies-Recent version of Globus Toolkit and gLite - Architecture, Components and Features.

Total Hours : 45

TEXT BOOKS:

1. Maozhen Li, Mark Baker, The Grid Core Technologies, John Wiley & Sons, 2005.

REFERENCES:

1. Ian Foster & Carl Kesselman, The Grid 2 – Blueprint for a New Computing Infrastructure, Morgan Kaufman, 2004.

2. Joshy Joseph & Craig Fellenstein, "Grid Computing", Pearson Education 2004. 3. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, "Grid Computing: Making the Global Infrastructure a reality", John Wiley and sons, 2000, UNIT III.

ELECTIVE	INDUSTRIAL TRIBOLOGY	L	T	P	C
		3	0	0	3

Aim	*The aim of the subject is to provide a fundamental knowledge in friction and wear, lubricants for reducing friction and wear and their types and effect of friction and wear in bearings.*
Objective	• **To gain knowledge about surfaces and to study the different types of friction in materials** • **To gain knowledge in wear mechanisms , types of wear for different environment and materials** • **To study the properties of fluid film for bearing applications.** • **To have a theoretical understanding of the film lubrication theory** • **To learn the various ways of modifying the surface of the materials for bearing** .
Outcome	*The students would be enable to learn the basic concepts of friction and wear, reducing techniques of friction and wear by using lubricants in bearings.*

UNIT – I : SURFACES AND FRICTION 9

Topography of Engineering surfaces- Contact between surfaces - Sources of sliding friction – Adhesion-Ploughing- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction – Stick slip motion - Measurement of Friction.

UNIT – II : WEAR 9

Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear – Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture - wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT – III : LUBRICANTS AND LUBRICATION TYPES 9

Types and properties of Lubricants - Testing methods - Hydrodynamic Lubrication – Elasto-hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication - Hydrostatic Lubrication.

UNIT -IV : FILM LUBRICATION THEORY 9

Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings – Reaction torque on the bearings - Virtual Co-efficient of friction - The Sommerfield diagram/.

UNIT -V : SURFACE ENGINEERING AND MATERIALS FOR BEARINGS 9

Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes – Surface coatings - Plating and anodizing - Fusion Processes – Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

Total Hours : 45

TEXT BOOK:

1.A.Harnoy " Bearing Design in Machinery "Marcel Dekker Inc, NewYork, 2003

REFERENCES:

1. M.M.Khonsari & E.R.Booser, " Applied Tribology",John Willey &Sons,New York, 2001
2. E.P.Bowden and D.Tabor., "Friction and Lubrication ", Heinemann Educational Books Ltd., 1974.
3. A.Cameron, " Basic Lubrication theory ", Longman, U.K.., 1981.
4. M.J.Neale (Editor), " Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K.,

ELECTIVE	INTELLIGENT CONTROLLERS	L	T	P	C
		3	0	0	3

AIM

To learn the knowledge of intelligent controllers in various fields.

OBJECTIVES

- To know the basic knowledge of expert systems.
- To study about the concept of neural networks.
- To learn the intelligent controllers applicable to various techniques.

Outcomes

Students can know the knowledge of intelligent controllers in various fields and also study about basic knowledge of expert systems

UNIT I INTRODUCTION 9

Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller

UNIT III GENETIC ALGORITHM 9

Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and ant-colony search techniques for solving optimization problems.

UNIT IV FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system.

UNIT V APPLICATIONS 9

GA application to power system optimization problem, Case studies: Identification and control of linear and nonlinear dynamic systems using Mat lab-Neural Network toolbox. Stability analysis of Neural-Network interconnection systems. Implementation of fuzzy logic controller using Matlab fuzzy-logic toolbox. Stability analysis of fuzzy control systems.

Total Hours : 45

TEXT BOOKS:

1. Padhy.N.P.(2005), Artificial Intelligence and Intelligent System, Oxford UniversityPress.
2. KOSKO,B. "Neural Networks And Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 1994.

REFERENCES:

1. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.
2. KLIR G.J. & FOLGER T.A. "Fuzzy sets, uncertainty and Information", Prentice-Hall of India Pvt. Ltd., 1993.
3. Zimmerman H.J. "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 1994.
4. Driankov, Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers.
5. Goldberg D.E. (1989) Genetic algorithms in Search, Optimization and Machine learning, Addison Wesley.

ELECTIVE	INTERNET PROGRAMMING	L	T	P	C
		3	0	0	3

AIM:

To Understand The Concept Of Different Internet Technologies

Objectives
1. To learn about Java, HTML , DHTML concepts.
2. To know about server side programming
3. To gain the Knowledge of XML and its applications

Outcomes

- This course gives a strong foundation to learn the
- Internet Technologies
- An ability To understand the basic concepts of Internet
- programming and protocols used.
- To create applications using HTML, DHTML,
- CSS and Java Script.
- To develop applications using SERVELETS.
- To work with JDBC, Web Databases and XML

UNIT – I : BASIC NETWORK AND WEB CONCEPTS 9

Internet standards – TCP and UDP protocols – URLs – MIME – CGI – Introduction to SGML.

UNIT – II : JAVA PROGRAMMING 9

Java basics – I/O streaming – files – Looking up Internet Address - Socket programming – client/server programs – E-mail client – SMTP - POP3 programs – web page retrieval – protocol handlers – content handlers - applets – image handling - Remote Method Invocation.

UNIT – III : SCRIPTING LANGUAGES 9

HTML – forms – frames – tables – web page design - JavaScript introduction – control structures – functions – arrays – objects – simple web applications

UNIT – IV : DYNAMIC HTML 9

Dynamic HTML – introduction – cascading style sheets – object model and collections – event model – filters and transition – data binding – data control – ActiveX control – handling of multimedia data

UNIT – V : SERVER SIDE PROGRAMMING 9

Servlets – deployment of simple servlets – web server (Java web server / Tomcat / Web logic) – HTTP GET and POST requests – session tracking – cookies – JDBC – simple web applications – multi-tier applications.

Total Hours : 45

TEXT BOOKS :

1. Deitel, Deitel and Nieto, "Internet and World Wide Web – How to program", Pearson Education Publishers, 2000.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, 2002

REFERENCES :

1. R. Krishnamoorthy & S. Prabhu, "Internet and Java Programming", New Age International Publishers, 2004.
2. Thomno A. Powell, "The Complete Reference HTML and XHTML", fourth edition, Tata McGraw Hill, 2003.
3. Naughton, "The Complete Reference – Java2", Tata McGraw-Hill, 3rd edition, 1999.

ELECTIVE	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

AIM

To provide the basic concepts in the design of electronic circuits using linear integrated circuits and their applications in the processing of analog signals.

OBJECTIVES

1. To introduce the basics of Integrated Circuits and its fabrication.
2. To familiarize with operational amplifiers and its Characteristics.
3. To introduce the applications of Operational Amplifier
4. To Introduce about the regulator and filters.
5. To introduce ADC/ DAC and PLL.

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Design linear and nonlinear applications of op – amps.
- Design applications using analog multiplier and PLL.
- Design ADC and DAC using op – amps.

UNIT I - INTEGRATED CIRCUIT FABRICATION 9

Classifications of ICs – IC chip size and Circuit Complexity – Fundamentals of Monolithic IC Technology – Basic Planar Process – Fabrication of Typical Circuit – Active and Pasive Components of ICs – Fabrication of FET – Thick and Thin Film Technology – Technology Trends.

UNIT II - OPERATIONAL AMPLIFIER AND ITS CHARACTERISTICS 9

Basic Information of operational Amplifier – Ideal Operational Amplifier - Operational Amplifier Internal Circuits – Examples of IC Op Amps – FET Operational Amplifiers – DC Characteristics – AC Characteristics – Analysis of Data Sheets of an Op Amp.

UNIT III - OPERATIONAL AMPLIFIER APPLICATIONS 9

Basic Op Amp Applications – Instrumentation Amplifiers – AC Amplifiers – V to I and I to V Converters – Op Amp Circuits Using Diodes – Sample and Hold Circuits – Log/Antilog Amplifiers – Adder/ Subtractor – Multiplier and Divider – Differentiator and Integrator – Operational Trans conductance Amplifier – Comparators – Multivibrators – Square, Triangular and Sawtooth wave Generators.

UNIT – IV: REGULATORS AND FILTERS 9

Series Op Amp Regulators – IC Voltage Regulators – 723 General Purpose Regulators – Switching regulators – RC Active Filters – Transformation – State variable Filter – Switched Capacitor Filters – Active Filters using OTA's.

UNIT – V: D/A AND A/D CONVERTERS, TIMERS AND PLL 9

Timer – Description of Functional Diagram – Monostable and Astable Operation – Schmitt Trigger – PLL – Basic Principles – Phase Detectors/ Comparators – Voltage Controlled Oscillator – Low Pass Filter – Monolithic PLL – PLL Applications – Basic DAC Techniques – A–D Converters – DAC/ ADC Specifications.

Total Hours: 45

TEXT BOOK:

- D. Roy Choudhury, Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, 3rd Edition 2007.

REFERENCE BOOKS:

- Segio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill, 2008.
- Ramakant A. Gayakwad, "OP – AMP and Linear ICs", Prentice Hall, 1994.
- Botkar K. R., "Integrated Circuits", Khanna Publishers, 1996.
- Gray and Mayer, "Analysis and design of Analog Integrated Circuits", Wiley International, 1995.

ELECTIVE	MEDICAL INFORMATICS	L	T	P	C
		3	0	0	3

AIM

To study the applications of information science and its impact in medical field

OBJECTIVE

1. To understand the hospital management system and integrated hospital information system
2. To know about the basic concepts of artificial intelligence and expert systems
3. To study the hospital management information systems and computer assisted patient education
4. To understand the concept of 3 dimensional imaging and its applications
5. To study the concepts of telemedicine, its issues and reliability

OUTCOMES

The students will be ale to design , use and maintain various medical equipments

UNIT I: **9**

Introduction - Hospital management and information system: functional area - pre-requisites - integrated hospital information systems - health information system- and disaster management plan.

UNIT II: **9**

Artificial intelligence - expert systems - materials and methods- computer based patient Records- computer assisted medical education

UNIT III: **9**

Hospital Management and Information systems - structure and functions - computer assisted patient education computer assisted patient surgery

UNIT IV: **9**

Three-dimensional imaging: limitations of endoscopy and imaging - benefits of virtual endoscopy - materials and methods- limitations- applications - merits and demerits - surgical simulation - virtual environment

UNIT V: **9**

Telemedicine – needs - materials and methods - Internet telemedicine - controversial issues – reliability - cost analysis – applications – telesurgery - the Internet

Total Hours : 45

TEXT BOOK:

1. Mohan Bansal, “Medical Informatics- a primer”, Tata McGraw-Hill, 2003.

REFERENCE BOOKS:

1. Hsinnchun Chen, “Medical Informatics: Knowledge Management and Data Mining in Biomedicine”, Springer, 2005.
2. F. T. De Dombal, “Medical Informatics: The Essentials”, Butterworth-Heinemann, 1996.
3. Charles P. Friedman, Jeremy C. (EDT) Wyatt, “Evaluation Methods in Medical Informatics” - Springer Verlag, 1997.

ELECTIVE	MEMS	L	T	P	C
		3	0	0	3

AIM

To students to gain basic knowledge on MEMS (Micro Electro Mechanical System). This enables them to design, analyze, fabricate and test the MEMS based components.

OBJECTIVES

- Introduction to MEMS.
- To study the Mechanics for MEMS Design.
- To study Electro Static Design and System Issues.
- To know various MEMS Applications

OUTCOMES

- Understand basics of microfabrication, develop models and simulate electrostatic and electromagnetic sensors and actuators, understand material properties important for MEMS system performance, analyze dynamics of resonant micromechanical structures.

Understand the design process and validation for MEMS devices and systems, and learn the state of the art in optical micro systems

UNIT I : INTRODUCTION TO MEMS 9

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Microaccelorometers and Micro fluidics, MEMS materials, Micro fabrication

UNIT II : MECHANICS FOR MEMS DESIGN 9

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics.

UNIT III : ELECTRO STATIC DESIGN AND SYSTEM ISSUES 9

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. bistable actuators. Electronic Interfaces, Feed back systems, Noise , Circuit and system issues,

UNIT IV : MEMS APLLICATION 9

Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Microfluidics application, Modeling of MEMS systems, CAD for MEMS.

UNIT V : INTRODUCTION TO OPTICAL AND RF MEMS 9

Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Memes – design basics, case study – Capacitive RF MEMS switch, performance issues.

Total Hours : 45

TEXT BOOKS:

- Stephen Santeria," Microsystems Design", Kluwer publishers, 2000.
- N.P.Mahalik, "MEMS",Tata McGraw hill, 2007

REFERENCES:

1. Nadim Maluf," An introduction to Micro electro mechanical system design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton,2000.
3. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002. Liu,"MEMS", Pearson education, 2007.

ELECTIVE	NANO ELECTRONICS	L	T	P	C
		3	0	0	3

AIM:

This course is offered to students to gain basic knowledge on Nano electronics and various fabrication techniques involved in nanoscience.

OBJECTIVE:

1. To Know basic concepts in Nanotechnology
2. To learn the Fundamental of Nano electronics
3. To learn the silicon MOSFET and Quantum Transport Devices
4. To learn the fabrication of Carbon Nanotubes
5. To study about the Molecular Electronics in Nanotechnology

OUTCOME

At end of the course students to gained basic knowledge on Nanoelectronics and various fabrication techniques involved in nanoscience. the fabrication of Carbon Nanotubes and Molecular Electronics in Nanotechnology

UNIT- I : INTRODUCTION TO NANOTECHNOLOGY 9

Background to nanotechnology: Types of nanotechnology and Nano machines – periodic table – atomic structure – molecules and phases – energy – molecular and atomic size – surface and dimensional space – top down and bottom up; Molecular Nanotechnology: Electron microscope – scanning electron microscope – atomic force microscope – scanning tunnelling microscope – nano manipulator – nano tweezers – atom manipulation – nano dots – self assembly – dip pen nanolithography. Nanomaterials: preparation– plasma arcing – chemical vapor deposition – sol-gels – electrodeposition – ball milling – applications of nanomaterials;

UNIT – II : FUNDAMENTALS OF NANOELECTRONICS 9

Fundamentals of logic devices:- Requirements – dynamic properties – threshold gates; physical limits to computations; concepts of logic devices:- classifications – two terminal devices – field effect devices – coulomb blockade devices – spintronics – quantum cellular automata – quantum computing – DNA computer; performance of information processing systems;- basic binary operations, measure of performance processing capability of biological neurons – performance estimation for the human brain. Ultimate computation:- power dissipation limit – dissipation in reversible computation – the ultimate computer.

UNIT – III : SILICON MOSFETs& QUANTUM TRANSPORT DEVICES 9

Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFET Devices-scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions & contacts – advanced MOSFET concepts. Quantum transport devices based on resonant tunneling, Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applications:- Single electron devices – applications of single electron devices to logic circuits.

UNIT - IV : CARBON NANOTUBES 9

Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs – Nanotube for memory applications – prospects of all carbon nanotube Nano electronics.

UNIT – V : MOLECULAR ELECTRONICS **9**

Electrodes & contacts – functions – molecular electronic devices – first test systems – simulation and circuit design – fabrication; Future applications: MEMS – robots – random access memory – mass storage devices.

Total Hours : 45

TEXT BOOKS:

1. Michael Wilson, KamaliKannangara, Geoff Smith, Michelle Simmons and BurkhardRaguse, "Nanotechnology: Basic Science and Emerging Technologies", Chapman & Hall / CRC, 2002
2. Rainer Waser (Ed.), "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices", Wiley-VCH, 20032. T.Pradeep, NANO:"The Essentials–Understanding Nanoscience and Nanotechnology", TMH, 2007.

REFERENCES:

1. T.Pradeep, "NANO: The Essentials–Understanding Nanoscience and Nanotechnology", TMH, 2007.

ELECTIVE	NANO MATERIALS	L	T	P	C
		3	0	0	3

AIM :

To introduce the students to the basics of the properties of Nano materials

OBJECTIVES :

- Understanding the importance of Physics in Nano material properties
- To make the students familiar with the properties behavior and applications and Implementation nanotechnology.

OUTCOMES:

At the end of the course, the student will

- Describe the basic science behind the properties of materials at the nanometer scale, and the principles behind advanced experimental and computational techniques for studying nanomaterials.
- Communicate clearly, precisely and effectively using conventional scientific language and mathematical notation.
- Systematically solve scientific problems related specifically to nanotechnological materials using conventional scientific and mathematical notation

UNIT – I: SCIENCE OF NANOMATERIALS 9

Introduction to Nano science and Technology and its advantages – Electronic Structure of Nano particles-Zero dimensional, one-dimensional, two dimensional and three dimensional nanostructures-Mechanical, Electronic, Optical, Magnetic, Thermal and other properties.

UNIT – II : DIFFERENT CLASSES OF NANOMATERIALS 9

Metal and Semiconductor Nano materials, Quantum Dots, Wells and Wires, Molecule to bulk transitions Bucky balls and Carbon Nano tubes.

UNIT – III : SYNTHESIS OF NANO MATERIALS 9

Top-down and Bottom-up approach - Ball milling – Sol-gel method - Vapour phase deposition – PVD, CVD – Molecular Beam Epitaxy - Photolithography, electron beam and X-ray lithography, Wet and dry etching.

UNIT – IV : CHARACTERISATION OF NANO MATERIALS 9

Scanning Electron Microscopy – Transmission Electron Microscopy – Scanning probe microscopy- AFM, STM –X-ray diffraction and Scherrer method, X-ray photoelectron spectroscopy – Secondary Ion Mass Spectrometry – Nano indentation

UNIT - V : CARBON NANOMATERIALS **9**

Graphene, Carbon Nanotubes (CNT) – Types of CNT- Single wall tubes, Multiwall tubes - Properties of CNT (Mechanical, Thermal, Electronic, Magnetic and Superconducting) - Applications of Carbon nanotubes.

Total Hours : 45

TEXT BOOKS:

1. M.S. Ramachandra Rao, Shubra Singh, "Nanoscience and Technology: Fundamentals to Frontiers" Wiley India, 2013.

2. B. Viswanathan, " Nano Materials" Published by Narosa Publishing House Pvt. Ltd., New Delhi, 2014. ISBN 10: 8173199361 / ISBN 13: 9788173199363

3. A. S. Edelstein and R. C. Cammarata, "Nano materials: Synthesis, Properties and Applications" Institute of Physics Pub., 1998.

REFERENCES:

1. Rajendran. V, "Engineering Physics" Tata Mc Graw Hill Publication and Co NewDelhi (2009).

2. B.S, Murthy, B.S., Shankar, P., Raj, B., Rath, B.B., Murday.J, "Textbook of nanoscience and technology", Springer (2013)

3. B. Bhushan (Ed.), "Springer handbook of nanotechnology", Springer (2010).

ELECTIVE	SOFT COMPUTING	L	T	P	C
		3	0	0	3

AIM :

To give an overall understanding on the theories that are available to solve hard real world problems

OBJECTIVES :

- To give the students an overall knowledge of soft computing theories and fundamentals
- To give an understanding on the fundamentals of non-traditional technologies and approaches to solving hard real-world problems
- Fundamentals of artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms.
- Use of ANN, Fuzzy sets to solve hard real-world problems
- To given an overview of Genetic algorithms and machine learning techniques to solving hard real-world problems
- To study about the applications of these areas
- OUTCOMES:
- Understand importance of soft computing.
- Understand different soft computing techniques like Genetic Algorithms, Fuzzy Logic , Neural Networks and their combination.
- Implement algorithms based on soft computing.
- Apply soft computing techniques to solve engineering or real life problems.

UNIT – I : FUZZY SET THEORY **9**

Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT – II : OPTIMIZATION **9**

Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT – III : NEURAL NETWORKS **9**

Supervised Learning Neural Networks – Perceptrons - Adaline – Backpropagation Mutilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning.

UNIT – IV : NEURO FUZZY MODELING **9**

Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT – V : APPLICATIONS OF COMPUTATIONAL INTELLIGENCE **9**

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Total Hours : 45

TEXT BOOKS:

- J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.

REFERENCES :

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
2. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
3. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
4. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.

ELECTIVE	ENGINEERING THERMODYNAMICS	L	T	P	C
		3	0	0	3

Aim	*The aim of the subject is to provide a fundamental knowledge of thermodynamics.*
Objective	5. *To achieve an understanding of fundamentals of thermodynamic systems and first law of thermodynamics.* 6. *To provide an in-depth study of availability and second law of thermodynamics.* 7. *To understand the concept of working fluid and its properties.* 8. *To provide in-depth study of power cycles applying the different working fluids studied in the previous chapter.* 9. *To understand the Thermodynamic Relations and also to understand combustion equations.*
Outcome	*The students would understand the basic fundamentals in thermodynamics and its applications.*

UNIT –I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS 9

Definition of Thermodynamics, macroscopic and microscopic approach, thermodynamic systems and surroundings, thermodynamic properties, thermodynamic equilibrium, state, path, process and cycle, reversible and irreversible processes, work, energy, and heat, state postulate and Zeroth-law of thermodynamics, thermometer and thermometric property, temperature Scales.

Internal energy, First law of thermodynamics, perpetual motion machine of the first kind PMM I, application of first law to non-flow processes or closed system and related problems, application of first law to steady flow process, steady flow energy equation. Problems

UNIT –II SECOND LAW OF THERMODYNAMICS 9

Limitations of First law of thermodynamics, thermal reservoir, heat engine, refrigerator, and heat pump, statements of Second law of thermodynamics, perpetual motion machine of II Kind - PMM II, Carnot cycle, , Carnot theorem, corollary of Carnot's theroem, Clausius inequality. Problems on heat engine ,refrigerator and heat pump. Entropy, Temperature – entropy diagram, entropy changes for a closed system. Problems on entropy change calculations in different processes. Availability and irreversibility , available and unavailable energy, availability in non-flow and steady flow systems. Problems on irreversibility and avaialbility.

UNIT 3 PURE SUBSTANCES AND THERMODYNAMIC RELATIONS 9

Definition of pure substance, phase change of a pure substance, p-T diagram, p-V-T Surface, phase change terminology, property diagram in common use. Formation of steam, sensible heat, latent heat, dryness fraction, enthalpy, superheated steam, thermodynamic properties of steam and steam table, work, internal energy, entropy calculation, Mollier diagram, calorimeters for determination of dryness fraction. Problems determining thermodynamic properties of steam.
Thermodynamic relations : Thermodynamic potentials, thermodynamic gradients, general thermodynamics relations, entropy (Tds) equations, equations for internal energy and enthalpy, equation of state, coefficient of expansion and compressibility, specific heats, Joule Thomson coefficient, Clausius –Claperyon equation, Maxwell's relations.

UNIT 4 : GASES AND VAPOUR MIXTURES 9

Ideal gas, equation of state for a perfect gas, Joules law, internal energy, enthalpy & specific heat capacities of an ideal gas, real gases, Van der waals equation – Amagats experiment , the cooling effect. Law of corresponding states, reduced properties, compressibility chart. Problem on calculation of properties ideal and real gases. Daltons law, Gibbs – Daltons law, volumetric analysis of a gas mixture, apparent molecular weight and gas constant, specific heats of a gas mixture, adiabatic mixing of perfect gases. Problems on gas mixture property values.

UNIT 5: FUELS AND COMBUSTION 9

Characteristics of an ideal fuel, properties of fuel , flash point , fire point, cloud point, pour point, viscosity, combustion reaction and combustion analysis, theoretical air and excess air, stoichiometric air fuel ratio, analysis of combustion products, internal energy and enthalpy of formation, calorific value, determination of calorific value of fuels, Junkers gas calorimeter, Orsat apparatus, exhaust gas analyser, problem on calculation of air fuel ratio.

TOTAL HOURS : 45

TEXTBOOKS :

1. Yunus. A.Cengel et al, Thermodynamics: An Engineering Approach, McGH, 8th Edn, 2015.
2. P.K.Nag, Engineering Thermodynamics, Mc Graw Hill, 5th edition,2013.
3. R.K.Rajput, A text book of Engineering Thermodynamics , Laxmi Publications, 5th Edn, 2016.
4. D.S.Kumar, Engineering Thermodynamics : Principles and Practices, Laxmi Publications, Katsun Books 2012.

ELECTIVE	UNCONVENTIONAL MANUFACTURING PROCESS	L	T	P	C
		3	0	0	3

Aim	The aim of this subject is to appreciate the students with the background, applications and current status of modern manufacturing and to make them understand the relevant basic principles in this field.
Objective	➢ To gain knowledge and understanding of basic concepts of unconventional machining processes ➢ To impart the knowledge and understanding of various mechanical methods ➢ To impart the knowledge and understanding of electrical energy based processes ➢ To impart the knowledge and understanding of chemical and hybrid processes ➢ To impart the knowledge and understanding of thermal energy based processes
Outcome	*The students would be enable to learn the basic difference between traditional manufacturing processes and unconventional manufacturing processes and also the concepts of various unconventional manufacturing processes.*

UNIT – I : INTRODUCTION **6**

Unconventional machining Process – Need – classification – Brief overview–merits –demerits– Applications

UNIT – II :MECHANICAL ENERGY BASED PROCESSES **9**

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. Working Principles & Applications – equipment used – process parameters – MRR - Variation in techniques used.

UNIT – III : ELECTRICAL ENERGY BASED PROCESSES **10**

Electric Discharge Machining - working principle and applications – equipments - process parameters - surface finish and MRR- Power and control circuits–Wire cut EDM – working principle and Applications.

UNIT – IV :CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES **10**

Chemical machining and Electro-Chemical Machining- Electro Chemical Grinding and Electro chemical Honing-working principle and applications-Process Parameters -Surface finish and MRR -Etchants–Maskants.

UNIT - V :THERMAL ENERGY BASED PROCESSES **10**

Laser Beam Machining and drilling, Plasma Arc Machining and Electron Beam Machining Working principles & Applications – Equipment –Types - Beam control techniques.
Micromachining and NanoFabrication Techniques

Total Hours : 45

TEXT BOOK:

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., 2007
2. P.K.Mishra , " Non Conventional Machining "- - The Institution of Engineers (India) Text Books: Series- 1997.

REFERENCES:

1. Benedict. G.F. “Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York (1987).
2. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi (2007).
3. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London (1998).
4. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., New Delhi ,8th Edition,2001.

ELECTIVE	VIBRATION AND NOISE CONTROL	L	T	P	C
		3	0	0	3

Aim	*The aim of the subject is to provide a fundamental knowledge in vibration and noise and the controlling techniques for vibration and noise.*
Objective	• To understand the various types of vibration and analyses. • To understand the basics of Noise and the relevant parameters. • To understand the noise sources relevant to automotives. • To understand the various vibration control techniques. • To understand the various noise control techniques.
Outcome	*The students would be enable to learn the basic concepts of different types of vibration, basics and sources of noise, controlling techniques of vibration and noise.*

.

UNIT – I : BASICS OF VIBRATION **9**

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies-Vibration Analyses.

UNIT - II :BASICS OF NOISE **9**

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT - III : AUTOMOTIVE NOISE SOURCES **9**

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNIT – IV : CONTROL TECHNIQUES **9**

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT - V : SOURCE OF NOISE AND CONTROL **9**

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

Total Hours : 45

TEXT BOOKS:

1. Singiresu S.Rao - “Mechanical Vibrations” - Pearson Education, ISBM –81-297- 0179-0 - 2004.
2. Kewal Pujara “Vibrations and Noise for Engineers”, Dhanpat Rai & Sons, 1992.

REFERENCES:

1. Bernard Challen and Rodica Baranescu - “Diesel Engine Reference Book” – Second edition - SAE International - ISBN 0-7680-0403-9 – 1999.
2. Julian Happian-Smith - “An Introduction to Modern Vehicle Design”- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - “Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.

ELECTIVE	VIRTUAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

AIM

To provide comprehensive knowledge in virtual instrumentation and some of its applications.

OBJECTIVES:

1. Review background information required for studying virtual instrumentation.
2. Study the basic building blocks of DAQ in virtual instrumentation.
3. Study the various techniques of interfacing of external instruments of PC.
4. Study the various graphical programming environments in virtual instrumentation
5. Study a few applications in virtual instrumentation

OUTCOMES:

Student can able to

1) Various techniques of interfacing of external instruments of PC.

UNIT – I : REVIEW OF DIGITAL INSTRUMENTATION 6

Representation of analog signals in the digital domain – Review of quantization in amplitude and time axes, sample and hold, sampling theorem, ADC and DAC.

UNIT - II : FUNDAMENTALS OF VIRTUAL INSTRUMENTATION 10

Concept of virtual instrumentation – PC based data acquisition – Typical on board DAQ card – Resolution and sampling frequency - Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

UNIT – III : CLUSTER OF INSTRUMENTS IN VI SYSTEM 10

Interfacing of external instruments to a PC – RS232, RS 422, RS 485 and USB standards - IEEE 488 standard – ISO-OSI model for serial bus – Introduction to bus protocols of MOD bus and CAN bus.

UNIT – IV : GRAPHICAL PROGRAMMING ENVIRONMENT IN VI 10

Concepts of graphical programming – Lab-view software – Concept of VIs and sub VI - Display types – Digital – Analog – Chart – Oscilloscopic types – Loops – Case and sequence structures - Types of data – Arrays – Formulae nodes –Local and global variables – String and file I/O.

UNIT – V : ANALYSIS TOOLS AND SIMPLE APPLICATIONS IN VI 9

Fourier transform - Power spectrum - Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – P-I-D controller - CRO emulation - Simulation of a simple second order system – Generation of HTML page.

Total Hours = 45

TEXT BOOKS:

1. S. Gupta and J.P Gupta, 'PC Interfacing for Data Acquisition and Process Control', Instrument society of America, 1994.
2. Peter W. Gofton, 'Understanding Serial Communications', Sybex International.
3. Robert H. Bishop, 'Learning with Lab-view', Prentice Hall, 2003.

REFERENCE BOOKS :

- Kevin James, 'PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control', Newness, 2000.
- Gary W. Johnson, Richard Jennings, 'Lab-view Graphical Programming', McGraw Hill Professional Publishing, 2001.

ELECTIVE	VLSI DESIGN	L	T	P	C
		3	0	0	3

Aim

To provide the knowledge on VLSI fabrication and circuit design procedures

Objective

1. To understand the MOS transistor theory, CMOS technologies and the Layout
2. To understand the circuit concepts and scaling of MOS Circuits.
3. To understand the concepts of designing combinational and sequential circuit using CMOS logic configuration
4. To understand the subsystem design of IC's
5. To understand the concepts of CMOS testing

OUTCOMES:

Upon completion of the course, students should

- Explain the basic CMOS circuits and the CMOS process technology.
- Discuss the techniques of chip design using programmable devices.
- Model the digital system using Hardware Description Language

Unit – I: Introduction to MOS Technology **9**

A brief History-MOS transistor, Ideal I-V characteristics, C-V characteristics, Non ideal I-V effects, DC transfer characteristics - CMOS technologies, Layout design Rules, CMOS process enhancements, Technology related CAD issues, Manufacturing issues.

Unit – II: Concepts and Scaling of MOS Circuits **9**

Sheet resistance – Area capacitances of layers – Delay: Inverter Delays – Driving Large Capacitance loads – Propagation Delay – Wiring Capacitances – Choice of Layers – Scaling of MOS Circuits: Scaling models and factors – Scaling factors of device parameters – Limitation of Scaling.

Unit – III: Combinational and Sequential Circuit design **9**

Circuit families –Low power logic design – comparison of circuit families – Sequencing static circuits, circuit design of latches and flip flops, Static sequencing element methodology-sequencing dynamic circuits – synchronizers

Unit – IV: Datapath and Array Subsystems **9**

Addition/ Subtraction – one/Zero Detectors – Comparators – Boolean Logical Operations – Coding – Shifters – Multiplication – Division – Parallel Prefix Computations – SRAM – DRAM – ROM – Serial Access Memory – Programmable Logic Arrays – Array yield, Reliability and Self-test.

Unit – V: Testing **9**

Need for testing- Testers, Text fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test – Design for testability – Boundary scan

Total Hours: 45

TEXT BOOKS:

- Weste and Harris: CMOS VLSI DESIGN (Third edition) Pearson Education, Third edition, 2006.
- D.A Pucknell & K. Eshraghian Basic VLSI Design, Third edition, PHI, 2003

REFERENCE BOOKS:

1. Wayne Wolf, Modern VLSI design, Pearson Education, 3rd edition 2003
2. M. J. S. Smith: Application specific integrated circuits, Pearson Education, 1997
3. J. Bhasker: Verilog HDL primer, BS publication, 2001.

INDUSTRIAL ELECTIVES

ELECTIVE	LEARNING IT ESSENTIALS BY DOING	L	T	P	C
		3	0	0	3

AIM

To learn about the essentials of Information Technology.

OBJECTIVES

- To get an idea about the scripting languages.
- To get an idea about the internet protocols

OUTCOMES:

1. Enabling Knowledge
2. Problem Solving
3. Communication
4. Team Work
5. Responsibility

Unit I:

1. Fundamentals of Computer architecture-introduction-organization of a small computer
2. Central Processing Unit - Execution cycle – Instruction categories – measure of CPU performance Memory – Input/output devices - BUS-addressing modes.
3. System Software – Assemblers – Loaders and linkers – Compilers and interpreters
4. Operating system – introduction – memory management schemes Process management Scheduling – threads.

Unit II:

- Problem solving with algorithms- Programming styles –
- Coding Standards and Best practices - Introduction to C Programming
- Testing and Debugging. Code reviews
- System Development Methodologies – Software development Models
- User interface Design – introduction – The process – Elements of UI design & reports.

Unit III:

- RDBMS- data processing – the database technology – data models
- ER modeling concept –notations – Extended ER features
- Logical database design - normalization
- SQL – DDL statements – DML statements – DCL statements
- Writing Simple queries – SQL Tuning techniques – Embedded SQL - OLTP

Unit IV:

- Objected oriented concepts – object oriented programming
- UML Class Diagrams– relationship – Inheritance – Abstract classes – polymorphism
- Object Oriented Design methodology - Common Base class
- Alice Tool – Application of OOC using Alice tool.

Unit V:

- Client server computing - Internetworking – Computer Networks –
- Working with TCP/IP – IP address – Sub netting – DNS – VPN – proxy servers World Wide Web – Components of web application - browsers and Web Servers
- URL – HTML – HTTP protocol – Web Applications - Application servers – Web Security.

Total Hours : 45

ELECTIVE	BUSINESS INTELLIGENCE AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

Aim:

Business Intelligence (*BI*) is a broad category of software *applications* and technologies used to gather, store, analyse, and access data

OBJECTIVE

This subject enables students to

1. master the basics in business intelligence (BI), data mining (DM), and knowledge discovery in databases;
2. learn the role that software tools/applications play in BI and DM, with emphasis on industrial case studies and practical applications;

Have an overall understanding of the major issues and applications in business intelligence and data mining, including a basic grasp of the algorithm classes and best practices for building successful BI projects

OUTCOMES

Upon completion of the subject, students will be able to

a. examine the concepts of data warehousing and OLAP;
b. apply the concepts of BI and DM techniques for clustering, association, and classification;
c. understand the operation procedures of BI projects in an organization;
d. select appropriate DM tools and methods to manipulate and achieve data;

apply DM concepts for formulating business strategies and programs to enhance business intelligence.

UNIT – I INTRODUCTION TO BUSINESS INTELLIGENCE **9**

Introduction to OLTP AND OLAP – BI Definition and BI Concepts – Business Applications of BI - BI Framework- Role of Data Warehousing in BI –BI Infrastructure Components- BI Process – Developing Data Warehouse – Management Framework – Business driven approach –BI Technology — BI Roles & Responsibilities

UNIT - II BASICS OF DATA INTEGRATION (Extraction Transformation Loading) **9**

Concepts of Data Integration need and advantages of using Data Integration – Introduction to common data integration approaches – Introduction to ETL using SSIS – Introduction to Data Quality – Data Profiling Concepts and Applications.

UNIT - III INTRODUCTION TO MULTIDIMENSIONAL DATA MODELING **9**

Introduction to Data and Dimensional Modeling – Multi Dimensional Data Model – ER modeling Vs Multi Dimensional Model – Concepts of Dimensions - facts - cubes- attributes- hierarchies- star and snowflake schema – Introduction to Business Metrics and KPIs – Creating Cubes using SSAS.

UNIT - IV BASICS OF ENTERPRISE REPORTING **9**

Introduction to Enterprise Reporting - Concepts of dashboards - balanced scorecards – Introduction to SSRS Architecture– Enterprise Reporting using SSRS reporting service

UNIT - V BI ROAD AHEAD **9**

BI and Mobility – BI and cloud computing – BI for ERP systems - Benefits of BI in ERP- NorthWind_Traders Data-Data Analyses through Excel-Kettle Tool – Conversion of data using Kettle Tool.

Total Hours : 45

TEXT BOOKS

1. RN Prasad, Seema Acharya, "Fundamentals Of Business Analytics" Wiley India,2011

REFERENCE BOOKS

1. Soumendra Mohanty, "Data Warehousing Design, Development and Best Practices", Tata McGraw-Hill, New Delhi, 2007
2. David Loshin, "Business Intelligence", Morgan Kaufmann Publishsers, San Francisco, Fifth edition, 2007
3. Larissa Terpeluk Moss and Shaku Atre, "Business Intelligence Roadmap", Pearson Education, 2007