SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

Kuniamuthur, Coimbatore-641 008

UG
Mechatronics Engineering

Autonomous Syllabus

Revised as on 09.05.2013

Regulation 2011

Sl.No	Code	Course	Hours/week			Credits	Maximum Marks		
			L	T	P		IA	FE	Total
Semester :I		**THEORY**							
1	11USL101	Communication Skills-I	3	0	1	3	40	60	100
2	11USM101	Engineering Mathematics- I	3	1	0	4	40	60	100
3	11USP101	Physics for Mechanical Science	3	0	0	3	40	60	100
4	11USC101	Chemistry for Mechanical Science	3	0	0	3	40	60	100
5	11UAK101	Engineering Mechanics	3	1	0	4	40	60	100
6	11UAK102	Engineering Drawing	2	0	2	3	40	60	100
7	11UEK101	History of Mechatronics Engineering	1	0	0	1	100	-	100
		PRACTICAL							
1	11USH111	Physical Science Laboratory –I	0	0	3	1	40	60	100
2	11UCK104	Computing Practices Laboratory	2	0	2	3	40	60	100
3	11UAK104	Engineering Practices Laboratory	0	0	3	2	40	60	100
		Total	**20**	**2**	**11**	**27**	**460**	**540**	**1000**

Sl.No	Code	Course	Hours/week			Credits	Maximum Marks		
			L	T	P		IA	FE	Total
Semester : II		**THEORY**							
1	11USL201	Communication Skills –II	3	0	1	3	40	60	100
2	11USM201	Engineering Mathematics -II	3	1	0	4	40	60	100
3	11USC201	Environmental Science And Engineering	3	0	0	3	40	60	100
4	11UCK204	C Programming	3	0	0	3	40	60	100
5	11USP201	Material Science	3	0	0	3	40	60	100
6	11UEK252	Basics of Electrical Circuits and Electron Devices	3	0	0	3	40	60	100
		PRACTICAL							
1	11USH211	Physical Science Laboratory – II	0	0	3	1	40	60	100
2	11UCK200	C Programming Laboratory	0	0	3	2	40	60	100
3	11UAK204	Computer Aided Drafting and Modeling Laboratory	1	0	3	3	40	60	100
		Total	**19**	**1**	**10**	**25**	**360**	**540**	**900**

NOTE: L-LECTURE T-TUTORIALS P-PRACTICALS IA-Internal Assessment FE-Final Exam

Sl.No	Code	Course	Hours/week			Credits	Maximum Marks		
			L	T	P		IA	FE	Total
Semester :III		**THEORY**							
1	11USM302	Transforms and Partial Differential Equations	3	1	0	4	40	60	100
2	11UEK302	Strength of Materials	3	1	0	4	40	60	100
3	11UEK352	Electrical Engineering	3	0	0	3	40	60	100
4	11UCK304	Object Oriented Programming	3	0	2	4	40	60	100
5	11UEK353	Linear and Digital ICs	3	0	0	3	40	60	100
6	11UEK303	Manufacturing Technology	3	0	0	3	40	60	100
PRACTICAL									
1	11UEK304	Manufacturing Technology Laboratory	0	0	3	2	40	60	100
2	11UEK354	Electrical and Electronics Laboratory	0	0	3	2	40	60	100
3	11UEK305	Computer Aided Machine Drawing Laboratory	0	0	3	2	40	60	100
		Total	**18**	**2**	**11**	**27**	**360**	**540**	**900**

Sl.No	Code	Course	Hours/week			Credits	Maximum Marks		
			L	T	P		IA	FE	Total
Semester : IV		**THEORY**							
1	11USM403	Statistics and Numerical Methods	3	1	0	4	40	60	100
2	11UEK411	Theory of Machines	3	1	0	4	40	60	100
3	11UEK412	Thermo fluid Engineering	3	1	0	4	40	60	100
4	11UEK455	Control Systems	3	1	0	4	40	60	100
5	11UEK408	Engineering Metrology	3	0	0	3	40	60	100
6	11UEK458	Microprocessor and Microcontroller	3	0	0	3	40	60	100
PRACTICAL									
1	11UEK409	Theory of Machines Laboratory	0	0	3	2	40	60	100
2	11UEK410	Thermo fluid Laboratory	0	0	3	2	40	60	100
3	11UEK457	Microprocessor and Microcontroller Laboratory	0	0	3	2	40	60	100
		Total	**18**	**4**	**9**	**28**	**360**	**540**	**900**

NOTE: L-LECTURE T-TUTORIALS P-PRACTICALS IA-Internal Assessment FE-Final Exam

Sl. No	Code	Course	Hours/week			Credits	Maximum Marks		
			L	T	P		IA	FE	Total
Semester :V		**THEORY**							
1	11UEK511	Machine Design for Mechatronics	3	1	0	4	40	60	100
2	11UEK512	Hydraulics and Pneumatics	3	0	0	3	40	60	100
3	11UEK524	Mechanical measurements and instrumentation	3	0	0	3	40	60	100
4	11UEK559	Signals and Systems	3	0	0	3	40	60	100
5	11UEK560	Power Electronics	3	0	0	3	40	60	100
6		Elective I	3	0	0	3	40	60	100
PRACTICAL									
1	11UEK513	Hydraulics and Pneumatics Laboratory	0	0	3	2	40	60	100
2	11UEK561	Power Electronics Laboratory	0	0	3	2	40	60	100
3	11UEK562	Mechanical Measurements and Instrumentation Laboratory	0	0	3	2	40	60	100
		Total	**18**	**1**	**9**	**25**	**360**	**540**	**900**

Sl. No	Code	Course	Hours/week			Credits	Maximum Marks		
			L	T	P		IA	FE	Total
Semester :VI		**THEORY**							
1	11UEK614	Modeling and Simulation in Engineering	3	1	0	4	40	60	100
2	11UEK663	Digital Signal Processing	3	1	0	4	40	60	100
3	11UEK615	Automated Manufacturing Systems	3	0	0	3	40	60	100
4	11UEK664	Virtual Instrumentation	3	0	0	3	40	60	100
5	11UEK616	Total Quality Management	3	0	0	3	40	60	100
6		Elective II	3	0	0	3	40	60	100
PRACTICAL									
1	11UEK617	Automation and Simulation Laboratory	0	0	3	2	40	60	100
2	11UEK665	Virtual Instrumentation Laboratory	0	0	3	2	40	60	100
3	11UEK666	Digital Signal Processing Laboratory	0	0	3	2	40	60	100
		Total	**18**	**2**	**10**	**26**	**360**	**540**	**900**

NOTE: L-LECTURE T-TUTORIALS P-PRACTICALS IA-Internal Assessment FE-Final Exam

Sl. No	Code	Course	Hours/week			Credits	Maximum Marks		
			L	T	P		IA	FE	Total
Semester :VII		**THEORY**							
1	11UEK718	CAD/ CAM / CIM	4	0	0	4	40	60	100
2	11UAK704	Industrial Psychology and Work Ethics	2	0	0	2	100	-	100
3	11UEK719	Robotics and Machine Vision System	3	0	0	3	40	60	100
4	11UEK767	Embedded Systems	3	0	0	3	40	60	100
5		Elective III	3	0	0	3	40	60	100
6		Elective IV	3	0	0	3	40	60	100
PRACTICAL									
1	11UEK720	CAE Laboratory	0	0	3	2	40	60	100
2	11UEK721	Robotics Laboratory	0	0	3	2	40	60	100
3	11UEK799	Project phase I	0	0	6	4	40	60	100
		Total	**17**	**0**	**12**	**26**	**420**	**480**	**900**

Sl. No	Code	Course	Hours/week			Credits	Maximum Marks		
			L	T	P		IA	FE	Total
Semester :VIII		**THEORY**							
1	11UEK823	Mechatronics Engineering Applications	3	0	0	3	40	60	100
2		Elective V	3	0	0	3	40	60	100
3		Elective VI	3	0	0	3	40	60	100
PRACTICAL									
1	11UEK899	Project phase II	0	0	18	12	40	60	100
		Total	**9**	**0**	**18**	**21**	**160**	**240**	**400**

NOTE: L-LECTURE T-TUTORIALS P-PRACTICALS IA-Internal Assessment FE-Final Exam

ELECTIVES:

Sl. No	Code	Course	Hours/week			Credits	Maximum Marks		
			L	T	P		IA	FE	Total
Semester :V									
1	11UEE551	Electronic circuits	3	0	0	3	40	60	100
2	11UEE552	Advanced Control Theory	3	0	0	3	40	60	100
3	11UEE501	Advanced Manufacturing Processes	3	0	0	3	40	60	100
4	11UEE502	Operations Research	3	0	0	3	40	60	100
5	11UEE591	Data Structures	3	0	0	3	40	60	100
Semester :VI									
1	11UEE653	Microprocessor based system design	3	0	0	3	40	60	100
2	11UEE654	Advanced Sensor Technology	3	0	0	3	40	60	100
3	11UEE603	Product Design and Development	3	0	0	3	40	60	100
4	11UEE604	Design for Manufacturing and Assembly	3	0	0	3	40	60	100
Semester :VII									
1	11UEE755	Advanced Digital System Design	3	0	0	3	40	60	100
2	11UEE756	Digital Image Processing	3	0	0	3	40	60	100
3	11UEE757	Electrical Drives and Control	3	0	0	3	40	60	100
4	11UEE705	Automotive Technology	3	0	0	3	40	60	100
5	11UEE706	MEMS and NEMS	3	0	0	3	40	60	100
6	11UEE707	Sociology and Global Issues	3	0	0	3	40	60	100
7	11UAK702	Finite Element Analysis							
Semester :VIII									
1	11UEE858	Communication Protocols	3	0	0	3	40	60	100
2	11UEE859	Soft Computing	3	0	0	3	40	60	100
3	11UEE860	HCI and HMI	3	0	0	3	40	60	100
4	11UEE808	Flexible Manufacturing Systems	3	0	0	3	40	60	100
5	11UEE809	Rapid Prototyping and Tooling	3	0	0	3	40	60	100
6	11UEE810	Entrepreneurship Development	3	0	0	3	40	60	100

NOTE: L-LECTURE T-TUTORIALS P-PRACTICALS IA-Internal Assessment FE-Final Exam

COMMUNICATION SKILLS I

	L	T	P	C
11USL101	**3**	**0**	**1**	**3**

Course Objectives

To improve the language proficiency of the students in English with emphasis on LSRW skills and equip them to study academic subjects with greater facility with theoretical and practical components of the English syllabus.

UNIT I - LISTENING SKILLS **9**

Listening for general content - Listening to fill up information - Intensive listening

Listening for specific purpose

UNIT II - SPEAKING SKILLS **9**

Introducing oneself in various situations - Describing objects, situation and people

Asking questions - Narrating incidents - Just a minute sessions - Day to Day Conversations - Debates

UNIT III - READING SKILLS **9**

Skimming the text - Understanding the gist of an argument - Inferring lexical and contextual meaning - Understanding discourse features - Recognizing coherence/ sequencing of sentences.

UNIT IV - WRITING SKILLS **9**

Paragraph writing - Extended Definition – Transcoding -Formal and informal letter

Note making - Editing a passage- itinerary- instructions.

UNIT V - LANGUAGE FOCUS **9**

Articles – Parts of speech – Tenses – Voice - Gerunds and infinitives – concord- modal verbs- definitions-‘ wh’ questions- comparative adjectives- Conditionals - Nominal compounds - Word formation – Prefixes and Suffixes/ one form to another form - Synonyms and Antonyms

Total hours: 45

TEXT BOOKS

1. Department of Humanities and Social Sciences, Anna University ‘English for Engineers and Technologists’, Combined Edition Volume I and II, Chennai: Orient Longman Private Limited, 2006.
2. Murphy, “Murphy’s English Grammar”, Cambridge University Press.

REFERENCES

1. Bhaskaran and Horsburgh, “Strengthen Your English”, , Oxford University Press.
2. Francis Soundararaj, “Speaking and Writing for Effective Business Communication”, MacMillan, India Ltd., 2007.
3. Robert J. Dixon, ‘Everyday Dialogues in English’, Prentice-Hall of India Ltd., 2006.
4. John Seely, ‘The Oxford Guide to Writing and Speaking’, Oxford.

ENGINEERING MATHEMATICS I

(Common to all branches**)**

	L	T	P	C
11USM101	**3**	**1**	**0**	**4**

OBJECTIVE – To provide strong foundation to the students to expose various emerging new areas of applied mathematics and appraise them with their relevance in Engineering and Technological field.

PREREQUISITE:

(i) Matrices – rank of matrix, Linear dependence and linear independence

(ii) Differential Calculus – Differentiation of Implicit functions, parametric functions

(iii) Ordinary Differential equations – Basic terminologies like definition, formation, meaning of solution, variable and separable method, linear differential equations.

UNIT I– LINEAR ALGEBRA **9**

Euclidean n-space – Vector spaces – Subspaces – Linear combinations – Linear dependence and independences – Basis and dimensions – Applications to matrices: Rank of a matrix, Inner product spaces – Example of inner product spaces – Cauchy-Schwarz inequality– Orthonormal bases – Gram Schmidtt process.

UNIT II – MATRICES **9**

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation

UNIT III – APPLICATIONS OF DIFFERENTIAL CALCULUS **9**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes.

UNIT IV – FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrangian multipliers.

UNIT V – ORDINARY DIFFERENTIAL EQUATIONS **9**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients – Applications to Engineering problems.

Total hours: 45 + 15

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2006.

2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).

2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).

3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

PHYSICS FOR MECHANICAL SCIENCE

11USP101

L	T	P	C
3	0	0	3

OBJECTIVE

To provide strong foundation to the students to expose various emerging areas of Applied Physics and appraise them with their relevance in Engineering and technological field.

UNIT I: LASER TECHNOLOGY AND FIBER OPTICS 9

Introduction, Principle – Spontaneous emission, Stimulated emission, Population Inversion, Pumping mechanisms - Types of Laser – He-Ne Laser, CO_2 , Semiconductor Laser. Applications – Lasers in Microelectronics, Drilling, Welding, Heat Treatment, Cutting and Holography. Principle, Modes of Propagation, Fabrication Techniques – Rod & Tube method, Crucible-Crucible Technique - Classification based on Materials, Refractive Index Profile and Modes. Splicing, Losses in Optical fiber. Light Sources for fiber Optics. Detectors, Fiber Optical Communication links.

UNIT II: QUANTUM PHYSICS AND MICROSCOPY 9

Development of quantum theory, Dual Nature of Matter and Radiation – de-Broglie wavelength, Uncertainty Principle, Schrodinger equation – Time dependent, Time independent. Particle in a box. Limitation of Optical Microscopy, Electron Microscopy, Transmission Electron Microscope, Scanning Transmission Electron Microscope and Application

UNIT III: HEAT AND THERMODYNAMICS 9

Thermal conductivity – Forbe's and Lees disc methods. Radial flow of heat. Thermal conductivity of rubber and glass. Laws of thermodynamics. Concepts of entropy. Carnot cycle as heat engine and refrigerator, carnot theorem, ideal Otto and diesel engines.

UNIT IV: THERMAL PROPERTIES 9

Introduction – Coefficient of thermal expansion, heat capacity, thermal conduction mechanisms, thermal stresses. Applications – bimetallic strip, thermal insulations, thermal shock resistance, tempered glass, ceramic – to – metal joints, cryogenic materials.

UNIT V: VACUUM TECHNOLOGY 9

Introduction – Concept of Vacuum – Throughput – Pumping speed – pumping speed, effective pumping, speed and conductance - Types of Pumps – working principle and construction of rotary pump, Diffusion pump – operation of pressure gauges – pressure range, Measurement of Vacuum using Pirani Gauge & Penning Gauges, merits and limitations. Working of a vacuum system applications and scope

TOTAL HOURS:45

TEXT BOOKS

1. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.
2. Rao V.V., Ghosh T.B and Chopra K.L, " Vacuum Science and Technology", Allied Publishers limited, New Delhi, 1998.

REFERENCES

1. William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2007
2. Jayakumar, S "Materials Science", RK Publishers, Coimbatore 2006.
3. Richard Wolfson, "Essential University Physics", Pearson Education ,Volume I & II

CHEMISTRY FOR MECHANICAL SCIENCE

	L	T	P	C
11USC101	**3**	**0**	**0**	**3**

Objective

To provide strong foundation to the students to expose various emerging new areas of applied chemistry and appraise them with their relevance in Engineering and technological field.

UNIT I - CHEMISTRY IN EVERYDAY LIFE 9

Applications of Chemistry in health and hygiene – Chemicals in medicines – analgesics, antiseptics, antacids, disinfectants – Chemicals in food preservatives – artificial sweetening agents –Water quality parameter and standards -types of hardness – estimation by EDTA method-characteristic of portable water –domestic water treatment –disinfection methods-Chlorination – UV treatment – Ozonation –desalination –reverse osmosis.

UNIT II- FUELS AND COMBUSTION 9

Classification of fuels – calorific value – characteristics of good fuel- Theoretical calculation of calorific value – solid fuels – coal – classification of coal by rank- analysis of coal- metallurgical coke – types of carbonization- manufacture of metallurgical coke – liquid fuel – petroleum – refining of petroleum –manufacture of synthetic petrol- knocking- octane number and cetane number- gaseous fuel- water gas- LPG- producer gas-CNG .

UNIT III - ELECTROCHEMISTRY AND CORROSION SCIENCE 9

Electrochemical cells - single electrode potential –Measurement of emf - Reference electrode- standard hydrogen electrode- Calomel electrode - glass electrode and measurement of pH- Corrosion – chemical corrosion- electrochemical corrosion- galvanic corrosion – differential corrosion- Protective coatings –Electroplating of gold - Electroless plating- anodizing- Electrochemical machining of metals and alloys.

UNIT IV - POLYMERS AND COMPOSITES 9

Introduction- classification of Polymers- polymerisation types –thermo plastic and thermosetting –free radical mechanism polymerization -Engineering plastics – classification – compounding of plastics- moulding methods- injection-compression-extrusion and blow moulding- Rubber – vulcanization of rubber- Synthetic rubber (Butyl rubber and SBR)-Composites – definition – types- polymer composites – metal composites – ceramic composites- fibre reinforcing materials.

UNIT V - ENGINEERING MATERIALS 9

Introduction Refractories – classification– Properties – (Refractoriness, RUL, dimensional stability, Porosity, thermal spalling) –Abrasive –classification –natural and synthetic abrasive –silicon carbide and boron carbide – Lubricants – mechanism of lubrication – liquid lubricants – properties – Viscosity Index, flash and fire points – cloud and pour points – oiliness – Solid lubricants – graphite , Molybdenum disulphide.

TOTAL HOURS: 45

TEXT BOOKS

1. Jain P.C & Monika Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Co Ltd, New Delhi.
2. Dr. Dara S.S & Dr. Umare S.S, “Engineering Chemistry”, S .Chand & Company Ltd, New Delhi.

REFERENCES

1. Steven S. Zumdahl and Susan A. Zumdahl “Chemistry” Houghton Mifflin Seventh Edition 2009
2. Dr.Sivakumar R and Dr Sivakumar N, “Engineering Chemistry”,Tata McGraw-Hill Publishing Company, New Delhi, 2009.
3 Dr. Ramachandran T, Dr Venkataraman H, Dr. Magudeswaran P N, “Chemistry for Engineers”, Vijay Nicole imprints Private Limited, Chennai.

ENGINEERING MECHANICS

L	T	P	C
3	1	0	4

11UAK101

COURSE OBJECTIVES

Upon completion of this subject students should be able to:

- *Analyse the static equilibrium of systems of forces in two and three dimensions*
- *Determine the forces experienced by components of common engineering structures such as simple frames and beams*
- *Describe and analyse the motion of particles along with forces and the application of impulse-momentum and work-energy principles in simple mechanical systems.*

Basics: Units and Dimensions, Law of Mechanics, Vectorial representation forces and moments , Vector Operations - Addition, subtraction, dot product, cross product

UNIT I - STATICS OF PARTICLES **9**

Coplanar forces, Resolution and composition of forces, Equilibrium of a particle, Forces in space, Equilibrium of particle in space, Application to simple problems.

UNIT II - STATICS OF RIGID BODIES **9**

Rigid Bodies:

Moment of a force about a point, resultant of coplanar non concurrent force systems, Free body Diagram - Types of supports and reactions, Equilibrium of rigid bodies in two dimensions, problems in beams and simple frames only.

Friction:

Types of friction - Laws of Coulomb Friction, simple problems, ladder friction, screw and belt friction

UNIT III - PROPERTIES OF SURFACES AND SOLIDS **9**

Determination of centroid and centre of gravity of composite sections and solid objects. Area moment of inertia, parallel axis and perpendicular axis theorems, polar moment of inertia, problems on composite sections (comprises rectangle, triangle, circle and semi circle only), Introduction to mass moment of Inertia - thin rectangular plate.

UNIT IV - KINEMATICS OF PARTICLES **9**

Rectilinear motion of particles, Displacement, velocity , acceleration and their relationship, Relative motion, Curvilinear motion – Rectangular, Tangential and Normal components of acceleration, Problems in projectile motion and curved paths.

UNIT V- KINETICS OF PARTICLES **9**

Newton's second Law , D Alembert's principle, Dynamic equilibrium , Work Energy equation of particles, Principles of impulse and momentum, application to simple problems.Collision of Elastic bodies – Direct central impact.

L = 45 T = 15 TOTAL HOURS: 60

TEXT BOOKS

1. S.Rajasekaran, G. Sankarasubramanian, "Fundamentals of Engineering Mechanics", Vikas Publishing House pvt. Ltd., New Delhi.

2. M.S. Palanichamy, S. Nagan, "Engineering Mechanics – Statics and Dynamics", Tata McGraw Hill publishing Company, New Delhi, 2008.

REFERENCES

1. Dr. N. Kottiswaran, "Engineering Mechanics – Statics and Dynamics", Sri Balaji Publication, Erode - 638003

2. Beer F.P and Johnson E.R., "Vector Mechanics for Engineers – Statics and Dynamics", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2001.

3. R.C. Hibbeler, "Engineering Mechanics" , Pearson education Asia Pvt. Ltd.

ENGINEERING DRAWING

11UAK 102

L	T	P	C
1	0	3	3

COURSE OBJECTIVES

To develop in students the technical drafting skills of the engineering drawing concepts, ideas and design of engineering products using drafting instruments and expose them to existing technical drawings standards.

Concepts and conventions (not for examination) **1**

Use of drafting instruments – Size, layout and folding of drawing sheets – Lettering and dimensioning

UNIT – I CURVES USED IN ENGINEERING PRACTICES **9**

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, epicycloids and hypocycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT – II PROJECTION OF POINTS AND SRAIGHT LINES **9**

General principles of orthographic projection - First angle projection – layout views - free hand sketching of multiple views from pictorial views of objects

Projection of points - Projection of straight lines – Parallel and inclined to both planes.

UNIT – IIII PROJECTION OF SOLIDS **9**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis to the solids is perpendicular and inclined to one plane by change of position method.

UNIT – IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **9**

Sectioning of simple solids with their axes in vertical position by cutting planes inclined to one reference plane and perpendicular to the other – True shape of section.

Need for development of surfaces - Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.

UNIT – V ISOMETRIC AND PERSPECTIVE PROJECTIONS **9**

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

Concepts of perspective projection of prisms, pyramids and cylinders by visual ray method (2 mark questions only)

L = 15 P = 45 TOTAL HOURS: 60

TEXT BOOKS:

1. K.Venugopal, V. Prabu Raja, "Engineering Graphics", New Age International Publishers, 2010
2. K.V. Natarajan, "A textbook of Engineering Graphics" , Dhanlaksmi publishers, Chennai, 2006

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. K. R. Gopalakrishnana, "Engineering Drawing" (Vol. I & II), Subhas Publications, 1998.
3 Shah, M.B., and Rana, B.C., "Engineering Drawing", Pearson Education, 2005

HISTORY OF MECHATRONICS ENGINEERING

11UEK101 **L T P C**

1 0 0 1

Study on evolution of:

- Mechanical Systems.
- Electrical and Electronic Systems.
- Sensors and Transducers.
- Computer Technology
- Synergy of different branches of Engineering leading to Mechatronics Engineering

PHYSICAL SCIENCE LABORATORY I

11USH111

L	T	P	C
0	0	3	1

AIM

To provide exposure to the students with hands-on experience on scientific equipments

PHYSICS LABORATORY I

1. a) Particle size determination using diode laser.
   b) Determination of laser parameters – Wavelength and angle of divergence
   c) Determination of acceptance angle in an optical fiber.
2. Determination of Band gap of a Semi conducting material.
3. Characteristics of LDR
4. Determination of thermal conductivity of a bad conductor – Lee's disc method.
5. Determination of Hysteresis Loss of a Ferro-magnetic material.
6. Determination of Young's modulus of the material – Non uniform bending.

DEMONSTRATION:

1. Optical phenomena using Laser.

CHEMISTRY LABORATORY-I

1. Determination of pH of strong acid by pH metry
2. Conductometric titration of strong acid with strong base.
3. Estimation of HCl and CH_3COOH by Conductometric titration.
4. Potentiometric titration of Ferrous ion using Potassium dichromate.
5. Determination of Electrode Potential of an electrode.
6. Estimation of Iron by Spectrophotometry**.**

COMPUTING PRACTICES LABORATORY

(Common to All)

11UCK104

L	T	P	C
2	0	2	3

COURSE OBJECTIVES

- *To enable the students to create technical reports, spread sheets and presentations*

A) WORD PROCESSING

- Document creation, Text manipulation with Scientific notations.
- Table creation, Table formatting and Conversion.
- Mail merge and Letter preparation.
- Drawing - flow Chart

B) SPREAD SHEET

- Chart - Line, XY, Bar and Pie.
- Formula - formula editor.
- Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
- Sorting and Import / Export features.

C) PRESENTATION

- Creating a Demo Presentation (Getting Started)
- Enhancing the slides (Changing the slide background, apply design templates to a presentation, Format the text in the slides, Modify the layout of a slide)
- Inserting Objects into a slide (Inserting Graph, Organizational Chart, Word Art, Clip Art)
- Using Autoshapes to create a drawing, Group and Ungroup Objects, Emboss Objects)
- Enhancing (Apply Build Effects, Animation Effects, Transition Effects, Specify a Time period for transition and build effects, Rehearse slide timings)
- Add Action Items and minutes of the meeting during the slide show
- Modify the slide setup to match presentation requirements, Preview slides in grey Scale, Print Slides, notes pages, outline and handouts

Total Hours: 30

REFERENCE

- University of California http://www.universityofcalifornia.edu
- University of Michigan http://www.umich.edu/
- University of Texas http://www.utexas.edu
- IIT Bombay http://www.cse.iitb.ac.in
- IISc Bangalore www.**iisc**.ernet.in
- University of Cambridge http://www.cam.ac.uk/

ENGINEERING PRACTICES LABORATORY

	L	T	P	C
11UAK205	**0**	**0**	**3**	**2**

COURSE OBJECTIVES

- *To provide fundamental knowledge and hands on experience to the students on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.*

GROUP A (MECHANICAL & CIVIL)

MECHANICAL ENGINEERING PRACTICE

Sheet Metal: Study of tools, equipments and safety precautions, Different types of joints - knocked up, double grooving joints, Model making –Tray and Funnel.

Welding: Arc welding practice - butt joint, lap joints and tee joints, Demonstration of gas welding.

CIVIL ENGINEERING PRACTICE

Plumbing: Preparation of plumbing line sketches for (i) water supply lines (ii) sewage lines, Cutting and threading of PVC pipes**,** Basic pipe connection using valves, taps, couplings, unions, reducers, elbows in household fitting.

Wood Work: Sawing, planing, making common joints like T joint, dovetail joint, etc. using power tools, Study of joints in door panels and wooden furniture.

Basic Construction Tools: Demonstration of power tools like rotary hammer, demolition hammer, hand drilling machine, etc.

GROUP B (ELECTRICAL & ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICE

Safety aspects of electrical wiring, Basic household wiring using switches, fuse, indicator-lamp, etc., Preparation of wiring diagrams, Stair case light wiring, Fluorescent lamp wiring, Measurement of electrical quantities – voltage, current, power and energy, Study of iron-box, fan with regulator, Measurement of resistance to earth of an electrical equipment.

ELECTRONICS ENGINEERING PRACTICE

Study of electronic components and equipments, Resistor color coding, Soldering simple electronic circuits and checking continuity, Assembling electronic components on a small PCB and testing, Study of telephone, FM radio, low-voltage power supplies, Emergency lamp, UPS.

Examination Pattern: The Examination is to be conducted for both groups A & B, allotting 1½ for each group. **Total Hours: :45**

COMMUNICATION SKILLS II

	L	T	P	C
11USL201	**3**	**0**	**1**	**3**

COURSE OBJECTIVES

To make students confident to express themselves fluently and appropriately in social and professional contexts and enhance their written communication in business context

UNIT I - BASIC COMMUNICATION THEORY **9**

Importance of communication -Stages of communication - Modes of communication - Barriers to Communication - Difference between Verbal and Non Verbal communication - Body Language - Psychological and cultural influence on communication

UNIT II - LISTENING AND ANALYSIS **9**

Listening to technical and Non technical material - Intensive listening - Note taking - Cloze Listening - Listening and interpreting the missing texts - Listening to lectures and speeches -Listening to discussions and explanations - Telephonic listening

UNIT III - BUSINESS CORRESPONDENCE **9**

Report writing - Recommendations - Memoranda – Notice - Minutes of meeting

- Letters and Emails (pertaining to business situations) - Resume and Job applications- advertisements- checklists- technical essays.

UNIT IV - ORAL COMMUNICATION **9**

Basics of Phonetics - Presentation Skills - Role-plays - Group Discussions - Short Extempore - Debates - Conversation Practices

UNIT V - LANGUAGE FOCUS **9**

Introduction to technical writing - spelling - Error detection – cause and effect- structures expressing purposes- prepositions- sequencing of words- Punctuation - Idioms and phrases - American and British Words - One word Substitutes (Technical) - Foreign Phrases

Total Hours: 45

TEXT BOOKS:

1. Asraf M Rizvi, “Effective Technical Communication” Tata McGraw.2005
2. Department of Humanities and Social Sciences, Anna University ‘English for Engineers and Technologists’, Combined Edition Volume I and II, Chennai: Orient Longman Private Limited, 2006.

ENGINEERING MATHEMATICS II

(Common to all branches**)**

	L	T	P	C
11USM201	**3**	**1**	**0**	**4**

OBJECTIVE – To provide strong foundation to the students to expose various emerging new areas of applied mathematics and appraise them with their relevance in Engineering and Technological field.

PREREQUISITE:

i) Three dimensional analytical geometry – Direction cosines and Direction ratios, equation of straight line and plane.
ii)Integration – Evaluation of single integrals – Definite integrals and its properties.
iii)Vector algebra – position vector – Dot and Cross product – Properties.
iv)Definition – examples – Modulus and amplitude form – Demovire's theorem – properties of complexvariable.

UNIT I – THREE DIMENSIONAL ANALYTICAL GEOMETRY (9)

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone –Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT II – INTEGRAL CALCULUS (9)

Double integration – Cartesian and polar coordinates – Change of order of Integration – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral –Beta and Gamma integrals – Properties – Simple problems.

UNIT III –VECTORCALCULUS (9)

Gradient **–** Divergence and Curl **–** Directional derivative **–** Irrotational and Solenoidal vector fields **–** Vector integration: Green's theorem in a plane **–** Gauss divergence theorem **–** stokes' theorem(excluding proofs) **–** Simple applications involving cubes and rectangular parallelepiped**.**

UNIT IV – COMPLEX VARIABLES (9)

Functions of a complex variable **–** Analytic functions **–** Necessary conditions and Sufficient conditions(excluding proofs) **–** Cauchy - Riemann equation **–** Harmonic and orthogonal properties of analytic function **–** Harmonic conjugate **–** Construction of analytic functions **–**

Conformal mapping: w = c+z, w = cz, w = 1/z and Bilinear Transformation.

UNIT V – COMPLEX INTEGRATION (9)

Complex integration **–** Statement and applications of Cauchy's integral theorem and Cauchy's integral formula **–** Cauchy's and Jordan's Lemma(statement only) **–** Classification of singularities **–** Calculus of residues **–** Residue theorem **–** Application of residue theorem to evaluate real integrals along unit circle and semi-circle.

Total hours: 45 + 15

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2006.

2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.

2. Glyn James, "Advanced Engineering Mathematics", 3rd Edition, Wiley India, 2007.

3. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., 2007.

4. George, B Thomas J.R. and Ross L. Finney, "Calculus and Analytical Geometry", 10th Edition, Addison Wesley, 2000.

ENVIRONMENTAL SCIENCE AND ENGINEERING

11USC201

L	T	P	C
3	0	0	3

OBJECTIVE:

- To learn the basic and create awareness of environment and ecology. To know about the role of an individual in preserving the natural resources and about the various legislations, acts and NGO's that aims to control pollution

UNIT – 1 ENVIRONMENT & ECOSYSTEM 9

Introduction – Components of the environment – People, society and environment – Need for public awareness – Scope and importance – Environmental problems and sustainable development. Ecosystem – Concept – Ecosystem degradation – Structure and functions of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Water cycle – Carbon cycle – Oxygen cycle – Nitrogen cycle – Energy cycle – Food chain – Food web – Ecological pyramid – Types of ecosystem – Forest – Grassland – Desert – Aquatic ecosystem- Case Studies in current scenario.

UNIT – 2 BIODIVERSITY & NATURAL RESOURCES 9

Biodiversity – Introduction – Ecosystem, Species & Genetic diversity – Biogeographical classification of India – Value of biodiversity – Hotspots of biodiversity – Threats to biodiversity – Conservation of biodiversity. Resources – Introduction – Renewable & Non-renewable resources – Forest resource – deforestation – timber extraction – Water resources – Flood – Drought – Dam – Conflict over water – Food resource – Changes & effects by modern agricultural practices – Overgrazing – Land resource – landslide – Biomass – Some non-renewable sources – Mineral resources – Alternate energy sources- Case Studies in current scenario.

UNIT – 3 POLLUTION 9

Pollution – Classification of pollutants – Cause, Source, Effect and Control measures - Air pollution – Causes, types & sources of air pollutant – Effect of air pollutants – Control of air pollution – Water pollution – Source and effects - Thermal pollution – Radioactive pollution – Marine pollution – Pesticidal pollution – Groundwater pollution – Land pollution – Sources and effects of soil pollutant – Solid waste – Methods of solid waste disposal – Soil degradation – Solid waste management – Recovery and conversion methods – Noise pollution – Sources, effects and control measures – An Introduction to E-Waste Management- Case Studies in current scenario.

UNIT – 4 LEGAL ACTS & MAJOR ENVIRONMENTAL CONCERNS **9**

Environmental legislations – Acts – Water act – Air act – Environment act – Land act – Wildlife protection act – Forest acts – Functions of CPCB & SPCB. Water conservation – Rainwater harvesting – Reducing water demand – Watershed management. Disaster – Tsunami – Bhopal gas disaster – Minamata tragedy – Polythene – Disaster management – Nuclear accident – Flood, Earthquake, Cyclone and Landslide. Major issues in environment – Climate change, Global warming, Acid rain and Ozone layer depletion- Case Studies in current scenario.

UNIT – 5 HUMAN POPULATION & ENVIRONMENT 9

Population - Population explosion – Effects of population growth on resources – Urbanization - Family welfare programme – Environment and human health – Climate & health, Infectious & water related diseases, Cancer & environment – Human rights – Equity – Nutrition, health and human rights – HIV/AIDS – Women and child welfare - Role of information technology in protecting the environment – Role of individual in the prevention of pollution – Role of NGO's in protecting the environment- Case Studies in current scenario.

TOTAL HOURS: 45

TEXT BOOKS:

1. Anubha Kaushik and C P Kaushik 'Environmental Science and Engineering' Third Edition, New age International(P) Limited, Publisher 2008. New Delhi
2. Aloka Debi, "Environmental Science and Engineering", Universities Press, 2008. (UNIT – 1, 2,3,4,5)

REFERENCE BOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006. (UNIT - 4: Major issues in environment)
2. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', Second Edition, Pearson Education, 2004.
3. Tyler Miller, Jr., 'Environmental Science, Brooks/Cole a part of Cengage Learning, 2006.

C PROGRAMMING

11UCK204

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To learn the control structures of C language*
- *To write programs using Functions & Pointers*
- *To use different data types and multi-dimensional arrays in programs*
- *To write programs using structures and files*

GETTING STARTED

What is a Programming Language – What is a compiler - What is C – Getting started with C – The first C Program – Compilation and Execution – Receiving input – C instructions – Control instructions in C

DECISION CONTROL STRUCTURE **9**

Decisions – if statement – if..else statement – Use of Logical operators – conditional operators.

LOOP & CASE CONTROL STRUCTURE **9**

Loops – while loop – for loop – Odd loop – break statement – continue statement – do .. while loop – Decisions using switch – switch vs if else ladder – goto statement

FUNCTIONS & POINTERS **9**

What is a function? – Passing values between functions – scope rule of functions – Calling convention - Advanced features of functions – function declaration and prototypes – call by value and call by reference - An Introduction to Pointers – Pointer Notations – Back to function calls – Conclusions – Recursion – Recursion and Stack.

DATA TYPES & ARRAYS **9**

Integers(long, short, signed and unsigned) – Chars (Signed and unsigned) – Floats and doubles – Few More issues on data types – storage classes in C – What are arrays – more on arrays – Pointers and Arrays – Two Dimensional Arrays – Array of Pointers – Three Dimensional Array.

STRUCTURES & FILES **9**

Why use structures – array of structure - additional features of structures – Uses of Structures – Data Organization – File operations – Counting Characters, Tabs, Spaces, - A file copy program – File opening modes – String I/O in Files – Text Files and Binary Files – Low level Disk I/O – I/O under windows.

TOTAL HOURS : 45

REFERENCES

1. Yashavant P. Kanetkar, "Let Us C", BPB Publications, 10th Edition, 2009
2. B. W. Kernighan, Dennis M. Ritchie, "The C Programming Language", Pearson Education, 2003.

MATERIALS SCIENCE

(Common to MECH &MCT)

11USP201

L	T	P	C
3	0	0	3

Objective: To give an exposure to the Students on materials and their applications in the field of Technology, and also to create awareness towards the impact of the materials.

UNIT I: CRYSTAL STRUCTURE **9**

Definition of a Crystal – Crystal classification - Unit Cell – Bravais Lattice – Miller Indices –Bragg's Law – Determination of Crystal structure by Debye Scherrer method - Crystal imperfections – Point, Line and Surface imperfections - Burger Vector

UNIT II: MECHANICAL PROPERTIES OF MATERIALS **9**

Elastic deformation – Tensile Properties – Plastic deformation – Plasticity – Ductility, Dislocation and strengthening mechanisms – viscoelastic deformation – Maxwell model – Voigt –Kelvin model – creep method to increase creep resistance, Fracture – fatigue – method to increase Fatigue Resistance.

UNIT III: METALS AND ALLOYS **9**

Drude Lorentz theory of electrical conduction, Wiedmann Franz law, Band theory of solids, Factors affecting resistivity of metals- temperature alloying, magnetic field and strain. Application of conductors – Strain gauges, transmission lines, Conducting materials, precision resistors, heating elements and resistance thermometer.

UNIT IV: COMPOSITIES **9**

Introduction, Features and benefits, structural characteristics, manufacturing techniques, Function of matrix and Reinforcement in composites. Classification of composites based on reinforcement, Types of composite materials. Applications.

UNIT V: ADVANCED MATERIALS: **9**

Nanophase materials – Synthesis Technique, Properties, Applications, Shape Memory Alloy (SMA) – Characteristics, Properties of NiTi alloy, Application, Advantages and Disadvantages of SMA. Metallic glasses – Preparation, Properties and Applications Introduction to nano materials - synthesis – plasma arcing – chemical vapour deposition – solgels – electrodeposition – ball milling - properties of nanoparticles and applications. Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications

TOTAL HOURS:45

TEXT BOOKS

1. William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2007.
2. Leonid V Azaroff and James J Brophy, " electronic Processes in Materials", McGraw hill Co, New York, 1991.

REFERENCES:

1. Jayakumar, S "Materials Science", RK Publishers, Coimbatore 2006.
2. Raghavan, V. "Materials Science and Engineering – A First Course" Prentice Hall of India, New Delhi 2004.
3. Palanisamy P.K, "Materials Science". SCITECH Publications, Chennai, 2002

BASICS OF ELECTRICAL CIRCUITS & ELECTRON DEVICES

	L	T	P	C
11UEK252	**3**	**0**	**0**	**3**

COURSE OBJECTIVES :

The subject is intended to familiarize the mechatronics students with the basic concepts of AC and DC circuits and its associated theorems. It also provides the concepts, characteristics and applications of various semiconductor devices.

UNIT I - CIRCUIT ANALYSIS TECHNIQUES **9**

Ohm's Law, Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II - TRANSIENT RESONANCE IN RLC CIRCUITS **9**

Basic RL, RC and RLC circuits and their responses to pulse – frequency response – Parallel and series resonances.

UNIT III - SEMICONDUCTOR DIODES **9**

Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT IV - TRANSISTORS **9**

Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET .

UNIT V - SPECIAL SEMICONDUCTOR DEVICES **9**

SCR characteristics and two transistor equivalent model – UJT – Diac and Triac –Photodiode, Phototransistor, Photoconductive and Photovoltaic cells.

TOTAL HOURS=45

TEXT BOOKS:

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Schaum series, Tata McGraw Hill, 2001
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCES

1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2nd Edition, 2008.

PHYSICAL SCIENCE LABORATORY II

11USH211

L	T	P	C
0	0	3	1

AIM

To provide exposure to the students with hands-on experience on scientific equipments

PHYSICS LABORATORY II

1. Comparative resistivities of alloy and metal – Meter Bridge.
2. Determination of efficiency of a solar cell.
3. Characteristics of photodiode.
4. Determination of lattice constant X-ray powder photograph.
5. Determination of Rigidity modulus- Torsion Pendulum
6. Determination of Young's modulus of the material – Non uniform bending
7. Determination of Velocity of Ultrasonic waves – Ultrasonic Interferometer

CHEMISTRY LABORATORY - II

1. Estimation of hardness of water by EDTA method.
2. Estimation of Calcium ions and Magnesium ions by EDTA method.
3. Estimation of alkalinity of water sample.
4. Determination of Chloride in water by Argentometric method.
5. Determination of Dissolved Oxygen in waste water using Winkler's titrimetry method.
6. Estimation of copper in brass by EDTA.

C PROGRAMMING LAB

11UCK200

COURSE OBJECTIVES	**L**	**T**	**P**	**C**
• *To gain mastery over the C language*	**0**	**0**	**3**	**2**

List of Programs / Experiments can be setup by the faculty with the following

1. Programming concepts involving I/O statements.
2. Programming concepts involving conditional statements.
3. Programming concepts involving looping statements.
4. Programming concepts involving functions.
5. Programming concepts involving Arrays (1D, 2D).
6. Programming concepts involving Pointers.
7. Programming concepts involving Structures.
8. Programming concepts involving Files.

Note: The above programs will be tuned to the various fundamental principles in the specific engineering branches

TOTAL HOURS : 45

COMPUTERS AIDED DRAFTING AND MODELING LABORATORY

11UAK204

L	T	P	C
0	0	3	2

COURSE OBJECTIVES

- *To provide fundamental knowledge and hands on experience to the students on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.*

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List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involutes using B- spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to MECH & MCT**)**

	L	T	P	C
11USM302	**3**	**1**	**0**	**4**

OBJECTIVE – To provide strong foundation to the students to expose various emerging new areas of applied mathematics and appraise them with their relevance in Engineering and Technological field.

PREREQUISITE:

Limit concepts, Integration, Periodic function, Basic terminologies of odd and even functions.

UNIT I - FOURIER SERIES **9**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT II – FOURIER TRANSFORMS **9**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem– Parseval's identity.

UNIT III - PARTIAL DIFFERENTIAL EQUATIONS **9**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients- Classification of PDE-Method of separation of variables.

UNIT IV - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **9**

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT V - LAPLACE TRANSFORMS **9**

Laplace transforms – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions. Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

Total hours: 45 + 15

TEXT BOOKS:

1. Grewal, B.S, 'Higher Engineering Mathematics' 40th Edition, Khanna publishers, Delhi, (2007)
2. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition - Wiley India (2007).

REFERENCES :

1. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-Graw Hill Publishing Company limited, New Delhi (2007).
2. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition - Pearson Education (2007).
3. Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications (P) Ltd. (2007).

STRENGTH OF MATERIALS

	L	T	P	C
11UEK302	**3**	**1**	**0**	**4**

COURSE OBJECTIVE:

- *To give brief descriptions about the behavior of solid materials due to axial, bending and torsional and combined loads*

UNIT I - SIMPLE STRESSES AND STRAINS **9**

Stress and strains in bars subjected to axial loading- elastic limit-Hook's law-factor of safety- stepped bars, uniformly varying section, Stress produced in compound bars subject to axial loading- Temperature stress and strain calculations in single and compound bars-strain energy due to axial force-proof resilience, stresses due to gradual load, sudden load and impact load.

UNIT II - CHANGES IN DIMENSION AND VOLUME, BIAXIAL STRESSES **9**

Lateral strain-poisson's ratio, volumetric strain, relationship between elastic constant- hoop stress, longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume; stresses in sphere and change in diameter and internal volume. Stresses on inclined plane – Principal planes and stresses- Mohr's circle for biaxial stresses

UNIT III - SFD, BMD AND BENDING STRESS **9**

S.F and B.M definitions. BM and SF diagrams for cantilevers, simply supported beams with or without overhangs and calculation of maximum BM and SF and the point of contraflexure under the following loads: a) Concentrated loads b) Uniformity distributed loads over the whole span or part of span c) Combination of concentrated loads (two or three) and uniformly distributed loads, Relation between rate of loading, shear force and bending moment Assumptions in the simple bending theory, derivation of formula: its application to bars of solid and hollow circular section, I and T sections.

UNIT IV - TORSION AND COLUMNS **9**

Derivation of torsion equation and its assumptions. Applications of the equation to the hollow and solid circular shafts, torsional rigidity- stepped shaft- compound shafts-fixed shafts.

Columns and failure of columns : Euler's formuls; Rankine's formula for axially loaded columns.

UNIT V - SLOPE AND DEFLECTION OF BEAMS AND SPRINGS **9**

Relationship between moment, slope and deflection, Moment area method; method of integration; Macaulay's method: Use of all these methods to calculate slope and deflection for the following : a) Cantilevers b) Simply supported beams (simple problems). Analysis of close coiled helical spring

TOTAL HOURS:45+15= 60

TEXT BOOKS

1. Popov E.P, Engineering Mechanics of Solids, Prentice-Hall of India, New Delhi, 1997.
2. Beer F. P. and Johnston R, Mechanics of Materials, McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES

1. Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, New Delhi, 1981
3. Ryder G.H, Strength of Materials, Macmillan India Ltd., Third Edition, 2002
4 Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2004.
5. Singh D.K "Mechanics of Solids" Pearson Education 2002.
6. Timoshenko S.P, Elements of Strength of Materials, Tata McGraw-Hill, New Delhi 1997

ELECTRICAL ENGINEERING

	L	T	P	C
11UEK352	**3**	**0**	**0**	**3**

OBJECTIVES

To impart knowledge on

• Constructional details, principle of operation, performance, starters and testing of D.C. machines and A.C. Machines.

• Constructional details, principle of operation and performance of transformers.

• Power System transmission and distribution.

UNIT I - D.C. MACHINES 9

Constructional details – emf equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators –Principle of operation of D.C. motor – Back emf and torque equation – Characteristics of series, shunt and compound motors - Starting of D.C. motors – Types of starters - Speed control of D.C. shunt motors.

UNIT II - TRANSFORMERS 9

Constructional details – Principle of operation – emf equation – Transformation ratio –Transformer on no load – Equivalent circuit –Transformer on load – Regulation –

UNIT III - INDUCTION MOTORS 9

Construction – Types – Principle of operation of three-phase induction motors –Equivalent circuit – Performance calculation – Starting and speed control – Single-phase induction motors (only qualitative treatment).

UNIT IV - SYNCHRONOUS AND SPECIAL MACHINES 9

Construction of synchronous machines-types – Induced emf – Voltage regulation emf and mmf methods – Brushless alternators – Reluctance motor – Hysteresis motor –Stepper motor.

UNIT V - TRANSMISSION AND DISTRIBUTION 9

Structure of electric power systems – Generation, transmission and distribution systems - EHVAC and EHVDC transmission systems–Substationlayout–Insulators–cables.

TOTAL HOURS:45

TEXT BOOKS

1. D.P.Kothari and I.J.Nagrath, ‘Basic Electrical Engineering’, Tata McGraw Hill publishing company ltd, second edition, 2007 (Reprint).

2. C.L. Wadhwa, ‘Electrical Power Systems’, New Age International, fourth edition, 2007.

REFERENCE BOOKS

1. S.K.Bhattacharya, ‘Electrical Machines’, Tata McGraw Hill Publishing company ltd, second edition, 2007.

2. V.K.Mehta and Rohit Mehta, ‘Principles of Power System’, S.Chand and Company Ltd, second edition, 2006.4

OBJECT ORIENTED PROGRAMMING

	L	T	P	C
11UCK304	**3**	**0**	**2**	**4**

Course Objectives

- *To introduce object oriented programming paradigm and the importance of it in software development.*
- *To introduce the basic OOPS concepts*
- *To introduce the merits of OOPS*
- *To enable the student in developing simple applications using C++*

UNIT I -INTRODUCTION TO OBJECT-ORIENTED PROGRAMMING PARADIGM & C++ 9

Object-oriented technology – Programming paradigms – Key concepts of object-oriented programming – objects – classes – method – abstraction – encapsulation – inheritance – polymorphism – Advantages of OOPS.

C++ - Input & output feature- Stream classes – Formatted & unformatted data – Unformatted & formatted console I/O operations – Bit fields – Manipulators - Declarations – Basic & user-defined data type in C++ - Typecasting - Operators in C++ – Control structures & loops in C++.

UNIT II - CLASSES, OBJECTS AND MEMBER FUNCTIONS IN C++ 9

Classes & objects in C++ - Access specifiers – Member functions – Static member variables, member functions and object – Array of object – Inline function - friend function – Constructor and destructor – Copy constructor – Dynamic initialization using constructors – Dynamic operators and constructors.

UNIT III - INHERITANCE AND POLYMORPHISM 9

Inheritance – Types of inheritance – Virtual base class – Abstract classes.Polymorphism – Overloading – Function overloading - Overloading unary and binary operators - Overloading new and delete operators – Overriding – Runtime binding – Virtual function – Pure virtual function – Introduction to Run Time Type Information.

UNIT IV EXCEPTION HANDLING AND TEMPLATES IN C++ 9

Exception handling – Principles – Exception handling mechanism – Multiple catch statement – Rethrowing exception – Specifying exception – Exceptions in constructors and destructors.

Generic programming – Templates – Class template – Function template – Templates with more parameters – Overloading of template functions – Member function templates.

UNIT V FILE HANDLING, STRINGS AND NAMESPACE IN C++ 9

File stream classes – File operations – File opening modes – File pointers and manipulators – Manipulators with arguments – Sequential read and write operations – Binary & ASCII files – Random access operation.Strings in C++ - String objects – Relational operators – String attributes – Accessing elements of strings – Namespace – Nested namespace.

TOTAL HOURS: 45

TEXT BOOKS

1. Ashok N. Kamthane, "Object-oriented programming with ANSI & Turbo C++", Pearson Education, 2009.
2. Bhushan Trivedi, "Programming with ANSI C++", Oxford University Press, 2009.

REFERENCES

1. K.R. Venugopal, Rajkumar and T. Ravishankar, "Mastering C++", Tata McGraw-Hill, 2008.
2. Bjarne Stroustrup, "The C++ Programming Language", 3rd Edition, Pearson Education, 2009.
3. Ira Pohl, "Object-Oriented Programming Using C++", Second Edition, Pearson Education, 2005.

LINEAR AND DIGITAL ICs

	L	T	P	C
11UEK353	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- *To introduce number systems and codes*
- *To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions*
- *To introduce the methods for simplifying Boolean expressions*

UNIT I - MINIMIZATION TECHNIQUES AND LOGIC GATES **9**

Minimization Techniques: Boolean postulates and laws – De-Morgan's Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions - Quine-McCluskey method of minimization. Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR- Implementations of Logic Functions using gates.

UNIT II - COMBINATIONAL CIRCUITS **9**

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor - Parallel binary adder, parallel binary Subtractor – Carry Look Ahead adder – Serial Adder / Subtractor - BCD adder – Binary Multiplier – Binary Divider – Multiplexer / Demultiplexer – decoder - encoder – code converters - Magnitude Comparator.

UNIT III - SEQUENTIAL CIRCUITS **9**

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM

UNIT IV - OPERATIONAL AMPLIFIER **9**

Classification, chip size and circuit complexity, basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

UNIT V - OP-AMP APPLICATIONS **9**

Basic application of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, sample & hold circuits, multipliers and dividers, Differentiators and Integrators, Comparators, Schmitt trigger, Multivibrators, introduction to voltage regulators, features of 723.

TOTAL HOURS = 45

TEXT BOOKS

1. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 /Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2006
3. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.

REFERENCES

1. Charles H.Roth. "Fundamentals of Logic Design", Thomson Publication Company, 2003.
2. Thomas L. Floyd, Digital Fundamentals, Pearson Education, Inc, New Delhi, 2003
3. Donald D.Givone, Digital Principles and Design, Tata Mc-Graw-Hill Publishing company limited, New Delhi, 2003.
4. Ramakant A.Gayakwad, 'OP-AMP and Linear IC's', Prentice Hall / Pearson Education, 1994.
5. K.R.Botkar, 'Integrated Circuits'. Khanna Publishers, 1996.
6. Taub and Schilling, Digital Integrated Electronics, McGraw-Hill, 1997.

MANUFACTURING TECHNOLOGY

11UEK303

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

-Understand modern manufacturing operations, including their capabilities, limitations, And how to design for lowest cost.

-Learn how to analyze products and be able to improve their manufacturability and Lower costs.

-Understand the relationship between customer desires, functional requirements, Product materials, product design, and manufacturing process selection

-Understand the advantages and disadvantages of hard (inflexible) and soft (flexible)Manufacturing automation

UNIT I - FOUNDRY TECHNOLOGY **9**

Pattern and Core making – Moulding sand – Melting furnaces Cupola and Induction furnaces – Special casting processes – Shell, Investment, Die casting – Defects in casting.

UNIT II - FORMING– PROCESSES **9**

Hot and Cold Working Rolling: Introduction – Rolling Mills – Rolling Operations – Production of Seamless Tubing and Pipe. Forging: Introduction – Related Forging Operations – Drop forging Extrusion and Drawing: Extrusion Practice – Hot, Cold, Impact and Hydrostatic extrusion. Drawing Process – Defects and Residual Stresses – Drawing Equipment. Sheet metal operations – Blanking, Punching and Piercing.

UNIT III - CONVENTIONAL MACHINING PROCESS **9**

Lathes and Lathe Operations, Drilling and Drilling Machines, Reaming and Reamers, Tapping and Taps – Tool nomenclature, cutting speed, feed, machining Time calculations.

UNIT IV - SPECIALIZED MACHINING AND SUPER FINISHING PROCESS **9**

Milling Machines and Operations, Planning and Shaping, Broaching, Gear Hobbing and Shaping. Grinding Process – Abrasives – Finishing Operations – Lapping, Honing Burnishing.

UNIT V - PRINCIPLES & APPLICATIONS OF JOINING PROCESSES **9**

Gas welding, Basic Arc Welding Processes, Thermit Welding, Electron – Beam Welding, Laser – Beam Welding. Solid State Welding: Cold Welding, Ultrasonic Welding, Friction Welding, Resistance Welding and Explosive Welding. Principles and applications of Brazing and Soldering.

TOTAL HOURS: 45

TEXT BOOK

1. Kalpakjian, S., "Manufacturing Engineering and Technology", Pearson education India, 4th edition, 2001.

REFERENCES

1. Hajra Choudhury, S.K., and Haqjra Choudhury, A.K., "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.

2. Paul Degarma E, Black J.T. and Ronald A. Kosher, Eighth edition, Materials and Processes in Manufacturing Prentice – Hall of India, 1997.

3. Sharma P.C. A Textbook of Production Technology, S. Chand and Co., Ltd., 1999.

MANUFACTURING TECHNOLOGY LABORATORY

11UEK304	L	T	P	C
	0	0	3	2

LIST OF EXPERIMENTS

LATHE PRACTICE

a. Plain Turning

b. Taper Turning

c. Thread Cutting

Estimation of machining time for the above turning processes.

DRILLING PRACTICE

a. Drilling

b. Tapping

c. Reaming

MILLING

a. Surface Milling

b. Gear Cutting

c. Contour Milling

PLANNING AND SHAPING

a. Cutting Key Ways

b. Dove tail machining.

ELECTRICAL AND ELECTRONICS LABORATORY

PART I

1. Load test on D.C. shunt motor.
2. Load test on D.C. series motor.
3. Swinburne's test and speed control of D.C. shunt motor.
4. Load test on single phase transformer
5. Load test on three phase induction motor.
6. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
7. Load test on single-phase induction motor.
8. Study of D.C. motor and induction motor starters.

PART II

1. Design and implementation of Adder and Subtractor using logic gates.
2. 2.Design and implementation of code converter using logic gates
3. Design and implementation of 2 Bit Magnitude Comparator using logic gates
4. Design and implementation of Multiplexer and De-multiplexer using logic gates
5. Design and implementation of encoder and decoder using logic gates
6. Construction and verification of 4 bit ripple counter
7. Implementation of shift register using Flip- flops
8. Inverting and non inverting and differential amplifiers using Op-Amp
9. Integrator and Differentiator using Op-Amp
10. Instrumentation amplifier using Op-Amp

COMPUTER AIDED MACHINE DRAWING LABORATORY

	L	T	P	C
11UEK305	**0**	**0**	**3**	**2**

COURSE OBJECTIVES:

Introduction to computer aided drafting software. Working with design files, management of drawing in 2D, manipulating and modifying drawing element. 3D solid modelling, assembly drawing to and utilities, rendering and visualization. Applications of other CAD software.

- *To aim computer-aided drawing skill of the students.*
- *Establishing relationship between traditional drafting technique and computer graphics.*
- *The ability 2 demonstrate ideas and design concepts using drafting software's*

UNIT I **9**

Indian standard code of practice for engineering drawing – general principles of Presentation. Conventional representations of threaded parts, springs, gear and Common features. Abbreviations and symbols for use on technical drawings. Conventions for sectioning and dimensioning.

UNIT II **9**

Tolerances – types – representation of tolerances on drawing fits – types – selection of Fits – allowance. Geometric tolerances – form – and positional tolerances – datum, datum Features. Maximum material principle – symbols and methods of indicating it on drawing Surface finish symbols – welding symbols and methods of indicating it on drawing.

UNIT III (Drafting work using mini drafter) **9**

Preparation of part and assembly drawings of Plummer block, screw jack, machine vice, lathe tailstock, Flange Coupling, stuffing box, piston & connecting rod universal joint)

UNIT IV **9**

Introduction to the use of 3D modeling and drafting software – creation of simple geometric bodies using basic commands. Assembling of various machine element parts.

UNIT V **9**

Preparation of 3-D drawings using PROE software for components and assemblies of Plummer block, screw jack, machine vice, lathe tailstock, universal and flange coupling.

TOTAL HOURS: 45

TEXT BOOKS

1. Sadhu Singh & P.L. Sah, Fundamentals of Machine Dynamics, Prentice Hall of India Pct Ltd, 2003.
2. P.N. Rao, CAD/CAM Principles and Applications, Tata McGraw-Hill 2003

REFERENCES

1. K. Venugopal, Engineering Graphics AutoCAD, John Wiley & Sons, 2002
2. K.R. Gopal Krishanan , Text book of Machine Drawing.

STATISTICS AND NUMERICAL METHODS

	L	T	P	C
11USM403	**3**	**1**	**0**	**4**

OBJECTIVE – To provide strong foundation to the students to expose various emerging new areas of applied mathematics and appraise them with their relevance in Engineering and Technological field.

UNIT I - SOLUTION OF EQUATIONS (9)

Solution of equation - Fixed point iteration : x = g(x) method – Newton's method – Regula Falsi method, Solution of linear system by Gaussian elimination and Gauss-Jordon methods – Crout's Mehod - Iterative methods - Gauss-Seidel methods

UNIT II - INTERPOLATION AND APPROXIMATION (9)

Lagrangian Polynomials – Divided differences - Newton's forward and backward difference formulas– Interpolating with a cubic spline .

UNIT III - NUMERICAL DIFFERENTIATION AND INTEGRATION (9)

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpson's rules.

UNIT IV - TESTING OF HYPOTHESIS (9)

Sampling distributions – Testing of hypothesis for mean, variance, proportions and Differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

UNIT V - DESIGN OF EXPERIMENTS (8)

Analysis of variance – One way classification – CRD – Two way classification – RBD – Latin square.

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Total hours: 45 + 15

TEXT BOOKS :

1. Gerald C.F. and Wheatley, P.O. 'Applied Numerical Analysis', Pearson Education Asia, New Delhi. 2002
2. Lipschutz,. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998.

REFERENCES :

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, 'Numerical Methods', S.Chand Co. Ltd., New Delhi, 2003.
2. Gupta, S.C, and Kapur, J.N., "Fundamentals of Mathematical Statistics", Sultan Chand, Ninth Edition , New Delhi ,1996.
3. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi , 2002.

THEORY OF MACHINES

11UEK411

L	T	P	C
3	1	0	4

COURSE OBJECTIVE :

To understand the basics of Kinematics and Dynamics involved in automation for developing localized automation for different systems.

UNIT I - BASICS OF MECHANISMS **7**

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

UNIT II - KINEMATICS **10**

Displacement, velocity and acceleration - analysis in simple mechanisms - Graphical Method (Relative velocity method) velocity and acceleration polygons -Coincident points- Coriolis Acceleration.

CAM Classifications - Displacement diagrams-parabolic, Simple harmonic and Cycloidal motions - Layout of plate cam profiles, Spur gear Terminology Basics and definitions-Fundamental Law of toothed gearing.

UNIT III - FORCE ANALYSIS **9**

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 – Turning moment diagrams - Fly wheels.

UNIT IV - BALANCING **9**

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

VIBRATION Basics & its Types, Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency, Critical speeds of shafts

UNIT V - MECHANISMS FOR CONTROL **10**

GOVERNORS - Types - Centrifugal governors-(Porter, Proell, Hartnell, Wilson-Hartnell Governor) Characteristics - Effect of friction - Controlling Force

GYROSCOPES - Gyroscopic forces and Torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes

TOTAL HOURS= 45 + 15 = 60

TEXT BOOKS

1. Rattan S.S, "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998.

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
3. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 1995.
4. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory ", Wiley-Eastern Limited, New Delhi, 1992.

THERMO FLUID ENGINEERING

11UEK412 **L T P C**

3 1 0 4

COURSE OBJECTIVES:

1. *To understand the properties of the fluid and appreciate the complexities involved in solving the fluid flow problems.*
2. *To integrate the concepts, laws and methodologies from the first course in thermodynamics into the analysis of cyclic process.*

UNIT I – FLUID STATICS AND KINEMATICS 9

Fluid – definition- Units and dimensions - Properties of fluids – density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension. Concept of fluid static pressure - pressure measurements by manometers (Qualitative treatment only)
Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration – continuity equation (one, two and three dimensional differential forms) – Equation of stream line-stream function-velocity potential function-circulation – flow net.

UNIT II – FLUID DYNAMICS AND INCOMPRESSIBLE FLUID FLOW 9

Fluid dynamics – equation of motion- euler's equation along stream line- Bernoulli's equation – applications - Venturi meter, Orifice meter and Pitot tube.
Introduction- Laminar flow and turbulent flow (preliminary treatment only). Flow through pipes - Darcy -weisbac's equation - minor losses - flow through pipes in series and in parallel.

UNIT-III BASIC THERMODYNAMICS 11

Classical approach: Thermodynamic systems - Boundary - Control volume - System and surroundings – Universe – Properties - State-process – Cycle – Equilibrium - Work and heat transfer in flow and non- flow process– Point and path functions - First law of thermodynamics for open and closed systems - First law applied to a control volume - SFEE equations (steady flow energy equation) - Second law of thermodynamics - Heat engines - Carnot cycle - Carnot theorem - Clausius inequality - Concept of entropy - Principle of increase of entropy.

UNIT-IV REFRIGERATION AND AIR-CONDITIONING 8

Principles of refrigeration, Refrigerator and heat pump, refrigerants, refrigerant properties. Vapour compression systems- Co-efficient of performance- Vapour absorption systems. Principles of Psychrometry - dry bulb temperature, wet bulb temperature, relative humidity, comfort air conditioning, Psychrometry chart, humidification, de-humidification, air coolers and cooling towers. Principle and types of air conditioning.

UNIT-V HEAT TRANSFER 8

Modes of heat transfer-Heat transfer through conduction- Fourier's law of conduction in plane, radial and composite walls. Basics of Convective heat transfer - Fundamentals of Radiative heat transfer – Stefan Boltzmann law, black body and grey body.

Total Hours : 45+15=60

TEXT BOOKS

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd., New Delhi, 1995.
2. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
3. Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
4. Arora C.P, "Refrigeration and Air Conditioning", Tata McGraw-Hill, New Delhi, 2000.
5. Sachdeva RC, "Fundamentals of Engineering Heat and mass Transfer", New age International (Private) Limited, 2002.

REFERENCES

1. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
2. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1998.
3. Som, S.K., and Biswas, G., "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd edition, 2004
4. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi (7th edition), 1995.
5. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
6. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006.

7. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2007.
8. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987.
9. Merala C, Pother, Craig W, Somerton, “ Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.

CONTROL SYSTEMS

	L	T	P	C
11UEK455	**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

- *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 response 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*

UNIT I - SYSTEM MODELING **9**

Basic elements in control systems – open and closed loop systems. Mathematical modeling of physical systems :Differential equation, Difference equation, and State variable representations; Modeling of electrical, mechanical systems, Equivalence between the elements of electrical and mechanical systems. Transfer function – Block diagram reduction techniques – Signal flow graphs

UNIT II - TIME DOMAIN ANALYSIS **9**

Time response – Time domain specification - Types of test inputs – I and II order system response - Error coefficients – Generalized error series – Steady state error - P ,PI, PID mode of feedback control

UNIT III - FREQUENCY DOMAIN ANALYSIS **9**

Frequency domain specification –Correlation between frequency and time domain specification Stability concept and definition –Bode plot -Polar plot – Determination of closed loop response from open loop response

UNIT IV - FREQUENCY DOMAIN ANALYSIS **9**

Characteristic equation-location of roots in S plane for stability – Routh Hurwitz criterion - Stability and relative stability using root-locus approach, Nyquist stability criterion

UNIT V - COMPENSATORS **9**

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

TOTAL HOURS: 45+15= 60

TEXT BOOK

I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers,2003

REFERENCE BOOKS

1. Benjamin C. Kuo, Automatic Control systems, Pearson Education, New Delhi, 2003.

2 K. Ogata, 'Modern Control Engineering', 4th edition, PHI, New Delhi, 2002.

3. Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004

4 M. Gopal, 'Control Systems, Principles and Design', Tata McGraw Hill, New Delhi

ENGINEERING METROLOGY

	L	T	P	C
11UEK408	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- *To know the measurement principles and its applications.*

UNIT I - CONCEPT OF MEASUREMENT AND SQC **9**

General Concept – Generalized measurement system – Units and standards Geometric dimensioning , tolerance- types, fits- types, Statistical Quality control- Attribute and variable methods, simple problems in X bar and R chart.

UNIT II - LINEAR AND ANGULAR METROLOGY **9**

Definition of metrology – Linear measuring instrument : Vernier, micrometer measurement, dial indicator, Slip gauges and classification, interferometery, optical flats - limit gauges, Comparators - Mechanical, pneumatic and electric types, applications – sine bar, optical bevel protractor, auto collimator, angle Decker – taper measurements.

UNIT III - SURFACE MEASUREMENT **9**

Surface evaluation, Stylus method, Numerical values for surface assessment, Surface texture specimens, straightness, flatness and roundness measurement.

UNIT IV - OPTICAL METROLOGY AND NON-DESTRUCTIVE TESTING **9**

Optical comparator- Principle and application, Pneumatic comparator – Principle and application Profile projector. Ultrasonic test, Dye penetrate and Magnetic particle Inspection

UNIT V - ADVANCED TECHNIQUES IN METROLOGY **9**

Coordinate measuring machine – constructional features – types and application, digital devices – computer aided inspection – – machine vision systems, Universal Measuring Machine, Laser principles – Laser interferometer – application in linear, angular measurement and machine tool metrology.

TOTAL HOURS: 60

TEXT BOOKS

1. Jain R K " Engineering Metrology" Khanna Publishers, 1994
2. Mahajan, "A textbook of Metrology", Dhanpat Rai & Co.

REFERENCES

1. Alan S. Morris " The Essence of Measurement" Prentice Hall of India, 1997
2. Connie Dotson, Ronger Harlow and Richard L Thomson, "Fundamentals of Dimensional Metrology", 4th edition, Thompson – Delmar, 2003.
3. Gupta S C " Engineering Metrology " Dhanpat rai Publications

MICROPROCESSOR AND MICROCONTROLLER

11UEK458	L	T	P	C
	3	0	0	3

COURSE OBJECTIVES:

- *To study the architecture and Instruction set of 8085*
- *To study different peripheral devices and their interfacing to 8085*
- *To study the architecture and programming of 8051 microcontroller and some basics of PIC microcontroller*

UNIT I - 8085 ARCHITECTURE **9**

8085 Architecture – Registers-Machine cycles and timing diagrams-Interrupt structure-memory mapping Programming of 8085: Addressing modes- arithmetic and logic instructions- jump and call instructions.

UNIT II - HARDWARE INTERFACING FOR 8085 MICROPROCESSOR **9**

Interfacing simple keyboards and LED displays - Interfacing of Programmable peripheral interface (8255) – 8253 timer-programmable interrupt controller (8259) - DMA controller.

UNIT III - INTRODUCTION TO 8051 MICRO-CONTROLLERS **9**

The 8051 microcontroller architecture, - Memory organization- I/O ports-Interrupts and interrupt handling - 8051 assembly language programming - 8051 addressing modes - arithmetic & logic instructions - jump and call instructions.

UNIT IV - HARDWARE INTERFACING FOR MICRO-CONTROLLERS **9**

8051 timer programming in assembly - 8051 serial port programming in assembly - interrupts programming in assembly - ADC, DAC, and sensor interfacing.

UNIT V - INTRODUCTION TO PIC MICRO-CONTROLLERS **9**

Introduction to Microchip PIC family of Micro-controllers - CPU architecture - Program memory considerations - Register file structure and addressing modes - CPU Registers.

TOTAL HOURS: 45

TEXT BOOK

1 Krishna Kant "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice – Hall of India, New Delhi , 2007

2 Ramesh S.Goankar,'Microprocessor Architecture: Programming and Applications with 8085', Fourth edition,Penram International,2000

REFERENCE

1 Douglas.V.Hall, 'Microprocessors and Interfacing Programming and hardware', second edition, McGraw Hill Inc., 1992

2 Mazidi, Mazidi and D.MacKinlay" 8051 Microcontroller and Embedded Systems using Assembly and C " , 2006 Pearson Education Low Price Edition.

3 Han Way,Huang," PIC Microcontrollers- An Introduction to Software and Hardware Interfacing".

THEORY OF MACHINES LABORATORY

	L	T	P	C
11UEK409	**0**	**0**	**3**	**2**

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorised Gyroscope-Verification of laws -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system - Spring mass system-Determination of damping co-efficient of single degree of freedom system.
9. Determination of influence co-efficients for multidegree freedom suspension system.
10. Determination of transmissibility ratio - vibrating table.
11. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

TOTAL HOURS : 45

LIST OF EQUIPMENTS

1. Cam analyzer.
2. Motorised gyroscope.
3. Governor apparatus - Watt, Porter, Proell and Hartnell governors.
4. Whirling of shaft apparatus.
5. Dynamic balancing machine.
6. Static and dynamic balancing machine.
7. Vibrating table
8. Vibration test facilities apparatus

THERMO FLUID LABORATORY

	L	T	P	C
11UEK410	**0**	**0**	**3**	**2**

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Performance test on four stroke twin cylinder diesel engine with electric dynamometer.
6. Performance test on air compressor
7. Test on heat exchanger
8. Heat conduction test on composite wall
9. Natural convection apparatus.
10. Performance test on Refrigeration test rig
11. Performance test on air condition test rig.

MICROPROCESSOR AND MICROCONTROLLER LABORATORY

	L	T	P	C
11UEK457	**0**	**0**	**3**	**2**

COURSE OBJECTIVES:

- *To understand programming using instruction sets of processors.*
- *To understand the interfacing techniques of external devices to the processors*

8-BIT MICROPROCESSOR

1. Simple arithmetic operations:8 and 16 bit addition & subtraction,8 bit multiplication, 8 bit division.
2. A Programming with control instructions: Increment , Decrement, Rotate instructions
3. Ascending & Descending order, Maximum / Minimum of numbers, Hex / ASCII / BCD code conversions.
4. A/D Interfacing.
5. D/A Interfacing.
6. Traffic light controller Interfacing
7. Stepper Motor Interfacing
8. Simple experiments using 8251, 8279, 8254.

8-BIT MICROCONTROLLER

1. Demonstration of basic instructions with 8051 Micro controller execution, including:
   a. Conditional jumps, looping
   b. Calling subroutines.
   c. Stack parameter testing
2. Interfacing Keyboard and Display
3. Stepper motor Interfacing
4. D/A Interfacing
5. Traffic light controller Interfacing

MACHINE DESIGN FOR MECHATRONICS

11UEK511

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

- *To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.*
- *To introduce students to the design and theory of common machine elements and to give students experience in solving design problems involving machine elements.*
- *To require the student to prepare professional quality solutions and presentations to effectively communicate the results of analysis and design.*

DESIGN FUNDAMENTALS **9**

Design Process - Computer aided design - Optimum design - Mechanical properties of materials - Types of loads - Stresses - Static, varying, thermal, impact and residual - Factors of safety - Theories of failure – Stress concentration factors.

LIMITS, FITS and TOLERANCE **9**

Limit system, Method of placing limit dimensions, Fits – types – selection of Fits – allowance. Tolerances – types – representation of tolerances on drawing, Geometric tolerances – form – and positional tolerances – datum, datum Features.

DESIGN OF SHAFTS, KEYS AND COUPLINGS **9**

Design of Solid and Hollow shafts – Based on strength, rigidity and deflection- Torsional rigidity – Lateral rigidity- Material constants - Design of Keys – Types – Keyways – Design of rigid and flexible couplings

DESIGN OF GEARS **9**

Principles of gear tooth action - Gear correction - Gear tooth failure modes - Stresses and loads – Component design of spur, helical, bevel and worm gears. Design of speed reducers

DESIGN OF BEARINGS AND SPRINGS **9**

Design of Bearings – Sliding contact – Rolling contact – Design of Journal Bearings – Calculation of Bearing dimensions – Design of helical and leaf springs.

TOTAL HOURS = 45 +15= 60

TEXT BOOKS

1. Joseph Edward Shigley and Charles R.Mischke, "Mechanical Engineering Design", 6th Edition, McGraw-Hill International Edition, 2004.
2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2003.
3. Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Third Edition, 2002.

REFERENCES

1. Norton R.L, "Design of Machinery", Tata McGraw-Hill Book Co, 2004.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

HYDRAULICS AND PNEUMATICS

11UEK512

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

- *Understand the concepts of fluid power systems*
- *Understand the Hydraulic and Pneumatic Systems*
- *Understand the design of Hydraulic and Pneumatic circuits*

INTRODUCTION TO HYDRAULIC SYSTEMS **9**

Properties of hydraulic fluids, Advantages and limitations, physical principles of oil hydraulics, filters, types of hydraulic pumps, - Characteristics - Pump Selection -Pumping Circuits - Hydraulic Actuators – Types- Single acting, Double acting - special cylinders like Tanden, Rod less, Telescopic, Cushioning mechanism- Selection -Characteristics - Hydraulic Valves - Pressure - Flow - Direction Controls - Applications - Hydraulic Fluids-Symbols

HYDRAULIC SYSTEM AND COMPONENTS **9**

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 – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

HYDRAULIC CIRCUITS **9**

Regenerative, meter in, meter out, bleed off, sequencing, pressure reducing Circuits, Electro hydraulic circuits Safety circuits - Industrial circuits - Press - Milling Machine Planner - Fork Lift, etc

INTRODUCTION TO PNEUMATIC SYSTEMS **9**

Advantages and limitations, Applications, Structure and signal flow of pneumatic Systems- Air generation and distribution, Constructional details and working of filter, Lubricator, pressure regulator, cylinders. Symbols of pneumatic valves, traverse time diagram, Control valves for direction and flow. Electro pneumatics - Electrically actuated direction control valves, Relay control systems, Limit switches.

DESIGN OF PNEUMATIC CIRCUITS **9**

Classic-Cascade-Step counter - Combination -Methods - PLC-Microprocessors - Uses - Selection criteria for Pneumatic components - Installation and Maintenance of Hydraulic and Pneumatic power packs - Fault finding - Principles of Low Cost Automation - Case studies

TOTAL HOURS = 45

TEXT BOOKS

1. Majumdar S.R., “Oil Hydraulics”, Tata McGraw-Hill, 2000
2. J.Michael, Pinches and John G.Ashby, " Power Hydraulics ", Prentice Hall, 1989
3. Anthony Esposito, “Fluid Power with Applications”, Pearson Education 2000

REFERENCES

1. Majumdar S.R.,“Pneumatic systems – Principles and maintenance”, Tata McGraw Hill, 1995
2. Anthony Lal, “Oil hydraulics in the service of industry”, Allied publishers, 1982
3. Ernest F Brater, Brater Ernest and King Horace, “ Hand book of Hydraulics”, McGraw Hill Professional 1996

MECHANICAL MEASUREMENTS AND INSTRUMENTATION

11UEK524

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *Understand the science of measurements and sensors*
- *Identify and avoid errors in measurements*
- *Select appropriate sensors for various applications*

MEASUREMENT SYSTEM **9**

Measurements and its Significance, Methods of Measurements, Classification of Instruments and application, Elements of a Generalized Measurement System, Static and Dynamic Characteristics of an Instruments, Errors in Measurement Systems - Units, System, Dimension and standard.

TRANSDUCERS AND MECHANICAL MEASUREMENTS **9**

Transducers - elastic, resistive, inductive, capacitive, thermo-electric, piezoelectric, photoelectric, electro-mechanical, electro-chemical, and ultrasonic.

Measurement of displacement, velocity (linear and rotational), acceleration, shock, vibration, force, torque, power, strain, stress, pressure, flow, temperature, humidity, viscosity, and density. Energy storing elements, suspension systems, and dampers. Strain gauges.

MEASUREMENT OF ACCELERATION, ANGULAR VELOCITY **9**

Angular velocity: Tachometers, tachogenerators, digital tachometers and stroboscopic methods

Theory of accelerometers and vibrometers. Practical accelerometers, strain gauge based and piezoelectric accelerometers. Temperature measurement: Thermodynamic temperature scale and IPTS. Electrical methods of temperature measurement. Resistance thermometers, Thermistors and thermocouples, Pyrometers.

MEASUREMENT OF PRESSURE & TEMPERATURE **9**

Units of pressure - Manometers - Different types - Elastic type pressure gauges - Bourdon tube bellows - Diaphragms - Electrical methods - Elastic elements with LVDT and strain gauges - Measurement of vacuum - Different types- McLeod gauge - Testing and calibration of pressure gauges - Dead weight tester. Bimetallic thermometers - Electrical methods of temperature measurement - RTDs and their - Thermocouples, Pyrometers - Optical pyrometers - Two colour radiation pyrometer.

MEASUREMENT OF VIBRATION AND DENSITY **9**

Mechanical type vibration instruments - Seismic instruments as an accelerometer and vibrometer - Calibration of vibration pickups - Units of density - Specific gravity and viscosity used in industries - Pressure head type densitometer - Float type densitometer - Ultrasonic densitometer.

TOTAL HOURS = 45

TEXT BOOKS

1. Ernest O. Doebelin, Measurement Systems- Application and Design, TMH, 2007.
2. Jain, R. K., Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999
3. Sawhney, A. K., A Course in Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai & Sons, New Delhi, 1999

REFERENCE BOOKS

1. Patranabis, D., Principles of Industrial Instrumentation, Tata McGraw-Hill Publishing Ltd., New Delhi, 1999
2. Nakra, B.C. and Chaudary, K. K., Instrumentation Measurement and Analysis, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1985

SIGNALS AND SYSTEMS

11UEK559

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To study the properties and representation of discrete and continuous signals.*
- *To study the sampling process and analysis of discrete systems using z-transforms.*
- *To study the analysis and synthesis of discrete time systems.*

CLASSIFICATION OF SIGNALS AND SYSTEMS **9**

Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and non periodic, random signals, CT systems and DT systems, Basic properties of systems - Linear Time invariant Systems and properties.

ANALYSIS OF CONTINUOUS TIME SIGNALS **9**

Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and Laplace Transform in Signal Analysis.

LINEAR TIME INVARIANT –CONTINUOUS TIME SYSTEMS **9**

Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency response, Fourier and Laplace transforms in analysis

ANALYSIS OF DISCRETE TIME SIGNALS **9**

Sampling of CT signals and aliasing, DTFT and properties, Z-transform in analysis and its properties.

LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS **9**

Difference equations, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms, State variable equations and matrix representation of systems.

TOTAL HOURS = 45

TEXT BOOK

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson Education, 2007.
2. Edward W Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007.

REFERENCES

1. H P Hsu, Rakesh Ranjan" Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007
2. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, McGraw Hill International/TMH, 2007.
3. Simon Haykins and Barry Van Veen, Signals and Systems John Wiley & sons , Inc, 2004.
4. Robert A. Gabel and Richard A.Roberts, Signals & Linear Systems, John Wiley, III edition, 1987.

POWER ELECTRONICS

11UEK560

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To study about various power electronic circuits and its protection.*
- *To learn the switching characteristic, series and parallel operation of SCRs*
- *To impart knowledge on triggering methods of power devices.*
- *To learn controlled rectification of AC supplies.*
- *To study of converters and inverters using matlab-simulink software.*

POWER ELECTRONICS DEVICES 9

Principle of operation – Characteristics of power diodes, SCR, TRIAC, GTO, Power BJT, Power MOSFET and IGBT – Protection of thyristors against over voltage , over current, dv / dt and di / dt.

PHASE CONTROLLED CONVERTERS **9**

Uncontrolled and controlled converters – single phase and three phase half controlled and fully controlled rectifiers – effect of source inductance –Thyristor triggering circuits - dual converters - Study of converters using Matlab.

DC TO DC CHOPPERS **9**

DC Chopper – control strategies – Principle of operation – step up and step down chopper – quadrant operation – Forced commutation – different techniques – voltage, current and load commutated choppers - Boost and buck choppers.

INVERTERS 9

Voltage and current source inverters – series, parallel and bridge inverters – PWM techniques – sinusoidal PWM , modified sinusoidal PWM, multiple PWM , resonant inverters. Study of inverters using Matlab.

AC VOLTAGE CONTROLLERS & CYCLOCONVERTERS **9**

Single phase ac voltage controller - On-off control and phase control - Multistage sequence control - Step up cyclo converters - Three phase to single phase cyclo converter - Three phase to three phase cyclo converter.

TOTAL HOURS=45

TEXT BOOKS

1. Mohamed H.Rashid, “Power Electronics Circuits, Devices and Applications”, PHI, 3rd Edn. 2004.
2. Mohan Undeland and Robbins, “Power semiconductor devices”, John Wilry and Sons,New York, 1995.
3. Singh, M.D., Khanchandani, K.B., “Power Electronics”, Tata McGraw-Hill, 1998.

REFERENCES

1. Sen , “Power Electronics”, TMH, 1987.
2. Dubey, G.K., Doradia, S.R., Joshi, A. and Singh, R.M., “Thyristorised Power Controllers”, Wiley Eastern Limited, 1986.
3. Vithayathil , “Power Electronics – Principles and applications”, McGraw-Hill, 1995.
4. Lander , “Power Electronics”, 3rd Edition, McGraw-Hill, 1994.

HYDRAULIC AND PNEUMATIC LABORATORY

11UEK513

COURSE OBJECTIVES

L	T	P	C
3	0	3	2

- *Design and testing of Hydraulic circuits and Pneumatic circuits*
- *Simulation using Automation studio software*

LIST OF EXPERIMENTS

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 sequences in Pneumatic Electro pneumatic Trainer.

3. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation Studio software.

TOTAL HOURS = 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

S.No	EQUIPMENTS	Qty
	Hydraulic Equipments	
1	Pressure relief valves	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotory actuator	2
8	Double solenoid actuated DCV	2
9	Single solenoid actuated DCV	1
10	Hydraulic power pack with 2 pumps & 2 pressure relief valve	1
	PLC	
	Pneumatic Equipments	
1	Pnumatic trainer kit with FRL Unit, Single acting cylinder, push buttons.	1
2	Pneumatic trainer kit with FRL unit, Double acting cylinder, manually actuated DCV.	1
3	Pneumatic training kit with FRL unit, Double acting cylinder, pilot actuated DCV.	1
4	Pneumatic trainer kit with FRL unit, Double acting cylinder, Double solenoid actuated DCV, DCV with sensors/magnetic Reed switches.	1
5	PLC with Interface card	1
	LABVIEW Software	
	Automation studio software	

POWER ELECTRONICS LABORATORY

11UEK561

L	T	P	C
0	0	3	2

COURSE OBJECTIVES

- *To expose the students to the basic operation of power semi conductor devices*
- *To help them to develop experimental skills.*

1. Study of SCR, MOSFET & IGBT characteristics.
2. UJT, R, RC firing circuits for SCR.
3. Voltage and current commutated chopper.
4. SCR phase control circuit
5. TRIAC phase control circuit.
6. Series inverter and Parallel inverter.
7. IGBT based PWM inverter (single phase) module
8. Step up and step down chopper.
9. Single phase half controlled and fully controlled converters.
10. Single phase cyclo converter.

LIST OF EQUIPMENTS

(for a batch of 30 students)

S.No	Equipments	Qty
1	Study of SCR, MOSFET & IGBT characteristics module	1
2	UJT, R, RC firing circuits for SCR module	1
3	Voltage & current commutated chopper module	1
4	SCR phase control circuit module	1
5	TRIAC phase control circuit module	1
6	Study of half controlled & fully controller converters module	1
7	SCR single phase cyclo converter module	1
8	SCR series and parallel inverters module	
9	IGBT chopper module	1
10	IGBT based PWM inverter (single phase) module	1
11	Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI Voltmeter (0-300V) MC, (0-600V) MC, (0-300V) MI, (0-600V) MI, Multimeter	Each 3
12	CRO	6
13	Transformer 1KVA, 1:1, 230V	5

MECHANICAL MEASURMENTS AND INSTRUMENTATION LABORATORY

11UEK562

L	T	P	C
0	0	3	2

COURSE OBJECTIVES

- *To train the students in the different aspects of transducers, which are magnetic, electrical, mechanical and optical in nature.*
- *To impart domain knowledge to the students with an adequate work experience in the measurement of different quantities and also the expertise in handling the instruments involved.*

1. Speed measurement using Proximity sensor and Stroboscope
2. Force measurement using load cell and proving ring
3. Torque measurement using strain gauge
4. Temperature measurement using thermocouple, RTD and Thermistor
5. Measurement of linear displacement using LVDT
6. Measurement of sound level using sound level meter
7. Calibration of pressure and vacuum gauge using transducer
8. Velocity measurement using rotary encoder
9. Power measurement using prony brake
10. Measurement of high temperature using radiation pyrometer
11. Capacitive transducers
12. Digital transducer – shaft angle encoder
13. P/I and I/P converters
14. A/D and D/A converters
15. Instrumentation amplifiers, charge and carrier frequency amplifiers

MODELING AND SIMULATION IN ENGINEERING

11UEK614

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

To expose the students to have analytical approach towards the understanding of the system . To facilitate hands on experience in solving system models in Matlab /LabVIEW

INTRODUCTION **9**

Concept and purpose of system modeling and analysis, Cause-Effect relationship. Laplace Transform: Theory and application to solution of linear time-invariant ODE

STANDARD FORMS FOR SYSTEM MODELS **9**

Basic concepts of state variable and Input/ Output models with examples.

SYSTEM MODELING **9**

Basic elements and motion laws, Fee-body diagrams – linear and rotational mechanical systems. Systems with pulleys. Series and parallel combinations of Systems. Input/output models for gear and composite systems

Passive elements and circuit laws. Input/output and state variable models. Controlled sources and Op. Amps

Modeling of thermal systems: First principles approach – modeling of heat exchangers(boiler scomponents)

INTRODUCTION TO SYSTEM IDENTIFICATION **9**

Concepts of System Identification – Identification using normal operating records (Integration method) – Identifiability conditions – System order determination

SYSTEM SIMULATION **9**

Simulation of electrical mechanical and thermal systems using MatLab and LabVIEW

TOTAL HOURS = 45

TEXT BOOKS

1. C.M. Close and D.F. Frederick, Modeling and Analysis of Dynamic Systems, (3rd Ed.) John Wiley.
2. System Identification – lecture notes

DIGITAL SIGNAL PROCESSING

11UEK663

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

- *To study DFT and its computation*
- *To study the design techniques for digital filters*
- *To study the finite word length effects in signal processing*
- *To study the non-parametric methods of power spectrum estimations*
- *To study the fundamentals of digital signal processors.*

DISCRETE FOURIER TRANSFORM **9**

DFT and its properties, Relation between DTFT and DFT, FFT computations using Decimation in time and Decimation in frequency algorithms, Overlap-add and save methods.

INFINITE IMPULSE RESPONSE DIGITAL FILTERS **9**

Design of IIR digital filters using impulse invariance technique – Design of digital filters using bilinear transform – pre warping – Realization using direct, cascade and parallel forms.

FINITE IMPULSE RESPONSE DIGITAL FILTERS **9**

Symmetric and Antisymmetric FIR filters – Linear phase FIR filters – Design using Hamming, Hanning and Blackmann Windows – Frequency sampling method – Realization of FIR filters – Transversal and Linear phase structures.

FINITE WORD LENGTH EFFECTS **9**

Fixed point and floating point number representations – Comparison – Truncation and Rounding errors - Quantization noise – derivation for quantization noise power – coefficient quantization error – Product quantization error - Overflow error – Roundoff noise power - limit cycle oscillations.

MULTIRATE SIGNAL PROCESSING **9**

Introduction to Multirate signal processing-Decimation-Interpolation-Multistage implementation of sampling rate conversion- Design of narrow band filters - Applications of Multirate signal processing.

TOTAL HOURS = 45 + 15 =60

TEXT BOOKS

1. John G Proakis and Manolakis, " Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fourth Edition, 2007.
2. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, TMH/McGraw Hill International, 2007

REFERENCES

1. E.C. Ifeachor and B.W. Jervis, " Digital signal processing – A practical approach", Second edition, Pearson, 2002.
2. S.K. Mitra, Digital Signal Processing, A Computer Based approach, Tata McGraw Hill, 1998.
3. P.P.Vaidyanathan, Multirate Systems & Filter Banks, Prentice Hall, Englewood cliffs, NJ, 1993.
4. Johny R. Johnson, Introduction to Digital Signal Processing, PHI, 2006.

AUTOMATED MANUFACTURING SYSTEMS

11UEK615 **L T P C**

COURSE OBJECTIVES **3 0 0 3**

- *To provide knowledge in automation based on industrial applications.*
- *To know the control functions involved in a plant*
- *To study about the hardware and software involved in a PLC*
- *To have an Integrated Automation approach*

INTRODUCTION TO INDUSTRIAL AUTOMATION **9**

Requirements of industrial automation- Industrial electrical equipment requiring control and integration through PLC –Functions of the central or distributed control panels in a plant- conventional central relay and interlock panels and the various components used - advantages of PLC based system .

PLC CONFIGURATION FOR MEETING PLANT CONTROL FUNCTION **9**

PLC configuration and various components of the PLC- CPU, I/O cards, power supply, memory, extension boards, communication boards- Overall Plant motor list from mechanical supplier - deriving the required control elements, various sensors and functions- area wise segregation of PLC depending on the locations of the inputs and outputs- concept of parallel and serial (remote) inputs and outputs – Optimizing the overall cost of PLC and the control cabling.

PLC HARDWARE AND SOFTWARE **9**

Detailed specifications of low, medium and high end PLC components like, CPU, Digital input and output modules, analog input and output modules, special function modules parallel I/O –s and remote I/O-s – special communication cables for the remote I/O-s PC based programming software- modes of PLC programming - configuring PLC memory for program and data- data types and addressing modes- Input and output configuration and addressing- PLC programming instructions- basic instructions, medium end instructions and high end instructions

TIMERS AND COUNTERS **9**

Timer instructions ON DELAY, OFF DELAY and RETENTIVE Timers, UP COUNTER, DOWN COUNTER and UP DOWN COUNTERS, control instructions – Data manipulating instructions, match instructions; Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.

INTEGRATED AUTOMATION SYSTEM ELEMENTS **9**

Introduction to integrated automation system and the various levels like level ‘0’, level’1’,level’2’- introduction to field bus, control bus and information bus- use of different protocols for interfacing with other automation system and drives- HMI-s and their functions for the various plant information- integration of PLCs with plant HMI-s located at different strategic locations – Concept of client- server HMI-s and development and run type HMI-s - Assignment of screen development for atypical plant requirement.

TOTAL HOURS = 45

TEXT BOOKS

1. Frank D Petruzella, "Programmable Logic Controllers", McGraw Hill Publishers
2. Webb, John W, Programmable logic controllers: Principles and applications, Prentice Hall of India, 2004, 5th edition.

REFERENCE BOOKS

1. Siemens PLC Handbook for total automation
2. Allen-Bradley handbook for total automation
3. GE- Fanuc hand book for total automation
4. System Manual for the medium end programmable controller

WEBSITES REFERENCES

1. www.automation-info.com
2. www.control.com
3. http://www.plcs.com
4. www.plantautomation.com/
5. http://www.koldwater.com/

VIRTUAL INSTRUMENTATION

11UEK664

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To study the basic building blocks of virtual instrumentation*
- *To study the various techniques of interfacing of external instruments*
- *To study a few applications in virtual instrumentation*

INTRODUCTION TO VIRTUAL INSTRUMENTATION **9**

Definition to Virtual Instrumentation (VI)– block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming LabVIEW software-LabVIEW basics- LabVIEW environment- Simple problems.

VI PROGRAMMING TECHNIQUES **9**

VIS and sub-VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers.

DATA ACQUISITION BASICS 9

Introduction to data acquisition on PC, Sampling fundamentals, Input/Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Data acquisition interface requirements**.**

VI CHASSIS REQUIREMENTS **9**

Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, PXI system controllers, Ethernet control of PXI. Networking basics for office & Industrial applications, VISA and IVI.

LabVIEW APPLICATIONS **9**

Instrument Control, Simulation of systems using VI, Development of Control system, Image acquisition and processing, Motion control.

TOTAL HOURS : 45

TEXT BOOKS

1. Rahman, and Herbert Pichlik,, 'LabVIEW – Applications and Solutions', National Instruments Release, ISBN 0130964239
2. National Instruments LabVIEW Manual

REFERENCE BOOKS

1. Lisa K. Wells Jeffrey Travis, 'LabVIEW for Everyone', National Instruments Release

TOTAL QUALITY MANAGEMENT

11UEK616 **L T P C**

COURSE OBJECTIVES **3 0 0 3**

- *Meaning of TQM and Theories about TQM*
- *Planning and manufacturing for quality its tools and techniques*
- *Human involvement to improve quality and the development and transformation due to such involvement*
- *About failure models, component reliability & system reliability*
- *About mean down time, maintainability of systems & condition monitoring*

INTRODUCTION **9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

TQM PRINCIPLES **9**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

STATISTICAL PROCESS CONTROL (SPC) **9**

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools. Fundamentals of Supply Chain Management.

TQM TOOLS **9**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

QUALITY SYSTEMS **9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

TOTAL HOURS: 45

TEXT BOOK

1. Dale H.Besterfiled, et at., Total Quality Management, Pearson Education Asia, 1999. (Indian reprint 2002).
2. James R.Evans&William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).

REFERENCES

1. Feigenbaum.A.V. "Total Quality Management, McGraw-Hill, 1991.
2. Oakland.J.S. "Total Quality Management Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.
4. Zeiri. "Total Quality Management for Engineers Wood Head Publishers, 1991.

AUTOMATION AND SIMULATION LAB

11UEK617

L	T	P	C
0	0	3	2

OBJECTIVES

- *Automation of process using PLC*
- *Automation of process using SCADA*

LIST OF EXPERIMENTS

1. Sequential control of Motor
2. Tank level control
3. Fan Control
4. Seven segment Display
5. Reaction Vessels
6. Starter Control
7. Star-Delta
8. Relay units fixed with '8' Relays
9. Implementation of PLC programming through SCADA
10. Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using MATLAB / LABVIEW software.

VIRTUAL INSTRUMENTATION LAB

11UEK665

L	T	P	C
0	0	3	2

OBJECTIVE

- ***T****o practically know the concepts of LabVIEW programming*
- *To apply the concepts for developing VIs for simulations and real time applications*

LIST OF EXPERIMENTS

1. Creating Virtual Instrumentation for simple applications
2. Programming exercises for loops and charts
3. Programming exercises for clusters and graphs.
4. Programming exercises on case and sequence structures, file Input / Output.
5. Data acquisition through Virtual Instrumentation.
6. Developing voltmeter using DAQ cards.
7. Developing signal generator using DAQ cards.
8. Simulating reactor control using Virtual Instrumentation.
9. Real time Temperature control using Virtual Instrumentation.
10. Real time sequential control of any batch process.

DIGITAL SIGNAL PROCESSING LAB

11UEK666

L	T	P	C
0	0	3	2

USING TMS320C5X/TMS320C 67XX

1. Study of various addressing modes of DSP using simple programming examples
2. Implementation of Linear and Circular Convolution
3. Sampling of input signal and display
4. Waveform generation
5. Implementation of FIR filter

USING MATLAB

6. Generation of Signals
7. Linear and circular convolution of two sequences
8. Sampling and effect of aliasing
9. Design of FIR filters
10. Design of IIR filters
11. Calculation of FFT of a signal
12. Decimation by poly phase decomposition.

Requirement for a batch of 30 students

S.No.	Description of Equipment	Quantity required
1.	PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)	15 Units (2 students per system)
2.	Function Generators (1MHz)	15
3.	CRO (20MHz)	15

List of software required:

1. MATLAB with Simulink and Signal Processing Tool Box	10 Users license

CAD/CAM/CIM

11UEK718

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

To familiarize with

- *Concepts of modeling in 2D and 3D*
- *Concepts of computer graphics*
- *Basics of manufacturing automation*
- *CNC machines and its constructional features and part programming*
- *Basics of computer aided inspection*
- *Automated material handling systems*

INTRODUCTION **9**

Introduction to Design process - CAD. **Geometric Modeling**: Types - Wireframe, surface and solid modeling. **Solid modeling techniques**: CSG and B-rep - Operations: Boolean - Extrude - Sweep - Revolve. Entities - Line - Circle - Ellipse - Parabola - Cubic Spline, Bezier and B-spline (Basic treatment only).

COMPUTER GRAPHICS (2D and 3D) 9

Coordinate systems - Transformations: translation, scaling, reflection, rotation - Concatenated transformation - Inverse transformation. Hidden line removal - Shading - Colouring - Rendering - Animation (Basic treatment only).

COMPUTER AIDED MANUFACTURING **9**

Introduction to CNC, DNC Machines and their elements- principles of operation - features – Classification - Fundamentals of CNC machines. Part Program Terminology-G and M Codes – Types of interpolation Methods of CNC part programming – Manual part programming – Computer Assisted part programming – CNC part programming using CAD/CAM.

INTEGRATED MANUFACTURING SYSTEM AND AUTOMATION **9**

Manufacturing systems - types, current trends, automation in manufacturing. Features - types of manufacturing systems-machine tools - Group technology - part families, coding and classification - Flexible manufacturing systems (FMS) - the FMS concept - Rapid prototyping - Artificial Intelligence and Expert system.

AUTOMATION **9**

Automated material handling systems (conveyor, automated guided vehicle, pallets etc.) - Automated storage and retrieval systems. Manufacturing planning and control - Hierarchical network of computers - Local Area Networks - Process Planning - Computer Aided Process Planning - Retrieval and Generative Approaches. Materials handling system computer control system

TOTAL HOURS = 45

TEXT BOOKS

1. Mikell P. Groover, Automation, Production systems and computer integrated manufacturing, Prentice Hall of India Private Ltd., New Delhi, 2001
2. Ibrahim Zeid, CAD / CAM - Theory and Practice, Tata Mcgraw-Hill, New Delhi, 2001
3. Radhakrishnan. P., CAD / CAM / CIM - New age international, 2000

REFERENCE BOOKS

1. Hans B. Kief and Frederick Waters, T., *Computer Numerical Control - A CNC Reference Guide*, Macmillan / McGraw-Hill, New York, 1992
2. James Madison, *CNC Machining Hand Book*, Industrial Press Inc., New York, 1996
3. Mikell P. Groover, Emory W. Zimmers Jr., *Computer Aided Design and Manufacturing*, Prentice Hall of India Private Ltd., New Delhi, 1996

INDUSTRIAL PSYCHOLOGY AND WORK ETHICS

11UAK704

L	T	P	C
2	0	0	2

COURSE OBJECTIVES

- *Familiarize students with aspects of industrial and organizational psychology, such as attitudes and behaviors of employees and employers; interpersonal relationships at work.*
- *Expose students to the complex processes of motivation and leadership; organizational and individual performance.*
- *To understand the principles of moral values, issues and decisions in engineering practice, the professional rights and responsibilities.*

INDUSTRIAL PSYCHOLOGY **9**

Introduction to Industrial Psychology – Definitions & Scope - characteristics Major influences on industrial Psychology- Scientific management and human relations – Time and Motion Study – Nature and Characteristics, use of Therbligs, Principles.

INDIVIDUAL IN WORKPLACE AND WORK ENVIRONMENT **9**

Motivation and Job satisfaction, stress management. Organizational culture, Leadership & group dynamics Work Environment & Engineering Psychology-fatigue. Boredom, accidents and safety. Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests.

ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' - variety of moral issued - 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.

ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – a balanced outlook on law - the challenger case and its safety issue

SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Three Mile Island, chernobyl and safe exits. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights – whistle blowing - discrimination.

TOTAL HOURS: 45

TEXT BOOKS

1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.
2. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York 1996.

ROBOTICS AND MACHINE VISION SYSTEM

11UEK719

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *The objective of this course is to introduce students to the principles of robotics.*
- *To familiarize the students with the concepts and techniques in robot manipulator control, enough to evaluate, chose, and incorporate robots in engineering systems*
- *Understanding of designing and implementing robot applications and their relationship to other automated technologies*

BASICS OF ROBOTICS **9**

Introduction- Basic components of robot-Laws of robotics- classification of robot-work space- accuracy-resolution – repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives.

ROBOT MECHANICS **9**

Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation – Basics of Trajectory Planning.

ROBOT END EFFECTORS **9**

Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper mechanism- gripper force analysis- other types of gripper- special purpose grippers.

ROBOT SENSORS & ROBOT PROGRAMMING **9**

Sensors: Position sensors – Potentiometers, encoders – LVDT, Velocity sensors, Acceleration Sensors, Force, Pressure and Torque sensors, Touch and Tactile sensors, Proximity, Range and sniff sensors, RCC, VOICE recognition and synthesizers.Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.

MACHINE VISION **9**

Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology, Feature Extraction and vision sensors and their types. Image resolution – Depth and volume, Color processing, Object recognition by features, Depth measurement, specialized lighting techniques. Segmentation using motion – Tracking. Image Data Compression; Real time Image processing, Application of Vision systems

TOTAL HOURS= 45

TEXT BOOKS

1. King Sun Fu, Rafael C. González, C. S. George Lee-Robotics : control, sensing, vision, and intelligence, Tata Mcgraw-Hill Publication, 1987
2. M.P.Groover, Industrial robotics- Technology, programming and Applications, McGraw-Hill, 1986
3. Saeed B. Niku, Introduction to Robotics: Analysis, Systems, Applications, 2nd edition, Pearson Education India, PHI 2003 (ISBN 81-7808-677-8).

REFERENCES

1. Sathya Ranjan Deb, robotics Technology & flexible Automation Sixth edition, Tata Mcgraw-Hill Publication, 2003.
2. John.J.Craig, Introduction to Robotics: Mechanics & control, Second edition-2002.

EMBEDDED SYSTEMS

11UEK767

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To introduce students to the embedded systems, its hardware and software.*
- *To introduce devices and buses used for embedded networking.*
- *To explain programming concepts for embedded systems.*
- *To explain real time operating systems and inter-task communication.*

INTRODUCTION TO EMBEDDED SYSTEMS **9**

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

DEVICES AND BUSES FOR DEVICES NETWORK **9**

I/O Devices - Device I/O Types and Examples – Synchronous - ISO-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Timer and Counting Devices - '12C', 'USB', 'CAN'

PROGRAMMING FOR EMBEDDED SYSTEMS **9**

Getting the most of C-data types-manipulating bits in memory and I/O ports-accessing memory mapped I/O devices – structures-variant access - mixing C to assembly - register usage-use of addressing options-instruction sequencing – procedure call and return - parameter passing – retrieving parameters memory management – scope - automatic allocation - static allocation-dynamic allocation – shared memory.

REAL TIME OPERATING SYSTEM CONCEPTS **9**

Architecture of the Kernel-task and task scheduler-Interrupt Service Routines -Semaphores- Mutex - Mailboxes-Message Queues - Event Registers – Pipes - Signals-Timers -Memory Management – Priority Inversion Problem.

REAL TIME OPERATING SYSTEM TOOLS AND CASE STUDIES **9**

Use of μC / OS-II- Case study of coding for an Automatic Chocolate Vending Machine using MUCOS RTOS- Case study of an Embedded system for an Adaptive Cruise Control Systems in a Car- Case study of an Embedded Systems for a Smart Card.

TOTAL HOURS=45

TEXT BOOKS

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First reprint Oct. 2003
2. K.V.K.K.Prasad "Embedded /Real-Time Systems: Concepts, Design and Programming" Dream tech, Wiley 2003.

REFERENCES

1. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
2. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001
3. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware /Software Introduction, John Wiley, 2002.
4. Ajay V Deshmukh "Microcontroller Theory and Applications" Tata McGraw Hill 2005.

CAE LABORATORY

11UEK720

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Modelling of a part using Pro-E / CATIA / UNIGRAPHICS.
2. Modelling of a component using Pro-E / CATIA / UNIGRAPHICS.
3. Modelling and assembling of the mechanical assembly using Pro-E / CATIA / UG.
4. Structural analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
5. Beam deflection analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
6. Thermal analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
7. Modelling and tool path simulation using Master CAM (MILL) or any CAM package.
8. Modelling and tool path simulation using Master CAM (Lathe) or any CAM package.
9. NC code generation for milling using Master CAM (MILL) or any CAM package.
10. NC code generation for turning using Master CAM (Lathe) or any CAM package.

TOTAL HOURS = 45

Requirements for a batch of 30 students:

S.No.	Description of Equipment	Quantity required
I	**HARDWARES**	
	Computer server	1 No.
	Computer nodes or systems (Intel Core with 2GB RAM) networked to the server	30 Nos.
	A3 size plotter	2 Nos.
	Laser Printer	2 Nos.
	Trainer CNC lathe	2 Nos.
	Trainer CNC milling	2 Nos.
	SOFTWARES	
II	Any CAD software	30 licenses
	Any FEA software	5 licenses
	Any CAM software	10 licenses

ROBOTICS AND MACHINE VISION SYSTEM LABORATORY

11UEK721

L	T	P	C
0	0	3	2

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)

MECHATRONICS ENGINEERING APPLICATIONS

11UEK823

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

To educate the students about the application of Mechatronics systems in various fields

INTRODUCTION **9**

Bio -potential, resting and action potential -ECG, EEG, EMG – machine description –methods of measurement ,Electrocardiograph measurements – blood pressure measurement by ultrasonic method –plethysmography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography.

MEDICAL SUPPORT **9**

Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – Bio-telemetry – laser equipment and application – Cardiac pacemaker –DC defibrillator ,Centralized patent monitoring system.

CASE STUDIES **9**

Data Acquisition: Introduction – Cantilever Beam Force Measurement system–Testing of Transportation bridge surface materials – Transducer calibration system for Automotive applications – Strain gauge weighing system – Solenoid Force-Displacement calibration system – Rotary optical encoder – Controlling temperature of a hot/cold reservoir – pick and place robot.

CASE STUDIES ON MECHATRONICS SYSTEM **9**

Case studies on Data Acquisition and control: Introduction – Thermal cycle fatigue of a ceramic plate – pH control system – Dc-Icing Temperature Control system – Skip control of a CD Player – Autofocus Camera, exposure control. Case studies of design of mechatronic products – Motion control using D.C.Motor & Solenoids – Car engine management systems.

APPLICATIONS IN MECHATRONICS **9**

Advanced applications in Mechatronics: Sensors for condition Monitoring – Mechatronic Control in Automated Manufacturing – Artificial intelligence in Mechatronics – Fuzzy Logic Applications in Mechatronics – Microsensors in Mechatronics.

Total Hours 45

TEXT BOOKS

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TMH, 1989.
2. Arumugam M., “Bio Medical Instrumentation”, Anuradha agencies Pub., 2002.
3. Devdas shetty, Richard A. Kolk, “Mechatronics System Design”, Thomson Learning Publishing Company, Vikas publishing house, 2001.
4.Tai-Ran Hsu,MEMS & Microsystems Design and Manufacture,Tata McGraw-Hill,2006.

REFERENCES

1. Cromwell, Weibell and Pfeiffer, “Biomedical Instrumentation and Measurements”, 2ndEdition, Prentice Hall of India, 1999.
2. Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999.
3. Bradley, D.Dawson, N.C. Burd and A.J. Loader, Mechatronics: Electronics in Products and Processes, Chapman and Hall, London, 1991.

ELECTRONIC CIRCUITS

11UEE551

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To study the fundamental requirements of Electronic circuits*
- *To study the amplifier characteristics.*
- *To study the MOSFET amplifiers.*
- *To study the different types of Oscillators.*

BIASING OF DISCRETE BJT AND MOSFET **9**

DC Load line, operating point, various biasing methods for BJT-Design-Stability- Bias compensation, Thermal stability, Design of biasing for MOSFET and JFET.

BJT AMPLIFIERS **9**

Small signal Analysis of Common Emitter-AC Load line, Voltage swing limitations, Common collector and common base amplifiers – JFET amplifiers – Differential Amplifiers - CMRR- Darlington Amplifier-Bootstrap technique - Cascaded stages -Cascode Amplifier.

MOSFET AMPLIFIERS **9**

Small signal Analysis of Common source, Source follower and Common Gate amplifiers - CMOS Inverters –DC Analysis of CMOS Inverters – Voltage transfer curve – BiMOS Cascode - Design of NMOS inverter using resistive load – Noise Margin – VTC.

FEEDBACK AMPLIFIERS AND STABILITY **9**

Basic feedback concepts – Properties of Negative feedback – Four feedback topologies with amplifier circuit. Examples – Analysis of series – shunt feedback amplifiers – stability problem – Frequency compensation.

OSCILLATORS **9**

Barkhausen criteria for oscillator – Analysis of RC oscillators – Phase shift, Wein bridge oscillators – LC oscillators – Colpitt, Hartley, Clapp, Crystal , Armstrong, Franklin and Ring Oscillators.

TOTAL HOURS = 45

TEXT BOOK

1. Adel .S. Sedra, Kenneth C. Smith, Micro Electronic circuits, 5th Edition, Oxford University Press, 2004.
2. David .A. Bell, Solid state pulse circuits, Prentice Hall of India,1992.

REFERENCES

1. Paul Gray, Hurst, Lewis, Meyer," Analysis and Design of Analog Integrated Circuits", 4th Edition ,. John Willey & Sons 2005
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 2007.
3. Donald .A. Neamen, Electronic Circuit Analysis and Design –2nd edition,Tata McGraw Hill, 2007.
4. Behzad Razavi, " Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 2007.
5. Paul Gray, Hurst, Lewis, Meyer "Analysis and Design of Analog IntegratedCircuits", 4th Edition , John Willey & Sons 2005

ADVANCED CONTROL THEORY

11UEE552

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

To introduce the students to the concept of state space analysis and some of the advanced control concepts like optimal control, adaptive control, digital control etc

STATE SPACE ANALYSIS **9**

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and Observability - State observer Design of Control Systems with observers. Tests for controllability and observability for continuous time systems

DESCRIBING FUNCTION ANALYSIS **9**

Introduction to nonlinear systems, Types of nonlinearities, describing functions, describing function analysis of nonlinear control systems.

SAMPLED DATA SYSTEMS **9**

Sampling process, Shannon's theorem, reconstruction of sampled signal zero order & first order hold, Z-transform, definition, evaluation of Z-transform, Inverse Z transform, pulse transfer function, limitations of Z-transform, state variable formulation of discrete time systems. Solution of discrete time state equations, stability, definition, the Schur-Cohn stability criterion,Jury's test of stability of extension of Routh-Hurwitz criterion to discrete time systems.

OPTIMAL CONTROL **9**

Formulation of optimal control problem. Minimum time, Minimum energy, minimum fuel problems. State regulator problem. Output regulator problem.Tracking problem, Continuous-Time Linear Regulators.

INTRODUCTION TO ADAPTIVE CONTROL SYSTEM **9**

Definition of adaptive control system, functions of adaptive control, gain scheduling, model reference ,series and parallel schemes and their industrial applications

TOTAL HOURS = 45

TEXT BOOKS

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition, 1996
2. Digital Control and State Variable Methods – by M. Gopal, Tata McGraw-Hill Companies, 1997.

REFERENCE

1. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003.
2. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998

ADVANCED MANUFACTURING PROCESSES

11UEE501

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- *This course will give a good perspective with adequate depth to understand the unconventional machining processes; its relative advantages were conventional techniques.*

MECHANICAL ENERGY BASED PROCESSES **9**

Introduction - Unconventional machining Process – Need – clarification – Advantages, Applications. Abrasive Jet Machining – Water Jet Machining – Ultrasonic Machining. (AJM, WJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

ELECTRICAL ENERGY BASED PROCESSES **9**

Electric Discharge Machining (EDM)- working Principles-equipments-Process Parameters-MRR- electrode / Tool – Power Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES **9**

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants-maskant-techniques of applying maskants-Process Parameters – MRR-Applications.

Principles of ECM-equipments-MRR-Electrical circuit-Process Parameters-Electro Chemical Grinding (ECG) and Electro Chemical Honing (ECH) Applications.

THERMAL ENERGY BASED PROCESSES **9**

Laser Beam machining (LBM), Plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles-Equipment-Types-Beam control techniques – Applications.

SURFACE COATING and SURFACE TREATMENT **9**

Galvanizing, Electroplating, Anodising, Thin film coating (PVD, CVD). Surface hardening- carburizing, carbonitriding, cyaniding, nitriding, ion nitriding, boronizing, laser hardening.

TOTAL HOURS : 45

TEXT BOOK

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi (2002) ISBN 81-7764-294-4.
2. Benedict. G.F. “Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York (1987).

REFERENCES

1. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi (1980).
1. Rao P.N., “Manufacturing Technology, Metal cutting and Machine Tools”, Tata McGraw Hill, 2000
2. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London (1998).
3. 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) ISBN – 81-203-1243-0.

OPERATIONS RESEARCH

11UEE502

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *Applications and use of Assignment, Transportation and Replacement models*
- *Techniques of PERT, CPM*
- *Detailed knowledge of Inventory control and queing theory*
- *Decision theory and game theory techniques*

INTRODUCTION TO OPERATION RESEARCH **9**

Introduction, Modeling in Operations Research, Phases of OR study, Scope of OR. Linear Programming and its Applications: Linear Programming Problem – Graphical solution of LP Problem. Simplex method, Revised Simplex method, Dual Simplex method.

TRANSPORTATION AND ASSIGNMENT MODELS **9**

Introduction – Methods of basic feasible solution, Optimality test, Degeneracy in transportation problem, unbalanced transportation Problem, Hungarian method for assignment problem, Traveling salesman problem. Theory of Games: Introduction, to solve the rectangular two person zero sum games, solution of rectangular games in terms f mixed strategies, solution of 2x2 games without saddle point, solution of a two person zero sum 2Xn game, Graphical method for 2Xn and nX2 games.

INVENTORY CONTROL **9**

Introduction – EOQ with uniform rate of demand, Economic lot size with finite rate of replenishment, Quantity discounts, Deterministic model with Shortages, ABC analysis of inventory.

PROJECT MANAGEMENT BY PERT/CPM **9**

Introduction, Basic steps in PERT/CPM techniques, Network diagram presentation, Rules of drawing network diagram, Fulerson's rule, Time estimates and Critical path in network analysis, Project evaluation and review technique, Application areas of PERT/CPM techniques.

DYNAMIC PROGRAMMING **9**

Introduction, The recursive equation approach, Computational Procedure in dynamic Programming, An application to inventory Control. Simulation: Introduction, Monte-Carlo Simulation, Application to Inventory Control, Application to Queuing Problems.

TOTAL HOURS: 45

TEXT BOOKS

1. SD Sharma, 'Operations Research (units: I, IV)', Kedarnath, Ramnath&Co.,Meerut.
2. BS Goel&S.K.Mithal, 'Operations Research (Units: II,III)', PragatiPrakasham, Meerut.

REFERENCE

1. KanthiSwarup, PK Gupta &Manmohan, 'Operations Research' Sultanchand& Sons, New Delhi.

DATA STRUCTURES

11UEE591

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To understand the various ADTs so as to use them in program design.*
- *To design algorithms to various problems based on the design strategies.*
- *To analyze algorithms to find out their time complexity.*

INTRODUCTION TO ALGORITHM ANALYSIS AND DATA STRUCTURES **9**

Introduction to Data Structures: Concept of Data, Data type – Introduction to pointers – Self-referential Structure - Data structure,Abstract Data Types (ADT) - Concept of Primitive and Non primitive, linear and Non-linear, Static and Dynamic Data Structures.

LINEAR DATA STRUCTURES **9**

List ADT: linked list, doubly linked list, circular linked list; applications, Stack ADT – Queue ADT – Stack and Queue ADT applications.

TREES **9**

Definitions, Implementation, Binary Trees and Traversals, Expression Trees, Binary Search Trees, AVL Trees.

SORTING, SEARCHING **9**

Selection Sort, Bubble Sort. InsertionSort, Merge Sort. Quick Sort, Heap Sort. Bucket Sort, External Sorting, Concepts of searching – Sequential searching –Binary Searching

GRAPH ALGORITHMS **9**

Definitions, Representation of Graphs, Topological Sort, Shortest - path algorithms. Minimum Spanning Tree, Graph Traversals.

TOTAL HOURS: 45

TEXT BOOKS

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, AddisionWilsey, ThirdEdition, 2006.
2. Yashavant P. Kanetkar, “Understanding Pointers in C”, BPB Publications

REFERENCES

3. A. Aho, J. Hopcroft, J. Ulman, “Data Structures and Algorithms”, Pearson Education, 1998.
4. Data Structures and Program Design in C, Robert Kruse, Tondo CL, Bruce Leung, ShashiMogalla, 2nd edition, Pearson Education, 2009.
5. GAV Pai, “Data Structures and Algorithms”, Tata-McGraw Hill, 2008.

MICRO CONTROLLER BASED SYSTEM DESIGN

11UEE653

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

To enable students to gain knowledge on interfacing of various components to a microcontroller and develop systems for real time applications

INTRODUCTION **9**

Embedded C compiler – advantages – memory models – interrupt functions – code optimization - 89C2051 micro-controller-architecture-comparison with 89C51- design of a simple trainer circuit using 89C51/89C2051 μC – interfacing of DIP switch, LED, 7 segment display, alphanumeric LCD – relay interface – design of a traffic light control system - interfacing programs using C and assembly language.

COMMUNICATION PROTOCOLS **9**

Serial bus standards - I2C bus, SPI bus – operation – timing diagrams – 2 wireserial EEPROM – 24C04 – 3wire serial EEPROM – 93C46 - interfacing – serial communication standards - RS232, RS422, RS485 – comparison – MAX232 line driver/ receiver - interfacing – interfacing programs using C and assembly language - low voltage differential signaling – PC printer port – registers – interfacing - universal serial bus – PCI bus.

PIC MICROCONTROLLER **9**

Introduction to PIC Microcontroller - PIC 16C6x and PIC 16C7x Architectures – PIC 16Cxx Instruction Set – Simple Operations.

SYSTEM DEVELOPMENT **9**

Microcontroller based System Design, , Application in Automobiles, Robotics and consumer Electronics.

INTERFACING CONCEPTS **9**

Matrix key board interface - AT keyboard – commands – keyboard response codes - watch dog timers - DS1232 watch dog timer – real time clocks – DS1302 RTC – interfacing - measurement of frequency - phase angle - power factor – stepper motor interface - dc motor speed control – L293 motor driver - design of a position control system - interfacing programs using C and assembly language.

TEXT BOOKS

1. The 8051 Microcontroller: Muhammad Ali Mazidi, Pearson Education.
2. Programming with ANSI C and turbo C: Kamthane, Pearson Education.
3. Julio Sanchez Maria P.Canton, “Microcontroller Programming: The microchip PIC”,CRC Press, Taylor & Francis Group,2007.

REFERENCE BOOKS

1. Programming and customizing the 8051 μC: Myke Predko, TMH
2. The 8051 Microcontroller: Kenneth J Ayala, Penram International.

ADVANCED SENSOR TECHNOLOGY

11UEE654

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

- *Understand the science of measurements and sensors*
- *Identify and avoid errors in measurements*
- *Select appropriate sensors for various applications*

CHEMICAL SENSORS **9**

Blood –Gas and Acid –base physiology Electrochemical sensors, Chemical Fibro sensors, Iron-Selective Field-Effect Transistor (ISFET),Immunologically Sensitive Field Effect Transistor (IMFET) , Integrated flow sensor and Blood Glucose sensors.

FIBER OPTICAL SENSORS **9**

Fiber optic light propagation, Graded index fibers, Fiber optic communication driver circuits, Laser classifications, Driver circuits for solid –state laser diodes, Radiation sensors and Optical combinations.

BIOMEDICAL SENSORS **9**

Sensors Terminology in human body, Introduction, Cell, Body Fluids Musculoskeletal system, Bioelectric Amplifiers, Bioelectric Amplifiers for Multiple input Circuits, Differentional Amplifiers, Physiological Pressure and other cardiovascular measurements and devices.

ELECTRODES **9**

Electrodes for Biophysical sensing, Electrode model circuits, Microelectrodes, ECG, EEG, electrodes ECG signals, waveforms, Standard lead system, Polarization, Polarizable, Non polarizable electrodes and body surface recording electrodes. Ultrasonic Transducers for Measurement and therapy – radiation detectors – NIR spectroscopy.

ADVANCED SENSOR DESIGN **9**

Fluoroscopic machines design, nuclear medical systems, EMI to biomedical sensors, types and sources of EMI, Fields, EMI effects. Computer systems used in X- ray and Nuclear Medical equipments. Calibration, Typical faults, Trouble shooting, Maintenance procedure for medical equipments and Design of 2& 4 wire transmitters with 4 – 20 mA output.

TOTAL HOURS: 45

TEXT BOOKS

1. Sensors Hand Book Sabaree Soloman - Sensors Hand Book, McGraw Hill, 1998
2. Smith H.M. - Principles of Holography, John Wiley & Sons, New York, 1975
3. J.G. Webster Medical instrumentation Application and Design, Houghton Mifilin Co. 2004,

REFERENCE

1. Carr and Brown - Introduction to Medical Equipment Technology, Addison Wesley. 1999
2. Culshaw B and Dakin J (Eds) Optical Fibre Sensors, Vol. 1 & 2 Artech House, Norwood. (1989)

PRODUCT DESIGN AND DEVELOPMENT

11UEE603

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To study about the successful product development strategies, product planning activities, specifications, various methods for concept selection and architecture planning*

INTRODUCTION **9**

Nature and scope of product engineering - creative thinking and organization. Characteristics of Successful Product Development –Development Processes and Organizations – A Generic Development Process – Concept Development– Product Development Process Flows – The AMF Development Process- Product Development Organizations – The AMF Organization, Collaborative product commerce(CPC).

PRODUCT PLANNING AND SPECIFICATIONS **9**

Product Planning Process – Identify Opportunities – Evaluating and Prioritizing Projects– Allocating Resources and Timing – Pre-Project Planning – Reflect on the Results and the Process – Identifying Customer Needs – Raw Data from Customers – Interpreting Raw Data in Terms of Customer Needs – Organizing the Needs into a Hierarchy –Establishing the Relative Importance of the Needs – Reflecting on the Results and the Process- Establishing product specifications.

CONCEPT GENERATION, SELECTION & TESTING **9**

Concept generation-search externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology – benefits – Concept screening – Concept scoring – Concept Testing Methodologies.

PRODUCT ARCHITECTURE **9**

Product Architecture – Implications of the Architecture – Establishing the Architecture –Delayed Differentiation – Platform Planning – Related System – Level Design Issues.

INDUSTRIAL DESIGN **9**

Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically -Need for industrial design-impact – design process - conceptualization - refinement - management of the industrial design process - technology driven products - user - driven products - assessing the quality of industrial design.

TOTAL HOURS: 45

TEXT BOOKS

1. Karl T.Ulrich and Steven D. Eppinger, “Product Design and Development”, McGraw Hill International Edition, 1999.
2. A.K.Chitale and R.C.Gupta, “Product Design and Manufacturing”, Prentice-Hall of India Pvt.Ltd., New Delhi, 2008.

REFERENCES

1. Kemnneth Crow, “Concurrent Engg. /Integrated Product Development”, DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569.
2. Stephen Rosenthal, “Effective Product Design and Development”, Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4.
3. Stuart Pugh, “Tool Design – Integrated Methods for successful Product Engineering”, Addison Wesley Publishing, 1991.

DESIGN FOR MANUFACTURE AND ASSEMBLY

11UEE604

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To understand modern manufacturing operations, including their capabilities, limitations and to design for lowest cost.*
- *To understand the relationship between customer desires, functional requirements, product materials, product design, and manufacturing process selection*
- *Develop a design skill set aimed towards optimizing design for ease of manufacture*

INTRODUCTION **9**

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

FACTORS INFLUENCING FORM DESIGN **9**

Selection of Materials in Design - Influence of materials on form design - form design of grey iron, malleable iron, steel and aluminium castings - form design of welded members, forgings.

COMPONENT DESIGN - MACHINING CONSIDERATION **9**

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.

COMPONENT DESIGN - CASTING CONSIDERATION **9**

Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores.

Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

DESIGN FOR THE ENVIRONMENT **9**

Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment –Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.

TOTAL HOURS: 45

TEXT BOOKS

1. Boothroyd, G, Design for Assembly Automation and Product Design, Marcel Dekker, New York.,1980
2. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.

REFERENCE BOOKS

1. Bralla, Design for Manufacture handbook, McGraw hill, 1999.
2. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and
3. Structural Approach, Field Stone Publisher, USA, 1995.
4. Fixel, J. Design for the Environment McGraw hill., 1996.
5. Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff, Prentice Hall. Reason Pub.,1996.
6. Kevien Otto and Kristin Wood, Product Design. Pearson Publication, 2004.

ADVANCED DIGITAL SYSTEM DESIGN

11UEE755

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To study the design of sequential circuit & Asynchronous sequential circuit*
- *fundamental requirements of Electronic circuits*
- *To study the fault detection methods and testability algorithms.*
- *To study the design of various systems using VHDL.*

SEQUENTIAL CIRCUIT DESIGN **9**

Analysis of clocked synchronous sequential circuits and modelling - State diagram, state table, state table assignment and reduction-Design of synchronous sequential circuits design of iterative circuits-ASM chart and realization using ASM

ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN **9**

Analysis of asynchronous sequential circuit – flow table reduction-races-state assignment-transition table and problems in transition table- design of asynchronous sequential circuit-Static, dynamic and essential hazards – data synchronizers – mixed operating mode asynchronous circuits – designing vending machine controller

FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS **9**

Fault table method-path sensitization method – Boolean difference method-D algorithm -Tolerance techniques – The compact algorithm – Fault in PLA – Test generation-DFT schemes – Built in self test

SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES **9**

Programming logic device families – Designing a synchronous sequential circuit using PLA/PAL – Realization of finite state machine using PLD – FPGA – Xilinx FPGA-Xilinx 4000

SYSTEM DESIGN USING VHDL **9**

VHDL operators – Arrays – concurrent and sequential statements – packages- Data flow – Behavioral – structural modeling – compilation and simulation of VHDL code –Test bench - Realization of combinational and sequential circuits using HDL – Registers – counters – sequential machine – serial adder – Multiplier- Divider.

TOTAL HOURS = 45

TEXT BOOK

1. Charles H.Roth Jr “Fundamentals of Logic Design” Thomson Learning 2004
2. Nripendra N Biswas “Logic Design Theory” Prentice Hall of India,2001

REFERENCES

1. Parag K.Lala “Fault Tolerant and Fault Testable Hardware Design” B S Publications,2002
2. Parag K.Lala “Digital system Design using PLD” B S Publications,2003
3. Charles H Roth Jr.”Digital System Design using VHDL” Thomson learning, 2004
4. Douglas L.Perry “VHDL programming by Example” Tata McGraw.Hill - 2006

DIGITAL IMAGE PROCESSING

11UEE756

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3	0	0	3

COURSE OBJECTIVES

- *To study the image fundamentals and mathematical transforms necessary for image processing..*
- *To study the image enhancement techniques*
- *To study image restoration procedures.*
- *To study the image compression procedures.*
- *To study the image segmentation and representation techniques.*

DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS **9**

Elements of visual perception – Image sampling and quantization Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT –Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar transforms.

IMAGE ENHANCEMENT TECHNIQUES **9**

Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters : Smoothing – Sharpening filters – Homomorphic filtering.

IMAGE RESTORATION **9**

Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo nverse – Singular value decomposition.

IMAGE COMPRESSION **9**

Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding-DPCM. Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG,Basics of Vector quantization.

IMAGE SEGMENTATION AND REPRESENTATION **9**

Edge detection – Thresholding - Region Based segmentation – Boundary representation: chaircodes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors – Simple descriptors- Texture

TOTAL HOURS: 45

TEXT BOOKS

1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing - Pearson Education2 003.
2. Image Processing Analysis and Machine Vision – Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, Thompson Learniy (1999).

REFERENCES

1. William K Pratt, Digital Image Processing John Willey (2001)
2. A.K. Jain, PHI, New Delhi (1995)-Fundamentals of Digital Image Processing.
3. Chanda Dutta Magundar – Digital Image Processing and Applications, Prentice Hall of India, 2000

ELECTRICAL DRIVES AND CONTROL

11UEE757

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To give an introduction to electrical drives*
- *To expose the students to the basic operation of different drives and its characteristics*
- *To study the starting and speed control operation of ac and dc drives*

INTRODUCTION TO ELECTRIC DRIVES **9**

Introduction - Electric drives – Types - Speed - Torque characteristics of various types of loads and drive motors - Selection of power rating for drive motors with regard to thermal overloading and load variation factors – load equalization – Starting, braking, and reversing operations.

DC DRIVES **9**

Speed control of DC motors - Ward - Leonard scheme - drawbacks - Thyristor converter fed dc drives: - Single, two and four quadrant operations - Chopper fed DC drives : - Time ratio control and current limit control - Single, two and four quadrant operations – Effect of ripples on the motor performance.

THREE PHASE INDUCTION MOTOR DRIVES **9**

Speed control of 3 phase Induction Motors - Stator control: Stator voltage and frequency control - Inverter and cycloconverter fed Induction Motor drives, rotor control - Rotor resistance control and slip power recovery schemes - Static control of rotor resistance using DC chopper - Static Krammer and Scherbius drives – Introduction to Vector Controlled Induction Motor Drives

THREE PHASE SYNCHRONOUS MOTOR DRIVES **9**

Speed control of 3 phase Synchronous Motors - Inverter fed Synchronous Motors – Commutator-less DC motors - cycloconverter fed Synchronous Motor - Effect of harmonics on the performance of AC motors

SPECIAL DRIVES , DIGITAL CONTROL AND DRIVE APPLICATIONS **9**

Special drives - BLDC Motor drives, Switched reluctance motor drives – Linear induction motor / linear synchronous motor drive, Stepper motor drive.

Digital techniques in speed control - Advantages and limitations – Microprocessor / Microcontroller and PLC based control of drives - Selection of drives and control schemes for Steel rolling mills, Paper mills, Lifts and Cranes.

TOTAL HOURS: 45

TEXT BOOKS

1. Dubey G.K., "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2003.
2. Bose, B.K., “Modern Power Electronics and AC Drives", Pearson Education (Singapore) Pvt.. Ltd, New Delhi, 2003
3. Vedam Subramanyam, “ Electric Drives: Concepts and Applications”, Tata McGraw hill Pvt. Ltd, New Delhi, 2002

REFERENCE

1. Bose, B.K., "Power Electronics and Variable frequency Drives – Technology and Applications", IEEE, Press, Inc. New York, 1997.
2. Krishnan R, “ Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall of India, Pvt. Ltd, New Delhi, 2002
3. Ion Boldea and S. A. Nasar”, Electric Drives”, CRC Press LLC, New York,1999.
4. J. Gnanavadivel, “Electrical Drives and Control”, Anuradha Publications.

AUTOMOTIVE TECHNOLOGY

11UEE705

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The Electrical control of Mechanical equipments in the field of Automobiles gives more comfort, efficiency and also user friendly to the user. This subject is formed such a way that to create a knowledge to the students to understand and create various electrical control of Automotive Equipments.

INTRODUCTION **9**

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Charging systems – working and design of charging circuit diagram – starter motors and starter circuits.

BASICS OF ENGINES **9**

Operating principles of IC engine – major engine components – engine cylinder arrangements – the ignition systems – Electronic ignition, direct ignition, injection systems – working of the carburetor – throttle body injection – Multipoint fuel injection – sequential fuel injection.

SENSOR AND ACTUATORS **9**

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

ENGINE CONTROL SYSTEMS **9**

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system – In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

CHASSIS AND SAFETY SYSTEMS **9**

Traction control system – Cruise control system – electronic control of automatic transmission –antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TOTAL HOURS: 45

TEXT BOOK

1. TOM DENTON, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.
2. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999

REFERENCES

1. William B. Ribbens, "Understanding Automotive Electronics", 5th edition, Newnes Publishing, 2000.
2. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2001.
3. "Fuel System and Emission controls", Check Chart Publication, 2000.

MEMS/NEMS

11UEE706

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To create knowledge to the students to have a concept on the scope and recent development of the science and technology of micro- and nano-systems*
- *To gain the physical knowledge underlying the operation principles and design of micro- and nano-systems;*

INTRODUCTION TO FABRICATION TECHNIQUES **9**

Introduction-Basic fabrication techniques (lithography, thin film deposition and doping) MEMS fabrication techniques-Nano fabrication techniques (E-Beam nano-imprint fabrication, Epitaxy and strain engineering. Scanned probetechniques)-Strings and membranes – Beam theory – Variational calculus: Lagrange equations and an alternative way tolook at strings, membranes and plates-Plate theory

MACHINING AND TRANSPORT PROPERTY **9**

Introduction to Micromachining and MEMS – Essential technical background for lithography-based micromachining -Photolithography, vacuum systems, etching methods, deposition methods, and process integration Microscopic Energy.Transport- Basics of statistical thermodynamics/quantum mechanics - Microscopic transport theory - Applications tosemiconductor electronic/optoelectronic devices - Applications to MEMS/NEMS devices - Applications tonanostructures - Applications to biological systems

MEMS DEVICE PHYSICS AND DESIGN **9**

Critical understanding of various transduction principles -Design, production, and characterization of MEMS devices -Sensing (piezoelectric, capacitive, magnetic, etc.) - Actuation (electrostatic, electromagnetic, thermal, piezoelectric,SMA, etc.) Layout and design rules Experimental Mechanics for Microelectromechanical Systems (MEMS) - Methods, techniques, and philosophies to characterize micro/nano electro-magneto-mechanical systems (NEMS) - Material andmechanical property characterization - Crystallographic and anisotropic properties - Emerging approaches formicro/nano scale characterization - Biomechanical testing techniques

INTERFACIALPHENOMENA **9**

Surface tension, surfactants, and interfacial forces - Interfacial thermodynamics - Interfacial hydrodynamics – Dynamicsof the triple line - Applications to wetting, change of phase, foams and emulsions, MEMS, and biological systems

APPLICATIONS **9**

Sensors, Actuators, and Signal Processing - Principles and performance of micro transducers - Design of experiments -Sensor and actuator spatial/temporal resolution, error analysis, uncertainty - propagation, and data acquisition - Applications of micro transducers for distributed real-time control of systems

TOTAL HOURS: 45

TEXT BOOKS

1. J. A. Pelesko and D. H. Bernstein, Modeling MEMS and NEMS. 2002, Boca Raton, Florida: Chapman &Hall/CRC.
2. N. Cleland, Foundations of Nanomechanics: From Solid-State Theory to Device Applications. Advanced Texts in Physics. 2003, Berlin: Springer.
3. V. Kaajakari, Practical MEMS. 2009, Las Vegas, Nevada: Small Gear.
4. Liu, Foundations of MEMS. Illinois ECE Series. 2006, Upper Saddle River, New Jersey: Pearson/Prentice Hall.

FINITE ELEMENT ANALYSIS

11UAK702

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3	1	0	4

COURSE OBJECTIVES

- *To expose the core concepts of FEA and apply them for solving 1D and 2D problems*

INTRODUCTION **9**

Historical background – Relevance of FEA to design problems, Application to the continuum – Discretisation – Matrix approach, Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method, Galerkin method.

ONE DIMENSIONAL PROBLEM **9**

Finite element modeling – Coordinates and shape functions – Potential energy approach–Element matrices and vectors – Assembly for global equations – Boundary conditions – Higher order elements - Shapes functions – Applications 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.

TWO DIMENSIONAL PROBLEMS – SCALAR VARIABLE PROBLEMS **9**

Finite element modeling – CST element – Element equations, Load vectors and boundary conditions – Assembly – Application to heat transfer – Examples.

TWO DIMENSIONAL PROBLEMS – VECTOR VARIABLE PROBLEMS **9**

Vector Variable problems – Elasticity equations – Plane Stress, Plane Strain and Axisymmetric problems – Formulation – element matrices – Assembly – boundary conditions and solutions Examples.

ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL PROBLEMS **9**

Natural coordinates, Iso parametric elements, Four node quadrilateral element– Shape functions – Element stiffness matrix and force vector – Numerical integration – Stiffness integration – Displacement and Stress calculations – Examples.

TOTAL HOURS =45+15=60

TEXT BOOKS

1. Chandrupatla T.R., and Belegundu A.D., “Introduction to Finite Elements in Engineering”, Pearson Education 2002, 3rd Edition.
2. Logan D.L., “A First course in the Finite Element Method”, Third Edition, Thomson Learning, 2002.

REFERENCES

1. Rao S.S., “The Finite Element Method in Engineering”, Pergammon Press, 1989.
2. David V Hutton “Fundamentals of Finite Element Analysis”2004. McGraw-Hill Int. Ed.
3. Reddy J.N., “An Introduction to Finite Element Method”, McGraw-Hill International Student Edition, 1985.

COMMUNICATION PROTOCOLS

11UEE858

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- *To introduce the students the functions of different layers.*
- *To introduce IEEE standard employed in computer networking.*
- *To make students to get familiarized with different protocols and network components.*

PHYSICAL LAYER **9**

Data Communications – Networks - Networks models – OSI model – Layers in OSI model – TCP / IP protocol suite – Addressing – Guided and Unguided Transmission media Switching: Circuit switched networks – Data gram Networks – Virtual circuit networks Cable networks for Data transmission: Dialup modems – DSL – Cable TV – Cable TV for Data transfer.

DATA LINK LAYER **9**

Data link control: Framing – Flow and error control –Protocols for Noiseless and Noisy Channels – HDLC Multiple access: Random access – Controlled access Wired LANS : Ethernet – IEEE standards – standard Ethernet – changes in the standard – Fast Ethernet – Gigabit Ethernet. Wireless LANS : IEEE 802.11–Bluetooth.

NETWORK LAYER **9**

Logical addressing: IPv4, IPv6 addresses Internet Protocol: Internetworking – IPv4, IPv6 - Address mapping – ARP, RARP, BOOTP, DHCP, ICMP, IGMP, Delivery - Forwarding - Routing – Unicast, Multicast routing protocols.

TRANSPORT LAYER **9**

Process-to-Process delivery - User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QoS) – Techniques to improve QoS.

APPLICATION LAYER **9**

Domain Name System (DNS) – E-mail – FTP – WWW – HTTP – Multimedia Network Security: Cryptography – Symmetric key and Public Key algorithms - Digital signature – Management of Public keys – Communication Security – Authentication Protocols.

TOTAL HOURS = 45

TEXT BOOKS

1. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill, 2006: Unit I-IV
2. Andrew S. Tannenbaum, “Computer Networks”, Pearson Education, Fourth Edition, 2003: Unit V

REFERENCES

1. Wayne Tomasi, “Introduction to Data Communication and Networking”, 1/e, Pearson Education.
2. James .F. Kurouse & W. Rouse, “Computer Networking: A Topdown Approach Featuring”,3/e, Pearson Education.
3. C.Sivaram Murthy, B.S.Manoj, “Ad hoc Wireless Networks – Architecture and Protocols”, Second Edition, Pearson Education.
4. Greg Tomshon, Ed Tittel, David Johnson. “Guide to Networking Essentials”, fifth edition, Thomson India Learning, 2007.
5. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson

SOFT COMPUTING

11UEE859

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3	0	0	3

COURSE OBJECTIVES

- *To know the basics of fuzzy logic ,neural networks*
- *To understand some of the optimization techniques*
- *To understand the applications of soft computing techniques in various fields*

FUZZTSETTHEORY 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.

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.

NEURALNETWORKS **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.

NEUROFUZZYMODELING 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.

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 BOOK

1. 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.

HCI AND HMI

	L	T	P	C
11UEE860	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- *To create an awareness of Industrial process control and its effective plant operations*
- *To mitigate the risk by design constraints*

INTRODUCTION **9**

HMI Overview, Hardware Requirements, Software Overview, How The HIO Works, Difference Between HIO Models, Models Included In The HIO Series, Comparison Between Keypad Based HIO Models, Comparison Between Touch Screen HIO Models.

HARDWARE DESIGN **9**

Managing Electrostatic Discharge, CE Compliance, Environmental Rating, Environmental Consideration, Safety Precaution, Installation Instruction, Panel Cutout for Prizm Models, Panel Cutout For HIO Models, Wiring Diagram, Communication Ports. DIAGNOSTICS & MAINTENANCE: Diagnostics, Erase Keys, Touch Screen Calibration 398, Maintenance.

GRAPHICAL USER INTERFACE DEVELOPMENT **9**

Menu Structure, File Menu, Define Menu, Communicate Menu, Utilities Menu, Creating New Application, Creating Screens, Protecting Prizm Application, Protecting Prizm Screen, Data Entry Object, Display Data Object, Global And Power On Task, Global Keys, Screen Keys

APPLICATIONS DEVELOPMENT **9**

Representing Data by Objects and Wizards, Task Management, Downloading and Uploading from Unit, Alarms, Trending, HIO Features, Printing, Miscellaneous.

INDUSTRIAL PROCESS CONTROL USING HMI **9**

Chemical Mixing, Medicine Packing, Emission Checking For Vehicles, HVAC (Heating Ventilation And Cooling System, NVH Test For Vehicles (Noise Vibration And Harshness Test), Fuel Filling In Jet Aircrafts, Logistics.

TOTAL HOURS: 45

REFERENCE

1. Bill Hollifield, Dana Oliver, Ian Nimmo and Eddie Habibi "The high performance HMI Hand book"

FLEXIBLE MANUFACTURING SYSTEM

11UEE808

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3	0	0	3

COURSE OBJECTIVES

- *Understand modern manufacturing operations, including their capabilities, limitations, and how to design for lowest cost.*
- *Learn how to analyze products and be able to improve their manufacturability and Lower costs.*
- *Understand the relationship between customer desires, functional requirements,*
- *Product materials, product design, and manufacturing process selection*
- *Understand the advantages and disadvantages of hard (inflexible) and soft (flexible) Manufacturing automation.*

INTRODUCTION **9**

FMS definition and classification of manufacturing systems, automated production cycle, Need of flexibility, Concept of flexibility, Types of flexibilities and its measurement.

FMS EQUIPMENT **9**

Why FMS, Factors responsible for the growth of FMS, FMS types and applications, Economic justification for FMS, Functional requirements for FMS equipments, FMS processing and QA equipment, e.g., turning and machining centers, Co-ordinate measuring machines, Cleaning and deburring machines, FMS system support equipment,Automated material handling and storage equipment, cutting tool and tool management, Work holding considerations, Fixture considerations in FMS environment.

GROUP TECHNOLOGY **9**

GT concepts, Advantages of GT, Part family formation-coding and classification systems; Partmachine group analysis, Methods for cell formation, Use of different algorithms, mathematical programming and graph theoretic model approach for part grouping, Cellular vs FMS production.

FMS RELATED PROBLEM AND SOLUTION METHODOLOGY **9**

FMS design problems: Part assignment, Machine selection, Storage system selection, Selection of pallets and fixtures, Selection of computer hardware and software, designing for layout integration of machine storage, Material handling System and computer system, Communication networks.

FMS PLANNING PROBLEMS **9**

Strategic planning, Part type selection, Machine grouping, production ratio and resource allocation, Machine loading problems. Part scheduling, Machines robots & AGVS, Process monitoring & control.FMS Implementation: Objectives, acceptance testing, Performance goals and expectation maintenance concerns.

TOTAL HOURS: 45

TEXT BOOKS

1. Automation, Production System & Computer Integrated Manufacturing Groover Englewood
2. Design and Operation of SMS Rankey IFS

REFERENCE BOOKS

1. Flexible Manufacturing System Wernecks Spring-Verlag
2. FMS in Practice BoncttoNorthox Ford
3. Flexible Manufacturing Cells and systems W.W. Luggen Prentice Hall India Performance Modelling of Automated Manufacturing Systems

RAPID PROTOTYPING AND TOOLING

11UEE809

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3	0	0	3

COURSE OBJECTIVES

- *This course provides students with an opportunity to design, optimize, manufacture, and validate a physical system component using rapid prototyping methods and computer-aid tools*
- *To familiarize with the various RPM techniques so as to compare their strengths and limitations*
- *To understand RP data format, applications areas and industrial case studies*

OVERVIEW OF RAPID PROTOTYPING **9**

Definitions, evolution, CAD for RPT, Product design and rapid product development, conceptual design, detail design, prototyping, Fundamentals of RP systems, 3D solid modeling software and their role in RPT, creation of STL file

LIQUID BASED RP PROCESSES **9**

Liquid based RP systems: Stereo lithography (SLA)-principle-process parameters-process details-machine details-applications, Solid Ground Curing - Principle- process parametersprocess details-machine details, Applications

SOLID BASED RP PROCESSES **9**

Fusion Deposition Modeling - Principle- process parameters-process details-machine details, Applications. Laminated Object Manufacturing - Principle- process parameters-process details-machine details, Applications.

POWDER BASED RP PROCESSES **9**

Powder based RP systems: Selective Laser Sintering (SLS)- Principle- process parametersprocess details-machine details- Applications. 3-Dimensional Printers - Principle- process parameters-process details-machine details, Applications,LENS- Principle- process parametersprocess details-machine details- Applications and other Concept Modelers like Thermo jet printers, Sander's model maker

RAPID TOOLING **9**

Principles and typical process for quick batch production of plastic and metal parts through quick tooling. Reverse Engineering – 3D scanning-3D digitizing and Data fitting

TOTAL HOURS: 45

TEXT BOOKS

1. Chua C.K. et al., " Rapid Prototyping: principles and applications" Wiley,2003
2. Pham D.T & Dimov.S.S, "Rapid manufacturing" , Springer-Verlag, London, 2001
3. Jacobs P.F., " Stereolithography and other Rapid Prototyping & Manufacturing Technologies", McGrawHill ,New york,1996

REFERENCE

1. Hilton P.D., " Rapid Tooling" Marcel Dekkar, 2000
2. Zeid I., " CAD/CAM : Theory & Practice", McGrawHill,Singapore,1991

ENTREPRENEURSHIP DEVELOPMENT

11UEE810

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3	0	0	3

COURSE OBJECTIVES

- *To know the different types of business organization*
- *To aware the procedure to start business activity*

ENTREPRENEURSHIP **9**

Entrepreneur-Types of Entrepreneurs-Difference between Entrepreneur and Intrapreneur-Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurical Growth.

MOTIVATION **9**

Major Motives Influencing an Entrepreneur-Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test-Stress management, Entrepreneurship Development Programs-Need, Objectives.

BUSINESS **9**

Small Enterprises-Definition, Classification-Characteristics, Ownership Structures-Project Formulation-Steps involved in setting up a Business-identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment-Preparation of Preliminary Project Reports-Project Appraisal-Sources of Information-Classification of Needs and Agencies.

FINANCING AND ACCOUNTING **9**

Need-Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM-Taxation-Income Tax, Excise Duty-Sales Tax.

SUPPORT TO ENTREPRENEURS **9**

Sickness in small Business-Concept, Magnitude, causes and consequences, Corrective Measures-Government Policy for Small Scale Enterprises-Growth Strategies in small industry-Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL HOURS: 45

TEXT BOOK

1. S.S.KHANKA "Entrepreneurial Development" S.Chand & Co. Ltd. New Delhi, 1999.

REFERENCES

1. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.
2. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
3. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.