KUMARAGURU COLLEGE OF TECHNOLOGY

(Autonomous Institution Affiliated to Anna University)

COIMBATORE – 641049

CURRICULUM AND SYLLABUS
(REGULATIONS 2013)

06.05.2014

1st - 8th Semesters

B.E. MECHANICAL ENGINEERING

08-08-2014

CURRICULUM - (REGULATIONS 2013)
B O S MEETING ON 06.05.2014

SEMESTER - I

Code	Course Name	L	T	P	C
THEORY					
U13EN*T*101	Technical English	2	1	0	3
U13MA*T*101	Engineering Mathematics – I	3	1	0	4
U13PH*T*101	Engineering Physics	3	0	0	3
U13CH*T*101	Engineering Chemistry	3	0	0	3
U13ME*T*101	Engineering Graphics	2	0	3	3
U13CS*T*101	Structured Programming using C	3	1	0	4
PRACTICAL					
U13PH*P*101/ U13CH*P*101	Physics Laboratory / Chemistry laboratory*	0	0	3	1
U13ME*P*101	Engineering Practices Laboratory	0	0	3	1
U13CS*P*101	Structured Programming Laboratory using C	0	0	3	1
U13GH*P*101	Human Excellence - Personal Values I	1	0	1	1
		Total			**24**

*Physics Lab is offered for 50% of the classes and Chemistry lab for remaining 50% of the classes in the first semester. In the second semester the labs are interchanged.

SEMESTER - II

Code	Course Name	L	T	P	C
THEORY					
U13EN*T*201	Professional English	1	0	2	2
U13MA*T*201	Engineering Mathematics – II	3	1	0	4
U13PH*T*202	Material Science	3	0	0	3
U13CH*T*202	Applied Chemistry	3	0	0	3
U13ME*T*201	Engineering Mechanics	3	1	0	4
U13EE*T*211	Basics of Electrical and Electronics Engineering	3	0	0	3
PRACTICAL					
U13CH*P*201	Chemistry Laboratory	0	0	3	1
U13CS*P*202	Computing Laboratory	0	0	3	1
U13EE*P*211	Basics of Electrical and Electronics Engineering Laboratory	0	0	3	1
U13GH*P*201	Human Excellence - Personal Values II	0	0	2	1
		Total			**23**

SEMESTER - III

Code	Course Name	L	T	P	C
THEORY					
U13MA*T*304	Partial differential equations and Fourier Analysis	3	1	0	4
U13ME*T*301	Engineering Thermodynamics	3	1	0	4
U13ME*T*302	Engineering Materials and Metallurgy	3	0	0	3
U13ME*T*303	Strength of Materials	3	1	0	4
U13ME*T*304	Machine Drawing	2	0	3	4
U13ME*T*305	Manufacturing Technology – I	3	0	0	3
PRACTICAL					
U13ME*P*301	a) Strength of Materials Laboratory b) Metallurgy Laboratory	0	0	3	1
U13ME*P*302	Manufacturing Technology – I Laboratory	0	0	3	1
U13ME*P*303	Computer Aided Design Laboratory	0	0	3	1
U13GH*P*301	Human Excellence – Family values	1	0	1	1
			Total		**26**

SEMESTER - IV

Code	Course Name	L	T	P	C
THEORY					
U13MA*T*401	Numerical Methods	3	1	0	4
U13ME*T*401	Fluid Mechanics and Machinery	3	1	0	4
U13ME*T*402	Engineering Metrology and Quality Control	3	0	0	3
U13ME*T*403	Manufacturing Technology – II	3	0	0	3
U13ME*T*404	Kinematics of Machinery	3	1	0	4
U13GS*T*001	Environmental Science and Engineering	3	0	0	3
PRACTICAL					
U13ME*P*401	Manufacturing Technology – II Laboratory	0	0	3	1
U13EN*P*401	Communication Skill Laboratory	0	0	3	1
U13CE*P*412	Fluid Mechanics and Machines Laboratory	0	0	3	1
U13GH*P*401	Human Excellence – Professional values	1	0	1	1
			Total		**25**

SEMESTER – V

Code	Course Name	L	T	P	C
THEORY					
U13ME*T*501	Dynamics of Machinery	3	1	0	4
U13ME*T*502	Design of Machine Elements	3	1	0	4
U13ME*T*503	Thermal Engineering	3	1	0	4
U13ME*T*504	Computer Aided Design and Manufacturing	3	0	0	3
U13ME*T*505	Instrumentation and Control systems	3	0	0	3
U13MC*T*506	Mechatronics	3	0	0	3
PRACTICAL					
U13ME*P*501	Mechanism and dynamics Laboratory	0	0	3	1
U13ME*P*502	Metrology and Instrumentation laboratory	0	0	3	1
U13ME*P*503	Thermal Engineering Laboratory - I	0	0	3	1
U13GH*P*501	Human Excellence - Social Values	0	0	2	1
			Total		**25**

SEMESTER – VI

Code	Course Name	L	T	P	C
THEORY					
U13ME*T*601	Design of Transmission Systems	3	1	0	4
U13ME*T*602	Heat and Mass Transfer	3	1	0	4
U13ME*T*603	Finite Element Analysis	3	1	0	4
U13GS*T*003	Principles of Management	3	0	0	3
E1	Elective – I	3	0	0	3
E2	Elective – II	3	0	0	3
PRACTICAL					
U13ME*P*601	Thermal Engineering Laboratory – II	0	0	3	1
U13ME*P*602	Design Project	0	0	3	1
U13MC*P*601	Mechatronics Laboratory	0	0	3	1
U13GH*P*601	Human Excellence - National Values	0	0	2	1
			Total		**25**

SEMESTER – VII

Code	Course Name	L	T	P	C
THEORY					
U13ME*T*701	Power Plant Engineering	3	0	0	3
U13GS*T*002	Total Quality Management	3	0	0	3
U13GS*T*008	Professional Ethics	3	0	0	3
U13GS*T*005	Engineering Economics and Financial Management	3	0	0	3
E3	Elective – III	3	0	0	3
E4	Elective – IV	3	0	0	3
PRACTICAL					
U13ME*P*701	Computer Aided Simulation and Analysis Laboratory	0	0	3	1
U13ME*P*702	Project Work	0	0	6	0
U13ME*P*703	Computer Aided Manufacturing (CAM) Laboratory	0	0	3	1
U13GH*P*701	Human Excellence - Global Values	0	0	2	1
			Total		**21**

SEMESTER – VIII

Code	Course Name	L	T	P	C
THEORY					
E5	Elective – V	3	0	0	3
E6	Elective – VI	3	0	0	3
E7	Elective – VII	3	0	0	3
PRACTICAL					
U13ME*P*801	Project work	0	0	18	8
			Total		**17**

I and II semestre : 24 + 23 = 47

III and IV semestre : 26 + 25 = 51
V and VI semestre : 25 + 25 = 50
VII and VIII semestre : 21 + 17 = 38
Total credit : 186

ELECTIVE SUBJECTS:

Code	Course Name	L	T	P	C
Group -1					
U13ME*T*E11	Advanced Machining Processes	3	0	0	3
U13ME*T*E12	Robotics	3	0	0	3
U13ME*T*E13	Advanced Welding Processes	3	0	0	3
U13ME*T*E14	Material Handling Systems & Equipment	3	0	0	3
U13ME*T*E15	Production Planning and Control	3	0	0	3
U13ME*T*E16	Maintenance Engineering	3	0	0	3
U13ME*T*E17	Computer Integrated Manufacturing	3	0	0	3
U13ME*T*E18	Lean Manufacturing	3	0	0	3
U13ME*T*E19	Advanced Foundry Technology	3	0	0	3
Group -2					
U13ME*T*E21	Industrial Safety Management	3	0	0	3
U13ME*T*E22	Marketing Management	3	0	0	3
U13ME*T*E23	Supply Chain Management	3	0	0	3
U13ME*T*E24	Ergonomics	3	0	0	3
U13ME*T*E25	Entrepreneurship Development	3	0	0	3
U13ME*T*E26	Project Engineering and Management	3	0	0	3
Group - 3					
U13ME*T*E31	Vibration and Noise Control	3	0	0	3
U13ME*T*E32	Fluid Power Systems	3	0	0	3
U13ME*T*E33	Advanced Mechanics of Solids	3	0	0	3
U13ME*T*E34	Design of Jigs, Fixtures and Press Tools	3	0	0	3
U13ME*T*E35	Composite Materials	3	0	0	3
U13ME*T*E36	Rapid Prototyping	3	0	0	3
U13ME*T*E37	Tool Engineering Design	3	0	0	3
Group - 4					
U13ME*T*E41	Design and Optimization	3	0	0	3
U13ME*T*E42	Modeling and Simulation of Engineering Systems	3	0	0	3
U13ME*T*E43	Design for Manufacture	3	0	0	3
U13ME*T*E44	Introduction to Human Body Mechanics	3	0	0	3
U13ME*T*E45	Tribology	3	0	0	3
U13GST006	Product Design and Development	3	0	0	3
U13MA*T*E03	Modeling and Analysis of Engineering Systems	3	1	0	4

Group – 5					
U13ME*T*E51	Theory of Combustion and Emission	3	0	0	3
U13ME*T*E52	Gas dynamics and Jet propulsion	3	1	0	4
U13ME*T*E53	Nuclear Engineering	3	0	0	3
U13ME*T*E54	Refrigeration and Air Conditioning	3	0	0	3
U13ME*T*E55	Solar Energy Engineering	3	0	0	3
U13ME*T*E56	Renewable Energy Sources	3	0	0	3
U13ME*T*E57	Energy Conservation and Management	3	0	0	3
U13ME*T*E58	Thermal System Modeling and Analysis	3	0	0	3
U13ME*T*E59	Automobile Engineering	3	0	0	3
Group -6					
U13ME*T*E61	Micro Electro Mechanical Sensors	3	0	0	3
U13GST004	Operations Research	3	0	0	3
U13ME*T*E62	Sustainable Development	3	0	0	3
U13ME*T*E63	Fundamentals of Nano Technology	3	0	0	3
U13ME*T*E64	Security and cyber crime	3	0	0	3
U13MA*T*E65	Signals and Systems	3	1	0	4
U13EC*T*E12	Electro Magnetic Field	3	0	0	3
U13ME*T*E65	Soft Computing Techniques	3	0	0	3

In VI semester Electives 1 and 2 - one each from Group 1 and Group 4
In VII semester Electives 3 and 4 - one each from Group 3 and Group 6
In VIII semester Electives 5,6 and 7- one each from Group 2 and Group 5 and 6

U13EN*T*101 TECHNICAL ENGLISH 2 1 0 3

(Common to all branches of Engineering and Technology)

OBJECTIVES

- To offer exposure to the extensive usage of Technical English with special reference to corporate world communication
- To embark on systematic, syntactic and semantic proficiency of Technically used English
- To embellish the usage of English to exhibit engineering and technical concepts.
- To improvise the quality of Written Technical English.
- To develop the competency level of professional writing with a keen focus to corporate situations

FUNDAMENTALS OF TECHNICAL ENGLISH 9 Hours

Glimpses of Technical English – Systematic nuances of Technical English – Parts of Speech - Word Formation using Affixation – Vocabulary (synonyms and one word substitutes) – Tenses – Concord – Note making- Paragraph writing – Discourse markers – Sequencing of jumbled sentences.

GRAMMAR IN TECHNICAL ENGLISH 9 Hours

Editing (Grammar - Articles, Parts of Speech, Punctuation and Spelling Rules) – Reading Comprehension – Application of Conditional Sentences.

TECHINICAL EXPRESSIONS 9 Hours

Abbreviations and Acronyms – Expressions of Purpose and Function (Devices, Theories & Hypotheses) – Letter for practical training- Industrial visit – Interrogatives (‘Wh’ questions, Verbal Questions & Question Tags) – Reporting an incident / accident

DRAFTING TECHNICAL DETAILS 9 Hours

Usage of Discourse Markers – Comparative Adjectives – Transcoding Graphics into continuous writing and text into graphics – Bar chart / Pie chart / Flow chart / Line graph / Tabulated data / Tree diagram or Organizational chart into text – E-mail Etiquette and its professional application.

APPLICATIONS OF TECHNICAL ENGLISH 9 Hours

Definitions – Impersonal passive structures – Describing a technical process – Writing instructions – Making suggestions – Writing formal letters (Leave Letters, Apology letters, Applying for bank loans, Bona-fide certificate/ mark list, Joining report, Letters of complaint).

TOTAL: 45 HOURS

REFERENCES:

1. DhanavelS.P., English and Communication Skills for Students of Science and Engineering, Chennai, Orient Blackswan, 2009.
2. Devadoss K. andMalathy P., Fundamentals and Usage of Technical English, National Book Publishers, Chennai, 2013.
3. Rizvi Ashraf M., Effective Technical Communciation, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2008.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Comprehend the technical jargon and define technical / engineering applications
- Exhibit practical proficiency in reading and writing skills
- Apply and analyze the technical and general communication

U13MA*T*101 ENGINEERING MATHEMATICS-I 3 1 0 4

(Common to all branches of Engineering and Technology)

OBJECTIVES

On completion of the course, the students are expected

- To know Eigen values and Eigen vectors and diagonalization of a matrix.
- To know about the geometrical aspects of curvature, evolute and envelope.
- To understand the concepts of partial differentiation, maxima and minima.
- To solve ordinary differential equations of first and higher order of certain types and its applications.

MATRICES 9 Hours

Rank of a matrix – Linearly dependent and independent vectors – Eigen values and eigenvectors of a real matrix – Properties of eigen values and eigenvectors – Cayley Hamilton theorem (excluding proof) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS 9 Hours

Curvature – Radius, Centre and Circle of curvature in Cartesian, Parametric and Polar form – Evolute – Envelope of family of curves with one and two parameters – Evolute as the envelope ofnormals.

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 Hours

Leibnitz's equation – Bernoulli's equation – Equations of first order and higher degree - Clairauts form – Applications: Orthogonal trajectories and simple Electric circuit problems. (Differential equation and associated conditions need to be given).

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS 9 Hours

Linear equations of second and higher order with constant coefficients – Euler's and Legendre's linear equations – Method of variation of parameters – First order Simultaneous linear equations with constant coefficients - Application - oscillatory electrical circuit. (Differential equation and associated conditions need to be given).

FUNCTIONS OF SEVERAL VARIABLES 9 Hours

Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraint – Jacobians.

L: 45, T: 15, TOTAL: 60 HOURS

REFERENCES:

1. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
2. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics,S. Chand & Co., New Delhi, 2008.
3. Kreyzig E., Advanced Engineering Mathematics, Eighth Edition, John Wiley & sons, 2010.
4. Arunachalam T., Engineering Mathematics I, Sri VigneshPublications, Coimbatore. (Revised) 2009.
5. Venkataraman M.K., Engineering Mathematics, The National Pub. Co., Chennai, 2003.
6. Ramana B.V, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, New Delhi, 2007.
7. Grewal B.S., "Higher Engineering Mathematics",Khanna Publishers, New Delhi, 40th Edition. .

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Know Eigen values and Eigen vectors and its role in the system of equations
- Discover the radius, centre and circle of curvature of any curves
- Solve the ordinary differential equations of certain types and its applications.
- Identify the maximum and minimum values of surfaces.

U13PH*T*101 ENGINEERING PHYSICS 3 0 0 3

(Common to all branches of Engineering and Technology)

OBJECTIVES

At the end of the course the students would be exposed to fundamental knowledge in

- Various engineering subjects and applications.
- Structure identification of engineering materials.
- Non-destructive techniques.
- Interferometric techniques in metrology and electrical phenomena.
- Application of lasers in engineering and technology.
- Atomic and Nuclear related theories.

CRYSTAL PHYSICS 9 Hours

Space lattice – unit cell – lattice planes – Bravais space lattices – Miller indices – calculation of interplanar distances – Atomic radius – co- ordination number – Packing factor for SC, BCC, FCC and HCP structures – crystal imperfections – point defects – line defects – surface defects – volume defects – effect of crystal imperfections.

APPLIED OPTICS 9 Hours

Interference – airwedge and its applications – Michelsons interferometer – construction, working – determination of wave length and thickness – Lasers – spontaneous and stimulated emissions – Einsteins coefficients – Nd: YAG, Co_2 and semiconductor laser – Homojunction and Hetrojunction (only qualitative description) – applications – CD-ROM and holography (qualitative only) – optical fibre – principle and propagation of light in optcal fibers – Numerical aperture and acceptance angle – types of optical fibres – applications – fibre optic communication system – medical endoscopy.

QUANTUM PHYSICS 9 Hours

Planck's quantum theory of black body radiation (derivation) – Photo electric effect – Compton effect (derivation) and experimental verification of Compton effect – De-broglies concept - Schrodinger wave equation – time independent and time dependent equations (derivations) – physical significance of wave function – particle in a box (one dimensional case) – Electron microscope – Scanning electron microscope – Transmission electron microscope.

ULTRASONICS AND NDT 9 Hours

Introduction – production – magnetostriction effect – magnetostriction generator – piezoelectric effect – piezo electric generator –properties –detection – cavitation –acoustic grating – velocity measurement – applications –Sonar –velosity of blood flow – NDT –Liquid Penetrant method – Ultrasonic flaw detector – A scan, B scan, C scan – X- ray radiography and fluoroscopy – Thermography.

ATOMIC AND NUCLEAR PHYSICS **9 Hours**

Introduction – Atomic spectra – Molecular spectra – Applications – Raman effect – Stokes lines and anti stokes lines – Applications – Nuclear models – Liquid drop model – The Shell model- Nuclear fission – Theory – Energy released per fission – Chain reaction – Controlled chain reaction – Nuclear reactors – Condition for sustained chain reaction – Types of Nuclear reactors – Nuclear fusion – Thermo nuclear reactions – Differences between fission and fusion

TOTAL: 45 HOURS

REFERENCES:

1. Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. Gopal S., Engineering Physics, Inder Publications, Coimbatore, 2006.
3. Palinisamy P.K., Engineering Physics I, Scitech Publications, Chennai, 2011.
4. Avadhanulu M.N. andKshirsagar P.G., A textbook of Engineering Physics, S.Chand & Company Ltd, New Delhi,2005.
5. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, DhanpatRai Publications (P) Ltd., New Delhi, 2003.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Analyze and identify the crystal structure in materials
- Categorize and illustrate the optical materials and its application to engineering
- Examine and compare samples at nano level
- Apply lasers in engineering and technology
- Describe the properties nuclear materials

U13CH*T*101 ENGINEERING CHEMISTRY 3 0 0 3
(Common to all branches of Engineering and Technology)

OBJECTIVES

- To inculcate an understanding of the importance of chemistry by providing an overall perspective of theoretical and modern technological aspects of applied chemistrybefore beginning their more specialized courses.
- To embellish the usage of chemistry to exhibit engineering and technical concepts

ELECTROCHEMISTRY 9 Hours

Introduction - Electrode potential – Nernst equation and problems - Electrochemical series - Application of EMF measurements & problems - Kohlrausch law of independent migration of ions & its application - Conductometric titrations (acid - base & precipitation titration)

Electrodes : Standard and reference electrode (Hydrogen & Calomel) – Types of electrodes (metal – metal ion; Metal – metal insoluble salt, Redox electrode) - Ion selective (glass electrode) – determination of pH using glass electrode

Cells : Galvanic cell – Types of concentration cells

ENERGY STORING DEVICES 9 Hours

Batteries : Primary Battery (Lechlanche& Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - cadmium battery & Lithium – Polymer battery) – Flow battery (hydrogen and oxygen Fuel Cell)

Solar Cells: Hybrid Solar cells

THERMODYNAMICS 9 Hours

Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy – first law of thermodynamics (Mathematical derivation & limitation) - Enthalpy - Second law of thermodynamics - Entropy - Entropy change of an ideal gas & problems - Free energy - work function - Gibbs Helmholtz equation (derivation, applications & problems) - Van't Hoff isotherm (derivation & problems) - Van't Hoff isochore - (derivation & problems) - Third law and zeroeth law (Only statements)

SURFACE CHEMISTRY 9 Hours

Introduction of adsorption - Types of Adsorption - Adsorption isotherm (Freundlich isotherm, Langmuir adsorption isotherm, BET isotherm) - Applications of adsorption : Role of adsorption in catalytic reactions, Ion exchange adsorption, adsorption chromatography (Column chromatography)

SPECTROSCOPY **9 Hours**

Introduction to spectroscopy - Beer Lambert's Law - Colorimetric analysis (principle, instrumentation (block diagram only) & application (Estimation of concentration of Ferrous and copper ions a solution by colorimetry) - UV – visible spectroscopy (principles, instrumentation (block diagram only) & simple Applications) - IR spectroscopy (principles, instrumentation (block diagram only) & simple applications) - Flame photometry (Principle, instrumentation (block diagram only) & simple Applications)

TOTAL: 45 HOURS

REFERENCES:

1. Bahl B.S.,Tuli G.D. and ArunBahl., Essential of Physical Chemistry, S.Chand& Co. Ltd., New Delhi.
2. Somorjai G.A., Introduction to surface chemistry and Catalysis, John Wiley & Sons Inc., New York.
3. Shaw D.J., Introduction to colloidal and surface Chemistry, Butterworth – Heinemann Publishers
4. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore.
5. Jain P.C. and Monika Jain, Engineering chemistry, Dhanpatrai Pub. Co. (P) Ltd., New Delhi.
6. Puri B.R., Sharma L.R. and PathaniaM.S., Principles of Physical chemistry, ShobanLalNagin Chand & Co., New Delhi

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Assemble a battery and illustrate the phenomenon of production of electric current
- Discuss the thermodynamic concepts and predict the feasibility of chemical reaction
- Apply the theory of adsorption in real life situations
- Outline the principles and instrumentation of spectroscopic techniques

U13ME*T*101 ENGINEERING GRAPHICS 2 0 3 3

(Common to all branches of Engineering and Technology)

OBJECTIVES

- To understand the principle of orthographic projection of points, lines, surfaces and solids.
- To understand the principle of section and development of solids.
- To understand the principle of Isometric and Perspective projections.
- To study the principle of free-hand sketching techniques.

PLANE CURVES, PROJECTION OF POINTS AND LINES 15 Periods

Importance of graphics in design process, visualization, communication, documentation and drafting tools, Construction of curves - ellipse, parabola, and hyperbola by eccentricity method only. Orthographic projection of points.

Projections of straight lines located in first quadrant - determination of true length and true inclinations.

PROJECTIONS OF SURFACES AND SOLIDS 15 Periods

Projections of plane surfaces - polygonal lamina and circular lamina, located in first quadrant and inclined to one reference plane., Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15 Periods

Sectioning of simple solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane. Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

PICTORIAL PROJECTIONS 15 Periods

Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones.

Perspective projection of prisms and pyramids when its base resting on the ground by vanishing point method.

FREE-HAND SKETCHING 15 Periods

Free hand sketching techniques sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning.

Sketching pictorial views from given orthographic views.

L: 30, P: 45 : 75 PERIODS

REFERENCES:

1. Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008
2. Venugopal K., and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi , 2008.
3. Nataraajan K.V, Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005.
4. Warren J. Luzadder and Jon. M.Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005.
5. Gopalakirishna K.R., Engineering Drawing (Vol. I & II), Subhas Publications, 2001

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

a) Construct various plane curves and projection of lines and surfaces.
b) Develop projection of solids, sections of solids and surfaces.
c) Apply the concepts of isometric, perspective and free hand sketching in engineering practice.

U13CS*T*101 STRUCTURED PROGRAMMING USING C 3 1 0 4

OBJECTIVES

- To enable students to learn about the basics of computers and problem solving methods
- To learn the various features of C
- To learn how to program using C language

INTRODUCTION **9 Hours**

Programs and Programming- Programming languages and Their Classification - Compiler, Linker, Loader and Interpreter – Structured Programming Concept –Algorithm – Pseudo Code – Flow Chart.Number System – Binary – Decimal – Conversion Problems.

C LANGUAGE BASICS **9 Hours**

Introduction to C Programming –Fundamentals – Structure of a C Program – Compilation And Linking Processes – Constants, Variables – Data Types – Expressions Using Operators In C – Managing Input And Output Operations – Decision Making And Branching – Looping Statements – Solving Simple Scientific And Statistical Problems.

ARRAYS AND STRINGS **9 Hours**

Arrays – Initialization – Declaration – One Dimensional And Two Dimensional Arrays. String- String Operations – String Arrays. Simple Programs- Sorting- Searching – Matrix Operations.

FUNCTIONS AND POINTERS **9 Hours**

Functions: Definition of function – Declaration of function – Pass by value – Pass by reference – Recursion.

Storage classes – auto, static, extern, register- scope rules.

Pointers: Definition – Initialization – Pointers arithmetic – Pointers and arrays- Dynamic memory allocation - Example Problems

STRUCTURES AND UNIONS AND FILES **9 Hours**

Structures and Unions: Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions.

Files: Introduction – Using files in C- Working with text files.

L: 45, T: 15, TOTAL: 60 Hours

REFERENCES:

1. Rajasekaran S., Numerical methods in Science and Engineering-A practical approach, S. Chand and Company, New Delhi, 2012.
2. Kernighan B.W. and Ritchie D.M., The C Programming language, Second Edition, Pearson Education, 2006.
3. Byron S. Gottfried and Jitendar Kumar Chhabra, Programming with C, Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
4. Ashok N. Kamthane, Computer programming, Pearson Education, 2007.
5. Pradip Dey and Manas Ghosh, Programming in C, Second Edition, Oxford University Press, 2011.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Understand structured programming concepts
- Develop a computer program to solve real world problems
- Develop simple applications using C

U13PH*P*101/ U13PH*P*201 **PHYSICS LABORATORY** **0 0 3 1**

List of experiments

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of a given specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of acceleration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser**:**
    a) Determination of wavelength of laser using grating
    b) Particle size determination.
    c) Acceptance angle of optical fibre.
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

11. Determination of solar cell parameters
12. Hall effect.
13. Four probe apparatus
14. Animations – (Laser ,Fiber optics and hysteresis curve)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Calculate the thermal conductivity of the material
- Compute the thickness of the yarn
- Examine the elastic properties of the fabric

U13CH*P*101/ U13CH*P*201 **CHEMISTRY LABORATORY** **0 0 3 1**

(Common to all branches of Engineering and Technology)

OBJECTIVES

Should be Conversant with the theoretical principles and experimental procedures for quantitative analysis and hands on experience in using analytical equipments.

PREPARATION OF SOLUTIONS (STANDARD)

1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING

3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler's method.
5. Estimation of alkalinity by Indicator method.
6. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
10. Estimation of Iron by potentiometry

PHOTOMETRY

11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotmetry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 PERIODS

REFERENCES:

1. Jeffery, G.H., Bassett, J., Mendham, J. and Denny, R.C., Vogel's Text Book of Quantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, Tata McGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba, U.S., Sivahari, R. and Mayildurai, R., Practical Chemistry, Inder Publications, Coimbatore, 2009.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Prepare normal solutions
- Analyse the properties of water
- Estimate the concentration of solutions by electrochemical methods

U13ME*P*101 ENGINEERING PRACTICES LABORATORY 0 0 3 1

(Common to all branches of Engineering and Technology)

A. CIVIL ENGINEERING

1. Carpentry

- Study of carpentry tools
- Preparation of T joint
- Preparation of dovetail joint

2. Plumbing

- Study of pipeline joints

B. MECHANICAL ENGINEERING

1. Fitting

- Study of fitting tools
- Preparation of L joint
- Preparation of square joint

2. Sheet Metal Working

- Study of sheet metal working tools
- Preparation of cone and tray

3. Welding

- Study of arc welding tools and equipment
- Preparation of butt joint

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1. Select the various tools and equipments used in the fabrication workshop.
2. Develop various models in carpentry, fitting, sheet metal work and welding.

21 Periods

Group - II (Electrical & Electronics Engineering)

C. ELECTRICAL ENGINEERING PRACTICE 12 Periods

- Basic household wiring using switches, fuse, indicator-lamp, etc.,
- Preparation of wiring diagrams.
- Stair case light wiring.
- Tube light wiring
- Study of iron-box, fan with regulator, emergency lamp and microwave oven.

D. ELECTRONIC ENGINEERING PRACTICE **12 Periods**

List of Experiments

1. Assembling simple electronic component on a small PCB and Testing.
2. Soldering simple electronic circuits and checking continuity.
3. Measurements using digital multimeter.
    - DC and AC voltage measurement
    - DC and AC current measurements.
    - Resistance Measurement.
    - Continuity measurement.
4. Testing of Electronic components
    - Resistors
    - Inductors and capacitors
    - Diodes (resistance in forward bias and reverse bias)
    - Transistors
5. Study of CRO and Function generator
    - Study of Panel Controls
    - Measurement of Amplitude, Frequency, phase difference

.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Demonstrate and evaluate the parameters of basic electronic components (wires, resistors, capacitors, diodes etc.) and test the components.
- Estimate DC and AC Voltage and currents using appropriate measuring instruments.

U13CS*P*101 STRUCTURED PROGRAMMING LABORATORY USING C 0 0 3 1

OBJECTIVES

- To enable students to solve problems using C
- To apply the various features of C

List of Experiments

1. Simple programs
    - To find whether the given number is prime or not
    - Factorial of the given number
2. Programs involving Control and Looping Structures
    - Arithmetic Progression
    - Trigonometric series evaluation
3. Programs using Arrays
    - Sorting
    - Matrix addition and Multiplication
4. Calculation of median of a frequency distribution.
5. Evaluation of integrals
    - Trapezoidal Rule
6. String Processing
7. Program using Recursive function
8. Using pointers in C
9. Program using Functions, Structures and Files
    - Students Mark Analysis
10. Iterative method for finding Roots of the polynomials
    - Lagrange interpolation method

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the student would be able to:

- Develop skills on use of C for simple problem solving
- Develop skills on the usage of C for statistical and scientific problem solving
- Acquire skills on the usage of C for statistical and scientific problem solving

U13GH*P*101 HUMAN EXCELLENCE-PERSONAL VALUES I 1 0 1 1

(Common to all branches of Engineering and Technology)

OBJECTIVE

- To inspire students to become best Humans.
- To know about self.
- To overcome evil temperaments.
- To practice meditation & pranayamam

LIFE & HUMAN EXCELLENCE **3 Hours**

Human Excellence: Introduction – objective – personal values - importance.
Life: Self – Society – Nature – yoga – purpose of life – philosophy of life.

BODY, SOUL, MIND & THEIR FUNCTIONAL RELATIONSHIP **3 Hours**

Panchboothas and it's association – Form of the body : physical body, astral body, causal body - Effect: Pain, Disease, Death; Soul – Life force – Bio magnetism – Genetic Centre – Mind : Origin & it's ten stages.

SELF INTROSPECTION **3 Hours**

Introduction – Importance – Blemishes – Six evil temperaments &their maneuvering.

THOUGHT ANALYSIS **3 Hours**

Introduction of Thought; process of thought – Mind& Thought relationship – causes for origin of Thoughts;Exercise : Training & Practice of Thought analysis

MEDITATION AND PRANAYAMAM - THEORY WITH PRACTICAL SESSION **3 Hours**

Meditation : Introduction to Meditation
Pranayamam: Importance of Naadisudhi, Thanduvadasudhi (Clearance practice), Kabhalabathi and their practice.

TOTAL : 15 Hours

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Acquire knowledge on the individual in relation to Nature and Society.
- Demonstrate the skill of self- realization values the significant relationship to be maintained between individual's Body, Mind and Soul.
- Analysis of Thoughts and origin of thoughts
- Learn about Purpose and Philosophy of Life

U13EN*T*201 PROFESSIONAL ENGLISH 1 0 2 2

OBJECTIVES

- To enhance application oriented usage of English language
- To inculcate essential language proficiency through a good combination of practical and theoretical exposure
- To widen the area of creative writing skill of the students
- To initiate the students to make use of English to exhibit their professionalism
- To enable the students with adequate language exposure to business, professional and corporate facets of life.

RUBRICS OF PUBLIC SPEAKING 9 Hours

Vocabulary (Antonyms) – Homonyms- Use of Compound Prepositions – Public address (compering /welcoming / proposing vote of thanks) –- Creating Advertisements.

ESSENTIAL REQUISITES OF PROFESSIONAL ENGLISH 9 Hours

Compound Nouns – Gerunds and Infinitives – Workplace Idioms – Reported Speech– Preparing a Check list- Composing Statement of Purpose (**SOP**) - Preparing a Resume with Cover letter.

CORPORATE CORRESPONDENCE 9 Hours

Usage of Cause and Effect Expressions – Collocation - Business Letters (quotation, order and complaint) – Composing a letter of resignation- recommendations – Composing e-Mail – Reading for information / global understanding- Writing Notices and Circulars.

NUANCES OF ENGLISH 9 Hours

American Vs British English – Contractions – Types of Conversations – Assertive, Persuasive Conversations – Telephonic Conversations – Greetings – Pronunciation tips – Reviewing books / articles.

SENSITIZING LANGUAGE SKILLS 9 Hours

Picture perception – Importance of Body Language in presentation – Strategic usage of Power Point Presentations – Essay writing.

TOTAL: 45 HOURS

REFERENCES:

1. Krishnaswamy N., Sri Raman T.Creative English for Communication, MacMillan Pub, Chennai, 2009.
2. Devadoss K.and Malathy P., Interfacing with Corporate, National Book Publishers, Chennai, 2013.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Describe & interpret objects, pictures & situations
- Write error-free English
- Maintain the standards of corporate communication

U13MA*T*201 ENGINEERING MATHEMATICS -II 3 1 0 4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS 9 Hours

Double integration – Cartesian and polar coordinates – Change of order of integration –Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral .

VECTOR CALCULUS 9 Hours

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vectorfields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION 9 Hours

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs)– Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION 9 Hours

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM 9 Hours

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer

Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem

L: 45, T: 15, TOTAL: 60 HOURS

REFERENCES:

1. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd., Singapore, 10th Edition, 2010.
2. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
3. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
4. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
5. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.
6. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012.
7. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- know the gradient, divergence and curl, related theorems useful for engineering applications.
- Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically
- Evaluate real and complex integrals over suitable closed paths or contours
- know the Applications of Laplace transform and its properties &to solve certain linear differential equations using Laplace transform technique

U13PH*T*202 MATERIALS SCIENCE 3 0 0 3

(Common to Mechanical, Mechatronics, Aeronautical Engineering and Automobile Engineering)

OBJECTIVES

At the end of the course students would be exposed to

- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS 9 Hours

Conducting Materials : Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting Materials : Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 9 Hours

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 9 Hours

Magnetic Materials : Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory.

Dielectric Materials : Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 9 Hours

New Engineering Materials : Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano Materials : synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

STRENGTHENING OF MATERIALS 9 Hours

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening-Fracture-Mechanism of brittle fracture (Griffith's theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 45 Hours

REFERENCE BOOKS

1. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.
2. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003.
3. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005
4. Rajendran V. and Marikani A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd, 2004
5. Arumugam M., Physics-II, Materials science for mechanical engineering, Anuradha agencies - publishers, Kumbakonam, 2005

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Apply core concepts in Materials Science to solve engineering problems
- Determine the position of the acceptor or donor levels and the brand gap of an extrinsic semiconductor
- Classify & differentiate the structure and physical properties of conducting materials
- Apply the techniques to manufacturing of modern materials and nano materials for engineering applications

- Recognize the basic concepts of strengthening of materials in technological applications

U13CH*T*202 APPLIED CHEMISTRY 3 0 0 3

(Common to Mechanical, Mechatronics, Aeronautical and Automobile Engineering)

OBJECTIVES

- To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS AND COMBUSTION 9 Hours

Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion : gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS 9 Hours

Abrasives: Moh's scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE 9 Hours

Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).

WATER TECHNOLOGY **9 Hours**

Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).

Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water.

PHASE RULE AND POWDER METALLURGY **9 Hours**

Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: one component system (Fe system only) - simple eutectic system (Ag-Pb system only).

POWDER METALLURGY : Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 45 Hours

REFERENCES

1. Samir Sarkar, Fuels and Combustion, Orient Longman, India.
2. Syed Shabudeen P.S., Engineering Chemistry II, Inder publications, Coimbatore.
3. Derek Pletcher and Frank C Walsh, Industrial Electrochemistry, Blackie Academic and Professional, London.
1. Dara S.S., A Text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi
2. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Classify the different types of fuels and their properties
- Categorize the engineering materials and their uses
- Defend the Corrosion problems
- Design a water purifier
- Identify the techniques of preparing metal powder

U13MET201 ENGINEERING MECHANICS 3 1 0 4

OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton's law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES 12 Periods

Introduction - Units and Dimensions - Laws of Mechanics Lame's theorem, Parallelogram and triangular Laws of forces – Coplanar Forces - Resolution and Composition of forces – Free body diagram - Equilibrium of a particle.

EQUILIBRIUM OF RIGID BODIES 12 Periods

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS 12 Periods

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION 12 Periods

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES 12 Periods

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.

L: 60, T: 15, TOTAL: 75 PERIODS

REFERENCES:

1. Sukumar T.R. and Sridhar S., Engineering Mechanics, Inder Publications, Coimbatore, 2013.
2. Hibbeller, R.C., Engineering Mechanics, Vol. I Statics and Vol. II Dynamics, Pearson Education, Asia Pvt. Ltd., 2000.
3. Ashok Gupta, Interactive Engineering Mechanics Statics A Virtual Tutor, Pearson Education, Asia Pvt. Ltd., New Delhi, 2002.
4. Palanichamy M.S., and Nagan S., Engineering Mechanics (Statics & Dynamics) Tata McGraw Hill, 2001.
5. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition, Pearson Education, Asia Pvt. Ltd., 2003.
6. Beer F.P. and Johnson Jr. E.R., Vector Mechanics for Engineers, Vol. I Statics and Vol. II Dynamics, McGraw-Hill International Edition, 2004.
7. Rajasekaran S. and Sankarasubramanian G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., Second Edition, 2002.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

a) Explain the concept of equilibrium of particles and rigid bodies.
b) Apply the concepts of equilibrium and moment of inertia for various shapes sections.
c) Make use of various concepts of friction.
d) Solve problems using the concepts in kinematics and kinetics.

U13EE*T*211 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING 3 0 0 3

UNIT –I ELECTRIC CIRCUITS FUNDEMENTALS 12 Periods

Electric current and Ohm's law – Resistance and Resistivity – Relation between Voltages, Current, Resistance and Power - Capacitance – Parallel plate capacitor – Energy stored in a capacitor.

UNIT-II ELECTROMAGNETISM 12 Periods

Magnetic field - Field intensity, magnetic flux , Flux density – Permeability – Magnetic effects of electric current – Magnetic circuit – Faraday's laws of Electromagnetic Induction – Self-inductance and Mutual inductance – Energy stored in magnetic field – Magnetic Hysteresis.

UNIT-III AC-CIRCUITS 12 Periods

Alternating voltages and current – Sinusoidal waveform – cycle and frequency – RMS value – vector diagram of sine waves of same frequency – Alternating current through Resistance, Inductance and Capacitance – current through series circuits – Power factor – Active and Reactive power – Generation of three phase voltage – Voltages, Currents and Power in Star and Delta connected loads.

UNIT-IV ELECTRICAL MACHINES (Qualitative Treatment Only) 12 Periods

DC motor – Principle of operation – Back-emf and voltage equation – Torque and speed Characteristics of Series and Shunt connected motors – Transformer – Ideal Transformer relationship – Three phase induction motor – Cage rotor and Wound rotor – Principle of operation – Slip – Torque Slip characteristics – Single phase induction motors.

UNIT-V ELECTRONIC CIRCUITS 12 Periods

Semiconductor diode – Half wave and Full wave rectifier – Bipolar Junction transistors – circuit configurations – static characteristics – load line and biasing – simple introduction to amplifiers – Introduction to Binary logic gates – AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR.

TOTAL: 60 PERIODS

REFERENCES

1. B.L. Theraja, Fundamentals of Electrical Engineering and Electronics, S. Chand Publishing, 2012.
2. Thomas L Floyd, Electronic Devices, 6th edition, Pearson Education, 2003.
3. Muthusubramanian R., Salivahanan S. and Muraleedharan. K.A., Basic Electrical Electronics and Computer Engineering, Tata Mcgraw Hill, 2nd edition, 2006.
4. Thyagarajan T., Sendur Chelvi K.P. and Rangaswamy T.R., Engineering Basics, Revised 2nd edition, New Age International Pvt. Ltd.

U13CH*P*101/ U13CH*P*201 **CHEMISTRY LABORATORY** **0 0 3 1**

(Common to all branches of Engineering and Technology)

OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)

1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING

3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler's method.
5. Estimation of alkalinity by Indicator method.
6. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
10. Estimation of Iron by Potentiometry

PHOTOMETRY

11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotmetry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 PERIODS

REFERENCES:

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book of Quantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, Tata McGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2009.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Prepare normal solutions
- Analyse the properties of water
- Estimate the concentration of solutions by electrochemical methods

U13CS*P*202 COMPUTING LABORATORY 0 0 3 1

OBJECTIVES

- To analyze webpage and identify its elements and attributes
- Learn the basic language of the web: HTML.
- Be able to embed social media content into web pages.
- Implement and understand how to get used with MATLAB

LIST OF EXPERIMENTS

1. Study of HTML tags
2. Design a web page using basic html tags
3. Design a webpage using table tags
4. Design a webpage using forms and frames
5. Design a webpage using list tags
6. Develop a website of your interest(include a minimum of 3 web pages)
7. Study of MATLAB functions
8. Working with matrix operations
9. Working with image arithmetic
    - Addition of two images
    - Subtraction of two images
10. Write a Matlab program for the following
    - Read an image and crop
    - Read an image and resize
11. Working with Integration and Differentiation
12. Working with graphs

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Acquire knowledge to create web pages using HTML.
- Develop skills in analyzing the usability of a website.
- Develop an attitude to embed social media content into web pages and to understand the basics of MATLAB operations.

U13EE*P*211 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY **0 0 3 1**

OBJECTIVES

- To experimentally verify the principle of operation, performance characteristics of DC Motors and AC Motors.
- To obtain the characteristics of electronic devices and its applications

LIST OF EXPERIMENTS

1. Load Test on DC Shunt Motor
2. Load Test on DC Series Motor
3. Speed Control of DC Shunt Motor
4. Load Test on three phase Induction Motor
5. Load Test on single phase Induction Motor
6. Load test on single phase transformer
7. Half wave and full wave rectifier
8. Characteristics of CE transistor configuration
9. Characteristics of PN diode
10. Verification of truth table of logic gates

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Conduct load test on DC motors.
- Conduct load test on induction motors.
- Verify truth tables of various logic gates.

U13GH*P*201 HUMAN EXCELLENCE-PERSONAL VALUES II 0 0 2 1

(Common to all branches of Engineering and Technology)

OBJECTIVE:

- To inspire students to become blissful humans.
- To make the students able to a come out of greed and keep mind pure.
- To outgrow the dangerous emotions.
- To achieve sound health and reach the intuition level.

MORALIZATION OF DESIRE **4 Hours**

Introduction – Causes of desire – Types of desire – Contra qualities evolving out of desire – effect of unfulfilled desire – Renunciation – Is attainment of desire in harmony with Law of Nature.

Training : Moralization of Desire.

NEUTRALIZATION OF ANGER **4 Hours**

Introduction – Origin of Anger – Alternative forms of Anger –A chain action – Consequence of anger on self & others – neutralization of anger – the point where anger is won.

Training : neutralizing anger.

ERADICATION OF WORRIES **4 Hours**

Worry – causes & Effects of worries – Types of problems – Solution to problems – Overcoming Worries.

Training : Eradication of Worries.

REALIZATION OF SELF **4 Hours**

Transformation Theory – Understating Self – Guru's role in guiding – Who am I? – Shaping one's destiny.

Training : Realization of self.

THEORY & PRACTICAL SESSION ON MEDITATION & PHYSICAL EXERCISE **15 Hours**

Exercises: Hand Exercise – Leg Exercise – Neuro muscular breathing Exercise – Kapalapathy – Magarasanas I & II – Massage – Acu-pressure –Body relaxation .

Meditation: AgnaMeditation – ShanthiMeditation.

TOTAL: 30 HOURS

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Acquire knowledge on the procedures involved in self-realization and meditation
- Develop skills in KayaKalpa and Simplified Physical Exercise
- Analysis Refinement of Desire, Eradication of Worries and Who am I?
- Learn about Anger management

U13MA*T*304 PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER ANALYSIS
3 1 0 4

OBJECTIVES:

On completion of the course, the students are expected

- to form partial differential equations and solve certain types of partial differential equations
- to know how to find the Fourier Series and half range Fourier Series of a function given explicitly or to find Fourier Series of numerical data using harmonic analysis
- to know how to solve one dimensional wave equation, one dimensional heat equation using Fourier series (Cartesian co-ordinates only)
- to know how to solve two dimensional heat equation in steady state using Fourier series - Cartesian and polar co-ordinates
- to find the Fourier transform, sine and cosine transform of certain functions and use Parseval's identity to evaluate certain integrals

PARTIAL DIFFERENTIAL EQUATIONS 9

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of PDE by variable separable method – Solution of standard types of first order partial differential equations (excluding reducible to standard types) – Lagrange's linear equation – Linear Homogeneous partial differential equations of second and higher order with constant coefficients.

FOURIER SERIES 9

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

BOUNDARY VALUE PROBLEMS – ONE DIMENSIONAL EQUATIONS 9

Classification of second order quasi linear partial differential equations – Fourier series solutions of one dimensional wave equation – One dimensional heat equation: Problems with temperature and temperature gradients.

BOUNDARY VALUE PROBLEMS – TWO DIMENSIONAL EQUATIONS 9

Steady state solution of two-dimensional heat equation in Cartesian coordinates: Infinite and finite plates – Steady state solution of two-dimensional heat equation in Polar coordinates: Circular and Semicircular disks – Fourier series solutions.

FOURIER TRANSFORM **9**

Infinite Fourier transform pair – Infinite Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

L + T: 45 + 15 TOTAL: 60

REFERENCES

1. Grewal B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Veerarajan T., "Engineering Mathematics" (for semester IV), , Tata McGraw Hill, New Delhi (2001)
3. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.
4. Ian Sneddon., "Elements of partial differential equations" , McGraw – Hill New Delhi, 2003.
5. Arunachalam T., "Engineering Mathematics III", Sri Vignesh Publications, Coimbatore (Revised) 2009.

COURSE OUTCOMES

On completion of the course, the students are expected

C1 : To form partial differential equations and solve certain types of partial differential equations.
C2 : To know how to find the Fourier Series and half range Fourier Series of a function given explicitly or to find Fourier Series of numerical data using harmonic analysis.
C3 : To know how to solve one dimensional wave equation, one dimensional heat equation and two dimensional heat equation in steady state using Fourier Series.
C4 : To find the Fourier transform, sine and cosine transform of certain functions and use Parseval's identity to evaluate integrals.

U13ME*T*301 ENGINEERING THERMODYNAMICS 3 1 0 4

(Use of standard Steam table and Mollier diagram are permitted)

OBJECTIVES

To enable the student to understand

- The basic concepts and the applications of thermodynamic laws and relations to various processes.
- The concept of formation of steam and applied to thermal power plant.
- The concept of psychrometric process and its applications.

BASIC CONCEPTS AND FIRST LAW 9 + 3

Basic concepts - concept of continuum, macroscopic approach: thermodynamic systems - closed, open and isolated: Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – SFEE - Application to closed and open systems

SECOND LAW AND ENTROPY 9 + 3

Second law of thermodynamics – Kelvin's and Clausius statements of second law, Heat Engines, Refrigerator and Heat Pump, Coefficient of Performance, Reversibility Carnot cycle - reversed Carnot cycle, efficiency, Carnot theorem, Thermodynamic temperature scale. Clausius theorem, Clausius inequality, concept of entropy, entropy of ideal gas, change of entropy for different non flow processes, principle of increase of entropy – absolute entropy, Availability and irreversibility

STEAM AND VAPOUR CYCLES 9 + 3

Formation of steam constant pressure, types of steam, steam tables and uses, external work done during evaporation, Internal energy of Steam, dryness fraction of steam, entropy of steam – Mollier diagram steam power cycles, standard Rankine cycle, modified Rankine cycle. Reheat and regenerative cycle.

IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 9+3

Gas mixtures- properties ideal and real gases, equation state, Avagadro's Law, VanderWall's equation of state, compressibility factor, compressibility chart- Dalton's law of partial pressure, exact differentials, T-D relations, Maxwell's relations, Clausius Clapeyron equations, Joule-Thomson coefficient.

PSYCHROMETRY 9+3

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, problems.

Total: 45 + 15: 60 hrs

REFERENCES:

1. Nag, P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2008.
2. Cengel Y., “Thermodynamics An Engineering Approach”, Tata McGraw-Hill, NewDelhi, 2008.
3. Holman.J.P., “Thermodynamics”, 3rd
4. Arora, C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2004.
5. Merala, C. Pother, Craig, W., Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, McGraw-Hill, 2008.
6. Venwylen and Sontag, “Clasical Thermodynamics”, Wiley Eastern, 1987.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:
1. Understand the basic concepts and laws of thermodynamics.
2. Apply concept of enthalpy and entropy in thermal systems.
3. Analyze basic power cycles and apply the laws of thermodynamics to various thermodynamic applications.

U13ME*T*302 ENGINEERING MATERIALS & METALLURGY 3 0 0 3

OBJECTIVES

- To impart knowledge on the structures, properties, heat treatments, testing and applications of metals and non metallic materials.
- To understand the basic concepts about testing of Materials.

INTRODUCTION AND CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectroid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalising, hardening and Tempering of steel. TTT diagram - Hardenability, Jominy end quench test – Austempering, martempering – case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening.

FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – High strength Low Alloy steels (HSLA) – Dual phased steel – Micro alloyed steels – maraging steels – Alloyed cast - Irons, Ni-hard and Ni-resist cast irons. Copper and Copper alloys - properties and applications of Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys + Alloys of Ti, Zn, Mg and Ni.

NON-METALLIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PEEK, PTFE Polymers – Urea and Phenol formaldeliydes – Engineering Ceramics – Properties and applications of Al_2O_3, SiC, SI_3 - N4.

TESTING OF MATERIALS 9

Properties Evaluated by tensile testing procedure, Engineering stress strain curve Vs true stress strain curve, stress strain curve for typical materials, Hardness testing, Impact testing ,Fracture toughness, Fatigue testing: creep testing

Total: 45hrs

REFERENCES:

1. Kenneth, G., Budinski and Michael K.Budinski, “Engineering Materials”, Prentice- Hall of India Private Limited, 4th Indian print, 2002.
2. Donald, R., Askeland and Pradeep, P., Pbule, “The Science and Engineering of Thomson Engineering, 2002.
3. Suriyanarayana , A.V.K, Testing of metallic materials, Tata Mcgraw-Hill, 2001.
4. William D Callsber, “Material Science and Engineering”, John Wiley and Sons, 1997.
5. Raghavan,V., “Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd, 1999.
6. Sydney H.Avner, “Introduction to Physical Metallurgy”, McGraw-Hill Book Company, 1994.
7. Vanvlack,L.H., “Materials Engineering: concepts and applications”, 2005.
8. Paul Dr. Garmo. E., Black, J.T., and Ronald A. Kohser, “ Materials and Processes in Manufacturing”, Prentice Hall of India, 2005.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:
1. Explain various reactions, microstructure and compositions in the phase diagrams.
2. Select appropriate heat treatment process for specific applications.
3. Identify the composition, properties, applications of various ferrous, non ferrous metals, alloys and non metallic materials.
4. Explain the various testing procedure to evaluate material properties.

U13ME*T*303 STRENGTH OF MATERIALS 3 1 0 4

COURSE OBJECTIVES:

- To learn fundamental concepts of stress, strain and deformation of solids with applications to bars, beams and thin cylinders.
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To understand the effect of torsion on shafts and springs.
- To analyse a complex two dimensional state of stress and plane trusses.

STRESS AND STRAIN 9+3

Stress and strain at a point-Tension, Compression, Shear stress- Hooke's law-Relationship among elastic constants- Stress, strain diagram for Mild steel, TOR steel, Concrete- Ultimate stress-Yield Stress-Factor of safety-Thermal stresses-Thin cylinders and shells-Strain energy due to axial force-Resilience –stresses due to impact and suddenly applied load- Compound bars.

SHEAR AND BENDING IN BEAMS 9+3

Beams and bending- Types of loads, supports- Shear force and bending moment diagrams for statically determinate beams with concentrated load, UDL, uniformly varying load. Theory of simple bending- Analysis of beams for stresses- Stress distribution at a cross section due to bending moment and shear force for cantilever, simply supported and overhanging beams with different loading conditions.

DEFLECTION 9+3

Double integration method-Macaulay's methods- Area moment method- Conjugate beam method for the computations of slopes and deflections of determinate beams.

TORSION 9+3

Torsion of Circular and Hollow Shafts- Elastic theory of Torsion- Stresses and Deflection in Circular solid and hollow shafts- Combined bending moment and torsion of shafts- strain energy due to torsion- Modulus of rupture- Power transmitted to shaft- Shaft in series and parallel- Closed and open coiled helical springs- Leaf springs- Springs in series and parallel- Design of buffer springs.

COMPLEX STRESSES AND PLANE TRUSSES 9+3

2 D State of stress- 2 D Normal and Shear stresses on any plane- Principal stresses and principal planes- Mohr's circle- Plane trusses- method of joints – method of sections

Total 45 + 15 = 60 Hrs

REFERENCES:

1. Popov, E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2007.
2. Rajput, R. K, "A Textbook of Strength of Materials", S. Chand, 2007.
3. Subramanian R., "Strength of materials", Oxford University Press, New Delhi 2005
4. Premalatha J. Mechanics of solids, Vignesh Publications, Coimbatore
5. R.K. Bansal Strength of materials, Laxmi Publications, New Delhi-2007.
6. William A.Nash, Theory and Problems of Strength of materials, Schaum's Outline series, Tata McGraw-Hill publishing co., New Delhi-2007.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1. Understand fundamentals of the concepts of stress and strain in mechanics of solids and structures.
2. Analyze determinate beams and trusses to determine shear forces, bending moments and axial forces.
3. Design shafts to transmit required power
4. Design springs for its maximum energy storage capacities.

U13ME*T*304 MACHINE DRAWING 2 0 3 4

OBJECTIVES:

- Acquire knowledge of use of drawing concepts and conventions on orthographic views of part and assembly drawings of machine components
- Develop skills in drawing orthographic views of assembly drawings when the orthographic views of the parts of the respective assembly drawing is given

BASIC CONCEPTS OF MACHINE DRAWING 6

BIS codes for Engineering Drawing – Abbreviations – Conventional representation of standard components – Systems of dimensioning and dimensioning of common components – surface finish, symbols and representing surface finish on drawing – sectioning conventions – Representation of welding joints, reverted joints and screw threads

FITS AND TOLERANCES 6

Types of fits – types of tolerance – representation of tolerance on drawing – calculation of minimum and maximum clearances and allowances – Geometrical tolerance – form and position tolerances – symbols – indicating geometrical tolerances on drawings – Introduction to selective assembly and interchangeable manufacture.

FASTENERS, JOINTS AND COUPLINGS 12

Making free hand sketches of the following assemblies: Fasteners – square threaded nut and bolt – Hexagonal headed nut and bolt – cotter joint with sleeve – knuckle joint – Gib and cotter joint – couplings – protected and unprotected type flanged coupling.

ASSEMBLY DRAWING OF BEARING AND VALVES 18

Plummer block – Foot step ball bearing – Foot step journal bearing – stop valve – Rams bottom safety valve.

ASSEMBLY OF MACHINE PARTS 18

Screw jack – Tailstock – Tool head of shaper – Machine vice – connecting rod.

Total: 60 Hrs

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REFERENCES:

1. Gopalakrishna, K.R., “Machine Drawing”, Subhas publishing House, Bangalore, 2002
2. Sidheswar, N., Kannaiah, P., and Sastri, V.V.S., “Machine Drawing”, TMH New Delhi, 2006.
3. John, K.C., and Verghese, P.L., “Machine Drawing”, Jovast Publishers, Trissur, 2004.
4. “Faculty of Mechanical Engineering”, “PSG Design Data Book”, DPV Printers, 2006.
5. Ajeet singh, “Machine Drawing”, TMH, New Delhi, 2008.
6. Narayanan, K.L., Kanniah, P., and Venkata Reddy, K., “Machine Drawing”, New Age International Publications, 2004.
7. “Engineering Drawing practice for Schools and Colleges” – Bureau of Indian standards.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1. Recall basic concepts of machine drawing and define fits and tolerance.

2. Develop sectional views of fasteners, joints and couplings.

3. Develop assembly drawings of bearings, valves and machine parts.

U13ME*T*305 MANUFACTURING TECHNOLOGY – I 3 0 0 3

OBJECTIVES:

- To understand the concept and basic mechanics of metal cutting, sheet metal forming and bulk deforming processes.
- To understand the basic concepts and working of different metal casting and welding processes.

METAL CASTING PROCESSES 9

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines – Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Pressure die casting – Centrifugal casting – Sand Casting defects – Inspection methods

FABRICATION PROCESS 10

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding – Gas metal arc welding – Flux cored – Submerged arc welding – Tig welding – Principle and application of special welding processes - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding – Weld defects – Brazing and soldering process – Methods and process capabilities.

BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals – Forging processes – Open and close die forging – Characteristics of the process – Typical forging operations – Rolling of metals – Flat strip rolling – Types of Rolling mills – Shape rolling operations – Tube piercing – Defects in rolled parts – Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion – Principle of rod and wire drawing.

SHEET METAL FORMING PROCESSES 8

Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations — Formability of sheet metal – Test methods – Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Explosive forming – Magnetic pulse forming – Super plastic forming – Process characteristics.

METAL CUTTING (TURNING) PROCESS 9

Lathe – specifications, types – mechanisms and major Sub-assemblies – operations performed – work holding and supporting devices – working principle of single and multi-spindle automats.

Total : 45 hrs

REFERENCES:

1. Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media Promotors Pvt. Ltd., Mumbai, 2001.
2. Serope Kalpajian and Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 2002.
3. B.S. Magendran Parashar and R.K. Mittal, Elements of Manufacturing Processes, Prentice Hall of India, New Delhi 2003.
4. P.N. Rao, Manufacturing Technology, Tata McGraw-Hill Publishing Limited, II Edition, 2002.
5. P.C. Sharma, Production Technology, S. Chand and Company, New Delhi, IV Edition, 2007.
6. Begman, Manufacturing Process – John Wilely & Sons, IX Edition, 2004.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:
1. Outline the manufacturing process casting and metal joining.
2. Understand basic operations in bulk deformation process and sheet metal forming processes.
3. Identify various operations, accessories and work holding devices in turning process.

U13ME*P*301 STRENGTH OF MATERIALS LABORATORY, METALLURGY LABORATORY **0 0 3 1**

a) STRENGTH OF MATERIALS LABORATORY:

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metals – Brinell and Rockwell Hardness
4. Deflection test on beams
5. Compression test on helical springs
6. Impact Test.

b) METALLURGY LABORATORY:

LIST OF EXPERIMENTS

1. Identification and Micro structure study on
    i. Ferrous Materials- EN8, Mildsteel
    ii. Non Ferrous Materials- Aluminium
2. Heat Treatment - Comparison of
    i. Unhardened specimens
    ii. Quenched Specimens
    iii. Quenched and tempered specimens
3. Heat Treatment - Comparison of
    i. Un hardened
    ii. Hardened specimens
4. Microstructure examination of
    i. Hardened samples
    ii. Hardened and tempered samples.

Total: 45Hrs

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1. Demonstrate various tests on mechanical properties of materials
2. Compare microstructure of ferrous and nonferrous metals
3. Identify the microstructure of heat treated specimens.

U13ME*P*302 MANUFACTURING TECHNOLOGY – I LABORATORY 0 0 3 1

1. Facing, plain and step turning
2. Taper turning using compound rest
3. Taper turning using taper turning attachment
4. Single start V thread cutting and knurling
5. Boring and internal thread cutting
6. Mould with solid and split patterns
7. Mould with loose-piece pattern
8. Mould with Core
9. Conversion of round rod in to square rod
10. Conversion of round rod in to hexagonal bolt head
11. SMAW of different types of joints
12. TIG welding of sheet metal
13. MIG Welding of different types of joints

Total : 45 Hrs

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:
1. Demonstrate various turning operations.
2. Prepare sand moulds for various patterns.
3. Convert round rod into square and hexagonal shape.

U13ME*P*303 COMPUTER AIDED DESIGN LABORATORY 0 0 3 1

OBJECTIVES:

- To learn wire frame, surface and solid modeling techniques using CAD Software.
- To model and study the machine elements using CAD Software.

LIST OF EXPERIMENTS:

3D Surface and solid modeling – protrusion, cut, sweep, draft, loft, blend, rib Editing – Move, Patttern, Mirror, Round, Chamfer

Assembly – creating assembly from parts – assembly constraints

Conversion of 3D solid model to 2D drawing – different views, sections, isometric view and dimensioning

Instrumentation to Surface Modeling

3D Modeling of machine elements like Flanged coupling, screw jack, etc.

Assembly of 3D model component like Flanged coupling, screw jack, etc.

Total : 45Hrs

LIST OF EQUIPMENT S:

Computer System with 17" VGA Color Monitor and Pentium IV,i5 Processor - 30 Nos.

40 GB HDD

512 MB / 1 GB RAM

Color Desk Jet Printer - 1 No.

Software: modeling software (Pro-E,CATIA etc) 30 licenses

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1. Construct 2D and 3D model of a component and convert 3D model into 2D drafting.
2. Create a 3D part assembly of a product and generate section and isometric views.

U13GH*P*301 HUMAN EXCELLENCE-FAMILY VALUES 1 0 1 1

(Common to all branches of Engineering and Technology)

OBJECTIVES

- To inculcate the basic need for family life and peace in it.
- To lead spiritual development through good family life.
- To respect womanhood and live disease free life.
- To live with sound health.
- To reach Intuition.

Restraint in family **4 Hours**

Definition - Greatness of life force & mind. Introduction - Kayakalpa yoga -aim - maintaining youthfulness – sex & spirituality – ten stage of mind – mental frequency-method of concentration – kayakalpa philosophy - physical body – sexual vital fluid – life force – bio-magnetism - mind –food transformation into seven minerals – postponing the ageing process – death – importance of kayakalpa training.

Spiritual development through good Family life **4 Hours**

Kayakalpa exercise – methods –aswinimudhra – ojus breathing – explanations – benefits – practices – Responsibility of men and women – introduction a good education – need of morality – spiritual development.Revision of previous physical exercises. Introduction – hints & caution – body massaging – accu-pressure –relaxation.

Peace in Family. **4 Hours**

Family value – meaning – Introduction – values – benefits of blessings – effect of vibrations – make blessings a daily habit – greatness of friendship – individual & family peace – reason for misunderstanding in the family – no comment – no command – no demand – no ego – peace of mind.

Greatness of womanhood & Food is Medicine **4 Hours**

Good–cultured behavioral patterns – love and compassion - Greatness of womanhood – Food is medicine (healthy food habits)

Simplified physical exercises **7 Hours**

Simplified physical exercises – Kaya Kalpa Yoga (Benefits related to the Patient, Tolerance, Sacrifice)

Meditation & Yogasanas **7 Hours**

Thuriya meditation – introduction – practice – benefits. Asanas– ashtanga yoga – pathanjali maharishi –hints & cautions – posture - movement – involvement – standing asanas: thadasana – ekapathasana – chakrasana(side) – uthkatasana – trikonasana. Sittingasanas: thandasana – padmasana – vajrasana – suhasana – siddhasana – parvathasana – yogamudhra.Downward lying asanas: makkarasana – bhujangasana – salabhasana –navukasana– dhanurasana. Upward lying asanas: savasana - arthapavanamukthasana– pavanamukthasana – utthanapathasana – navasana& Surya namaskara.

Total: 30 Hours

REFERENCES:

1. Yoga for Modern Age ---- Vethathiri Maharishi
2. The Man making Messages ---- Swami Vivekananda
3. Manavalakalai Part- 1&2&3 ---- Vethathiri Maharishi
4. Value Education for Health & Happiness and Harmony. ---- Vethathiriyam

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Develop skills in maintaining harmony among the family members.
- Acquire skills in traditional yogasanas leading to sound health.
- Behaves as a family member and leading to a blissful family life.
- Learnt Food is Medicine.

U13MA*T*401 NUMERICAL METHODS 3 1 0 4

INTRODUCTION 5

Simple mathematical modeling and engineering problem solving – Algorithm Design – Flow charting and pseudocode - Accuracy and precision – round off errors

NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS 5

Solution of nonlinear equations - False position method – Fixed point iteration – Newton Raphson method for a single equation and a set of non- linear equations

Solution of linear system of equations by Gaussian elimination, Gauss Jordan method - Gauss Seidel method.

CURVE FITTING AND INTERPOLATION 5

Curve fitting – Method of least squares - Newton's forward and backward difference formulas – Divided differences – Newton's divided difference formula - Lagrange's interpolation – Inverse interpolation.

NUMERICAL DIFFERENTIATION AND INTEGRATION 5

Numerical differentiation by using Newton's forward, backward and divided differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Numerical double integration.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 10

Initial value problems - Single step methods: Taylor's series method – Truncation error – Euler and Improved Euler methods – Fourth order Runge – Kutta method – Multistep methods: Milne's predictor - corrector method.

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS (PDEs) 15

PDEs and Engineering Practice – Laplace Equation derivation for steady heat conduction – Numerical solution of the above problem by finite difference schemes – Parabolic Equations from Fourier`s Law of Transient Heat Conduction and their solution through implicit schemes – Method of Lines – Wave propagation through hyperbolic equations and solution by explicit method.

Use of MATLAB Programs to workout solutions for all the problems of interest in the above topics.

L + T : 45 + 15 = 60

REFERENCES:

1. Steven C.Chapra and Raymond P. Canale, " Numerical Methods for Engineers with Programming and Software Applications", SixthEdition, WCB/McGraw-Hill, 1998.
2. John H. Mathews and Kurtis D. Fink, "Numerical Methods using Matlab", Fourth Edition, Prentice Hall of India, 2004.
3. Gerald C. F. and Wheatley P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
4. Sastry S.S, "Introductory Methods of Numerical Analysis", Third Edition, Prentice – Hall of India Pvt Ltd, New Delhi, 2003.
5. Kandasamy P., Thilagavathy K. and Gunavathy K., "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2007.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1) Solve a set of algebraic equations representing steady state models formed in engineering problems
2) Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables
3) Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
4) Predict the system dynamic behaviour through solution of ODEs modeling the system
5) Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.
6) Have the necessary proficiency of using MATLAB for obtaining the above solutions.

U13ME*T*401 FLUID MECHANICS AND MACHINERY 3 1 0 4

OBJECTIVES:

- To study and understand Properties and Mechanics of Fluids
- To study and understand the working of hydraulic machines

FLUID PROPERTIES, STATICS AND KINEMATICS 14

Fluid Properties: Why learn Fluid Mechanics?- Some applications. Solid vs Fluid - Units and Dimensions – Properties of fluids (Definition only)-Mass density – Specific weight – Specific volume – Specific gravity – Viscosity – Compressibility – Surface tension – Capillarity – Vapor pressure.

Fluid Statics: Hydrostatic equation – Forces on plane and curved surfaces – Buoyancy – Metacentre – Simple and differential manometers. Fluid Kinematics: Path line – Stream line – Streak line – Stream and Potential functions – Flownets.

FLUID DYNAMICS 14

Fluid Element and properties - Lagrangian vs Eulerian description – Governing equations: Mass balance (Continuity equation) – Newton's second law (momentum equation- statement only) – First law of thermodynamics (Energy equation-statement only). Non-viscous flows (Euler's equation) – Frictionless flows (Bernoulli's equation), Introduction to CFD.

Case study (not for exam): Demonstration of solving Euler's and Navier-Stokes equation using analysis tools like ANSYS, HyperWorks etc.

FLUID FLOW AND DIMENSIONAL ANALYSIS 12

Laminar and turbulent flows through pipe – Hagen-Poiseuille equation – Darcy-Weishbach equation – Major and Minor losses – Pipes in series and in parallel.

Dimensional Analysis- Buckingham's π theorem- Discharge and velocity measurements- venture meter and pitot tube.

HYDRAULIC TURBINES 10

Force exerted on moving plate/ vanes- Definition and classifications- Pelton, Francis, Propeller and Kaplan turbine: Working principles- Velocity triangle – Work done – specific speed – efficiencies – Performance curve for turbines

HYDRAULIC PUMPS 10

Definition and classifications- Centrifugal and Reciprocating Pumps: Working principles- Indicator diagram – Specific speed – efficiency and performance curves - Cavitations in pumps.

Total: 60Hrs

REFERENCES:

1. P.N. Modi & S.M. Seth – "Hydraulics and fluid mechanics including hydraulic machines," Standard book house, 2005.
2. R.K. Bansal – "Fluid mechanics and hydraulic machines," Laxmi Publications (P) Ltd, 2006.

3. K.L. Kumar – "Engineering fluid mechanics," Eurasia publishing house, 1995
4. V.L. Streeter – "Fluid mechanics," McGraw-Hill, 1998
5. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, New Delhi, 2003
6. Versteeg, H.K, and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The Finite Volume Method", Pearsons, 2007.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:
1. Understand properties of fluids and classification of flows
2. Formulate and solve equations of the control volume for fluid flow systems
3. Explain the working of turbines and pumps and draw their performance curves.

U13ME*T*402 ENGINEERING METROLOGY AND QUALITY CONTROL 3 0 0 3

OBJECTIVES:

- To understand the basic principles of measurements
- To learn the various linear and angular measuring equipments, their principle of operation and applications
- To understand the various measuring instruments for form measuring
- To impart the knowledge of advanced measuring techniques
- To learn about various methods of measuring mechanical parameters

CONCEPT OF MEASUREMENT 9

Definition of metrology - General concept – Generalised measurement system -Units and standards – measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability - systematic and random errors – error correction - calibration – measurement uncertainty Introduction to Dimensional and Geometric Tolerance – interchangeability.

ADVANCES IN METROLOGY 9

Precision instruments based on Laser – principles - laser interferometer - application in measurements and machine tool metrology- Coordinate Measuring Machine (CMM): need, construction, types, applications- Surface Metrology - Computer Aided Inspection, Machine Vision - Introduction to Nano – metrology

PROCESS CONTROL FOR VARIABLES 10

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors – process capability – process capability studies and simple problems – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart.

PROCESS CONTROL FOR ATTRIBUTES 8

Control chart for attributes –control chart for proportion or fraction defectives – p chart and np chart – control chart for defects – C and U charts, State of control and process out of control identification in charts.

ACCEPTANCE SAMPLING 9

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

Total: 45 Hrs

REFERENCES:

1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 19th edition, 2005.
2. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997.
3. Gupta S.C, “Engineering Metrology”, Dhanpat rai Publications, 2005
4. Jayal A.K, “Instrumentation and Mechanical Measurements”, Galgotia Publications, 2000
5. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education, 2006.
6. Donald Deckman, “Industrial Instrumentation”, Wiley Eastern, 1985.

COURSE OUTCOMES:

After successful of the course, the student would be able to:

1. Understand the various concepts measurements and explain the operation of various measuring devices and precision instruments.
2. Construct various control charts for the attributes and variables.
3. Explain various sampling methods, concepts and OC curves.

U13ME*T*403 MANUFACTURING TECHNOLOGY – II 3 0 0 3

OBJECTIVES:

- To study basic metal cutting operations in machines
- To understand the working principles, structure of all machines, construction designs of all machines
- To learn the techniques, skills and economics of manufacturing
- To know applications of all manufacturing methods and apply it for doing project works
- To design machine tools ultimately for technological development.

THEORY OF METAL CUTTING 9

Introduction to Metal Cutting Methods – Mechanics of Metal Cutting – Orthogonal – Oblique – Merchants' Circle Diagram – Details of Derivation – Chip Details – Heat Generation – Cutting Tool Life – Cutting Tool Nomenclature – Cutting tool Materials - Cutting fluids – Recent Developments and Applications (Dry Machining and High Speed Machining)

MACHINE TOOLS 9

Introduction to Lathe – Shaper – Planing – Milling – Drilling – Boring – Grinding – Honing – Working Principles – Operations – Working Holding Devices.

MANUFACTURING COMPONENTS 9

Production of Axi-symmetrical components – Shafts – Hubs – Pins – Production of Prismatic Components – Housing – Lathe Beds – Gear Boxes – Machine Columns – Hole Production in Components using drilling – boring – Honing.

SURFACE FINISHING PROCESSES AND GEAR MANUFACTURING 9

Grinding Machines – Grinding wheel Specifications – Honing – Lapping – Tapping – Burnishing – Super Finishing – Surface Integrity concepts – Gear Manufacturing Processes – Gear Welding – Gear Hobbing – Gear Shaping Machines – Manufacture of Spur – Helical – Bevel – Worm and Worm Wheel – Gear Finishing

ECONOMICS OF MACHINING 9

Calculations of Machining Time – Turning – Drilling – Shaping – Milling – And Drilling – Cost estimation – General Principles of Economics in Machine usage and Machining – Economics of Tool Life – Optimal Cutting Speed for Productivity – Estimation of Machine hour rate and Machining Cost Computation.

Total: 45Hrs

REFERENCES:

1. Jain, R.K., and Gupta, S.C., "Production Technology", Khanna Publishers, New Delhi, 2004.
2. Sharma P.C., "A Text Book of Production Technology", S.Chand & Company Ltd., New Delhi, 2003.
3. Hajra Choudhry, S.K., and Bose, S.K., "Workshop Technology Vol II", Media Promoters and Publishers Pvt. Ltd., Bombay, 2004.
4. Suresh Dalela, and Shankar, R., " A Text book of Production Engineering", Galgotia Publications (P) Ltd., New Delhi, 2000.
5. Amstead B.H., "Manufacturing Processes", Phillip Ostwald, L.Begemon, John Wiley and Sons, 2002.
6. Rajput, R.K., "Manufacturing Technology", Laxmi Publications (P) Ltd, New Delhi, 2007.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1. Outline theory of metal cutting and working principles of machine tools.

2. Identify manufacturing components, surface finishing processes and gear manufacturing.

3. Interpret the economics of machining.

U13ME*T*404 KINEMATICS OF MACHINERY 3 1 0 4

OBJECTIVES:

- To study the fundamentals of mechanisms
- To analyze the motion, energy and power transfer in mechanisms.

BASICS OF MECHANISMS 9+3

Terminology and Definitions- Degree of freedom, mobility-Kutzbach criterion- Grashoff's law-Gruebler's criterion - Mechanical Advantage -Transmission angle - Kinematic Inversions of 4-bar chain and slider crank chains - Description of common mechanisms -- Ratchets and escapements - Indexing mechanisms - Rocking mechanisms - Straight line generators

KINEMATICS OF PLANE MECHANISMS 9+3

General plane motion - Relative velocity method – Displacement, Velocity and acceleration analysis in simple mechanisms - Instantaneous center method, Kennedy theorem – Coincident points – Corioils acceleration - Analytical method of Kinematic analysis – Computer applications in the kinematic analysis of simple mechanisms.

KINEMATICS OF CAM 9+3

Classifications - Displacement diagrams-Uniform velocity, Simple harmonic, uniform acceleration and retardation and Cycloidal motions – Graphical layout of plate cam profiles - Derivatives of follower motion - High speed cams - circular arc and tangent cams – unbalance and wind up - Pressure angle and undercutting – spring surge, jump speed analysis of cam.

GEARS AND GEAR TRAINS 9+3

Introduction – Types – Terminology – Law of toothed gearing – Velocity of sliding – Involute and cycloidal tooth profile– Interchangeable gears – Length of Path and arc of contact – contact ratio – Interference and under cutting – Minimum number of teeth to avoid interference in pinion and gear – Non standard gear teeth. Gear trains –Simple, compound, reverted and Epicyclic gear trains – Differentials.

FRICTION 9+3

Surface contacts – Friction in screw threads - Friction clutches - Belt and rope drives, Friction aspects in Brakes.

Total : 60Hrs

REFERENCES:

1. Rattan, S.S., "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2009.
2. Uicker, J.J., Pennock, G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2003.
3. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
4. Ghosh, A., and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 2006.
5. Rao, J.S., and Dukkipati, R.V, "Mechanism and Machine Theory", Wiley-Eastern Ltd., New Delhi, 2002.
6. Khurmi, R.S., and Gupta, J.K., "Theory of Machines", S.Chand & Company, 2009.
7. Norton L Robert 'Kinematics and Dynamics of Machinery' Tata McGraw Hill, 2009.

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1. Recall basics of mechanisms and construct velocity and acceleration diagrams.
2. Construct CAM profile for the specific follower motion.
3. Solve problems in gears, gear trains and friction applications.

U13GS*T*001 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

(Common to all branches of Engineering and Technology)

OBJECTIVE:

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve biodiversity.

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES **10 hrs**

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

ECOSYSTEMS AND BIODIVERSITY **14 hrs**

ECOSYSTEM : Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem, Food chains, food webs and ecological pyramids - Ecological succession – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) –

BIODIVERSITY : Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

ENVIRONMENTAL POLLUTION **8 hrs**

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT **7 hrs**

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

HUMAN POPULATION AND THE ENVIRONMENT **6 hrs**

Population growth, variation among nations – Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.

Field Work

Visit to local area to document environmental assets- river / grassland / hill / mountain, visit to local polluted site- urban / rural / industrial / agricultural, study of common plants, insects, birds, study of simple ecosystems-pond, river, hill slopes etc.,

TOTAL: 45 hrs

REFERENCES:

1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co., 2013
2. Masters G.M., and Ela W.P., Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India., 2002
4. Trivedi R.K and Goel P.K., "Introduction to Air pollution" Techno-science Pubications. 2003
5. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media. 1996
6. Cunningham, W.P., Cooper, T.H.., & Gorhani E., Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001
7. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998
8. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwell science Publishing Co., 2003
9. Syed Shabudeen, P.S. Environmental chemistry, Inder Publishers, Coimbatore. 2013

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Play a important role in transferring a healthy environment for future generations
- Analyze the impact of engineering solutions in a global and societal context
- Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
- Ability to consider issues of environment and sustainable development in his personal and professional undertakings
- Highlight the importance of ecosystem and biodiversity
- Paraphrase the importance of conservation of resources

U13ME*P*401 MANUFACTURING TECHNOLOGY-II LABORATORY 0 0 3 1

LIST OF EXPERIMENTS:

1. Spur Gear cutting using Milling machine
2. Helical Gear cutting by gear hobbing machine
3. Step milling
4. Key way cutting using milling machine
5. Contour profile milling
6. Dove tail machining using shaper machine
7. V-block machining using shaping machine
8. Key way cutting using shaping machine
9. Step block machining using shaping machine
10. Internal and external keyway machining using vertical slotting machine
11. Drilling, tapping and reaming
12. Cylindrical grinding of a shaft
13. Surface grinding
14. Study on bevel gear cutting and generation

Total : 45hrs

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1. Operate shaper, milling and slotting machines for the specified job.
2. Perform turning, drilling, boring, reaming and tapping operations for the given drawing.
3. Perform cylindrical and surface grinding operations to the required surface finish.

U13EN*P*401 COMMUNICATION SKILL LABORATORY 0 0 3 1

(Common to all branches of Engineering and Technology)
Method of End Semester Evaluation : Practical : 60 marks, Online Exam : 40 marks
OBJECTIVES:

- To impart communicative ability to exhibit the individual's subject knowledge
- To achieve the desirable communicative competence by the students to meet the expectation of corporate
- To show the need for a comprehensive link language to share subject expertise
- To offer adequate exposure to soft skills needed for the corporate.
- To sensitize towards corporate culture.

GRAMMAR IN COMMUNICATION 9

Grammar and Usage – Building Blocks, Homonyms, Subject and Verb Agreement, Error Correction - Grammar Application, Framing Questions – Question words, Verbal Questions, Tags, Giving Replies –Types of Sentences, Listening Comprehension –Listening and Ear training.

ASSERTIVE COMMUNICATION 9

Listening Comprehension in Cross–Cultural Ambience, Telephonic Conversations/Etiquette, Role Play Activities, Dramatizing Situations- Extempore – Idioms and Phrases.

CORPORATE COMMUNICATION 9

Video Sensitizing, Communicative Courtesy – Interactions – Situational Conversations, Time Management, Stress Management Techniques, Verbal Reasoning, Current Affairs – E Mail Communication / Etiquette.

PUBLIC SPEAKING 9

Giving Seminars and Presentations, Nuances of Addressing a Gathering - one to one/ one to a few/ one to many, Communication Process, Visual Aids & their Preparation, Accent Neutralization, Analyzing the Audience, Nonverbal Communication.

INTERVIEW & GD TECHNIQUES 9

Importance of Body Language –Gestures & Postures and Proxemics, Extempore, Facing the Interview Panel, Interview FAQs, Psychometric Tests and Stress Interviews, Introduction to GD, Mock GD Practices.

Total: 45hrs

REFERENCES:

1. Bhatnagar R.P. & Rahul Bhargava, "English for Competitive Examinations", Macmillian Publishers, India, 1989, ISBN: 9780333925591
2. Devadoss K. & Malathy P., "Career Skills for Engineers", National Book Publishers, Chennai, 2013.
3. Aggarwal R.S., "A Modern Approach to Verbal & Non–Verbal Reasoning", S.Chand Publishers, India, 2012, ISBN : 8121905516

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

1. Present the individual, academic curricular and career profiles
2. Speak to prove the industry-ready communication competency in GDs & interviews
3. Project desirable soft skills to interface the corporate

U13CE*P*412 FLUID MECHANICS AND MACHINES LABORATORY 0 0 3 1

LIST OF EXPERIMENTS:

1. Determination of the Coefficient of discharge of a given Orifice meter.
2. Determination of the Coefficient of discharge of a given Venturi meter.
3. Determination of friction factor for a given set of pipes.
4. Characteristic curves of centrifugal pump
5. Performance characteristics of Pelton wheel.
6. Performance characteristics of Francis turbine.
7. Verification of Bernoulli's theorem
8. Study on Wind tunnel

Total: 45Hrs

COURSE OUTCOMES:

After successful of the course, the student would be able to:

1. Study the functioning of orifice meter and venturimeter.
2. Sketch the characteristic curves of centrifugal pumps.
3. Demonstrate the performance characteristics of pelton wheel and francis turbine.

U13GH*P*401 HUMAN EXCELLENCE-PROFESSIONAL VALUES 1 0 1 1

(Common to all branches of Engineering and Technology)

Objective:

- To know the 5 Cs (Clarity, courage, confidence, commitment, compassion)
- To Know the 5 Es(Energy, Enthusiasm, Efficiency, Enterprise, Excellence)
- To Practice the IQ Questions and given to the result
- To Learn about Professional Ethics
- To know the examples for Self Control

Personality concepts - 5C's & 5E's **5 Hours**

Personality-concepts, definition,-types of personality-personality development activities- how to develop a good personality factors affecting personality development tools of improve personality-steps to a dynamic personality-5 C's and 5 E's

Time Management **5 Hours**

Self-development – importance of self development – how to develop oneself – continuous learning – laser focus +persistence – working a plan – sound mind follows sound body – complete responsibility – practice – those who make it, made it – never give-up – meditation – ten commandments of self development – self control technique for teenagers.

Leadership traits **5 Hours**

Leadership traits – style – factors of leadership – principles of leadership - time management – importance of time management – benefits – top five time sucks of the average Human –time management for college students. Passion for excellence – what is passion? – Why passion? – Value of life – index of life – fuel for fulfillment – secret of physical & spiritual fitness – improves learning ability.

Empowerment of Mind **5 Hours**

IQ, - Factors affecting the intelligence quotient – IQ and the brain – sex – race – age – relationship between IQ & intelligence – how to develop good intelligence quotient power – exercise can improve IQ – food plan to increase IQ – meditation – reading – playing – try right with opposite hands – learn new things - the IQ tests. EQ – emotional Intelligence – list positive & negative emotions. SQ – spiritual quotients – definition – basic science of spiritual quotient – how to build SQ? – Relationship between IQ, EQ, SQ.

Meditation **3 Hours**

Panchendhriya meditation – Introduction – practice – benefits.

Simplified Physical Exercise& Yogasanas **7 Hours**

Asanas – revision of previous asanas–standing asanas: natarasana –virabhadrasana – pathangusthasana– ardhachandrasana–utthithatrikonasana–parsvakonasana.

Total : 30 Hours

REFERENCES:

- Personality & Self Development –ICFAI University
- Leadership-Dr.A Chandra Mohan
- Intelligence-Swami Vivekananda
- Ways to make every second valuable- Robert W. Bly
- Manavalkkalai Part-II-Vethathiri Maharishi
- Professional Ethics& Human Values-D.R Kiran&S.Bhaskar
- Extraordinary performance from ordinary people- Keith Ward& Cliff Bowman,
- Mind-Vethathiri Maharishi.
- Manavalkkalai Part-I-Vethathiri Maharishi,
- Self Cotrol-Russell Kelfer

COURSE OUTCOMES:

After successful completion of the course, the student would be able to:

- Acquire knowledge on the Clarity, courage, confidence, commitment, compassion for a good Professionalize
- Demonstrate Skills of IQ test
- Contribute to the better Management of Time
- Behave a good Professionalism from Quality Enhancement

U13ME*T*501 DYNAMICS OF MACHINERY

L	T	P	C
3	1	0	4

Course Objectives

- To understand the method of static and dynamic force analysis.
- To study the undesirable effects of unbalance in rotating and reciprocating masses.
- To understand the concept of free vibrations.
- To understand the concept of forced vibrations and vibration isolation.
- To understand the principles of governors and gyroscopes.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Calculate inertia force in reciprocating mass and turning moment in flywheels.
CO 2 : Analyze balancing of reciprocating and rotating masses.
CO 3 : Predict the natural frequency of free and forced vibration systems.
CO 4 : Appreciate the gyroscopic effect in mechanical applications and calculate the equilibrium speed of governors.

Course Content

FORCE ANALYSIS AND FLYWHEELS **9 + 4Hours**

Static force analysis of mechanisms – D' Alembert's principle - Inertia force and Inertia torque – Dynamic force analysis - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque–Engine shaking Forces - Turning moment diagrams – Fluctuation of energy, Flywheels of engines.

BALANCING **9 + 3Hours**

Static and dynamic balancing – Balancing of rotating masses - Balancing of reciprocating masses in a single cylinder Engine – Primary and secondary unbalanced forces - Balancing Multi-cylinder Engines – Firing order –Balancing machines.

FREE VIBRATION **9 + 3Hours**

Basic features of vibratory systems - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - Natural frequency - Types of Damping - Damped vibration – Whirling of shafts and critical speed - Torsional vibration of two and three rotor systems, torsionally equivalent shaft.

FORCED VIBRATION **9 + 2Hours**

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

MECHANISMS FOR CONTROL **9 + 3Hours**

Governors - Types - Centrifugal governors – Porter & Proell governer , Hartnell, Hartung – Characteristics - Effect of friction - Controlling Force

Gyroscopes - Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in Automobiles, Aeroplanes and Ships.

Theory :45Hr Tutorial :15Hr **Total Hours: 60**

REFERENCES:

1. Rattan S.S., “Theory of Machines”, 3rd edition, TMH, New Delhi, 2009.
2. Thomas Bevan, “Theory of Machines”, CBS Publishers and Distributors, 1984.
3. Ghosh A. and Mallick A.K., “Theory of Mechanisms and Machines”, Affiliated East- West Press Pvt. Ltd., New Delhi, 3rd edition, 1998.
4. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 4th edition, 2010.
5. Rao J.S. and Dukkipati R.V., “Mechanism and Machine Theory”, Wiley-Eastern Limited, New Delhi, 1992.
6. John Hannah and Stephens R.C., “Mechanics of Machines”, Viva low-Priced Student Edition, 1999.
7. Sadhu Singh “Theory of Machines” Pearson Education, 2002.

STANDARDS:

1. IS 11717 : 2000, Vocabulary on Vibration and Shock
2. IS 13301 : 1992, Guidelines for vibration isolation for machine foundations
3. IS 10000 : Part 7 : 1980, Methods of tests for internal combustion engines: Part 7 Governing tests for constant speed engines and selection of engines for use with electrical generators
4. IS 13274 : 1992, Mechanical vibration - Balancing – Vocabulary
5. IS 13277 : 1992, Balancing machine - Description and evaluation

U13ME*T*502 DESIGN OF MACHINE ELEMENTS L T P C
3 1 0 4

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

Course Objectives

- To familiarize the various steps involved in the Design Process.
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
- To learn the designing procedure for energy storing elements

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Design a shaft subject to combined static and variable loads.
CO 2 : Select appropriate rolling contact bearing, gasket and seal from the standard catalog based on loads.
CO 3 :Design of flywheel, fasteners, helical spring, compression and tension springs for the specific applications.

Course Content

STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS **9 + 3 Hours**

Introduction to the design process – Product development cycle- factors influencing machine design, selection of materials based on mechanical properties -- Preferred numbers– Direct, Bending and Torsional stress – Impact and shock loading – Calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and ‘C’ frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations

DESIGN OF SHAFTS AND COUPLINGS **9 + 3Hours**

Design of shafts based on strength, rigidity and critical speed – Design of keys, key ways and splines- Design of rigid and flexible couplings- Design of levers

DESIGN OF BEARINGS, SEALS AND GASKETS **9 + 3Hours**

Sliding contact and rolling contract bearings – Design of hydrodynamics journal bearings – selection of rolling contact bearings – Design of hydro static bearing – Design of seals and gaskets.

DESIGN OF TEMPORARY AND PERMANENT JOINTS 9 + 3Hours

Threaded fasteners - Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of welded joints, riveted joints for structures.

DESIGN OF ENERGY STORING ELEMENTS 9 + 3 Hours

Design of various types of springs, helical springs, leaf springs -- Design of flywheels considering stresses in rims and arms, for engines and punching machines.

Theory :45Hr Tutorial :15Hr Total Hours: 60

REFERENCES:

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw-Hill , 2003.
2. Bhandari V.B, "Design of Machine Elements", Second Edition, Tata McGraw-Hill Book Co, 2007.
3. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
4. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
5. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.

U13ME*T*503	THERMAL ENGINEERING	L	T	P	C
		3	1	0	4

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted in the examination)

Course Objectives

- To understand the concept of internal combustion engines and their performance characteristics.
- To study the working principle of air compressors, refrigeration and air conditioning systems.
- To study the steam nozzles and various types of steam turbines for power generation.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand the working principle and performance of IC engines for various power cycles.
CO 2 : Predict dimensions of steam nozzles and steam turbines for power generation.
CO 3 : Estimate the power requirement of reciprocating air compressors.
CO 4 : Calculate the cooling load for air conditioning and COP of refrigeration systems.

Course Content

INTERNAL COMBUSTION ENGINES **9+3 Hours**

Classification of IC engine, engine components and functions - timing diagram. Fuel supply systems, Ignition Systems - Combustion phenomenon – Knocking and Detonation. Air-fuel ratio calculation, Lubrication system and cooling system.

GAS POWER CYCLES & ENGINE PERFORMANCE **9+3 Hours**

Otto, Diesel, Dual, Brayton cycles (Air standard efficiency derivation only), Calculation of mean effective pressure and air standard efficiency, Actual and theoretical PV diagram of Four stroke engines, Actual and theoretical PV diagram of two stroke engines. Engine testing - Performance – Heat balance – Frictional Power – Retardation Test - Morse Test -Exhaust gas analysis, pollution control norms.

STEAM NOZZLES AND TURBINES **9+3 Hours**

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio - Impulse and reaction principles, compounding, velocity diagrams for simple turbines, speed regulations – governors.

AIR COMPRESSOR **9+3 Hours**

Classification - Reciprocating Air Compressor - working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling (Descriptive treatment only), Rotary Compressors – Centrifugal Compressor and axial flow compressor (Descriptive treatment only).

REFRIGERATION AND AIR CONDITIONING **9+3 Hours**

Vapour compression refrigeration cycle-super heat, sub cooling- Performance calculations- working principle of vapour absorption system, Ammonia- Water, Lithium boride- water systems (Description only) – Alternate refrigerants- comparison between vapour compression and absorption systems- Air conditioning systems: types, working principles- Psychrometry - Cooling Load calculations – Concept of RSHF, GSHF, ESHF.

Theory :45Hr Tutorial :15Hr **Total Hours: 60**

REFERENCES:

1. Sarkar, B.K, “Thermal Engineering” Tata McGraw-Hill Publishers, 2007.
2. Kothandaraman.C.P., Domkundwar.S, Domkundwar.A.V.,”A course in thermal Engineering,” Dhanpat Rai&sons, Fifth edition, 2002.
3. Rajput.R.K., “Thermal Engineering” S.Chand Publishers, 2000.
4. Arora, C.P., “Refrigeration and Air conditioning”, Tata Mc-Graw-Hill Publishers 1994.
5. Ganesan.V., “Internal Combustion Engines”, Third edition, Tata McGraw-Hill 2007.
6. Rudramoorthy.R., “Thermal Engineering”, Tata McGraw-Hill, New Delhi, 2003.

U13ME*T*504	COMPUTER AIDED DESIGN AND MANUFACTURING	L	T	P	C
		3	0	0	3

Course Objectives

- To explain the basic concept of a computer aided design process and types of geometrical modeling.
- To understand parametric design and part programming.
- To discuss component modeling and interfacing with CAM software.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Explain the basic concept of a CAD system and different types of geometrical modeling.
CO 2 : Apply the concept of parametric design for mechanical assembly.
CO 3 : Discuss the various part programming for different operations in CNC machines.

Course Content

OVERVIEW OF CAD SYSTEMS **9Hours**

Conventional and computer aided design processes-advantages and disadvantages. Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations. Networking of CAD systems.

GEOMETRIC MODELING **9Hours**

Wireframe, surface, NURBS and solid modeling-applications and advantages. Creating primitive solids, sweeping solids, Boolean operations. Extracting entities from a solid. Filleting of edges of solids. Boundary representation (B-rep) Constructive Solid Geometry(CSG) and Analytical Solid Modeling(ASM)

PARAMETRIC DESIGN AND OBJECT REPRESENTATION **9Hours**

Types of co-ordinate systems. Parametric design - definition and advantages. Parametric representation of analytic and synthetic curves. Parametric representation of surfaces and solids – manipulations, Automated 2D drafting - basics, mechanical assembly - bill of materials generation. Mass property calculations.

PART PROGRAMMING: **9Hours**

Manual part programming (Using G and M Codes) in CNC lathe and CNC Milling, Part programming for Linear and Circular interpolation, Part programming using standard canned cycles for Turning, Drilling and Milling.

POST PROCESSING: **9 Hours**

Component Modeling and interfacing with CAM software. CL data generation, NC Code generation for CNC controller like FANUC, HAAS, SINUMERIC etc., Post processing commands for different CAD/CAM software like Pro-E, SOLID WORKS, EDGE CAM etc.,

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Vera B Anand, "Computer Graphics and Geometric Modeling for Engineers", John Wiley & Sons, New York, 2000.
2. Radhakrishnan P and Subramanyan S, “CAD/CAM/CIM”, New Age International Pvt. Ltd., 2004.
3. Radhakrishnan P and Kothandaraman C P, "Computer Graphics and Design”, Dhanpat Rai & Sons, New Delhi, 2002.
4. Ibrahim Zeid,"CAD/CAM Theory and Practice", McGraw Hill Inc., New York, 2003.
5. Barry Hawhes, "The CAD/CAM Process”, Pitman Publishing, London, 1998.
6. William M Newman and Robert Sproul, "Principles of Interactive Computer Graphics", McGraw Hill Inc., New York, 1994.
7. Sadhu Singh, "Computer-Aided Design and Manufacturing", Khanna Publishers, New Delhi, 1998.
8. Rao S S, “Optimisaiton Techniques”, Wiley Eastern, New Delhi, 2003.

U13ME*T*505	INSTRUMENTATION AND CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the principle of measuring displacement, velocity, acceleration, vibration, force, stress and strain.
- To build mathematical model for control system.
- To familiar with bode plots.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Perform measurement of displacement, velocity, force, torque, strain, stress, pressure and temperature.
CO 2 : Develop mathematical model of physical systems.
CO 3 : Draw bode plots.

Course Content

INTRODUCTION **9 Hours**

Static and dynamic characteristics of measurement systems, standards and calibration, error and uncertainty analysis, statistical analysis of data, and curve fitting.

MECHANICAL MEASUREMENTS AND INDUSTRIAL INSTRUMENTATION **10 Hours**

Measurement of displacement, velocity (linear and rotational), acceleration, shock, vibration, force, torque power, strain, stress, pressure temperature.

DATA DISPLAY AND RECORDING DEVICES **8 Hours**

Data display-CRO,LED, LCD, magnetic tape recorders, x-y recorders, UV recorders, Oscilloscope recorders, digital printers and data loggers.

CONTROL **9 Hours**

Introduction to control systems, mathematical model of physical systems in transfer function and state space forms, response of dynamic systems, concept of pole and zero of a system, realization of transfer functions.

STABILITY ANALYSIS **9 Hours**

Stability criteria bode plots, routh and Nyquist criteria.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Nakra, B.C and Choudry, K.K. “Instrumentation, Measurement and analysis”, Tata McGraw Hill 2002
2. Nagrath. J.J. and Gopal, “control system engineering”, New age international (p) ltd., 2000.
3. Rangan. C.S., Sarma. G.R., Mani. VSV, Instrumentation Devices and Systems”, Tata McGraw Hill, 2000
4. Sowhney. A.K., “Electrical and Electronic Measurement and Instrumentation, “Dhanpat rai & Cu, 2003.
5. Benjamin C.Kuo, “Automatic Control System”, prentice hall of India pvt ltd., 2002
6.Ernest O.Doeblin, “measurement systems applications and design”, McGraw Hill International editions, 1990
7. Renganathan. S., “transducer engineering”, Allied publishers, 1990.

U13ME*T*506	MECHATRONICS	L	T	P	C
		3	0	0	3

Course Objectives

To understand the working of modern mechanical system, deals with sensors, actuators and controllers in specific

- Sensors and Transducers
- Actuation Systems
- System Models and Controllers
- Programming Logic Controllers and
- Design of Mechatronics Systems

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Classify various sensors, transducer and actuators according to the applications.
CO 2 : Explain various system models and controllers.
CO 3 : Select a controller for a mechanical and mechatronics system.

Course Content

MECHATRONICS, SENSORS AND TRANSDUCERS **9 Hours**

Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Displacement, Potentiometer LVDT – Encoders – Hall Effect – Capacitive Transducers Microprocessor based Controllers - Applications.

Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, (thermistor, thermocouple) Light Sensors – Selection of Sensors

ACTUATION SYSTEMS **9 Hours**

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and Pawl – Belt and Chain Drives – Bearings.
Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – D.C Motors – A.C Motors – Stepper Motors - Servomotors.

SYSTEM MODELS AND CONTROLLERS **9 Hours**

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems.
Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

PROGRAMMING LOGIC CONTROLLERS **9 Hours**

Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC Problem – Application of PLCs for control

DESIGN OF MECHATRONICS SYSTEM **9 Hours**

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions. Case Studies of Mechatronics Systems, Pick and place robot – Automatic Car Park Systems – Automatic Camera – Automatic Washing Machine - Engine Management Systems.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Bolton, W. "Mechatronics", Pearson Education, 4th Edition, 2008.
2. 'Mechatronics', HMT Ltd., Tata McGraw Hill Publication Co. Ltd., New Delhi, 5th Edition, 2009.
3. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2005.
4. Ramachandran, K.P., Vijayaraghavan, G.K.and Bala Sundaram, M.S. "Mechatronics: Integrated Mechanical Electronic System" Wiley India Pvt Ltd.
5. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall, 1993.
6. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
7. Lawrence J. Kamm, "Understanding Electro – Mechanical Engineering", An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
8. Nitaigour Premchand Mahadik, "Mechatronics", Tata McGraw-Hill publishing Company Ltd, 2003.

U13ME*P*501	MECHANISMS AND DYNAMICS LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To understand the working principle of governors and gyroscopes.
- To determine moment of inertia and gear ratio and balance reciprocating masses.
- To find the frequency of vibrating systems.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Construct characteristic curve for governor and profile of cam.
CO 2 : Manipulate the gyroscopic couple and moment of inertia for a given application.
CO 3 : Perform static and dynamic balancing of rotating and reciprocating masses.
CO 4 : Measure natural frequency of forced and free vibrations.

Course Content

LIST OF EXPERIMENTS:

1. Study of the characteristics curves and sensitivity of various types of governors
2. Determination of jump speed and construction of cam profile.
3. Determination of gyroscopic couple and its verification.
4. Determination of Moment of Inertia of Rod using Bifilar Suspension and Compound Pendulum.
5. Determination of Moment of Inertia of Disc and Ring using Turn Table.
6. Determination of Gear Ratio and Torque in Epicyclic Gear Train Apparatus.
7. Balancing of reciprocating masses.
8. Static and dynamic balancing of rotating masses.
9. a) Determination of Natural Frequency of Longitudinal Vibrations in Helical Spring.
   b) Verification of Dunkerley's Rule in Transverse Vibrations.
10. Determination of Natural Frequency of Torsional Vibrations in single and double Rotor Systems.
11. a) Determination of Critical Speed using Whirling of Shaft apparatus.
    b) Determination of transmissibility ratio in vibrating table.
12. Study on simple bar and link mechanisms

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

9. Gear Model.

Practical :45Hr **Total Hours: 45**

U13ME*P*502 METROLOGY AND INSTRUMENTATION LABORATORY

L	T	P	C
0	0	3	1

Course Objectives

- To measure the dimensions of component using measuring devices.
- To measure the displacement, force and torque.
- To determine the pressure and surface roughness.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Identify various gauges for measurement.
CO 2 : Demonstrate linear and angular measurement using precision instruments.
CO 3 : Apply the load cell, thermocouple and vibrometer.

Course Content

LIST OF EXPERIMENTS:

1. Measurement of dimensions using vernier height gauge
2. Calibration of dial gauge
3. Checking dimensions of part using slip gauges
4. Measuring part dimensions using Electrical, Optical and Mechanical comparators
5. Measurements of gear tooth dimensions using gear tooth vernier
6. Measurements of composite gear tooth error using gear roll tester
7. Measurement of Taper Angle using sine bar
8. Measurement of screw thread parameters using Tool Makers Microscope and Profile Projector.
9. Measurement of displacement using LVDT.
10. Measurement of Force and Torque using load cell
11. Measurement of temperature using Thermocouple
12. Measurement of Vibration / Shock using vibration pick up
13. Measurement of pressure
14. Measurement of surface roughness

Practical :45Hr **Total Hours: 45**

U13ME*P*503 THERMAL ENGINEERING LABORATORY –I

L	T	P	C
0	0	3	1

Course Objectives

- To understand the working principle and performance of internal combustion engines.
- To understand the working principle and performance of air compressor.
- To study the fuel properties
- To understand the emission characteristics in internal combustion engines.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Perform internal combustion engine (Petrol/Diesel) test to measure power, efficiency, fuel consumption and emissions.
CO 2 : Measure fuel properties such as viscosity, flash point and fire point.
CO 3 : Conduct performance test on reciprocating air compressor.

Course Content

LIST OF EXPERIMENTS:

1. Valve Timing and Port Timing Diagrams.
2. Performance and emission Test on Diesel Engine by Hydraulic loading.
3. Heat Balance Test on Diesel Engine by Electrical loading.
4. Morse Test on Multi cylinder Petrol Engine.
5. Performance and emission Test on single cylinder petrol engine.
6. Determination of Frictional Power by retardation test.
7. Determination of Viscosity of given oil.
8. Determination of Flash Point and Fire Point.
9. Study on boiler efficiency calculation using indirect method.
10. Performance test on reciprocating air compressor.
11. Efficiency calculations in Non IBR boiler.
12. Study on CRDI and MPFI engines.

Practical :45Hr **Total Hours: 45**

U13GH*P*501 HUMAN EXCELLENCE-SOCIAL VALUES L T P C
0 0 2 1

(Common to All Branches of Engineering and Technology)

Course Objectives

- To produce responsible citizens to family and society
- To uplift society by pure politics and need education
- To realize the value of unity, service
- To immunize the body
- To get Divine peace through inward travel

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Learn knowledge on the Duties and responsibilities
CO 2 : Demonstrate skills required for the Disparity among human being
CO 3 : Behave as a responsible Politics and Society & Education and Society
CO 4 : Analyze Impact of Science in Society.

Course Content

RESPONSIBLE CITIZENS TO FAMILY AND SOCIETY **5 Hours**

Evolution of man - evolution of universe – creating theory – evolution theory – theory permanence theory – mithya – maya or illusion – evolution of living being

POLITICS AND NEED EDUCATION **5 Hours**

Human being & group – unity of man in society – relationship between individual – society.

DEVELOPMENT OF SCIENCE, EDUCATION & ECONOMICS **5 Hours**

Duties and Responsibilities- Duty to self, family, society and world – politics & society – education & society – case study and live example – impact of science, economic & society.

DISPARITY AMONG HUMAN BEINGS **5 Hours**

Disparity among human beings – seven values – bodily structure – character of personality – advancement of knowledge or intellectual clarity – fame of service – physical strength –health – financial status. sixteen factors heredity – food – historical age – place of living – education – work – government – art – effort – physical age – friendship – opportunity – research – practice – accepted sentiments of society – morality.

SERVICE AND SACRIFICE **3 Hours**

Social welfare – need – pure & pure society.

YOGASANAS & MEDITATION **7 Hours**

Pancha bhootha navagraha meditation – Introduction – practice – benefits. Sitting asanas: mahamudhra – ustrasana– gomukhasana– matsyasana – ArdhaMatsyendrasana.Upward lying asanas: setubhandasana–viparitakaranai – sarvangasana – halasana. Downward lying asanas: arthasarvangasana – adhomukhasvanasana–padmamayura.

Theory :30Hr **Total Hours: 30**

REFERENCES:

1. World peace plane ---- Vethathiri Maharishi
2. Prosperous India ---- Swami Vivekananda
3. Samudhaya chikkalukkana nala Aaivugal ---- Vethathiri Maharishi
4. World Community Life ---- Vethathiriyam

U13ME*T*601 DESIGN OF TRANSMISSION SYSTEMS L T P C
3 1 0 4

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

Course Objectives

- To study the principles and designing of the flexible elements like Belt, Pulley and Rope etc.
- To design the different type of gears using standard procedure
- To learn the standard data and catalogues for the power transmission systems
- To design the gear boxes using standard procedure
- To understand the different types of bearing and its design concepts

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Select suitable flexible drive for a given application using standard codes.

CO 2 : Estimate the nomenclature of various types of gears and gear boxes based on load and speed requirement.

CO 3 : Design a cam and clutches for a given application.

Course Content

DESIGN OF FLEXIBL ELEMENTS **9+3 Hours**

Selection of V belts and pulleys-selection of Flat belts and pulleys-Wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

SPUR GEARS AND HELICAL GEARS **9 + 3 Hours**

Gear Terminology-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and Face width-power rating calculations based on strength and wear considerations - Helical Gears – Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces and stresses. Estimating the size of the spur and helical gears.

BEVEL, AND WORM GEARS **9+3 Hours**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: terminology, Merits and demerits. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

DESIGN OF GEAR BOXES **9+3Hours**

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

DESIGN OF CAM AND CLUTCHES **9+3 Hours**

Cam Design: Pressure angle, under cutting and base circle determination-forces and surface stresses.
Design of plate clutches – axial clutches-cone clutches-internal expanding rim clutches.

Theory :45Hr Tutorial :15Hr **Total Hours: 60**

REFERENCES:

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill , 2008.
2. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
3. Maitra G.M., Prasad L.V., "Hand book of Mechanical Design", II Edition, Tata McGraw-Hill, 1985.
4. Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd., 1994.
5. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
6. Hamrock B.J., Jacobson B., Schmid S.R., "Fundamentals of Machine Elements", McGraw-Hill Book Co., 1999.
7. Ugural A. C, "Mechanical Design, An Integrated Approach", McGraw-Hill, 2003.

STANDARDS:

1. IS 4460: Parts 1 to 3: 1995, Gears – Spur and Helical Gears – Calculation of Load Capacity.
2. IS 7443 : 2002, Methods of Load Rating of Worm Gears
3. IS 15151: 2002, Belt Drives – Pulleys and V-Ribbed belts for Industrial applications – PH, PJ, PK, Pl and PM Profiles : Dimensions
4. IS 2122: Part 1: 1973, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 1 Flat Belt Drives.
5. IS 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 2 V-Belt Drives.

U13ME*T*602	HEAT AND MASS TRANSFER	L	T	P	C
		3	1	0	4

(Use of Standard Heat and Mass Transfer Data Book is permitted in the End semester Examination)

Course Objectives

- To understand, the basic concepts of conduction, convection and radiation and its applications.
- To differentiate between free and forced convection and solve problems for each applications.
- To know the radiation and study the various laws of radiation, shape factor
- To study convective mass transfer and its types and applications.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Appraise the conduction, convection and radiation mode of heat transfer through various applications.
CO 2 : Design and select heat exchangers, condensers and evaporator for various applications.
CO 3 : Apply principles of heat and mass transfer to basic thermal engineering systems.

Course Content

CONDUCTION **10 + 4 Hours**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – Fourier Law of Conduction - General Differential Conduction equation in Cartesian and Cylindrical Coordinate systems – One Dimensional Steady State Heat Conduction through Plane Wall, Cylindrical and Spherical systems – Composite Systems – Critical thickness of insulation - Conduction with Internal Heat Generation – Extended Surfaces – Numerical Methods of One dimensional Heat conduction- Unsteady Heat Conduction – Lumped Analysis, Infinite and semi Infinite solids using Heislers Chart.

CONVECTION **10 + 3 Hours**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar, Turbulent and Combined flows – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical, Horizontal and Inclined Plates, Cylinders and Spheres.

PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9 + 3 Hours

Nusselts theory of condensation - Regimes in boiling - Correlations in condensation and boiling - Types of Heat Exchangers- compact heat exchanger – Overall Heat Transfer Coefficient – Fouling Factors - LMTD and Effectiveness – NTU methods of Heat Exchanger Analysis.

RADIATION 8 + 3 Hours

Basic Concepts, Laws of Radiation – Black Body Radiation – Grey body radiation –radiation shield - Shape Factor Algebra (Plates, parallel, perpendicular, parallel circular disc) – Gas radiations (qualitative study).

MASS TRANSFER 8 + 2 Hours

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

Theory :45Hr Tutorial :15Hr Total Hours:60

REFERENCES:

1. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, August 2007, Reprint 2008, 3rd edition.
2. Yunus Cengal "Heat and Mass Transfer" Tata McGraw Hill, 3rd edition, 2008.
3. Holman J.P 'Heat Transfer' - Tata Mc Graw Hill, Ninth edition, 2007.
4. Ozisik M.N, "Heat Transfer", McGraw-Hill Book Co., 1994.
5. Nag P.K, "Heat Transfer", Tata McGraw-Hill, New Delhi, 2002.
6. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, 3rd Edition, 2006, Reprint 2008.
7. Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, March 2006.

U13ME*T*603 FINITE ELEMENT ANALYSIS L T P C
3 1 0 4

Course Objectives

- To understand the principles involved in discretization and finite element approach
- To learn to form stiffness matrices and force vectors for simple elements
- To familiar with triangular element, force vector
- To understand the finite element method adopted for cylinders and other axisymmetric objects
- To study the four node quadrilateral elements.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand the principles involved in discretization and finite element approach.
CO 2 : Solve problems in finite element method adopted for cylinders and other axisymmetric objects.
CO 3 : Apply finite element concepts for solving thermal and solid mechanics problems.

Course Content

INTRODUCTION 9 + 3 Hours

Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method

ONE DIMENSIONAL PROBLEMS 9 + 3 Hours

Finite element modeling – Coordinates and shape functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses- One dimensional steady state conduction heat transfer problems.

TWO DIMENSIONAL CONTINUUM 9 + 3 Hours

Introduction – Finite element modeling – Scalar valued problem – Poisson equation –Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation – Temperature effects – Two dimensional heat transfer problems

AXISYMMETRIC CONTINUUM 9 + 3 Hours

Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures.

ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM

9 + 3 Hours

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

Theory :45Hr Tutorial :15Hr **Total Hours:60**

REFERENCES:

1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", Pearson Education, 3rd Edition, 2002.
2. David V Hutton "Fundamentals of Finite Element Analysis" McGraw-Hill Int. Edition, 2004.
3. Rao S.S., "The Finite Element Method in Engineering", Pergammon Press, 2005.
4. Reddy J.N., "Finite Element: An Introduction to Finite Element Method", McGraw-Hill International Student Edition, 2005.
5. O.C.Zienkiewicz and R.L.Taylor, "The Finite Element Methods, Vol.1", Butterworth Heineman, 5th Edition, 2000.
6. Logan D.L, 'A first course in the Finite Element Method" Third edition, Thomson Learning, 2002.

U13GS*T*003 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Course Objectives

- To study the importance and functions of management in an organization
- To study the importance of planning and also the different types of plan
- To understand the different types of organization structure in management
- To understand the basis and importance of directing and controlling in management
- To understand to the importance of corporate governance and social responsibilities.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand the concepts of management, administration and the evolution of management thoughts.
CO 2 : Understand and apply the planning concepts.
CO 3 : Analyze the different organizational structures and understand the staffing process.
CO 4 :Analyze the various motivational and leadership theories and understand the communication and controlling processes.
CO 5 : Understand the various international approaches to management

Course Content

MANAGEMENT CONTEXT **9 Hours**

Management – Definition – Importance – Functions – Skills required for managers - Roles and functions of managers – Science and Art of Management –Management and Administration.
Evolution of Classical, Behavioral and Contemporary management thoughts.

PLANNING **9 Hours**

Nature & Purpose – Steps involved in Planning – Forms of Planning – Types of plans – Plans at Individual, Department and Organization level - Managing by Objectives. Forecasting – Purpose – Steps and techniques. Decision-making – Steps in decision making.

ORGANISING **9 Hours**

Nature and Purpose of Organizing - Types of Business Organization - Formal and informal organization – Organization Chart – Structure and Process – Strategies of Departmentation– Line and Staff authority – Benefits and Limitations. Centralization Vs De-Centralization and Delegation of Authority. Staffing – Manpower Planning – Recruitment – Selection – Placement – Induction.

DIRECTING & CONTROLLING **9 Hours**

Nature & Purpose – Manager Vs. Leader - Motivation - Theories and Techniques of Motivation.
Leadership – Styles and theories of Leadership.
Communication – Process – Types – Barriers – Improving effectiveness in Communication.
Controlling – Nature – Significance – Tools and Techniques.

CONTEMPORARY ISSUES IN MANAGEMENT **9 Hours**

Corporate Governance Social responsibilities – Ethics in business – Recent issues.
American approach to Management, Japanese approach to Management, Chinese approach to Management and Indian approach to Management.

Theory :45Hr Tutorial :15Hr **Total Hours:60**

REFERENCES:

1. Tripathy PC And Reddy PN, "Principles of Management", Tata McGraw-Hill, 4th Edition, 2008.
2. Dinkar Pagare, "Principles of Management", Sultan Chand & Sons, 2000.
3. Kanagasapapathi. P "Indian Models of Economy, Business and Management", Prentice Hall of India, New Delhi, ISBN: 978-81-203-3423-6, 2008.
4. Vijayaraghavan, G.K.and Sivakumar, M. "Principles of Management", Lakshmi Publications, 5th Edition, 2009.
5. Harold Koontz & Heinz Weihrich, "Essentials of Management – An International perspective", 8th edition. Tata McGraw-Hill, 2009.
6. Charles W.L. Hill and Steven L McShane – Principles of Management, Tata Mc Graw-Hill, 2009.

U13ME*P*601 THERMAL ENGINEERING LABORATORY - II

L	T	P	C
0	0	3	1

Course Objectives

- To determine the heat transfer coefficient of convection apparatus.
- To find the effectiveness of heat exchangers.
- To determine the coefficient of performance of a refrigeration systems.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Perform steady state conduction, free and forced convection experiments.
CO 2 : Conduct radiation heat transfer experiment.
CO 3 : Measure the performance of refrigerator and air conditioner.

Course Content

LIST OF EXPERIMENTS:

HEAT TRANSFER **35Hours**

1. Thermal conductivity measurement by guarded plate method.
2. Thermal conductivity of insulation using lagged pipe apparatus.
3. Determination of convective heat transfer coefficient by free convection apparatus.
4. Determination of convective heat transfer coefficient by forced convection apparatus.
5. Heat transfer from pin-fin (natural & forced convection modes).
6. Determination of Stefan-Boltzmann constant.
7. Determination of emissivity of a grey surface.
8. Effectiveness of Parallel/counter flow heat exchanger.
9. Study on various types of heat exchangers

REFRIGERATION AND AIR CONDITIONING **10Hours**

1. Determination of COP of a refrigeration system.
2. Experiments on air-conditioning system.
3. Cooling tower characteristics

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Guarded plate apparatus – 1 No.
2. Lagged pipe apparatus – 1 No.
3. Natural convection-vertical cylinder apparatus – 1 No.
4. Forced convection inside tube apparatus – 1 No.
5. Pin-fin apparatus – 1 No.
6. Stefan-Boltzmann apparatus – 1 No.
7. Emissivity measurement apparatus – 1 No.
8. Parallel/counter flow heat exchanger apparatus – 1 No.
9. Refrigeration test rig – 1 No.
12. Air-conditioning test rig – 1 No.

Practical :45Hr **Total Hours: 45**

U13ME*P*602	DESIGN PROJECT	L	T	P	C
		0	0	3	1

Course Objective

- The objective of this design project course is to provide an opportunity for students, to implement their knowledge acquired in previous semesters, to solve real-world problems.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Analyze and identify the problems in the mechanical systems.
CO 2 : Select and apply proper modern tools.
CO 3 : Propose solution for problem in mechanical system.

Course Content

The students in convenient groups of not more than five members have to choose one simple item for design. If required, the project team can also have an industrial guide.

The problem chosen may be for a component or a process of mechanical systems.

A proper solution to be proposed by means of model, design and analysis.

The project report should contain detailed drawing, analytical calculations, bill of materials and applications of modern tools where ever applicable.

U13MC*P*601 MECHATRONICS LABORATORY L T P C
0 0 3 1

Course Objectives

- To design and test various types of fluid power circuits.
- To interface servo controller for open and closed loop.
- To interface PID controller and stepper motor.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Simulate Hydraulic, Pneumatic and Electric circuits using software tool.
CO 2 : Design and test various fluid power circuits.
CO 3 : Conduct experiments using servo controller and stepper motor.

Course Content

LIST OF EXPERIMENTS:

1. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.
2. Design and testing of circuits using basic pneumatic trainer kits.
3. Design and testing of circuits with logic sequence using Electro pneumatic trainer kits
4. Design and testing of sequential circuits in Electro pneumatic kit using PLC.
5. Design and testing of fluid power circuits to control
   (i) velocity (ii) direction and (iii) force of single and double acting actuators
6. Study of sequential and hydraulic motor circuit using hydraulic systems.
7. Servo controller interfacing for open loop
8. Servo controller interfacing for closed loop
9. PID controller interfacing
10. Stepper motor interfacing with 8051 Micro controller
    (i) full step resolution (ii) half step resolution

LIST OF EQUIPMENTS

1. Basic Pneumatic Trainer Kit - 1 Number
2. Electro pneumatic trainer kit –2 Numbers
3. Electro Pneumatic Trainer Kit with PLC control - 1 Number
4. Hydraulic Trainer kit – 2 numbers
5. H Simulator & P Simulator Software / Automation studio - 10 Licenses
6. 8051 - Microcontroller kit with stepper motor and drive circuit - 1 number
7. PID Controller kit – 1 number
8. Servo controller kit with servo motor – 1 number

Practical :45Hr **Total Hours: 45**

U13GH*P*601 HUMAN EXCELLENCE- NATIONAL VALUES L T P C 0 0 2 1

(Common to all branches of Engineering and Technology)

Course Objectives

- To produce responsible citizens.
- To uphold our culture and spiritual life.
- To realize the value of unity, service.
- To immunize the body.
- To get Divine peace through inward travel.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Acquire knowledge on the Enlightened Citizenship.
CO 2 : Demonstrate skills required for the Indian Culture and it's greatness.
CO 3 : Behave as responsible Great spiritual Leaders.
CO 4 : Analyze National Values identification and practice.

Course Content

RIGHTS AND RESPONSIBLE CITIZENSHIP **5 Hours**

Citizenship- its significance-Enlightened citizenship - what are the rights to citizenship Emerging India-its glory today- Global perspective

GREATNESS OF INDIAN CULTURE **5 Hours**

Outsiders view about India – about yoga - culture – joint family – morality – service - food– behavior – attitude – work.

Indian culture and it's greatness – dress coding - festivals – food is medicine – games – traditional medicines

INDIA AND PEACE **5 Hours**

India and Peace – who are the person to participate world peace - India and Spirituality- Great spiritual leaders – Shankarar – Ramanujar – mathvar – budha – mahaveerar – vallalar – Ramakrishna paramahamsar –mathaamirthananthamaayi – ramanar – aravindhar – annai.

INDIA'S MESSAGE TO THE WORLD **5 Hours**

India's message to the world – thiruvalluvar – thirukural – manivasagar – tiruvasagam – aravindhar – B.K.S Iyengar – yoga asanas – Sir C.V.Raman – Physics –ramanujam – maths – rabinthranathtagore – literature – A.P.J Abdulkalam.

GLOBAL PEACE **3 Hours**

It's role in global peace - – vethathiri maharishi – world peace –Thiruvalluvar – vallalar - Service and sacrifice-Unity in diversity – case studies-live examples - National values identification and practice.

MEDITATION & YOGASANAS **7 Hours**

Nine Centre Meditations – Introduction – practice – benefits. Yogasanas - II

Theory :30Hr **Total Hours: 30**

REFERENCES:

1. World peace plane ---- Vethathiri Maharishi
2. Prosperous India ---- Swami Vivekananda
3. Samudhaya chikkalukkana nala Aaivugal ---- Vethathiri Maharishi
4. World Community Life ---- Vethathiriyam

U13ME*T*701 POWER PLANT ENGINEERING L T P C
3 0 0 3

Course Objectives

- To learn the layout of different conventional power plants
- To understand the various components, operations and applications of different types boilers and steam power plant
- To study the principles of nuclear reaction and different nuclear reactor
- To understand the working of diesel and gas turbine power plant
- To create awareness about cost of electric energy, tariff calculation and economics of various power plants.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Describe sources of energy and types of power plants.
CO 2 : Draw the layout of conventional and renewable power plants and describe its working principle.
CO 3 : Discuss the economics of power plants.

Course Content

INTRODUCTION TO POWER PLANTS & BOILERS 9Hours

Layout of Steam, Hydel, Diesel, Nuclear and Gas Turbine Power Plants - Combined Power Cycles – Comparison and Selection, - Steam Boilers – High Pressure and Super Critical Boilers – Fluidized Bed Boilers.

STEAM POWER PLANT 9Hours

Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Fabric filters & Bag filters - Draught – different types - Surface Condenser and Cooling towers.

NUCLEAR AND HYDEL POWER PLANTS 9Hours

Nuclear Energy – Types of Reactors, pressurized water reactor, Boiling Water Reactor, Liquid Metal fast breeder reactor, CANDU type reactors - Waste Disposal and safety - Hydel power plant – Selection of site for a Hydroelectric Power Plant, Hydrological cycle, Hydro graphs, Essential Elements, Selection of turbines, Governing of hydraulic Turbines.

DIESEL AND GAS TURBINE POWER PLANT 9Hours

Types of Diesel Plants, Components, and Selection of Engine Type, Applications Gas Turbine Power Plant – Fuels - Gas Turbine Material – Open and Closed Cycles – Reheating Regeneration and Intercooling Combined Cycle.

OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS 9Hours

Geo thermal – OTEC- Tidal – Pumped storage – Solar thermal power plants. Load curves - Cost of Electric Energy – Fixed and operating Costs – Energy Rates – Types of Tariffs – Economics of load sharing – Variable load operation - Comparison of economics of various power plants.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. EI- Wakil M.M, "Power Plant Technology", Tata McGraw-Hill, 1st Edition, 2001.
2. Arora S.C and Domkundwar S, "A course in Power Plant Engineering", Dhanpatrai, 2001.
3. Nagpal, G.R. "Power Plant Engineering", Kanna Publishers, 15th Edition (7th Reprint) 2008.
4. Rai, G.D. "Introduction to Power Plant Technology", Khanna Publishers, 1995.
5. Rajput, R.K. "Power Plant Engineering", Laxmi Publications, 4th Edition (24th Reprint), 2009.
6. Nag P.K, "Power plant Engineering", Tata McGraw-Hill, 3rd Edition, 2008.

U13GS*T*002 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

Course Objectives

- Acquire knowledge on TQM concepts
- Acquire knowledge on quality systems
- Develop skills to use TQM tools for domain specific applications.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand quality concepts and philosophies of TQM
CO 2 : Apply TQM principles and concepts of continuous improvement
CO 3 : Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality
CO 4 : Understand the TQM tools as a means to improve quality
CO 5 : Remember and understand the quality systems and procedures adopted

Course Content

INTRODUCTION **9 Hours**

Definition of Quality, Dimensions of Quality, Quality costs, Basic concepts of Total Quality Management, Role of Senior Management, Quality Council, Quality Statements, Barriers to TQM Implementation, Principles of TQM, Contributions of Deming, Juran and Crosby

TQM PRINCIPLES **9 Hours**

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,5S, Kaizen, Supplier Partnership, Performance Measures – Basic Concepts, Strategy.

STATISTICAL PROCESS CONTROL **9 Hours**

The seven tools of quality, New seven Management tools, 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.

TQM TOOLS **9 Hours**

Benchmarking, Quality Function Deployment (QFD), Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA.

QUALITY SYSTEMS **9 Hours**

Need for ISO 9000 and Other Quality Systems, ISO 9001:2008 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 14001:2004

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Dale H. Besterfiled, "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 2007.
3. James R.Evans & William M.Lidsay, "The Management and Control of Quality", South-Western (Thomson Learning), 2008.
4. Feigenbaum.A.V. "Total Quality Management", McGraw Hill, 1993.
5. Oakland.J.S. "Total Quality Management", Butterworth – Hcinemann Ltd., Oxford. 2004.
6. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 2000.

U13GST008 PROFESSIONAL ETHICS L T P C
3 0 0 3

Course Objectives

- To create an awareness on Engineering Ethics and its use in ones profession
- To instill moral values, social values and loyalty
- To provide an insight into ones professional rights and a view of professional ethics in the global context.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand the ethical theories and concepts
CO 2 : Understand an engineer's work in the context of its impact on society
CO 3 : Understand and analyze the concepts of safety and risk
CO 4 : Understand the professional responsibilities and rights of Engineers
CO 5 : Understand the concepts of ethics in the global context.

Course Content

ENGINEERING ETHICS AND THEORIES 9 Hours

Definition, Moral issues, Types of inquiry, Morality and issues of morality, Kohlberg and Gilligan's theories, consensus and controversy, Professional and professionalism, moral reasoning and ethical theories, virtues, professional responsibility, integrity, self respect, duty ethics, ethical rights, self interest, egos, moral obligations.

SOCIAL ETHICS AND ENGINEERING AS SOCIAL EXPERIMENTATION 9 Hours

Engineering as social experimentation, codes of ethics, Legal aspects of social ethics, the challenger case study, Engineers duty to society and environment.

SAFETY 9 Hours

Safety and risk – assessment of safety and risk – risk benefit analysis and reducing risk – the Three Mile Island and Chernobyl case studies. Bhopal gas tragedy.

RESPONSIBILITIES AND RIGHTS OF ENGINEERS 9 Hours

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

GLOBAL ISSUES AND ENGINEERS AS MANAGERS, CONSULTANTS AND LEADERS 9 Hours

Multinational Corporations – Environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – Engineers as trend setters for global values.

Theory :45Hr **Total Hours: 45**

REFERENCE BOOKS:

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”. (2005) McGraw-Hill, New York.
2. John R. Boatright, “Ethics and the Conduct of Business”, (2003) Pearson Education, New Delhi.
3. Bhaskar S. “Professional Ethics and Human Values”, (2005) Anuradha Agencies, Chennai.
4. Charles D. Fleddermann, “Engineering Ethics”, 2004 (Indian Reprint) Pearson Education / Prentice Hall, New Jersey.
5. Charles E. Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and cases”, 2000 (Indian Reprint now available) Wadsworth Thompson Learning, United States.

U13GS*T*005	ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic financial management aspects
- Develop the skills to analyze financial statements.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Evaluate the economic theories, cost concepts and pricing policies
CO 2 : Understand the market structures and integration concepts
CO 3 : Understand the measures of national income, the functions of banks and concepts of globalization
CO 4 : Apply the concepts of financial management for project appraisal
CO 5 : Understand accounting systems and analyze financial statements using ratio analysis

Course Content

ECONOMICS, COST AND PRICING CONCEPTS **9 Hours**

Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual cost and opportunity cost – Incremental cost and sunk cost – Fixed and variable cost – Marginal costing – Total cost – Elements of cost – Cost curves – Breakeven point and breakeven chart – Limitations of break even chart – Interpretation of break even chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods

CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES **9 Hours**

Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration

NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT **9 Hours**

National income concepts – GNP – NNP – Methods of measuring national income – Inflation – Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization – Privatization – Globalization

CONCEPTS OF FINANCIAL MANAGEMENT **9 Hours**

Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital

ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS 9 Hours

Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance – Financial statements – Ratio analysis – Types of ratios – Significance – Limitations.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Prasanna Chandra, " Financial Management (Theory & Practice) TMH
2. Weston & Brigham, " Essentials of Managerial Finance"
3. Pandey, I. M., "Financial Management"
4. Fundamentals of Financial Management- James C. Van Horne.
5. Financial Management & Policy -*J*ames C. Van Horne
6. Management Accounting & Financial Management- M. Y. Khan & P. K. Jain
7. Management Accounting Principles & Practice -P. Saravanavel.

U13ME*P*701	COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY	L	T	P	C
		0	0	3	1

Course Objectives

- To analyse stresses of different components.
- To conduct heat transfer analysis of a 2D piping systems.
- To solve problems in CFD.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Demonstrate stress analysis of various mechanical components using analysis software.
CO 2 : Perform modal analysis for 2D component.
CO 3 : Analyze thermal stresses in a component.
CO 4 : Simulate mechanical systems using CAD software.

Course Content

LIST OF EXPERIMENTS: (ANY 10 Experiments)

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Modal analysis of a 2 D component
6. Modal analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D/piping system
8. Thermal stress analysis of a 2D/piping system
9. Conductive heat transfer analysis of a 2D/piping system
10. Convective heat transfer analysis of a 2D/piping system
11. Convert of simple mechanical model (flange, screw jack, etc) into IGES file, and analysis.
12. Simulation of Hydraulic / Pneumatic cylinder using CAD software.
13. Simulation of cam and follower mechanism using CAD software.
14. Simple problems using CFD

LIST OF EQUIPMENTS:

Computer System with 17” VGA Color Monitor and Pentium IV Processor - 30 Nos.

40 GB HDD

1 GB RAM

Color Desk Jet Printer - 1 No.

Software: Suitable analysis software ANSYS /NATRAN 30 licenses

MATLAB,. 5 licenses

Practical :45Hr **Total Hours: 45**

U13ME*P*702	PROJECT WORK	L	T	P	C
		0	0	6	0

Course Objectives

- To identify problem in the mechanical engineering field.
- To analyse/simulate/design a component or process and mechanical engineering systems.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Identify aproblem in mechanical engineering field through survey.
CO 2 : Develop methodology to find the solution for the problem.
CO 3 : Learn suitable modern tools.

Course Content

- The objective of the Project Work –Phase I is to enable the students to identify a problem in mechanical engineering field using literature survey / industry survey. The project work can be a innovative, improvement of existing system in the mechanical engineering/interdisciplinary area and may include design, experimentation, fabrication and analysis.
- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design, manufacture of a device, experimentation, simulation of mechanical systems.
- Suitable methodology to be arrived by evaluating existing solutions. Suitable modern tools shall be used to find the solution.
- Every project work shall have a guide who is the member of the faculty of the institution.
  For industrial projects, supervisor from the organization will be a co-guide.
  Each project work will be carried out by a batch of maximum three students.
- The project period allotted shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
- The continuous assessment shall be made as prescribed in the regulations.
- The review committee will be constituted by the Head of the Department.

- The progress of the project is evaluated based on a minimum of three reviews.
- Each student shall finally submit a report covering background information, literature survey, problem statement, methodology and use of modern tools with in stipulated date.

U13ME*P*703 COMPUTER AIDED MANUFACTURING (CAM) LABORATORY

L	T	P	C
0	0	3	1

Course Objectives

- To write part programming for different operations.
- To generate NC code using CAD/CAM software.
- To demonstrate the operations of a robot.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Write manual part programming for a component in CNC Lathe and CNC Milling machine.
CO 2 : Write part programming for a component and also standard canned cycle for different turning and milling operations.
CO 3 : Develop CAD models, CL data and NC Code using CAD/CAM Software.

Course Content

LIST OF EXPERIMENTS:

1 Manual part programming (Using G and M Codes) in CNC lathe

Part programming for Linear and Circular interpolation, Chamfering and Grooving

Part programming using standard canned cycles for Turning, Facing, Taper turning and Thread cutting.

2 Manual part programming (using G and M codes) in CNC milling

2.1 Part programming for Linear and Circular interpolation and Contour motions.

2.2 Part programming involving canned cycles for Drilling, Peck drilling, andBoring.

3 Exposure to Component Modeling and CL data generation using CAD/CAM Softwarelike Unigraphics, Pro/E, Edge CAM , Master CAM, etc.,

NC code generation using CAD/CAM software-Post processing for standard CNC control like FANUC, HAAS, SINUMERIC etc.,

4. Study on machining centre (VMC/HMC)

5. Study on 3D Printing

6. Demonstration on operation of Robot.

HARDWARE:

1. Computer Server 1
2. Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server – 30 Nos
3. A3 size plotter 1
4. Laser Printer 1
5. Trainer CNC Lathe 1
6. Trainer CNC milling 1

SOFTWARE:

7. CAD/CAM software 15 licenses
8. CAM Software (CNC Programming and tool path simulation for FANUC / Sinumeric and Heiden controller) - 15 licenses
9. Licensed operating system Adequate

Practical :45Hr **Total Hours: 45**

U13GH*P*701 HUMAN EXCELLENCE-GLOBAL VALUES L T P C
0 0 2 1

(Common to all branches of Engineering and Technology)

Course Objectives

- To realize global brotherhood and protect global.
- To know the youths participation in politics.
- To know importance of retain of our culture and Maintain
- To know impact of global terrorism.
- To know the current economic status among the youths.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Behave as responsible human beings respecting the global values.
CO 2 : Acquire knowledge on the complex patterns involved in maintaining world's peace and ecological balance.
CO 3 : Demonstrate skills required for the emergency of mono-culture at the global level.
CO 4 : To learn about Man is the cause and Man is the solution.

Course Content

GLOBAL BROTHERHOOD AND PROTECT GLOBE **5 Hours**

Global values – understanding and identification – its importance - Racial discrimination and solution

MAN IS THE CAUSE AND MAN IS THE SOLUTION **5 Hours**

Ecological imbalance – global warming – rain fall – status – acid rain – plastic usage – control - Political upheavals – nowadays political status – basic rights to citizen – corruption – youths participate in politics –e.g: M.K.Stalin – Kanimozhi – ragul Gandhi.

GREATNESS OF CULTURE **5 Hours**

Social inequality and solution– live case discussions and debate – black money – poverty people - Cultural degradation– live case discussions and debate – difference between Indian culture & western culture – impact of western culture in India – how to retain our culture and solution.

EMERGENCE OF MONOCULTURE **4 Hours**

Emergence of monoculture – solution - Global terrorism – it's cause and effect – solution –

MARGINALIZATION OF GLOBAL ECONOMIC **4Hours**

Economic marginalization and solution – it's impact in the globe – globalization in market – its effect in local market – merits – demerits of globalization - Man is the cause and man is the solution.

MEDITATION & YOGASANAS **7 Hours**

Nithyananda Meditation & Divine Meditation – Introduction – practice – benefits. Yogasanas - III

Practical :30Hr **Total Hours: 30**

REFERENCES:

1. World peace plane ---- Vethathiri Maharishi
2. Prosperous India ---- Swami Vivekananda
3. Samudhaya chikkalukkana nala Aaivugal ---- Vethathiri Maharishi
4.World Community Life --- Vethathiri Maharishi

U13ME*P*801	PROJECT WORK	L	T	P	C
		0	0	18	8

Course Objectives

- To apply engineering principles for the problems in the mechanical field.
- To analyse/simulate/design a component or process and mechanical engineering systems.
- To find appropriate solution and compile a report on the project work.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Perform methodology using appropriate tools for the problem.
CO 2 : Analyze data and interpret the results obtained.
CO 3 : Summarize the results and submit a report.

Course Content

- Create a model/fabricate a model/conduct experiment/simulate system for the project work carried in Phase-I. Analyze data, evaluate the results and conclude the appropriate solution, suggestion for feature work.
- The continuous assessment shall be made as prescribed in the regulations.
- The review committee may be constituted by the Head of the Department.
- The progress of the project is evaluated based on a minimum of three reviews.
- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
- This final report shall be typewritten form as specified in the guidelines.

U13ME*T*E11 ADVANCED MACHINING PROCESSES L T P C 3 0 0 3

Course Objectives

- To make an awareness among students on recent trends in advanced machining processes
- To understand the knowledge of advanced machining over conventional machining
- To learn the advantages of advanced machining and applications
- To understand and apply the advanced machining processes
- To design and develop new methods for improvement and research works.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Select appropriate advanced materials processes for a given product or component recognising material, size, precision, and surface quality requirements.
CO 2 : Discuss the working of unconventional machining processes.
CO 3 : Solve simple problems in EDM and ECM Processes.

Course Content

INTRODUCTION **9 Hours**

Need for Modern Advanced Machining Processes - Classification based on Materials – Machining Methods – Energy – Processes Selection – Physical Parameters – Cost of Production – Volume of Production – Shapes of Product – Process Capability – Economical Production

MECHANICAL ENERGY BASED PROCESSES **9 Hours**

Ultrasonic Machining – Principles – Transducer Type – Concentrators – Abrasive Slurry – Process Parameters – Tool Feed Mechanisms – Advantages – Limitations – Applications – Abrasive Jet Machining – Process – Principle – Process Variables – Material Removal Rate – Advantages and Disadvantages – Applications – Water Jet Machining – Principle Process Variables – Advantages and Disadvantages – Applications.

ELECTRICAL DISCHARGE MACHINING AND ELECTRICAL DISCHARGE WIRE CUT **9 Hours**

Electrical Discharge Machining – Mechanism of Material Removal – Dielectric Fluid – Electrodes Materials – Spark Erosion Generators – Electrode Feed System – Material Removal Rate – Process Parameters – Tool Electrodes Design – Characteristics of Spark Eroded Surfaces – Advantages and Disadvantages – Applications – Electrical Discharge Wire Cut and Grinding – Principle – Wire Feed System – Advantages and Disadvantages – Applications.

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

Chemical Machining – Fundamentals – Principle – Classification – Selection of Etchant – Chemical Milling – Engraving – Blanking – Drilling – Trepanning - .Advantages – Disadvantages – Applications – Electro Chemical Machining – Electro Chemistry Process – Electrolytes – Properties – Material Removal Rate – Tool Materials – Tool Feed Systems – Design of Electrolyte Flow – Process Variables – Advantages – Disadvantages – Applications – Electro Chemical Grinding – Honing – Cutting Off – De burring – Turning.

ELECTRON BEAM – LASER BEAM – ION BEAM PLASMA ARE MACHING AND MICRO MACHINING **9 Hours**

Electron Beam Machining – Principle – Generation – Control of Electron Beam – Advantages – Disadvantages – Applications – Laser Beam Machining – Principle – Solid – Gas – Laser Methods – Applications – Thermal Features – LBM – Advantages – Disadvantages – Applications – Ion Beam Machining – Equipment – Process Characteristics – Advantages – Disadvantage – Applications – Plasma Arc Machining – Principle – Gas Mixture – Types of Torches – Process Parameters – Advantages – Disadvantages – Applications – Introduction – Definition – Micro Machining – Classification of Micro Machining – Nano Machining – Nano Finishing - Mechanical – Thermal Micro Machining –Electro Discharge – Electron Beam – Laser Beam –Electro Chemical – Nano Finishing

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2002, ISBN 81-7764-294-4.
2. Pandey P.C., and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 1980.
3. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London, 1998.
4. Paul De Garmo, Black, J.T.and Ronald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., New Delhi (8^{th} Edition), 2001: ISBN – 81-203-1243-0.
5. Benedict. G.F. “Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York, 1987.
6. Amitadha Bhattacharyya, “New Technology”, The Institution of Engineers(India)
7. “Production Technology” HMT Bengaluru, Tata McGraw Hill Publishing company Limited, New Delhi, 2006

U13ME*T*E12	ROBOTICS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the fundamentals of robot and Co-ordinate systems
- To study about
  - different robot derive systems and different grippers
  - different types of sensors and image processing
  - kinematics of robot and manipulators with two, three and four degrees of Freedom
- To implementation of robots in industries

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Infer robot anatomy and robot drive systems.
CO 2 : Know the working of various sensors and machine vision.
CO 3 : Write robot programming and understand the implementation of robotics in industries.

Course Content

FUNDAMENTALS OF ROBOT **9Hours**

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification, Micro robot – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot parts and their functions – Different applications

ROBOT DRIVE SYSTEMS AND END EFFECTORS **9Hours**

Pneumatic Drives – Hydraulic Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors, Linear Motors – Salient Features, Applications of all these Drives, End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers.

SENSORS AND MACHINE VISION **9Hours**

Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors, Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection, Feature Extraction and object Recognition – Algorithms.

ROBOT KINEMATICS AND ROBOT PROGRAMMING 9Hours

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional). Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands.

IMPLEMENTATION AND ROBOT ECONOMICS 9Hours

Implementation of Robots in Industries –Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

Theory :45Hr Total Hours:45

REFERENCES:

1. Groover, M.P. “Industrial Robotics – Technology, Programming and Applications”, McGraw-Hill, 2005
2. Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992
3. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co., 1987
4. Janakiraman.P.A., “Robotics and Image Processing”, Tata McGraw-Hill, 1995
5. Deb, S.R. “Robotics Technology and Flexible Automation” Tata McGraw Hill, 2003.

U13ME*T*E13 ADVANCED WELDING PROCESSES

L	T	P	C
3	0	0	3

Course Objectives

- To understand the principles of various pressure welding processes
- To study in detail about the laser welding process
- To understand the various techniques of electro slag welding
- To familiar about the special features of plasma welding
- To understand concept of testing and design.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Recognize different solid state and beam welding processes.
CO 2 : Illustrate the working of electro slag welding and plasma arc welding.
CO 3 : Solve problems in testing and design of weldments.

Course Content

SOLID STATE WELDING PROCESSES **9 Hours**

Fundamental principles, survey of the various pressure welding processes and their applications. Friction, friction stir, explosive, diffusion, and Ultrasonic welding – principles of operation, process characteristics and application.

ELECTRON AND LASER BEAM WELDING **9 Hours**

Heat generation and regulation, equipment details in typical set-up, electron beam welding in different degrees of vacuum, advantages and disadvantages, applications. Laser Welding: Principles of operation, advantages, and limitations, applications.

ELECTRO SLAG WELDING **9 Hours**

Heat generation, principles of operations, wire and consumable guide techniques, selection of current, voltage and other process variables, nature of fluxes and their choice. Electro-gas welding: Principle and applications. Narrow gap welding, Under Water welding.

PLASMA ARC WELDING **9 Hours**

Special features of plasma arc- transferred and non transferred arc, key hole and puddle-in mode of operation, micro low and high current plasma arc welding and their applications, plasma cutting, surfacing and applications.

TESTING AND DESIGN OF WELDMENT **9 Hours**

Design and quality control of welds. Edge preparation types of joints, weld symbols. Stresses in butt and fillet welds – weld size calculations. Design for fatigue. Testing – tensile, bend hardness. Impact, notch and fatigue tests. Life assessment of weldments.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Schwartz M.M. “Metals Joining Manual”. McGraw Hill Books, 1979.
2. Tylecote R.F. “The Solid Phase Welding of Metals”. Edward Arnold Publishers Ltd. London, 1968.
3. Parmer R.S., Welding Engineering and Technology, Khanna Publishers,2002
4. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002
5. Nadkarni S.V. “Modern Arc Welding Technology”, Oxford IBH Publishers, 1996.
6. Schwariz, M.M. – Source book on innovative welding processes – American Society for Metals (OHIO), 1981
7. Christopher Davis. “Laser Welding- Practical Guide”. Jaico Publishing House, 1994.

U13ME*T*E14 MATERIAL HANDLING SYSTEMS AND EQUIPMENT

L	T	P	C
3	0	0	3

Course Objectives

- To understand the principles of material handling systems.
- To design different materials handling equipment.
- To understand the automation of material handling component.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Outline and select the material handling equipments.

CO 2 : Apply the design procedures of material handling equipments and components.

CO 3 : Demonstrate the automation of material handling.

Course Content

INTRODUCTION **9 Hours**

Elements of Material Handling System-Importance, Terminology, Objectives and benefits of better Material Handling; Principles and features of Material Handling System; Interrelationships between material handling and plant layout, physical facilities and other organizational functions; Classification of Material Handling Equipment.

SELECTION OF MATERIAL HANDLING EQUIPMENT **9 Hours**

Selection of Material Handling Equipment-Factors affecting for selection; Material Handling Equation; Choices of Material Handling Equipment; General analysis Procedures; Basic Analytical techniques; The unit load concept; Selection of suitable types of systems for applications ; Activity cost data and economic analysis for design of components of Material Handling Systems; functions and parameters affecting service; packing and storage of materials.

DESIGN ASPECTS OF MATERIAL HANDLING EQUIPMENT **9 Hours**

Design of Mechanical Handling Equipment- Design of Hoists, Drives for hoisting, components, and hoisting mechanisms; rail travelling components and mechanisms; hoisting gear operation during transient motion; selecting the motor rating and determining breaking torque for hoisting mechanisms. Design of Cranes, Hand-propelled and electrically driven E.O.T. overheat Travelling cranes; Traveling mechanisms of cantilever and monorail cranes; design considerations for structures of rotary cranes with fixed radius ; fixed post and overhead travelling cranes; Stability of stationary rotary and travelling rotary cranes.

MATERIAL HANDLING COMPONENTS **9 Hours**

Design of load lifting attachments- Load chains and types of ropes used in Material Handling System; Forged, Standard and Ramshorn Hooks; Crane Grabs and Clamps; Grab Buckets; Electromagnet; Design consideration for conveyor belts; Application of attachments.

Study of systems and Equipment used for Material Storage- Objectives of storage; Bulk material handling; Gravity flow of solids through slides and chutes; Storage in bins and hoppers; Belt conveyors; Bucket-elevators; Screw conveyors; Vibratory Conveyors; Cabin conveyors; Mobile racks etc.

AUTOMATION OF MATERIAL HANDLING **9 Hours**

Material Handling / Warehouse Automation and Safety considerations-Storage and warehouse planning and design; computerized warehouse planning; Need, Factors and Indicators for consideration in warehouse automation; which function, when and How to automate; Levels and Means of Mechanizations. Safety and design; Safety regulations and discipline.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Rudenko, N. „Material Handling Equipments", Peace Publishers, Moscow.
2. James M. Apple, „Material Handling System Design", John-Willlwy and Sons Publication, New York.
3. John R. Immer, „Material Handling" McGraw Hill Co. Ltd., New York.
4. Colin Hardi, „Material Handling in Machine Shops". Machinery Publication Co. Ltd., London.
5. Nexandrn, M .P. „Material Handling Equipment", MIR Publication, Moscow.
6. Cock C. R. and Mason, J. Bulk Solid Handling", Leonard Hill Publication Co. Ltd., U.S.A.
7. Spivakovsy, A.O. and Dyachkov, V.K., „Conveying Machines", Volumes I and II, MIR
8. Kulwiac R. A., „Material Handling Hand Book", JohnWilly Publication, New York.

U13ME*T*E15 PRODUCTION PLANNING AND CONTROL

L	T	P	C
3	0	0	3

Course Objectives

To understand

- the components and functions of production planning and control
- work study methodology
- product planning, process planning and process capabilities
- production scheduling
- Inventory Control.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : State the fundamentals of production planning and work study.
CO 2 : Express the details of process planning and production scheduling.
CO 3 : Solve problems in inventory control.

Course Content

INTRODUCTION **9 Hours**

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect-aesthetic aspect. Profit consideration-Standardization, Simplification & specialization-Break even analysis-Economics of a new design.

WORK STUDY **9Hours**

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and macro motion study - work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

PRODUCT PLANNING AND PROCESS PLANNING **9Hours**

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.

PRODUCTION SCHEDULING **9Hours**

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance - Flow production scheduling-Batch production scheduling-Product sequencing - Production Control systems-Periodic batch control-Material requirement planning kanban –Dispatching-Progress reporting

and expediting-Manufacturing lead time -Techniques for aligning completion times and due dates.

INVENTORY CONTROL AND RECENT TRENDS IN PPC **9Hours**

Inventory control - Purpose of holding stock - Effect of demand on inventories- Ordering procedures. Two bin system - Ordering cycle system - Determination of Economic order quantity and economic lot size -ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems-elements of Just In Time systems-Fundamentals of MRP II and ERP.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Martand Telsang, "Industrial Engineering and Production Management", S. Chand and Company, Second Edition, 2006.
2. S.K. Hajra Choudhury, Nirjhar Roy and A.K. Hajra Choudhury, "Production Management", Media Promoters and Publishers Pvt. Ltd., 1998.
3. Samson Eilon, "Elements of production planning and control", Universal Book Corpn.1984
4. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Ed. John Wiley and Sons, 2000.
5. K.C.Jain & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, (1990) reprint 2002.
6. N.G. Nair, "Production and Operations Management", Tata McGraw-Hill, 1996.
7. S.N.Chary, "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.

U13ME*T*E16	MAINTENANCE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- To enable the student to understand principles, functions and practices adapted in industry for successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring, and diagnostic maintenance. To illustrate some of the simple instruments used for condition monitoring in industry.
- To discuss the tehniques used for contaminant monitoring.
- To study the basic repair methods and Failure analysis.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Discuss the principles of maintenance planning.
CO 2 : Outline the basics of condition and contaminant monitoring.
CO 3 : Identify the various failure analysis and repair methods.

Course Content

PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING **9 Hours**

Basic Principles of maintenance planning - Objectives and principles of planned maintenance activity - Types of maintenance - Benefits of sound Maintenance systems - Reliability and machine availability – MTBF, MTTR, MTTF and FIT– Factors of availability – Maintenance organization – Maintenance economics.

MAINTENANCE POLICIES AND DIAGNOSTIC MAINTENANCE **9 Hours**

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, Repair cycle - Principles and methods of lubrication – Total Productive Maintenance. Leak detection-wear monitoring-Temperature monitoring-Vibration monitoring-Signature analysis - Shock monitoring-Lubricant-Analysis-Methodology-Equipments-Applications

CONDITION MONITORING **9 Hours**

Condition Monitoring (CM) – Cost comparison with and without CM – On-load testing and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

CONTAMINANT MONITORING **9 Hours**

Contaminant Monitoring: Ferrography – spectral oil analysis procedure – non destructive testing: liquid penetrant testing – radio graphic inspection – ultra sonic testing acoustic emission - Corrosion monitoring – resistance techniques – Other probe techniques-analytical techniques.

REPAIR METHODSAND FAILURE ANALYSIS **9 Hours**

Repair methods for beds, slideways, spindles, gears, lead screws and bearings - Repair methods for Material handling equipment – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location-Use of computers in maintenance.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Srivastava S.K., “Maintenance Engineering & Management”, - S. Chand and Co., 2007.
2. Venkataraman, “Maintenance Engineering & Management”, PHI Learning, 2009.
3. White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979.
4. Garg H.P., “Industrial Maintenance”, S. Chand & Co., 1986.
5. Keithmobley L.R., “Maintenance Engineering Hand book”, McGraw Hill, 7th Edition, 2008.
6. Armstrong, “Condition Monitoring”, BSIRSA, 1988.
7. Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1996.
8. Collacott, " Mechanical Fault Diagnosis and Condition monitoring "- McGraw Hill-1985
9. Machinery Failure Analysis and Trouble shooting, Heinz P Bloch and Fred K Geitner-Gulf Publishing Co, Houston, 1997.

U13ME*T*E17	COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
		3	0	0	3

Course Objectives

- Introduction to the CIM related with plant operations
- To impart the knowledge of Group Technology and the various approaches of Computer Aided Process Planning
- To give the idea about shop floor control activities and FMS
- To create the knowledge of system modeling tools in CIM and the fundamental of data communications
- To study the details of open system protocols and the database applications.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Identify the manufacturing activities interrelated with computers for plant operations
CO 2 : Understand the concept of Group Technology and the various approaches of Computer Aided Process Planning.
CO 3 : Apply the system modeling tools in CIM and the fundamental concepts of data communications.

Course Content

INTRODUCTION **8 Hours**

The meaning and origin of CIM- the changing manufacturing and management scene - External communication - islands of automation and software-dedicated and open systems-manufacturing automation protocol - product related activities of a company- marketing engineering - production planning - plant operations - physical distribution- business and financial management.

GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10 Hours

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

SHOP FLOOR CONTROL AND INTRODUCTION OF FMS **9 Hours**

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

CIM IMPLEMENTATION AND DATA COMMUNICATION **9 Hours**

CIM and company strategy - system modeling tools -IDEF models - activity cycle diagram - CIM open system architecture (CIMOSA)- manufacturing enterprise wheel-CIM architecture - Product data management-CIM implementation software.
Communication fundamentals- local area networks -topology - LAN implementations - network management and installations.

OPEN SYSTEM AND DATABASE FOR CIM **9 Hours**

Open systems-open system inter connection - manufacturing automations protocol and technical office protocol (MAP /TOP)
Development of databases -database terminology- architecture of database systems-data modeling and data associations -relational data bases - database operators - advantages of data base and relational database.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Mikell.P.Groover "Automation, Production Systems and computer integrated manufacturing", Pearson Education, 3rd Edition, July 2007.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition New Age International (P) Ltd, New Delhi,. 2004.
3. Yorem koren, "Computer Integrated Manufacturing system", McGraw-Hill, 1983.
4. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International 1986.
5. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe "Computer Integrated Design and Manufacturing", McGraw-Hill Inc. 1991.
6. Roger Hanman "Computer Intergrated Manufacturing", Addison –Wesley, 1997.
7. Mikell.P.Groover and Emory Zimmers Jr., "CAD/CAM", Prentice hall of India Pvt. Ltd., New Delhi, 2003.
8. Kant Vajpayee S, "Principles of computer integrated manufacturing", Prentice Hall India, 2006.

U13ME*T*E18	LEAN MANUFACTURING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the importance of lean manufacturing and its benefits
- To be familiar with lean concepts and 5S principle
- To understand the value stream mapping
- To know about the various tools involved in lean manufacturing implementation.

Course outcomes

After successful completion of the course, the students should be able to

CO 1: Explain various concepts and implementation tools in lean manufacturing
CO 2 : Describe group technology and Just in time manufacturing process
CO 3: Draw value stream mapping for given manufacturing setup.

Course Content

INTRODUCTION AND LEAN MANUFACTURING CONCEPTS 11Hours

Objectives of lean manufacturing-key principles and implications of lean manufacturing-Traditional Vs lean manufacturing – Lean benefits. Value creation and waste elimination- Major kinds of waste- pull production-different models of pull production-continuous flow-continuous improvement / Kaizen- Worker involvement.

LEAN MANUFACTURING TOOLS & METHODOLOGIES 10 Hours

Standard work -communication of standard work to employees -standard work and flexibility -visual controls-quality at the source- 5S principles -preventive maintenance-total quality management-total productive maintenance -changeover/setup time -batch size reduction.

GROUP TECHNOLOGY AND JUST IN TIME MANUFACTURING 9 Hours

Part family- Production flow analysis – Composite part concept – Machine cell design -Case studies. Introduction to JIT- elements of JIT - Kanban system.

VALUE STREAM MAPPING 8 Hours

The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -poke yoka- Kanban – overall equipment effectiveness.

IMPLEMENTING LEAN AND RECONCILING LEAN WITH OTHER SYSTEMS **7 Hours**

Road map-senior management Involvement-best practices. Toyota production system-lean six sigma-lean and ERP-lean with ISO9001: 2000

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Michael L George, David T Rowlands, Bill Kastle, “What is Lean Six Sigma”, McGraw-Hill, New York, 2004.
2. Askin R G and Goldberg J B, “Design and Analysis of Lean Production Systems”, John Wiley and Sons Inc., 2003.
3. Micheal Wader, “Lean Tools: A Pocket guide to Implementing Lean Practices”, Productivity and Quality Publishing Pvt Ltd, 2002.
4. Kenichi Sekine, “One-piece flow”, Productivity Press, Portland, Oregon, 1992.
5. Joseph A De Feo, William W Bearnard “ Juran Institute’s Six Sigma Break Through and Beyond”, Tata McGraw-Hill Edition, New Delhi, 2004.
6. Richard B Chase F. Robert Jacobs and Nicholas J Aquilano, “Operations Management for Competitive Advantage”, McGraw Hill/Irwin; Tenth Edition, 2003.
7. Poka - Yoke, "Improving Product Quality by Preventing Defects", Productivity Press, 1992.
8. Alan Robinson “Continuous Improvement in Operations”, Productivity Press, Portland, Oregon, 1991.

U13ME*T*E19 ADVANCED FOUNDRY TECHNOLOGY L T P C
3 0 0 3

Course Objectives

- To understand the principle, procedure and applications of various foundry processes.
- To be familiar with design of gating systems
- To know about the various testing of castings.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Design different casting system and use different Foundry practices to make practical component.
CO 2 : Design gating systems for casting
CO 3 : Perform different testing to study the defect in the casting and apply engineering skills to minimize the defects.

Course Content

CASTING PROCESS **10 Hours**

Introduction to casting – pattern – materials allowances – coding – types – moulds – mould making, sand – properties, types and testing of sands – core making – type of cores – single box, two box and 3 box moulding processes.

CASTING METALLURGY **8 Hours**

Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification — Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys ,Babbit alloy and Cu alloy.

DESIGN OF GATING SYSTEMS **10 Hours**

Gating systems and their characteristics; the effects of gates on aspiration; turbulence and dross trap; recent trends. Chvorinov's Rule Riser design; risering curves; NRL method of riser design; feeding distance; risering of complex casting.

RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT **8 Hours**

Shell moulding, precision investment casting, CO2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry — Computer aided design of casting.

TESTING OF CASTINGS **9 Hours**

Causes and remedies for casting defects –Destructive testing – NDT – Dye penetrant – magnetic particle – X-ray, ultrasonic cell – studies in testing of joints & castings. Methods of elimination and control of dissolved gases in castings. use of statistical quality control in foundry.

Theory :45Hr **Total Hours:45**

REFERENCES

1. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003
2. Principle of metal casting – Heime, Looper and Rosenthal – Tata McGraw Hill – 2001
1. Taylor H.F., Fleming.M.C.,, "Foundry Engineering" M.C. & Wiley Eastern Ltd., 1993
2. ASM Handbook, Vol 15, Casting, 2004

U13ME*T*E21 INDUSTRIAL SAFETY MANAGEMENT L T P C
3 0 0 3

Course Objectives

- To understand the safety concepts, need of safety for employee
- To know the principle of Ergonomics and its applications in machine shop
- To study the case studies and controlling of major industrial hazards
- To highlight the safety of employee and accident prevention training
- To know the safety rules, Indian boiler act, explosive act and factories act.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Outline about safety management and ergonomics.
CO 2 : Recognize various safety measures followed in industries.
CO 3 : Explain about accident prevention and various safety standards.

Course Content

SAFETY MANAGEMENT **9 Hours**

Evaluation of modern safety concepts - Safety management functions - safety department - safety committee, safety audit - performance measurements and motivation - employee participation in safety - safety and productivity.

ERGONOMICS AND OPERATIONAL SAFETY **9 Hours**

Introduction to Ergonomics – areas of applications – Anthropometry and it uses in ergonomics – principles of applied Anthropometry in ergonomics. Hot metal and Cold metal Operation - Boiler, pressure vessels - heat treatment shop - gas furnace operation - electroplating- Safety in welding and cutting. Safety in Machine shop - metal cutting - shot blasting, grinding, painting - power press and other machines.

SAFETY MEASURES **9 Hours**

Layout design and material handling various classes of Fires – ABCDE, fire extinguishers - Use of electricity - Management of toxic gases and chemicals - Industrial fires and prevention - Safety of sewage disposal and cleaning - Control of environmental pollution - Managing emergencies in Industries. Control of major industrial hazards.

ACCIDENT PREVENTION **9 Hours**

Human side of safety - personal protective equipment - Causes and cost of accidents. Accident prevention programmes, training methods - Specific hazard control strategies - HAZOP - Training and development of employees - First Aid- Accident reporting, investigation.

SAFETY, HEALTH, WELFARE & LAWS **9 Hours**

Safety and health standards - Industrial hygiene - occupational diseases prevention - Welfare facilities - History of legislations related to Safety- Indian boiler act - The environmental protection act - Electricity act - Explosive act – Factories act 1948 – statutory authorities.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. John V. Grimaldi and Rollin H. Simonds, "Safety Management", All India Travellers bookseller, New Delhi- 5th edition 1994.
2. Krishnan N.V., “Safety in Industry", Jaico Publisher House, 1997.
3. Occupational Safety Manual BHEL, 1988.
4. Industrial safety and the law by P.M.C. Nair Publisher's, Trivandrum, 1998.
5. Managing emergencies in industries, Loss Prevention of India Ltd., Proceedings, 1999
6. Singh, U.K. and Dewan, J.M., "Safety, Security and risk management", APH Publishing Company, New Delhi, 1996.

U13ME*T*E22	MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To understand marketing philosophies.
- To learn the buyer behaviour and segmentation techniques.
- To know the techniques of a product pricing and process of marketing research.
- To understand the importance of portfolio analysis in market planning.
- To formulate strategies for advertising, sales promotion and distribution.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand marketing philosophies.
CO 2 : Know the techniques of a product pricing and process of marketing research
CO 3 : Understand the importance of portfolio analysis in market planning.

Course Content

MARKETING PROCESS **10 Hours**

Definition, Marketing process, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, marketing organizations, industrial versus consumer marketing, product hierarchy

BUYER BEHAVIOUR AND MARKET SEGMENTATION **8 Hours**

Cultural, demographic factors, motives, types, buying decisions, customer value and loyalty, segmentation factors - demographic -Psycho graphic and geographic segmentation, new line.

PRODUCT PRICING AND MARKETING RESEARCH **9 Hours**

Definition, Objectives, pricing, decision frame work, pricing methods, price sensitivity . Introduction, uses, process of marketing research, marketing information systems – Data mining & ware housing.

MARKETING PLANNING **9 Hours**

Market opportunity, Components of marketing plan, product market selection, the marketing planning process, portfolio analysis, BCG, GEC grids, strategic planning process.

ADVERTISING, SALES PROMOTION AND DISTRIBUTION **9 Hours**

Introduction to advertising, Factors in audience pervasions, decisions, role of media. Significance of sales promotion, planning sales promotion programmes, types. Marketing channels, channel design, wholesaling, retailing, modern trends in retailing.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Rajan Saxena, "Marketing Management", Tata Mc-graw Hill, 3rd edition, 2006.
2. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context" Macmillan 4 edition, 2009.
3. Philip Kotler and Gary Armstrong "Principles of Marketing" – 12th Edition, Prentice Hall of India, 2008.
4. Green Paul, Donald Tull and Albaum, "Research for marketing decisions", 5th Edition Prentice Hall of India, 2008

U13ME*T*E23	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To understand supply chain and inventory management.
- To study the impact of internet on SCM.
- To know the international issues in SCM.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Know global optimization and inventory management.
CO 2 : Discuss about supply chain technology and logistics.
CO 3 : Summarize international issues in SCM.

Course Content

INTRODUCTION TO SUPPLY CHAIN MANAGEMENT **9 Hours**

Definition, global optimization, objectives of SCM. Logistics networks- data collection, solution techniques.

INVENTORY MANAGEMENT **9 Hours**

Introduction, single warehouse, Inventory examples, economic lot size model, Risk pooling, centralized and decentralized system, managing inventory in the supply chain

VALUE OF INFORMATION **9 Hours**

Bullwhip effect, information and supply chain technology. Supply chain integration- push, pull and push-pull system. Impact of internet on SCM, distribution strategies.

STRATEGIC ALLIANCES **9 Hours**

Framework for strategic alliance, third party logistics, retailer, supplies partnership, distributor-integration, procurement and out servicing strategies.

INTERNATIONAL ISSUES IN SCM **9 Hours**

Introduction, risks and advantages- design for logistics, supplies integration into to new product development, mass customization. Issues in customer value.

Theory :45Hr **Total Hours:45**

REFERENCE:

1.Sunil chopra Peter meindl, D.V.Kalra, Supply chain management, Fourth edition, Pearson Education,Printice Hall of India, 2010.

U13ME*T*E24	ERGONOMICS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the various recording techniques and work measurement.
- To know incentive schemes and MOST technique.
- To explain human factor engineering and types of display systems.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand method study and work measurement.
CO 2 : Explain incentive schemes and human factor engineering.
CO 3 : List various types of displays.

Course Content

METHOD STUDY **9 Hours**

purpose of work study,its objectives, procedure & applications;method study definition & basic procedure,selection of job, various recording techniques like outline process charts, flow process charts, man machine charts, two handed process charts, string diagram,flow diagram, multiple activity chart, simo,cyclo-graphs and chrono-cyclographs; critical examination, development, installation and maintenance of improved method; principles of motion economy and their application in work design; micro motion study, memo motion study and their use in methods study.

WORK MEASUREMENT **9 Hours**

Introduction & definition, objectives and basic procedure of work measurement;application of work measurement in industries;time study: basic procedure, equipments needed, methods of measuring time, selection of jobs, breaking a job into elements; numbers of cycles to be timed; rating and methods of rating, allowances,calculation of standard time.Work sampling: Basic procedure,design of work sampling study conducting work sampling study and establishment of standard-time.

JOB EVALUATION AND INCENTIVE SCHEMES **9 Hours**

Starlight line,Tailor,Merrick and Gantt incentive plans Standard data system;elemental & non-elemental predetermined motion system,work factors system;Methods Time Measurement (MTM), MOST.

HUMAN FACTOR ENGINEERING **9 Hours**

Definition and history of development of human factors engineering, types &characteristics of man-machine-system, relative capabilities of human being and machines; development and use

of human factor data; information input and processing: Introduction to information theory; factors effecting information reception and processing; coding and selecting of sensory inputs.

DISPLAY SYSTEMS AND ANTHROPOMETRIC DATA **9 Hours**

Display- types of visual display,visual indicators and warning signals; factorial and graphic display; general principles of auditory and tactral display, characteristics and selection.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. ILO; work-study; International Labour Organization
2. Khan MI; Industrial Ergonomics; PHI Learning
3. Barrnes RM; Motion and Time Study; Wiley pub
4. Megaw ED; Contenmprory ergonomics; Taylor & fracis
5. Sandera M and Mc Cormick E; Human Factors in Engg and design; MGHill
6. Currie RM; Work study; BIM publications
7. Mynard; Hand book of Industrial Engg;

U13ME*T*E25 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

Course Objectives

- To Identify the Entrepreneurial attitude among students
- To Motivate the students to understand the importance of Entrepreneurship
- To Make them to learn the concepts of Entrepreneurship and application
- To make entrepreneurs for growth.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Discuss about entrepreneurship, economic development and creativity.
CO 2 : Explain the project management and role of government in entrepreneurship development.
CO 3 : Understand professional ethics and human values.

Course Content

ENTREPRENEURSHIP AND ECONOMIC DEVELOPMENT **9 Hours**

Entrepreneur – Definition – Need for Entrepreneurship – Concepts – Characteristics – Competencies – Why Entrepreneurs – Contribution of Entrepreneurship to Economic Growth of Country – types of Entrepreneurs – Intrapreneurs – Differences – Entrepreneur – Intrapreneur – Manager – Factors Contributing and affecting Entrepreneurs growth - Qualities

ENTREPRENEURIAL PROMOTION **9 Hours**

The Role of Creativity – The Innovation Process – Sources of New Ideas - Methods of Generating Ideas Creative Problem Solving – Entrepreneurial Process – The Importance of a Business Model – Components of Effective Business Models – Developing and Writing a Business Model

PROJECT MANAGEMENT **9 Hours**

Forms of Business Organization – Micro Small Medium Enterprises – Sole Proprietorship – Partnership – Joint stock Companies – Cooperatives – Determining the Financial Needs – Sources of Financing – Equity and Debt funding – Evaluating Financial Performances – The Marketing Function – Industry Analysis – Competitor Analysis – Market Research for New Venture – Marketing Strategy

GOVERNMENT ROLE IN ENTREPRENEURIAL DEVELOPMENT 9 Hours

Government Schemes – Micro – Small – Medium –Women – Enterprises – District Industry Centre – Special Economic Zones – Tax Benefits – Export and Import – Financial – Non Financial Incentives from State and Central Governments – Sector Reservation for Micro, Small and Medium Industries - Essential Contacts for Entrepreneurs

INDUSTRY MANAGEMENT 9 Hours

Challenges of Growth – Strategies for Firm Growth – Internal and External Growth Planning – Professional Ethics – Human Values – Creativity for Growth – Social Responsibility – Modernization Methods – Labour Welfare – Tax Knowledge – Expansion – Investment Reserve Strategy – Contribution to Society.

Theory :45Hr Total Hours:45

REFERENCES:

1. Entrepreneurial Development by S S Khanka, S. Chand & Co: 2008.
2. Intellectual Property Rights Text and Case, by Dr. R. Radhakrishnan and
3. Dr. S. Balasubramanian, Excel Books – 2008.
4. Vasanth Desai "Dynamics of Entrepreneurial Development and Management" Himalaya Publishing House, 6th edition, 2011.
5. N.P.Srinivasan & G.P. Gupta "Entrepreneurial Development" Sultanchand & Sons, 1999.
6. P.Saravanavelu "Entrepreneurship Development" Eskapee publications, 2008.
7. S.S.Khanka "Entrepreneurial Development" S.Chand & Company Ltd., 2008.

U13ME*T*E26	PROJECT ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the concept of a project, categories of projects, roles and responsibilities of a Project leader.
- To learn how to plan and estimate a project, project planning steps, preparation of cost estimation, project profitability.
- To empathize about different types of organization, staffing, authorities and responsibilities of a project manager, project execution, tenders and contracts in a project.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand the concept of a project, categories of projects, roles and responsibilities of a Project leader and estimate a project.
CO 2 : Evaluate project profitability using the tools and techniques of project management.
CO 3 : Know the performance indicators in project management and its role in the environment.

Course Content

CONCEPTS OF PROJECT MANAGEMENT **9 Hours**

Concept of a Project, Categories of projects, Phases of project life cycle, Roles and responsibilities of project leader, tools and techniques for project management.

PROJECT PLANNING AND ESTIMATING **9 Hours**

Feasibility report, phased Planning, Project planning steps, Objectives and goals of the project, preparation of cost estimation, evaluation of the project profitability.

ORGANIZING AND STAFFING THE PROJECT TEAM **9 Hours**

Skills and abilities required of project manager, Authorities and responsibilities of project manager, Project organization and types, accountability in project execution, controls, tendering and selection of contractors.

TOOLS & TECHNIQUES OF PROJECT MANAGEMENT **9 Hours**

Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Technique (PERT) and Critical path method (CPM) Planning.

PERFORMANCE MEASURES IN PROJECT MANAGEMENT **9 Hours**

Performance indicators, Performance improvement for the CM & DM companies for better project management, Project management and environment.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Project Management a System approach to Planning Scheduling & Controlling, Harold Kerzner, CBS Publishers and Distributors.
2. Project Management - Beningston Lawrence-McGraw Hill-1970.
3. PERT & CPM - L.S. Srinath, Affiliated East West Press Pvl. Ltd.
4. A Management Guide to PERT and CPM, WEIST & LEVY, Eastern Economy of PHI
5. Project Management with PERT and CPM, Moder Josep and Phillips cerel R., 2nd edition, New York VAN Nostrand, Reinhold- 1976

U13ME*T*E31	VIBRATIONS AND NOISE CONTROL	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basics and classifications of vibration
- To study the vibration analysis in single and two degree of freedom systems
- To study the vibration analysis in multi degree of freedom systems
- To study the design modifications to reduce the vibration
- To study the sources of noise and controlling techniques

Course outcomes

After successful completion of the course, the students should be able to

CO 1: Apply their knowledge, skills to measure and analyze the content of vibration and design the vibration control system.
CO 2 : Solve problems in multi degrees of freedom systems.
CO 3 : Discuss about noise and its control.

Course Content

FUNDAMENTALS OF VIBRATION **9 Hours**

Introduction -Sources of vibration-Mathematical models-Types of vibration. Review of Single degree freedom systems with and without damping –Types of Damping- Dynamics of rotating and reciprocating engines– Critical speed of industrial rotors with specific reference to rigid and flexible rotors – Influence of type of bearings – Vibration isolation – Nonmetallic isolators.

TWO DEGREE FREEDOM SYSTEM **9 Hours**

Introduction- Free vibration of Undamped and damped system. Torsional system-Spring coupled system – mass coupled system – Vibration of two degree freedom system – Forced vibration with harmonic Excitation – Dynamic Vibration Absorber – Torsional Vibration Absorber-Vibration control.

MULTI-DEGREE FREEDOM SYSTEM **9 Hours**

Longitudinal, Transverse, Torsional systems, Geared systems Complexities – Normal mode of vibration – Flexibility Matrix and Stiffness matrix – Eigen values and eigen vectors – Orthogonal properties – Energy methods of Rayleigh, Ritz and Dunkerley

EXPERIMENTAL VIBRATION ANALYSIS **9 Hours**

Need for the experimental methods in Vibration analysis. Vibration Measuring Devices: seismometer, accelerometer and velometers-Vibration exciters: mechanical, hydraulic, electromagnetic and electrodynamic –Frequency measuring instruments: single reed,multi reed and stroboscope. Vibration meters and sound level meter. Signal conditioning devices: Filters,

Amplifiers, Modulators/Demodulators, ADC/DAC. Signal analysis devices. Vibration recording and display devices. Experimental modal analysis. System Identification from frequency response

ENGINEERING NOISE AND ITS CONTROL **9 Hours**

Introduction-Sound Power, Sound Intensity and Sound pressure level. Sound spectra. The decibel scale-Decibel addition, subtraction and averaging- Loudness, Weighting networks, Equivalent sound level. Noise: Effects, Ratings and Regulations. Noise: Sources, Isolation and control-Industrial noise sources-Industrial noise control strategies-Noise control at the source, along the path and at the receiver.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Ambekar.A.G. “Mechanical Vibrations and Noise Engineering”, Prentice Hall of India, New Delhi,2006
2. Thomson, W.T. – “Theory of Vibration with Applications”, CBS Publishers and Distributors, New Delhi, 1990
3. Rao, S.S.,” Mechanical Vibrations,” Addison Wesley Longman, 1995.
4. Den Hartog, J.P, “Mechanical Vibrations,” Dover Publications, 1990.
5. Ramamurti. V, “Mechanical Vibration Practice with Basic Theory”, Narosa, New Delhi, 2000.
6. Seto, “Mechanical Vibrations,”Schaum Outline Series,Mcgraw Hill Inc.,Newyork,1990

U13ME*T*E32	FLUID POWER SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To know the advantages and applications of Fluid Power
- To understand the hydraulic system components and its uses
- To study the applications of Fluid Power System in automation of machine Tools and other Industrial applications.
- To know the pneumatic components and its purpose
- To understand and designing various pneumatic circuits for various applications.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand fundamentals of fluid power systems.
CO 2 : Discuss the working of control components in hydraulics and pneumatics.
CO 3 : Construct various hydraulic and pneumatic circuits.

Course Content

FUNDAMENTALS OF FLUID POWER SYSTEMS **9 Hours**

Introduction to fluid power - properties of hydraulic fluids - Selection of hydraulic fluids- comparison between hydraulics and pneumatics – Fluid power symbols.
Pumps and motors - types - Gear, vane and piston – construction and working. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting and special cylinders like tandem, Rodless and Telescopic cylinder, cylinder cushioning mechanism.

HYDRAULIC SYSTEM CONTROL COMPONENTS **9 Hours**

Construction of Control Components : Direction control valve – DCV 3/2 , DCV 2/2 DCV 4/2 and DCV 5/2 Rotary DCV, Shuttle valve , check valve – pressure control valve – Simple pressure relief valve, pressure reducing valve, pressure sequencing valve, counter balance valve - Flow control valve – Fixed and adjustable- Electrical control solenoid valves, Relays, ladder diagram.

HYDRAULIC SYSTEM DESIGN AND INDUSTRIAL APPLICATION **9 Hours**

Power pack–elements, design. Pipes - material, pipe fittings. seals and packing. Maintenance of hydraulic systems Selection criteria for cylinders, valves, pipes.
Accumulators and intensifiers: Types of accumulators- Accumulators circuits, sizing of accumulators, Intensifiers – Application of intensifier – Intensifier circuit.
Circuits for deceleration, regenerative circuits, differential circuits, feed circuits, sequencing circuits, synchronizing circuits, fail-safe circuits.

PNEUMATIC SYSTEMS AND COMPONENTS **9 Hours**

Properties of air, pneumatic components – Compressors, Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves and pneumatic actuators.
Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, fail- safe circuit, Pneumo hydraulic circuit.

DESIGN OF PNEUMATIC CIRCUITS **9 Hours**

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves, Design of Pneumatic Circuit using Cascade Method.
Fluidics – Introduction to fluidic devices, simple circuits, PLC-construction, types, operation, programming. Applications of PLC in fluid power control. Fluid power circuits failures and troubleshooting.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Anthony Esposito, “Fluid Power with Applications”, Prentice Hall, 2006.
2. Majumdar S.R., “Oil Hydraulics”, Tata McGraw-Hill, 2001.
3. Majumdar S.R., “Pneumatic Systems: Principles and maintenance”, Tata McGraw Hill, 2001.
4. Anthony Lal, “Oil hydraulics in the service of industry”, Allied publishers, 1982.
5. Harry L. Stevart D.B, “Practical guide to fluid power”, Taraoeala sons and Port Ltd. Broadey, 1976.
6. Dudelyt, A. Pease and John T. Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.
7. Shanmuga Sundaram K., “Hydraulic and Pneumatic Controls”, S.Chand & Company Ltd, 2006.
8. Festo Didatic, TP 100, 101, 201, 202
9. Srinivasan R, “Hydraulic and Pneumatic controls”, Vijay Nicole, 2006.

U13ME*T*E33 ADVANCED MECHANICS OF SOLIDS L T P C
3 0 0 3

Course Objectives

- To know the fundamentals of stresses and strains.
- To understand the theory of simple bending.
- To solve problems in pin jointed frame and deflection of beams.

Course outcomes

After successful completion of the course, the students should be able to

CO 1: Solve problems in stresses and strains and draw shear force and bending moment diagrams.
CO 2 : Analyze pin joint plane frames.
CO 3 : Solve problems in deflection of beams.

Course Content

SIMPLE STRESSES & STRAINS **9 Hours**

Simple Stresses & Strains-Elasticity and plasticity Types of stresses & strains, Hooke‟s law stress strain diagram for mild steel, Working stress , Factor of safety , Lateral strain, Poisson‟s ratio & volumetric strain ,Elastic moduli & the relationship between them, Bars of varying section, composite bars, Temperature stresses. Strain energy , Resilience , Gradual, sudden, impact and shock loadings.

SHEAR FORCE AND BENDING MOMENT **9 Hours**

Shear Force and Bending Moment- Definition of beam , Types of beams , Concept of shear force and bending moment , S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads ,Point of contra flexure , Relation between S.F., B.M and rate of loading at a section of a beam.

THEORY OF SIMPLE BENDING **9 Hours**

Flexural Stresses-Theory of simple bending ,Assumptions , Derivation of bending equation: M/I = f/y = E/R Neutral axis , Determination bending stresses , section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections, Design of simple beam sections.

ANALYSIS OF PIN-JOINTED PLANE FRAMES **9 Hours**

Shear Stresses- Derivation of formula ,Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.
Analysis of Pin-Jointed Plane Frames- Determination of Forces in members of plane, pin jointed, perfect trusses by (i) method of joints and (ii) method of sections. Analysis of various

types of cantilever& simply ,supported trusses-by method of joints, method of sections & tension coefficient methods.

DEFLECTION OF BEAMS AND CYLINDRICAL SHELL **9 Hours**

Deflection of Beams- Bending into a circular arc ,slope, deflection and radius of curvature, Differential equation for he elastic line of a beam , Double integration and Macaulay methods, Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr‟s theorems , Moment area method , application to simple cases including overhanging beams.
Cylinders-Thin seamless cylindrical shells , Derivation of formula for longitudinal and circumferential stresses, hoop, longitudinal and volumetric strains , changes in dia, and volume of thin cylinders, Riveted boiler shells, thin spherical shells.Thick cylinders, Lame's equation , cylinders subjected to inside & outside pressures , compound cylinders.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Bruhns, O. T Advanced mechanics of solids: Springer.
2. Cook, R. D., & Young, W. C. Advanced mechanics of materials: Macmillan.
3. Ugural, A. C., & Fenster, S. K. Advanced strength and applied elasticity: PTR Prentice Hall.
4. Hartog, J. P. D. Advanced strength of materials: Dover Publications.
5. Boresi, A. P., Schmidt, R. J., & Sidebottom, O. M. Advanced Mechanics of Materials: John Wiley
6. Solecki, R., & Conant, R. J. Advanced mechanics of materials: Oxford University Press.

U13ME*T*E34 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

L	T	P	C
3	0	0	3

(Use of approved design data book is permitted in the End semester examination)

Course Objectives

- To understand the principles and functions of jigs and fixtures
- To design different types of Jigs.
- To design of fixtures and dies in press working.
- To understand the principles of locating elements and clamping Devices.
- To understand the concepts involved in development of dies.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : List the types of jigs and fixtures and explain its functions.
CO 2 : Illustrate the working of press tools and solve problems in strip layout.
CO 3 : Design and develop various types of press tool dies.

Course Content

TYPES AND FUNCTIONS OF JIGS AND FIXTURES **9 Hours**

Tool design objectives - Production devices - Inspection devices –Purpose and types of Jigs and Fixtures - Materials used in Jigs and Fixtures - Principles of location and clamping- Mechanical actuation-pneumatic and hydraulic actuation -Analysis of clamping force-Tolerance and error analysis.

JIGS **9 Hours**

Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs, Design and development of Jigs for given components.

FIXTURES **9 Hours**

General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component**.**

PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT **9 Hours**

Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies:Die block-die shoe. Bolster plate-punch plate-punch holder-guide pins and bushes – strippers – knockouts-stops – pilots-Selection of standard die sets strip lay out-strip lay out calculations

DESIGN AND DEVELOPMENT OF DIES **9 Hours**

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Edward G Hoffman, "Jigs & Fixture Design", Thomson – Delmar Learning, Singapore 2004.
2. Donaldson. C, "Tool Design", Tata McGraw-Hill,2008.
3. Kempster, "Jigs & Fixtures Design", The English Language Book Society", 1978.
4. Joshi, P.H., "Jigs & Fixtures", Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2010.
5. Hiram E Grant, "Jigs and Fixture" Tata McGraw-Hill, New Delhi, 2003.
6. "Fundamentals of Tool Design", CEEE Edition, ASTME, 1983.
7. PSG Design Data –Faculty of mechanical engineering, PSG College of Technology, Coimbatore.

U13ME*T*E35	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives

- To learn the different types of composite materials and their properties
- To study the
  - Metal Matrix Composites (MMC)
  - Ceramic Matrix Composites
  - Polymer Matrix Composites
- To study the applications of composite materials in various field.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Explain the various types of composites and its fabrication techniques.
CO 2 : Discuss the applications of composites in different field.
CO 3 : Summarize the advanced composites.

Course Content

INTRODUCTION TO COMPOSITES **9 Hours**

Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix and their role- Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Polymer matrix composites (PMC), Reinforcement – Particle reinforced composites, Fibre reinforced composites. Rule of mixtures. Applications of various types of composites.

METAL MATRIX COMPOSITES **9 Hours**

Metal Matrix, Reinforcements – particles – fibres, Effect of reinforcement - Volume fraction. Various types of Metal Matrix Composites, Characteristics of MMC, Alloy vs. MMC, Advantages and limitations of MMC –Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

CERAMIC MATRIX COMPOSITES **9 Hours**

Engineering ceramic materials – Properties – Advantages – Limitations – Monolithic ceramics - Need for CMCs – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – Non oxide Ceramics – Aluminium oxide – Silicon nitride – Reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

POLYMER MATRIX COMPOSITES **9 Hours**

Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – Various types of fibres. Methods for producing PMC - Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament

winding – Injection moulding. Fibre Reinforced Plastics (FRP), Glass fibre Reinforced Plastics (GRP).

ADVANCES IN COMPOSITES **9 Hours**

Carbon /Carbon composites – Advantages of carbon matrix – Limitations of carbon matrix Carbon fibre – Chemical Vapour Deposition (CVD) of carbon on carbon fibre perform. Sol - gel technique.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Mathews F.L. and Rawlings R.D., "Composite materials: Engineering and Science", Chapman and Hall, London, England, 1st edition, 2006.
2. Chawla K.K., "Composite materials" Springer –Verlag, (1987), 3rd edition, 2008.
3. Clyne T.W. and Withers P.J., "Introduction to Metal Matrix Composites", Cambridge University Press, 2003.
4. Strong A.B., "Fundamentals of Composite Manufacturing", SME, 2008.
5. Sharma S.C., "Composite materials", Narosa Publications, 2004.
6. "Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy", IIT- Madras, December 2001.
7. Autar.K.Kaw, "Mechanics of Composite Materials", CRC Press, 2006.

U13ME*T*E36	RAPID PROTOTYPING	L	T	P	C
		3	0	0	3

Course Objectives

- To Generate a good understanding of RP history, its development and applications.
- To impart knowledge on different types of RP systems, i.e., the process, advantages, limitations and applications.
- To expose the students to different types of materials used in RP systems to make best use of various RP machines.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Illustrate the fundamentals of RPT and its materials

CO 2 : Demonstrate the various RPT systems

CO 3 : Explain the reverse engineering and new technologies pertaining to RPT.

Course Content

INTRODUCTION **9 Hours**

History – Development of RP systems – Applications in Product Development,Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle –Fundamental – File format – Other translators – medical applications of RP – On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS **9 Hours**

Classification – Liquid based system - Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

POWDER BASED RAPID PROTOTYPING SYSTEMS **9 Hours**

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, emanufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

MATERIALS FOR RAPID PROTOTYPING SYSTEMS **9 Hours**

Nature of material – type of material – polymers, metals, ceramics and compositesliquid based materials, photo polymer development – solid based materials, powder based materials - case study.

REVERSE ENGINEERING AND NEW TECHNOLOGIES **9 Hours**

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Rafiq I. Noorani, Rapid Prototyping – Principles and Applications, Wiley & Sons, 2006.
2. Chua C.K, Leong K.F and Lim C.S, Rapid Prototyping: Principles and Applications, second edition, World Scientific, 2003.
3. N.Hopkinson, r.j.m, hauge, p m, dickens, "Rapid Manufacturing – An Industrial revolution for the digital age", Wiley, 2006
4. IAN GIBSON, "Advanced Manufacturing Technology for Medical applications:Reverse Engineering, Software conversion and Rapid Prototying", Wiley, 2006
5. Paul F.Jacobs, Rapid Prototyping and Manufacturing, "Fundamentals of Stereolithography", McGraw Hill 1993.
6.D.t.Pham and S.S.Dimov, "Rapid Manufacturing", Springer Verlog 2001.

U13ME*T*E37	TOOL ENGINEERING DESIGN	L	T	P	C
		3	0	0	3

Course Objectives

- To select suitable point cutting tool and multipoint cutting tool for machining process.
- Design Jigs and Fixtures for holding tool and work price respective.
- Use of suitable moulding for the design of die components.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Select suitable cutting tool for machining process.
CO 2 : Explain the construction of jigs and fixtures.
CO 3 : Apply suitable moulding for the design of die components.

Course Content

CUTTING TOOLS **9 Hours**

Materials-properties, classification, selection, insert and coated tools, tool wear, tool life. Recent developments and applications.

SINGLE POINT TOOLS **9 Hours**

Nomenclature, types and styles, design and manufacture of HSS and carbide insert type tools for turning, boring, shaping, planning and slotting operations. Design of form tools. Tools and holders for CNC applications, tools for dry machining.

MULTIPOINT CUTTERS:

Nomenclature, classification and selection, construction methods, cutter setting, design and manufacture of drills, reamers, taps, dies, thread chasers, milling cutters, broaches, hobs and gear shaper cutters. Grinding-wheel specification and selection.

JIGS **9 Hours**

Degrees of freedom, principles of location and clamping, principles of jig design, fool proofing, elements of jigs, classification of jigs, design of jigs for drilling and reaming.

FIXTURES:

Principles of fixture design, locators and different types of clamps, elements of fixtures, provision for tool setting, design of fixtures for milling, turning, boring and grinding operations. Fixtures for turning centers and machining centers. Modular fixturing-concepts and applications.

PRESS TOOLS **9 Hours**

Design and manufacture of die sets for sheet metal components-simple, compound and progressive dies for punching and blanking operations. Dies for drawing and bending operations. Selection of presses and tools.

DESIGN OF INJECTION MOULDING AND DIE CASTING DIES **9 Hours**

Product and mould, thermal considerations, design of two plate mould, runner and gate design, mould cooling and ejection, analysis of mould flow.

SPECIAL TOOLS:

Design of limit gauges. Tool maintenance and planning.

Theory :45Hr **Total Hours:45**

REFERENCES

1. Arshinov V and Alekseev G, "Metal cutting Theory and Cutting Tool Design", MIR Publishers, Moscow, 1976.
2. Donaldson C and LeCain C H, "Tool Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.
3. Bhattacharyya A, “Metal Cutting Theory and Practice”, New Central Books Agency (P) Ltd, Calcutta, 2000.
4. Cracknell P C and Dyson R W, “Handbook of Thermoplastics Injection Mould Design”, Chapman and Hall, 1993.
5. Mikell P Groover, “Fundamentals of Modern Manufacturing”, John Wiley and Sons, Singapore, 2004.

6. SME, "Manufacturing Engineers Hand Book", 1998.
7. Kempster, "Introduction to Jig and Tool Design", VIVA Books, New Delhi, 1998.
8. Rodin P, "Design and Production of Metal cutting Tools", MIR Publishers, Moscow, 1968.

U13ME*T*E41	DESIGN AND OPTIMIZATION	L	T	P	C
		3	0	0	3

Course Objectives

- To know about optimum design and selection of materials.
- To solve variety of problems using optimization techniques.
- To study the applications of optimization techniques.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Choose appropriate optimization algorithms for a problem.
CO 2 : Become familiar with advanced optimization methods and tools.
CO 3 : Understand the basic principles of common optimization algorithms.

Course Content

INTRODUCTION **9 Hours**

Introduction to Optimum design. Introduction to detail design optimization by simulation, prototyping and optimum. Selection of configuration, materials and processes.

OPTIMIZATION APPROACH **9 Hours**

Optimization approach-Classical mathematical methods of optimization. Mechanical System Design problem-economic political environment, issues of human safety & welfare, and professional ethics.

OPTIMIZATION METHODS **9 Hours**

Optimum mechanical design concepts. Overview and application of optimization methods to machine elements and mechanical system design. Prototyping, simulation, and use of standards for detail design optimization.

OPTIMIZATION TECHNIQUES **9 Hours**

Optimization techniques- Optimum selection of material & processes in mechanical design using material selection charts and optimisation methods.

APPLICATIONS **9 Hours**

Applications- Optimizing product design functionality, aesthetics and economics by employing industrial design principles and by suitable selection of material & processing including use of polymers, composites and other non metallic materials.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. H. Adeli. Advances in Design Optimization.
2. Robert F. RHYDER ,Manufacturing Process Design and Optimization, , New York: Marcel Dekker,
3. S.S.Rao ,Optimization: Theory & Application Wiley Eastern,
4. K. Deb ,Optimization for engineering design, Prentice Hall India
5. J.S.Arora ,Introduction to optimum design, McGraw Hill

U13ME*T*E42	MODELLING AND SIMULATION OF ENGINEERING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To explain the basic concepts of building a model, study of simulation and systems
- To study about the generation of random numbers, testing of random numbers
- To study about the generation of random variables
- To study the concepts of analysis and evaluation of models
- To study about various simulation soft wares.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Outline random number and variate generation.
CO 2 : Understand validation of simulated models.
CO 3 : Familiar with various simulation packages.

Course Content

SYSTEM AND SYSTEM ENVIRONMENT **9 Hours**

Component of a System – Continuous and discrete systems – Types of model; Steps in Simulation study; Simulation of an event occurrence using random number table – Single server queue –two server queue – inventory system.

RANDOM NUMBER GENERATION **9 Hours**

Properties of random numbers – Generation of Pseudo – random numbers – techniques of generating pseudo random numbers; Test for random numbers: the Chisquare test-the kolmogrov Smirnov test – Runs test – Gap test – poker test.

RANDOM – VARIATE GENERATION **9 Hours**

Inverse transform technique for Exponential, Uniform, triangular, weibull, empirical, uniform and discrete distribution, Acceptance rejection method for Poisson and gamma distribution; Direct Transformation for normal distribution.

ANALYSIS AND EVALUATION OF MODEL **9 Hours**

Data collection, identifying the distribution, Parameter estimation, goodness of fit tests, verification and validation of simulation models.

SIMULATION SOFTWARE PACKAGES **9 Hours**

Comparison and selection of General Purpose Simulation System (GPSS), SIMSCRIPT, SLAM, Arena simulation language, Modeling basic operations using Arena – An Electronic Assembly and testing system, Development of simulation models using Arena simulation package for queuing system, Production system, inventory system, Arena Integration and customization.

Theory :45Hr **Total Hours:45**

REFERENCES :

1. Banks J., Carson J.S. and Nelson B.L., "Discrete – Event System Simulation", 3rd Edition, Pearson Education, Inc 2004
2. David Kelton.W. and Randall P. Sowdowski, "Simulation with Arena", 2nd Edition , McGraw Hill, 2002.
3. Geoffrey Gorden, "System Simulation", Prentice Hall of India, 2003.
4. Narsingh Deo., "System Simulation with Digital Computer", Prentice Hall of India, 2003.
5. www.arenasimulation.com
6. www.gpss.co.uk
7. www.caciasl.com

U13ME*T*E43 DESIGN FOR MANUFACTURE L T P C
3 0 0 3

Course Objectives

- To enable the students to understand the knowledge of the general design principles of manufacturing
- To enable the students to understand the design principles of
  - Casting and welding
  - Non metallic parts
  - Machined components
  - Components produced by EDM.

Course outcomes

After successful completion of the course, the students should be able to

CO 1: Illustrate the basic of design for manufacture.

CO 2 : Outline casting, weldment, forming, nonmetallic and machined component design for manufacture.

CO 3 : Model the design for assembly.

Course Content

INTRODUCTION **9 Hours**

Economics of Process selection, process capability and process capability metrics – General design principles of manufacturability – Proper material selection – Strength and Mechanical factors- geometric tolerances, surface finish, cumulative effect of tolerances and application of form design.

CASTING DESIGN AND WELDMENT DESIGN **9 Hours**

Factors affecting casting design- Strength aspects – Sand casting and die casting design-Factors affecting weldment design-Gas and arc welding design.

FORMED METAL COMPONENTS AND NON METALLIC PARTS DESIGN 9 Hours

Design considerations for the manufacture of extruded, cold headed metal parts – Tube and section bends – Powder metal parts -Thermo setting plastic parts-Reinforced – Plastic/Composite parts.

MACHINED COMPONENTS DESIGN **9 Hours**

Design considerations for the manufacture of Turned parts-drilled parts-milled parts, planned, shaped and slotted parts-Ground parts-parts produced by EDM.

DESIGN FOR ASSEMBLY **9 Hours**

Types of assembly – DFA –Index – evaluation of assembly – assembly cost reduction – case of assembly – impact on quality – related software usage – case studies.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. James G. Bralla – "Handbook of product design for manufacture", McGraw Hill Book Co., 1986.
2. Henry Peck – "Designing for manufacture", Sir Isaac Pitman & Sons Ltd., 1973.
3. Matousek – "Engineering Design", Blackie & sons, 1974 ISBN-13: 9780216912731

U13ME*T*E44	INTRODUCTION TO HUMAN BODY MECHANICS	L	T	P	C
		3	0	0	3

Course Objectives

- To study the basic biomechanics of the musculoskeletal system.
- To understand the economics with structure and biomechanical behaviors.
- To understand the properties and application of biomaterials.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand the basics biomechanics of the musculoskeletal system.
CO 2 : Explain the properties and applications of biomaterials.
CO 3 : Discuss the biomechanics of joints.

Course Content

BIOMECHANICS **9 Hours**

Introduction to Biomechanics- Basic terminology and concept of human musculoskeletal system, anatomy and overall function.

BIOMECHANICS OF TISSUES **9 Hours**

Biomechanics of Tissues- Structures of musculoskeletal system – composition, structure and biomechanical behaviour: bone, articular cartilage, muscle, tendon and ligament.

BIOMECHANICS OF JOINTS **9 Hours**

Biomechanics of joints-Structure, range of motions, musculoskeletal model of forces: (i) hip; (ii) knee; (iii) shoulder; (iv) elbow; spine. Lubrication of joints.

MOTION AND GAIT ANALYSIS **9 Hours**

Motion and gait analysis- Method, gait cycle, segmental kinetics, engineering approaches to posture analysis.

JOINT REPLACEMENT AND FRACTURE-FIXATION **9 Hours**

Joint replacement and fracture-Fixation – stress analysis and basic design approach, failure mechanisms, wear in joint arthroplasty and bone remodeling. Biomaterials- Properties and application.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Leveau, B. F. Biomechanics Of Human Motion: Basics And Beyond For The Health Professions: Slack Incorporated.
2. Tözeren, A. Human Body Dynamics: Classical Mechanics And Human Movement: Springer.
3. Yamaguchi, G. T. Dynamic Modeling Of Musculoskeletal Motion: A Vectorized Approach For Biomechanical Analysis In Three Dimensions: Springer.
4. Zatsiorsky, V. M. Kinematics Of Human Motion: Human Kinetics.
5. Nordin, M., & Frankel, V. H. Basic Biomechanics Of The Musculoskeletal System: Lippincott Williams & Wilkins.
6. Winter, D. A. Biomechanics And Motor Control Of Human Movement: Wiley.
7. Perry, J. Gait Analysis: Normal And Pathological Function: Slack.

U13ME*T*E45	TRIBOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

- To understand friction concepts and types of wear.
- To know the different types of lubricants and its applications.
- To know the various bearing materials.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Explain the basics of friction and wear.
CO 2 : Discuss about various lubricants and its properties.
CO 3 : Recall various materials for bearings.

Course Content

SURFACES AND FRICTION **9 Hours**

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

WEAR **9 Hours**

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

LUBRICANTS AND LUBRICATION **9 Hours**

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

FILM LUBRICATION **9 Hours**

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

MATERIALS FOR BEARINGS **9 Hours**

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

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Hutchings, I.M. “Tribology, Friction and Wear of Engineering Material”, Edward Arnold
2. Stolarski, T.A. “Tribology in Machine Design” , Industrial Press Inc
3. Bowden, E. P.and Tabor.D., “Friction and Lubrication” , Heinemann Educational Books Ltd
4. Cameron, A. “Basic Lubrication theory” , Longman, U.K.., 1981.
5. Neale M. J. (Editor), “Tribology Handbook”, Newnes. Butter worth, Heinemann, U.K.

U13GS*T*006 PRODUCT DESIGN AND DEVELOPMENT L T P C
3 0 0 3

Course Objectives

- Acquire knowledge on the various stages of a product development process
- Develop skills for using the various tools and techniques for developing products
- Acquire knowledge on project management techniques.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand the process to plan and develop products
CO 2 : Understand the process of collecting information and developing product specifications
CO 3 : Understand the concept generation, selection and testing processes
CO 4 : Understand the concepts of product architecture, industrial design and design for manufacture
CO 4 : Understand the basics of prototyping, economic analysis and project planning and execution processes

Course Content

INTRODUCTION - DEVELOPMENT PROCESSES AND ORGANIZATIONS - PRODUCT PLANNING 9 Hours

Characteristics of successful product development to Design and develop products, duration and cost of product development, the challenges of product development.
A generic development process, concept development: the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization. The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

IDENTIFYING CUSTOMER NEEDS - PRODUCT SPECIFICATIONS 9 Hours

Gathering 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 and reflecting on the results and the process. Specifications, establish specifications, establishing target specifications setting the final specifications.

CONCEPT GENERATION - CONCEPT SELECTION - CONCEPT TESTING 9 Hours

The activity of concept generation clarify the problem search externally, search internally, explore systematically, reflect on the results and the process, Overview of methodology, concept screening, concept scoring, caveats. Purpose of concept test, choosing a survey population and a survey format, communicate the concept, measuring customer response, interpreting the result, reflecting on the results and the process.

PRODUCT ARCHITECTURE - INDUSTRIAL DESIGN - DESIGN FOR MANUFACTURING 9 Hours

Meaning of product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.
Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, is assessing the quality of industrial design. Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

PROTOTYPING - PRODUCT DEVELOPMENT ECONOMICS - MANAGING PROJECTS 9 Hours

Prototyping basics, principles of prototyping, technologies, planning for prototypes, Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis. Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.

Theory :45Hr Total Hours:45

REFERENCES:

1. Ulrich, T. Steven D Eppinger,. Irwin “Product Design and Development”McGrawHill.
2. Chitale, A. C, and Gupta, R. C, “Product Design and Manufacturing” PHI
3. Timjones. Butterworth Heinmann, “New Product Development”,, Oxford. UCI.
4. Geoffery Boothroyd, Peter Dewhurst and Winston Knight.Product “Design for Manufacture and Assembly”.

U13MA*T*E03	MODELING AND ANALYSIS OF ENGINEERING SYSTEMS	L	T	P	C
		3	1	0	4

Course Objectives

- To identify systems, their inputs and outputs
- To apply laws of physics to derive models for simple dynamic systems
- To evaluate the dynamic response of systems of interest with selected excitation signals
- To analyze signals through their frequency components using Fourier series and Fourier transforms
- To appreciate the frequency response characteristics of linear systems and its usefulness in specifying system dynamic behavior.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Attempt modeling real life systems of interest in order to predict its dynamic behavior
CO 2 : Use simulation tools to determine dynamic response of system following external inputs
CO 3 : Use Fourier analysis to identify the different frequency components in signals used for monitoring system health
CO 4 : Use frequency response techniques to appreciate inherent dynamics of linear systems and design suitable feedback controllers
CO 5 : Take up advanced courses on system dynamics, monitoring and control with familiarity on terminology and techniques employed in the above.

Course Content

FUNDAMENTAL MODELING CONCEPTS **7 Hours**

Systems, Modeling and Analysis – Abstraction of physical behaviour using laws of physics – Linearity and Superposition – Lumped system dynamic behaviour represented by ordinary differential equations – Conservation laws to form dynamic equations

MODELING ELEMENTARY SYSTEMS **10 Hours**

Modeling Translational Mechanical Systems, RLC Electrical Circuit, Electrical Analogues for Mechanical System Parameters, Modeling of rotational mechanical systems, hydraulic systems and thermal systems, Model Representation of time delay

SYSTEM DYNAMIC RESPONSE **10 Hours**

Obtaining dynamic response of first order and second order linear systems for step inputs through analytical solution of governing equations – Transient response specifications – Delay

time, rise time, peak overshoot, undamped natural frequency, damping factor, settling time – Experimental determination of above parameters.

Dynamic response of general (including non - linear) system models through numerical integration of ODEs using MATLAB.

FOURIER ANALYSIS OF SIGNALS 8 Hours

Obtaining trigonometric Fourier series – Exponential Fourier Series – Fourier Spectra – Parseval's Theorem – Fourier Transform pairs and equations relating them – Magnitude and Phase Spectra from Fourier Transforms

FREQUENCY RESPONSE OF LINEAR TIME–INVARIANT SYSTEMS 10 Hours

Excitation and response signals of systems – Transfer functions – The sinusoidal steady state – Magnitude and phase response – Bode plots from transfer functions – Contributions from first order poles and zeros and complex conjugate pole pairs in frequency response – Frequency filtering characteristics of simple electrical and mechanical systems.

Theory :45Hr Tutorial :15Hr Total Hours:60

REFERENCES:

1. Cha, P.D. Rosenberg J.J. & Dym, C.L. `Fundamentals of Modeling and Analyzing Engineering Systems', Cambridge University Press, 2000
2. Mrinal Mandal and Amrit Asif, `Continuous and Discrete Time Signals and Systems', Cambridge University Press, 2007 (for Unit IV only)
3. Jaluria, Y. `Design and Optimization of Thermal Systems', Mc Graw Hill, 1998
4. Chopra, A. K. `Dynamics of Structures: Theory and Applications to Earthquake Engineering', Pearson, 2007.
5. Phillips, W. F. `Mechanics of Flight', John Wiley & Sons, 2010.
6. Brockman J. B.,` Introduction to Engineering : Modeling and Problem Solving', John Wiley & Sons,2009.

U13ME*T*E51 THEORY OF COMBUSTION AND EMISSION L T P C 3 0 0 3

Course Objectives

- To understand theory of combustion and combustion in SI engines.
- To study the combustion in CI and gas turbine engines.
- To know the engine emissions.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Analyze the combustion phenomena in SI and CI engines.
CO 2 : Understand the emission standards for SI and CI engines.
CO 3 : Appraise combustion characteristics of gas turbines.

Course Content

THEORIES OF COMBUSTION **9 Hours**

Combustion Principles- Combustion - Combustion equations, heat of combustion - Theoretical flame temperature, Chemical equilibrium and dissociation - Theories of Combustion - Pre-flame reactions, Reaction rates-Laminar and Turbulent, Flame Propagation in Engines.

COMBUSTION IN SI ENGINE **9 Hours**

Combustion in SI Engine- Initiation of combustion, stages of .combustion, normal and abnormal combustion, knocking combustion, pre-ignition, knock and engine variables, features and design consideration of combustion chambers.- Flame structure and speed, Cycle by cycle variations, Lean burn combustion, stratified charge combustion systems. Heat release correlations. After treatment devices for SI engines.

COMBUSTION IN CI ENGINE **9 Hours**

Combustion in CI Engine- Stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl measurement, knock and engine variables, features and design considerations of combustion chambers- delay period correlations, heat release correlations, and influence of the injection system on combustion. Direct and indirect injection systems. After treatment devices for diesel engines.

COMBUSTION IN GAS TURBINES **9 Hours**

Combustion in Gas Turbines- Flame stability, re-circulation zone and requirements – Combustion chamber configuration, materials.

EMISSIONS AND POLLUTANTS IN ENGINES **9 Hours**

Emissions- Main pollutants in engines, Kinetics of NO formation, NOx formation in SI and CI engines. Unburned-hydrocarbons, sources, formation in SI and CI engines, Soot formation and oxidation, Particulates in diesel engines, Emission control measures for SI and CI engines, Effect of emissions on Environment and human beings.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Ganesan, V . “Internal Combustion Engines”, Tata McGraw Hill Book Co.
2. John B. Heywood, “Internal Combustion Engine Fundamentals”, Tata McGraw Hill New Delhi
3. Mathur, M. L, and Sharma. R. P., “A Course in Internal Combustion Engines”, Dhanpat Rai-Publications New Delhi
4. Obert, E. F., “Internal Combustion Engine and Air Pollution”, International Text Book Publishers.
5. Ramalingam, K.K. “Internal Combustion Engines”, Scitech Publications (India) Pvt. Ltd.
6. Cohen, H, Rogers, G. E. C, and Saravanamuttoo, H. I. H., “Gas Turbine Theory”, Longman.

U13ME*T*E52	GAS DYNAMICS AND JET PROPULSION	L	T	P	C
		3	1	0	4

(Use of approved gas tables is permitted in the End semester examination)

Course Objectives

- To understand the compressible flow fundamentals
- To study the compressible flow with friction and heat transfer.
- To know the application of normal shock in compressible flow.
- To study the aircraft propulsion systems and rocket propulsion and its applications.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Know the differences between compressible and incompressible flows.
CO 2 : Solve problems in Rayleigh and Fanno flow.
CO 3 : Understand the knowledge about the rocket propulsion and various propellants.

Course Content

COMPRESSIBLE FLOW – FUNDAMENTALS **9 + 3 Hours**

Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.

FLOW THROUGH VARIABLE AREA DUCTS **9 + 3 Hours**

Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

FLOW THROUGH CONSTANT AREA DUCTS **9 + 3 Hours**

Flow in constant area ducts with friction (Fanno flow) - Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length.
Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.

NORMAL AND OBLIQUE SHOCK **9 + 3 Hours**

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl – Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock.

Flow with Oblique Shock – Fundamental relations, Prandtl's equation, Variation of flow parameters

PROPULSION **9 + 3 Hours**

Aircraft propulsion – types of jet engines – study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines – thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engine, ram jet and pulse jet engines.

Rocket propulsion – rocket engines thrust equation – effective jet velocity specific impulse – rocket engine performance, solid and liquid propellants.

Theory :45Hr Tutorial :15Hr **Total Hours:60**

REFERENCES:

1. Yahya. S.M., Fundamental of compressible flow with Aircraft and Rocket propulson", New Age International (p) Ltd., New Delhi, 2005.
2. Patrich.H. Oosthvizen, William E.Carscallen, "Compressible fluid flow", McGraw-Hill, 1997.
3. Cohen.H., Rogers R.E.C and Sravanamutoo, "Gas turbine theory", Addison Wesley Ltd., 1987.
4. Ganesan. V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 1999
5. Rathakrishnan. E., "Gas Dynamics", Prentice Hall of India, New Delhi, 2001.

U13ME*T*E53	NUCLEAR ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- To gain fundamental knowledge about
  - nuclear physics
  - nuclear reactions , nuclear fuels and reactors
- To know the reprocessing methods of nuclear fuel
- To study the different nuclear reactors and heat transfer techniques in a nuclear reactor
- To highlight the safety disposal of nuclear wastes.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand fundamental knowledge about nuclear reactions, fuels and reactors.
CO 2 : Illustrate the reprocessing methods of nuclear fuel, heat transfer techniques in a nuclear reactor and the safety disposal of nuclear wastes.
CO 3 : Describe the concepts and applications of nuclear energy.

Course Content

NUCLEAR PHYSICS **9 Hours**

Nuclear model of an atom-Equivalence of mass and energy-binding- radio activity-half life-neutron interactions-cross sections.

NUCLEAR REACTIONS AND REACTION MATERIALS **9 Hours**

Mechanism of nuclear fission and fusion- radio activity- chain reactions-critical mass and composition-nuclear fuel cycles and its characteristics-uranium production and purification-Zirconium, thorium, beryllium.

REPROCESSING **9 Hours**

Reprocessing: nuclear fuel cycles-spent fuel characteristics-role of solvent extraction in reprocessing-solvent extraction equipment.

NUCLEAR REACTORS **9 Hours**

Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding reactors-heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors.

SAFETY AND DISPOSAL **9 Hours**

Safety and disposal: Nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Thomas J.Cannoly, “Fundamentals of nuclear Engineering” John Wiley, 1997.
2. Collier J.G., and Hewitt G.F, “Introduction to Nuclear power”, Hemisphere publishing, New York, 2002.
3. Wakil M.M.El., “Power Plant Technology” – McGraw-Hill International, 1992.

U13ME*T*E54 REFRIGERATION AND AIR CONDITIONING L T P C 3 0 0 3

(Use of Psychrometric chart and Refrigeration Table is permitted in the End semester Examination.)

Course Objectives

- To study the concepts of various refrigeration systems and comparison of its performance
- To make the student to understand the essential properties refrigerant and selection of refrigeration systems and proper refrigerant
- To study the basics of psychrometry and pschrometric processes
- To make the student to calculate the cooling load calculation for different applications
- To analyse the parameters for designing a Refrigeration or Air Conditioning system.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Analyze vapour compression and absorption refrigeration system.
CO 2 : Select the components and refrigerants for specific applications.
CO 3 : Estimate cooling load calculations for various air-conditioning systems.

Course Content

REFRIGERATION CYCLE **9 Hours**

Thermodynamic principles of refrigeration - Concept of Aircraft refrigeration system (Elementary Treatment only) - Vapour compression refrigeration cycle - use of P-H charts - Vapor absorption refrigeration system - Ammonia water and Lithium Bromide water systems - Steam jet refrigeration system, COP comparison..

REFRIGERANTS AND SYSTEM COMPONENTS **9 Hours**

Compressors and its types (elementary treatment.) - Condensers – Thermostatic expansion devices - evaporators - cooling towers. Refrigerants - properties - selection of refrigerants, Alternative Refrigerants, charging of refrigeration units - Applications to refrigeration systems - ice plant - food storage plants - milk -chilling plants – refrigerated cargo ships.

PSYCHROMETRY **9 Hours**

Psychometric processes - Grand and Room Sensible Heat Factors - bypass factor - requirements of comfort air conditioning and types - comfort charts - factors governing optimum effective temperature - Use of psychometric charts.

COOLING LOAD CALCULATIONS **9 Hours**

Types of load - design of space cooling load - heat transfer through building. Solar radiation - infiltration - internal heat sources (sensible and latent) - outside air and fresh air load - estimation of total load - Domestic, commercial and industrial system.

AIRCONDITIONING **9 Hours**

Air conditioning equipments – air cleaning and air filters - humidifiers - dehumidifiers - air washers - condenser – cooling tower and spray ponds - elementary treatment of duct design-Air distribution systems, Window, Split type and central air conditioning systems, applications: automobiles, industry, stores, and public buildings

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Manohar Prasad, "Refrigeration and Air Conditioning", New Age International (P) Ltd, Revised Edition 2007.
2. Arora. C.P., "Refrigeration and Air Conditioning", Tata McGraw-Hill New Delhi, 3rd Edition, 2007.
3. Roy.J Dossat, “Principles of Refrigeration”, Prentice Hall, 5th Edition, 2001
4. Stoecker N.F and Jones, "Refrigeration and Air Conditioning", MCG raw Hill Education (Asia) 2nd Edition 2001.
5. “Refrigeration and Airconditoning” R.K.Rajput, S.K.Kataria & Sons, 2007.

U13ME*T*E55 SOLAR ENERGY ENGINEERING L T P C
3 0 0 3

Course Objectives

- To study the sources of solar radiation and types of collectors.
- To classify and design solar concentrator.
- To study the applications of photovoltaic cell and design solar ponds.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Explain the working principle of solar radiation measuring instruments.
CO 2 : Discuss the construction and performance of various solar collectors.
CO 3 : Design a solar storage system for various applications.

Course Content

INTRODUCTION **9 Hours**

Source of radiation – solar constant– solar charts – Measurement of diffuse, global and direct solar radiation: pyrheliometer, pyranometer, pyregeometer, net pyradiometer-sunshine recorder

COLLECTOR AND ITS PERFORMANCE **9 Hours**

Solar Non-Concentrating Collectors- Design considerations – Classification- air, liquid heating collectors –Derivation of efficiency and testing of flat plate collectors –Analysis of concentric tube collector - Solar green house.

CONCENTRATOR **9 Hours**

Design – Classification– Concentrator mounting –Focusing solar concentrators- Heliostats. Solar powered absorption A/C system , water pump, chimney, drier, dehumidifier, still, cooker.

PHOTO-VOLTAIC CELL **9 Hours**

Photo-voltaic cell – characteristics- cell arrays-power electric circuits for output of solar panels-choppers-inverters-batteries-charge regulators, Construction concepts.

APPLICATIONS **9 Hours**

Energy Storage - Sensible, latent heat and thermo-chemical storage-pebble bed etc. materials for phase change-Glauber's salt-organic compounds. Solar ponds.

Theory :45Hr **Total Hours:45**

REFERENCES:

1Yogi Goswami, . D. Frank Kreith, Jan. F. Kreider, "Principles of Solar Engineering", 2nd Edition, Taylor & Francis, 2000, Indian reprint, 2003

2. Edward E. Anderson, "Fundamentals for solar energy conversion", Addison Wesley Publ. Co., 1983.

3. Duffie J. A and Beckman, W .A., "Solar Engineering of Thermal Process", John Wiley, 1991.

4. Tiwari G. N. and Ghosal, M. K. "Fundamentals of Renewable energy Sources", Narosa Publishing House, New Delhi, 2007.

5. Energy Studies, Second Edition, by W. Shepherd and D. W. Shepherd, Imperial College Press, London, 2004.

U13ME*T*E56	RENEWABLE ENERGY SOURCES	L	T	P	C
		3	0	0	3

Course Objectives

- To know about different primary energy sources and renewable energy sources
- To study the solar energy measurement and designing of various solar energy utilized systems
- To study the principles of different non-conventional energy sources and their utilization.
- To understand the applications of energy from waste and designing of biogas plant
- To get an exposure in various direct energy conversion systems

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Identify the various renewable energy sources and national and international scenario.
CO 2 : Calculate the performance of solar collectors.
CO 3 : Explain the working principle of renewable energy power plants and direct energy conversion systems.

Course Content

ENERGY AND ENVIRONMENT **9 Hours**

Primary energy sources - world energy resources - energy cycle of the earth –environmental aspects of energy utilization, Emissions and Global warming – Renewable energy resources and their importance - Potential impacts of harnessing the different renewable energy resources.

SOLAR ENERGY **9 Hours**

Principles of solar energy collection -.solar radiation - measurements - instruments - data and estimation- types of collectors - characteristics and design principles of different type of collectors, performance and testing of collectors - Solar water and air heaters - performance and applications - solar cooling - solar drying - solar ponds - solar tower concept - solar furnace.

WIND, TIDAL AND GEO THERMAL ENERGY **9 Hours**

General theory of windmills - types of windmills - design aspects of horizontal axis windmills – applications - Energy from tides and waves – working principles of tidal plants and ocean

thermal energy conversion plants - Geothermal power plants. Principle of ocean thermal energy conversion (OTEC).

BIO ENERGY **9 Hours**

Energy from bio mass and bio gas plant – types and design of biogas plants – applications - Energy from wastes - utilization of industrial, municipal and agricultural wastes. Emission norms: emission from renewable fuels and its effect on environment, study of environment protection norms ISO 14000, 16000 etc.

DIRECT ENERGY CONVERSION SYSTEM **9 Hours**

Magneto hydrodynamic systems (MHD) - thermoelectric generators – thermionic generators - Fuel cells and its classification; Transport mechanism in fuel cells and concept of energy conversion. Solid oxide fuel cells (SOFC); PEM fuel cells; Direct methanol fuel cells (DMFC), Molten carbonate fuel cell (MCFC)- solar cells - types, Emf generated, power output, losses and efficiency applications. Hydrogen conversion and storage systems.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Rai G.D, "Non conventional Energy sources" 4th edition (24th Reprint), Khanna Publishers, New Delhi, 2009.
2. "Renewable Energy Sources and Emerging Technologies", Kothari, Eastern Economy Edition, 2009.
3. Sukhatme, S.P., "Solar Energy, Principles of Thermal Collection and Storage", 3rd Edition, TataMCGraw Hill, 2008.
4. S.RAo and Parul ehar, "Energy Technology – Non conventional, Renewable and Conventional, 3rd Edition (6th Reprint), Khanna Publishers, 2009.
5. Garg. H. P and Prakash. J., "Solar Energy - Fundamentals and applications", T1st revised edition, Tata Mc Graw Hill, 2000.
6. Non Conventional Energy Sources - G.D. Rai – Khanna Publishers, New Delhi,1999.
7. Renewable Energy Sources - Twidell, J.W. and Weir, A. - EFN Spon Ltd., 1986

U13ME*T*E57	ENERGY CONSERVATION AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To Understand and analyse the plant energy data
- To Carryout Energy audit and suggest methodologies for energy savings, Energy accounting and balancing
- To Utilise the available resources in optimal way.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : List major energy loads in commercial buildings.
CO 2 : Identify the energy conservation techniques in electrical and thermal systems.
CO 3 : Analyze the economics in energy management.

Course Content

IMPORTANCE OF ENERGY CONSERVATION AND MANAGEMENT 9 Hours

World, national Energy consumption – environmental aspects – Energy prices, policies – Energy auditing : methodology, analysis, energy accounting – Measurements – Thermal and Electrical.

ELECTRICAL SYSTEMS 9 Hours

AC / DC current systems, Demand control, power factor correction, load management, Motor drives : motor efficiency testing, energy efficient motors, motor speed control – Lighting : lighting levels, efficient options, daylighting, timers, Energy efficient windows – electrical distribution systems – Transformers – Power quality – harmonic distortion.

THERMAL SYSTEMS 9 Hours

Boiler – efficiency testing, excess air control, Steam distribution & use – steam traps, condensate recovery, flash steam utilization, Thermal Insulation. Heat exchanger networking – concept of pinch, target settling, problem table approach.

ENERGY CONSERVATION 9 Hours

Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.

ENERGY MANAGEMENT, ECONOMICS **9 Hours**

Energy resource management – Energy Management information systems – Computerized energy management – Energy economics – discount rate, payback period, internal rate of Return, life cycle costing – Financing energy conservation Projects.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Witte, L.C. Schmidt, P.S. Brown, D.R. “Industrial Energy Management and Utilisation” Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
3. Dryden, I.G.C. “The Efficient Use of Energy” Butterworths, London, 1982
4. Turner W.C., “Energy Management Hand book” Wiley, New York, 1982.
5. Murphy W.R. and KAY, G. M, “Energy Management” Butterworths, London 1987.

U13ME*T*E58	THERMAL SYSTEM MODELING AND ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives

- To learn to apply mass and energy balances for the systems enable to perform enthalpy
- Learn to calculate to size performance and cost of energy equipments turns modeling and simulation techniques.
- Learn to optimize the energy system for its maximum or minimum performance output.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Know the fundamentals of Modeling and simulation of energy systems and exergy analysis.
CO 2 : Develop models for thermal systems using Newtons Rapson and regression methods.
CO 3 : Find the optimum solutions using Lagrange multiplier and search techniques.

Course Content

INTRODUCTION **9 Hours**

Primary energy analysis - dead states and energy components - energy balance for closed and control volume systems - applications of energy analysis for selected energy system design - modeling overview - levels and steps in model development - examples of models – curve fitting and regression analysis.

MODELLING AND SYSTEMS SIMULATION **9 Hours**

Modeling of energy systems – heat exchanger - solar collectors – distillation - rectification turbo machinery components - refrigeration systems - information flow diagram - solution of set of non- linear algebraic equations - successive substitution - Newton Raphson method- examples of energy systems simulation.

OPTIMISATION TECHNIQUES **9 Hours**

Objectives - constraints, problem formulation - unconstrained problems - necessary and

sufficiency conditions. Constrained optimization - lagrange multipliers, constrained variations, Linear Programming - Simplex tableau, pivoting, sensitivity analysis.

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ENERGY- ECONOMY MODELS **9 Hours**

Multiplier Analysis - Energy and Environmental Input / Output Analysis - Energy Aggregation – Econometric Energy Demand Modeling - Overview of Econometric Methods - Dynamic programming - Search Techniques - Univariate / Multivariate.

APPLICATIONS AND CASE STUDIES **9 Hours**

Case studies of optimization in Energy systems problems- Dealing with uncertainty probabilistic techniques – Trade-offs between capital and energy using Pinch analysis.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Stoecker, W.F., Design of Thermal Systems, McGraw Hill, 1989.
2. Bejan, A, Tsatsaronis, G and Moran, M., Thermal Design and Optimization, John Wiley & Sons 1996.
3. Rao, S.S., Engineering Optimization - Theory and Applications, Wiley Eastern, 2000.
4. Meier, P., Energy Systems Analysis for Developing Countries, Springer Verlag, 1984.
5. Beveridge and Schechter, Optimization Theory and Practice, McGraw Hill, 1970.
6. Jaluria, S., Design and Optimization of Thermal Systems, McGrawHill, 1997.

U13ME*T*E59	AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge in vehicle structure and Electronic Engine Management systems
- To study the various engine auxiliary systems like carburetor, fuel injection, Electrical and Ignition system
- To study the different power transmission system
- To study the alternative fuels and recently developed vehicles.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Classify the engine components and accessories.
CO 2 : Explain the working principle of various transmission and control systems.
CO 3 : Discuss the alternative energy sources.

Course Content

VEHICLE STRUCTURE AND ENGINES **9 Hours**

Types of Automobiles - Vehicle Construction – Chassis – Frame and Body – Aerodynamic forces. Engine components, Materials and functions - Cooling and Lubrication systems in engines – Turbo Chargers – Engine Emission Control by three way Catalytic converter – Electronic Engine Management System.

ENGINE AUXILIARY SYSTEMS **9 Hours**

Carburetor–working principle - Electronic fuel injection system – Mono-point and Multi - Point Injection Systems – Construction, Operation and Maintenance of Lead Acid Battery - Electrical systems – Battery generator – Starting Motor and Drives – Lighting and Ignition (Battery, Magneto Coil and Electronic Type) - Regulators-cut outs.

TRANSMISSION SYSTEMS **10 Hours**

Clutch – Types and Construction – Gear Boxes, Manual and Automatic – Floor Mounted Shift Mechanism – Over Drives – Fluid flywheel - Torque converters– Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle – Hotchkiss Drive and Torque Tube Drive – Introduction to rear wheel drive.

STEERING, BRAKES AND SUSPENSION **9 Hours**

Wheels and Tyres – Wheel Alignment Parameters - Steering Geometry and Types of steering gear box– Power Steering – Types of Front Axle – Suspension systems – Braking Systems – Types and Construction – Diagonal Braking System – Antilock Braking System.

ALTERNATIVE ENERGY SOURCES **8 Hours**

Use of Natural Gas, LPG, Biodiesel, Alcohol and Hydrogen in Automobiles - Electric and Hybrid Vehicles, Fuel Cells – Introduction to off road vehicles.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Ed May, "Automotive Mechanics", Tata McGraw-Hill-2003
2. Kirpal Singh "Automobile Engineering Vol. 1& 2", Standard Publishers, New Delhi, 2009.
3. William H.Crouse and Donald L.Angline "Automotive Mechanics", 9th Edition. Tata McGraw-Hill, 2007.
4. Srinivasan, "Automotive Mechanics" 2nd edition, Tata McGraw-Hill, 2003.
5. Joseph Heitner, "Automotive Mechanics", 2nd edition, East-West Press, 1999.
6. Halderman, "Automotive Engines "Theory and Servicing" 5th Edition, Pearson, 2009.
7. Ramalingam, K.K. "Automobile Engineering", Scitech publications, 2008.

U13ME*T*E61 MICRO ELECTRO MECHANICAL SENSORS L T P C 3 0 0 3

Course Objectives

- To know the micro systems and its manufacturing techniques.
- To understand the working of micro sensors and actuators.
- To design Microsystems.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Overview of micro systems and explain the micro manufacturing techniques.
CO 2 : Discuss the principles and types of micro sensors and actuators.
CO 3 : Understand the ffundamentals of micro fluidics and design microsystems.

Course Content

INTRODUCTION TO MICROSYSTEMS 9 Hours

Overview of Microsystems technology, Multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries.

MICRO MANUFACTURING TECHNIQUES 9 Hours

Photolithography, Film deposition, Etching processes, Bulk micro machining, silicon surface micro machining, L1GA process, Rapid micro product development.

MICRO SENSORS AND MICRO ACTUATORS 9 Hours

Transducer principles, various types of displacement force, vibration and temperature micro sensors, signal detection and processing. Energy conversion and force generation, Electromagnetic Actuators, Reluctance motors, piezoelectric actuators, bimetal-actuator Friction and wear.

INTRODUCTION TO MICRO NANO FLUIDS 9 Hours

Fundamentals of micro fluidics, Micro pump - introduction - Types - Mechanical Micro pump - Non Mechanical micro pumps, Actuating Principles, Design rules for micro pump - modeling and simulation, Verification and testing - Applications.

MICROSYSTEMS DESIGN AND PACKAGING 9 Hours

Design considerations, Mechanical Design, Process design, Realisation of MEMS components using intellisuite. Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Mohamed Gad "MEMS Handbook:" Edited by - el - Hak CRC Press 2002.
2. Sabrie Solomon "Sensors Handbook ", Mc Graw Hill 1998
3. Marc F Madou "Fundamentals of micro fabrication" CRC Press 2002 2nd Edition
4. Francis E.H. Tay and W.O.Choong "Micro fluidics and bio mems application"
5. Trimmer William S., "Micromachanics and MEMS" Ed., IEEE Press New York 1997
6. Boston "An introduction to Micro electro mechanical Systems Engineering" Maluf, Nadim AR Tech house, 2000.

U13GS*T*004	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

Course Objectives

- Apply knowledge of OR techniques to industrial situations to optmize the quality of decisions
- Conduct investigations by the use of OR techniques

Course outcomes

After successful completion of the course, the students should be able to

CO 1: Apply linear programming model and assignment model to domain specific situations
CO 2 : Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results
CO 3 : Apply the concepts of PERT and CPM for decision making and optimally managing projects
CO 4 : Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions
CO 5 : Analyze the inventory and queuing theories and apply them in domain specific situations.

Course Content

LINEAR MODEL **9 Hours**

The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simplex

TRANSPORTATION AND ASSIGNMENT MODELS **9 Hours**

Transportation model – Initial solution by North West corner method – least cost method – VAM. Optimality test – MODI method and stepping stone method, Assignment model – formulation – balanced and unbalanced assignment problems

PROJECT MANAGEMENT BY PERT & CPM **9 Hours**

Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM – Resource smoothening, Resource leveling, PERT cost

REPLACEMENT AND SEQUENCING MODELS **9 Hours**

Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies), Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem

INVENTORY AND QUEUING THEORY **9 Hours**

Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management, Queuing system and its structure – Kendall's notation – Common queuing models - M/M/1: FCFS/∞/∞ - M/M/1: FCFS/n/∞ - M/M/C: FCFS/∞/∞ - M/M/1: FCFS/n/m

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Taha H.A., "Operation Research", Pearson Education, Sixth Edition, 2003
2. Hira and Gupta "Introduction to Operations Research", S.Chand and Co.2002
3. Hira and Gupta "Problems in Operations Research", S.Chand and Co.2008
4. Wagner, "Operations Research", Prentice Hall of India, 2000
5. Bhaskar, S., "Operations Research", Anuradha Agencies, Second Edition, 2004

U13ME*T*E62	SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To know about economy, market and industrial policy.
- To understand sustainable development.
- To asses environment impact and conduct environmental audit.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand Indian money market, stock market and exchange rate management.
CO 2 : Discuss economic planning in india, sustainable development and green marketing.
CO 3 : Conduct environmental audit.

Course Content

BUSINESS ENVIRONMENT: **9 Hours**

Meaning of business, nature of modern business, Environment of business, Economic system, Macro economic scenario, neoliberal profile of the economy(LPG) Indian Money Market, Capital Market in India, Stock market and its regulation, Currency convertibility, Exchange rate management

BUSINESS AND GOVERNMENT IN INDIAN PERSPECTIVE **9 Hours**

Economic roles of the state and government, Economic planning in India, Export import policy and trade liberalization, Industrial policy resolution in India, Indian economic policies, Exit policy, disinvestment policy, taxation policy.

BASICS OF SUSTAINABLE DEVELOPMENT **9 Hours**

Sustainable Development: Definition, Elements, Indicators, Principles, Guidelines for sustainable development, Concern for environment: Eco-friendly manufacturing, Packaging , Green marketing, Green funding , Institutional support for establishing and maintaining Environment Friendly Business.

EVOLUTION OF SUSTAINABLE DEVELOPMENT **9 Hours**

Sustainable development-History, ideology, concept and approaches, Sustainable development and Human Development, Concept of Environmental Sustainability, Review of key international and local drivers of the sustainability agenda, Sustainable finance, Ethics and sustainable development.

ENVIRONMENT AND SUSTAINABILITY **9 Hours**

Environment Impact Assessment, Environmental Audit, Environment Management System, Environmental Legislations, ISO 14000, Governmental Institutions for Environmental Management.

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Bala Krishnamurthy, Environmental Management: Text and Cases, PHI.
2. Arindita Basak, Environmental Studies, Pearson Education.
3. Kaushik, Anubha, Environmental Studies, New Age International.
4. Betz, Fredrick, Managing Technology, Prentice Hall, Englewood cliffs, New Jersey.
5. Rohatgi, P.K, Rohatgi K and Bowonder. B , , Technological Forcasting, Tata Mc Graw Hill.

U13ME*T*E63 FUNDAMENTALS OF NANO TECHNOLOGY L T P C
3 0 0 3

Course Objectives

- To know the fundamentals and classifications of nano materials.
- To study about the characterization of nano materials.
- To study the applications of nano devices.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Classify the nanostructures and explain its properties.
CO 2 : Explain the various production methods of nano particles.
CO 3 : Discuss the nano devices and their applications.

Course Content

INTRODUCTION AND CLASSIFICATION 9 Hours

Classification of nanostructures, nanoscale architecture – Effects of the nanometre length scale – Changes to the system total energy, changes to the system structures, vacancies in nanocrystals, dislocations in nanocrystals – Effect of nanoscale dimensions on various properties – Structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems.

NANOMATERIALS AND CHARACTERIZATION 9 Hours

Fabrication methods – Top down processes – Milling, lithographics, machining process – Bottom-up process – Vapour phase deposition methods, plasma-assisted deposition process, MBE and MOVPE, liquid phase methods, colloidal and solgel methods – Methods for templating the growth of nanomaterials – Ordering of nanosystems, self-assembly and self-organisation – Preparation, safety and storage issues.

GENERIC METHODOLOGIES FOR NANOTECHNOLOGY 9 Hours

Characterisation: General classification of characterisation methods – Analytical and imaging techniques – Microscopy techniques - Electron microscopy, scanning electron microscopy,

transmission electron microscopy, STM, field ion microscopy, scanning tunnelling microscopy, atomic force microscopy – Diffraction techniques – Spectroscopy techniques – Raman spectroscopy – Surface analysis and depth profiling – Mechanical properties, electron transport properties, magnetic and thermal properties.

INORGANIC SEMICONDUCTOR NANOSTRUCTURES 9 Hours

Quantum confinement in semiconductor nanostructures - Quantum wells, quantum wires, quantum dots, superlattices, band offsets and electronic density of states – Fabrication techniques – Requirements, epitaxial growth, lithography and etching, cleared edge overgrowth – Growth on vicinal substrates, strain-induced dots and wires, electrostatically induced dots and wires, quantum well width fluctuations, thermally annealed quantum wells and self-assembly techniques.

NANODEVICES AND THEIR VARIOUS APPLICATIONS 9 Hours

Nanomagnetic materials – Particulate nanomagnets and geometrical nanomagnets – Magneto resistance – Probing nanomagnetic materials – Nanomagnetism in technology – Carbon nanotubes – fabrication- applications – Organic FET, organic LED"s – Organic photovoltaics – Injection lasers, quantum cascade lasers, optical memories, electronic applications, colulomb blockade devices.

Theory :45Hr Total Hours:45

REFERENCES:

1. Charles P Poole, Frank J Owens, “Introduction to Nanotechnology”, John Wiley and Sons, 2007.
2. Kelsall Robert W, Ian Hamley, Mark Geoghegan, “Nanoscale Science and Technology”, Wiley Eastern, 2005.
3. Gregory Timp, “Nanotechnology”, Springer-Verlag, 2005.
4. Michael Kohler, Wolfgang, Fritzsche, “Nanotechnology: Introduction to Nanostructuring Techniques”, 2004.
5. Bharat Bhushan, “Springer Handbook of Nanotechnology”, 2004.

U13ME*T*E64 SECURITY AND CYBER CRIME

L	T	P	C
3	0	0	3

Course Objectives

- To know about information systems and E governance.
- To understand network security and security metrices.
- To understand ethical issues and cyber crime.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Explain about information systems and e governors.
CO 2 : Discuss network security concepts and security metrices.
CO 3 : Know ethical issues and cyber crime.

Course Content

INFORMATION SYSTEMS **9 Hours**

History of Information Systems and its Importance, Information System Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles.

E GOVERNANCE **9 Hours**

Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards. Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems.

NETWORK SECURITY **9 Hours**

Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection

Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN

SECURITY METRICES **9 Hours**

Classification and their benefits Information Security & Law, Intellectual property rights, Patent Law, Copyright Law, Legal Issues in Data mining Security, Building Security into Software Life Cycle

ETHICS **9 Hours**

Ethics- Ethical Issues, Issues in Data and Software Privacy, Cyber Crime Types & overview of Cyber Crimes

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Godbole,“ Information Systems Security”, Willey
2. Merkov, Breithaupt,“ Information Security”, Pearson Education
3. Yadav, “Foundations of Information Technology”, New Age, Delhi
4. Schou, Shoemaker, “ Information Assurance for the Enterprise”, Tata McGraw Hill
5. Sood,“Cyber Laws Simplified”, Mc Graw Hill
6. Furnell, “Computer Insecurity”, Springer.

U13MA*T*E65	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

Course Objectives

- To identify continuous time systems and signals that interact with them
- To apply laws of physics to derive simple models for real-life dynamic systems
- To obtain system behavior through model based simulation
- To represent periodic signals using Fourier series and understand the significance of frequency spectra
- To understand Fourier Transformation of aperiodic signals and the resulting continuous spectra
- To infer linear time invariant system behavior through state space as well as frequency domain models.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Apply laws of Physics to model simple real life systems to predict its dynamic behavior
CO 2 : Use Fourier analysis to identify the frequency characteristics of signals of interest
CO 3 : Use time domain and frequency domain methods to understand the inherent behavior of LTI systems
CO 4: Take up advanced courses on system dynamics, digital signal processing and design of feedback control systems

Course Content

REPRESENTATION OF SIGNALS AND SYSTEMS **3 Hours**

Introduction to systems, signals and their interaction. Continuous time and discrete time signals, periodic and aperiodic signals, energy and power signals. Representation of simple systems with examples. Linear and nonlinear systems, Systems with and without memory, Time varying and time- invariant systems

DYNAMIC SYSTEM MODELING & SIMULATION **12 Hours**

Lumped element modeling - Laws of Physics applied to Simple Mechanical Systems and RLC Electrical circuits System State - State variables and forms of state equations. Matrix representation of state equations for linear dynamic systems – Free response and forced response Time response from general system models through numerical integration. Use of Continuous System Simulation Tools (MATLAB)

PERIODIC SIGNALS AND FOURIER SERIES **7 Hours**

Obtaining trigonometric Fourier series – Exponential Fourier Series –Fourier Spectra – Parseval's Theorem- Linearity and time-shifting properties of Fourier Series

FOURIER TRANSFORMS FOR APERIODIC SIGNALS **10 Hours**

Fourier Transform(FT) pair and equations relating them – Magnitude and phase spectra from Fourier Transforms – Linearity, time scaling , time shifting, time differentiation and integration properties of FTs - Parseval's Energy Theorem – Existence condition for FT

ANALYSIS OF LINEAR TIME INVARIANT (LTI) SYSTEMS USING TRANSFORMS **13 Hours**

Impulse Response of LTI system- Convolution integral – FT for convolved time signals - Transfer function of LTI system using Fourier Transform – System gain and phase responses in sinusoidal steady state – Bode plots – Applications in Communication and Control – Analog filters

Theory :45Hr Practical :15Hr **Total Hours:60**

REFERENCES:

1. Mrinal Mandal and Amrit Asif, `Continuous and Discrete Time Signals and Systems', Cambridge University Press, 2007
2. Cha, P.D., Rosenberg J.J. & Dym, C.L. `Fundamentals of Modeling and Analyzing Engineering Systems', Cambridge University Press, 2000
3. Yang W.Y. et. al., `Signals and Systems with MATLAB', Springer, 2009
4. Oppenheim A.V. & Willsky A.S., `Signals & Systems', PHI Learning Pvt.Ltd.,2011
5. Krishnaveni V. & Rajeshwari, A. `Signals & Systems',Wiley – India, 2012.

U13EC*T*E12	ELECTRO MAGNETIC FIELD	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basic concepts of static electric and magnetic field.
- To analyze electric and magnetic fields in materials
- To analyze time varying electric and magnetic fields
- To apply the concept of electric and magnetic fields in engineering.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand the basic concepts of static electric and magnetic field.
CO 2 : Analyze electric and magnetic fields in materials
CO 3 : Analyze time varying electric and magnetic fields.

Course Content

STATIC ELECTRIC FIELD **9 Hours**

Introduction to electromagnetic fields and its applicability in various engineering fields. Different Co-ordinate Systems – Curl, Divergence and Gradient – Stokes theorem and Divergence theorem - Coulomb's Law– Electric Field Intensity – Principle of Superposition – Electric Field due to discrete charges , continuous charge distribution, charges distributed uniformly on an infinite and finite line, Infinite uniformly charged sheet.

Electric Scalar Potential – Relationship between potential and electric field - Potential due to infinite uniformly charged line, electrical dipole - Electric Flux Density – Gauss Law.

STATIC MAGNETIC FIELD **9 Hours**

Biot-Savart Law– Magnetic Field intensity due to a finite and infinite wire carrying a current, – Magnetic field intensity on the axis of a circular loop carrying a current – Ampere's circuital law.

Magnetic flux density – The Lorentz force equation – Force on a wire carrying a current placed in a magnetic field – Torque on a loop carrying a current – Magnetic moment – Magnetic Vector Potential.

ELECTRIC AND MAGNETIC FIELDS IN MATERIALS 9 Hours

Poisson's and Laplace's equation – Electric Polarization - Capacitance – Capacitance of parallel plate capacitor , coaxial cable, two wire line – Capacitance of parallel plate capacitor with two dielectrics – Electrostatic energy and energy density – Boundary conditions for electric fields – Electric current – Current density – point form of ohm's law – continuity equation for current. Inductance – Inductance of loops and solenoids – Mutual inductance –Energy density in magnetic fields – magnetization and permeability - magnetic boundary conditions.

TIME VARYING ELECTRIC AND MAGNETIC FIELDS 9 Hours

Faraday's law – Transformer and Motional electromotive forces - Displacement current – Maxwell's equations in integral form and differential form –Maxwell's equation in phasor form - Poynting Vector and the flow of power – Poynting theorem. Electromagnetic wave equations – Waves in free space and in homogenous material- Skin effect

APPLICATIONS OF ELECTROMAGNETICS 9 Hours

Power generation using Magneto Hydro Dynamics, Case study on risk managements of electromagnetic fields due to mobile phones and power lines, Case study on nuclear fusion reactors. Simulation of electromagnetic force analysis for models using FEM, MOM solvers.

Theory :45Hr Total Hours:45

REFERENCES:

1. William H.Hayt, J A Buck, "Engineering Electromagnetics" 7th Edition, Tata McGraw-Hill 2006.
2. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems," Prentice Hall of India 2nd Edition 2003.
3. Sadiku M.N.O. "Elements of Engineering Electromagnetics" Oxford University Press, Third Edition.
4. Clayton.R.Paul, Keith W.Whites, Syed.A.Nasar"Introduction to Electro Magnetic Fields", Third Edition, WCB/McGraw-Hill, Edition 2007.
5 Ramo, Whinnery and Van Duzer: "Fields and Waves in Communications Electronics" John Wiley & Sons (Third edition 2003).
6. Narayana Rao, N : "Elements of Engineering Electromagnetics" Fifth Edition, Prentice Hall of India, New Delhi, 2003.
7. David K.Cheng "Field and Wave Electromagnetics" Second Edition, Pearson Edition.

U13ME*T*E65	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basic concepts of fuzzy logic systems.
- To study the applications of fuzzy logic systems.
- To know the applications of pattern recognitions and image processing.

Course outcomes

After successful completion of the course, the students should be able to

CO 1 : Understand the fundamentals of fuzzy logic systems.
CO 2 : Discuss the applications of fuzzy systems and artificial neural networks.
CO 3 : Explain the principles of image processing and pattern recognitions.

Course Content

INTRODUCTION **9 Hours**

Introduction- Introduction to soft computing; introduction to biological and artificial neural network; Introduction to fuzzy sets and fuzzy logic systems.

ARTIFICIAL NEURAL NETWORKS **9 Hours**

Artificial neural networks and applications- Different artificial neural network models; learning in artificial neural networks; neural network applications in control systems.

FUZZY SYSTEMS **9 Hours**

Fuzzy systems and applications- Fuzzy sets; fuzzy reasoning; fuzzy inference systems; fuzzy control; fuzzy clustering; applications of fuzzy systems.

NEURO-FUZZY SYSTEMS **9 Hours**

Neuro-fuzzy systems- Neuro-fuzzy modeling; Neuro-fuzzy control, Genetic Algorithms- Simple GA, crossover and mutation, genetic algorithms in search and optimization.

APPLICATIONS **9 Hours**

Applications- Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design, Robotics and Sensors, Information Retrieval Systems, Share Market Analysis, Natural Language Processing .

Theory :45Hr **Total Hours:45**

REFERENCES:

1. Konar, A Computational intellingence [i.e. intelligence]: principles, techniques, and applications: Springer.
2. Friedman, M., & Kandel, A. Introduction to pattern recognition: statistical, structural, neural, and fuzzy logic approaches: World Scientific.
3. Jang, J. S. R., Sun, C. T., & Mizutani, E. Neuro-fuzzy and soft computing: a computational approach to learning and machine intelligence: Prentice Hall.
4. Mitchell, M. An introduction to genetic algorithms: MIT Press.
5. Ross, T. J. Fuzzy Logic with Engineering Applications: John Wiley & Sons.