118ENT01 **TECHNICAL ENGLISH** **L T P C**
2 0 0 2

COURSE OBJECTIVES:

The Course prepares first semester Engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT I **9**

Listening - Ink talks and gap exercises - Speaking – Asking for and giving directions - Reading – short technical texts from journals and newspapers - Writing - definitions – instructions – checklists – recommendations - Vocabulary Development - technical vocabulary - Language Development – parts of speech – articles – word formation.

UNIT II **9**

Listening - longer technical talks - Speaking – process description - Reading – longer technical texts – Writing – graphical representation - Vocabulary Development - vocabulary used in formal letters/emails and reports - Language Development – tenses - voices - numerical adjectives – question tags.

UNIT III **9**

Listening - listening to classroom lectures - Speaking – introduction to technical presentations - Reading – longer texts both general and technical and practice in speed reading – Writing – process description using sequence words and sentences - Vocabulary Development - Misspelled words – one-word substitution - Language Development - embedded sentences – singular and plural nouns - compound nouns - editing

UNIT IV **9**

Listening - Listening to documentaries and making notes - Speaking – mechanics of presentations - Reading – reading comprehension – Writing - email etiquettes - job application – cover letter –Résumé preparation - essay writing - Vocabulary Development – synonyms and antonyms –paraphrasing - Language Development – modals – conditionals.

UNIT V **9**

Listening - TED talks - Speaking – brainstorming and debate – Reading – reading and understanding technical articles – Writing – reports - minutes of a meeting - Vocabulary Development- verbal analogies - phrasal verbs - Language Development - concord - reported speech.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

At the end of the course learners will be able to:

CO1: Read technical texts and write area- specific texts effortlessly.
CO2: Listen and comprehend lectures and talks in their area of specialization successfully.
CO3: Speak appropriately and effectively in varied formal and informal contexts.
CO4: Understand the basic grammatical structures and its applications.
CO5: Write reports and winning job applications.

TEXT BOOKS

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.
2. Sudharshana. N. P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.
3. Uttham Kumar. N. Technical English I (with work book). Sahana Publications, Coimbatore, 2016.

REFERENCE BOOKS

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015.
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007.

Students can be asked to read Tagore and Chetan Bhagat

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Read technical texts and write area- specific texts effortlessly.				2				1	1	3	1		1	1	
Co2	Listen and comprehend lectures and talks in their area of specialization successfully.				1	1				2	3	1		1		
Co3	Speak appropriately and effectively in varied formal and informal contexts.									2	3					
Co4	Understand the basic grammatical structures and its applications.										2					
Co5	Write reports and winning job applications.				2					1	2	1		1	1	1

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118MAT02 **ENGINEERING MATHEMATICS - I** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the eigenvalue problems.
- To understand the concepts of curvatures, evolutes and envelopes.
- To learn the total derivatives and apply the same to find maxima and minima.
- To solve differential equations of certain types, including systems of differential equations that they might encounter in engineering subjects.
- To solve certain linear differential equations using the Laplace transform technique which has applications in control theory and circuit theory.

UNIT I MATRICES **9**

Eigenvalues and eigenvectors of a real symmetric matrix –Properties – Cayley - Hamilton theorem (Statement and applications only) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form –Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II DIFFERENTIAL CALCULUS **9**

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

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Jacobians – Taylor's expansion– Maxima and Minima – Method of Lagrangian multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS **9**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients-Applications to Engineering problems-Electric Circuits, Simple Harmonic Motions and bending of beams.

UNIT V LAPLACE TRANSFORM **9**

Laplace transforms – Conditions for existence –Basic properties (Statement and applications only) – Laplace Transform of elementary functions, derivatives and integrals, unit step function and impulse functions, periodic functions. Definition of Inverse Laplace transform – Convolution theorem (Statement and applications only) – Initial and final value theorems (Statement and applications only) – Solution of linear ordinary differential equations of second order with constant coefficients using Laplace transform techniques.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the student will be able to

CO1: Develop the knowledge of linear algebraic concepts.

CO2: Use the differential calculus tools application to seek solutions for many problems in engineering subjects.

CO3: Acquire the knowledge of partial differential concepts and apply to find maxima and minima of a function.

CO4: Determine the solutions of ordinary differential equations by various methods which have an application in their core subjects.

CO5: Apply Laplace transform techniques to solve ordinary differential equations which have an application in many engineering fields.

TEXT BOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th edition New Delhi 2016.
2. Grewal. B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2017.

REFERENCE BOOKS

1. T.Veerarajan, "Engineering Mathematics " Tata McGraw-Hill Publishing company, New Delhi, 2014.
2. Kandasamy.P, Thilagavathy,K., & Gunavathi.K., "Engineering Mathematics for first year "., S.Chand & Company Ltd., New Delhi,2014.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
5. V.Prameelakaladharan and G.Balaji, "Engineering Mathematics - I", 3rd Edition, Amrutha marketing, Chennai, 2017.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Develop the knowledge of linear algebraic concepts.	3	2											3		
Co2	Use the differential calculus tools application to seek solutions for many problems in engineering subjects.	3	3											3		
Co3	Acquire the knowledge of partial differential concepts and apply to find maxima and minima of a function.	3	3											3		
Co4	Determine the solutions of ordinary differential equations by various methods which have an application in their core subjects.	3	3											3		
Co5	Apply Laplace transform techniques to solve ordinary differential equations which have an application in many engineering fields.	3	3											3		

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118EGT05 **ENGINEERING GRAPHICS** **L T P C**
2 0 4 4

COURSE OBJECTIVES:

- To understand the graphical skills for drawing the object and the principle of free-hand sketching techniques.
- To understand the principle of orthographic projection of points, lines and plane surfaces.
- To study the principle of simple solids.
- To understand the principle of section and development of solids.
- To understand the principle of Isometric and Perspective projections.

Concepts and conventions (Not for Examination) **3**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING **15**

Curves used in engineering practices:

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

Free hand sketching:

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES **15**

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS **15**

Projection of simple solids like prisms, pyramids, cylinders and cones when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **15**

Sectioning of simple solids like prisms, pyramids, cylinders and cones in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **12**

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

Perspective projection of prisms, pyramids and cylinders by visual ray method.

TOTAL HOURS: 75 PERIODS

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COURSE OUTCOMES

The student will be able to

CO1: Recognize the conventions and apply dimensioning concepts while drafting simple objects.
CO2: Draw the orthographic projection of points, line, and plane surfaces.
CO3: Draw the orthographic projection of simple solids.
CO4: Draw the section of solid drawings and development of surfaces of the given objects.
CO5: Apply the concepts of isometric and perspective projection in engineering practice.

TEXT BOOKS

1. Ranganath G, Channankaiah and Halesh Koti, "Engineering Graphics", Second Edition, Sahana Publishers, 2015.
2. Bhatt. N.D., "Engineering Drawing" Charotar Publishing House, 53th Edition, 2014.

REFERENCE BOOKS

1. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited, 2017.
2. Gopalakrishnana. K. R, "Engineering Drawing" (Vol. I & II), Subhas Publications, 2014.
3. Basant Agarwal and C.M.Agarwal, "Engineering Drawing", Tata McGraw Hill, 2013.
4. Natrajan K. V, "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2012.
5. M.B.Shaw and B.C.Rana, "Engineering Drawing", Pearson Education India, 2011.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Recognize the conventions and apply dimensioning concepts while drafting simple objects.		2		1								1	1		1
Co2	Draw the orthographic projection of points, line, and plane surfaces.	2	1		1								1		2	
Co3	Draw the orthographic projection of simple solids.	2	2		2								1		3	
Co4	Draw the section of solid drawings and development of surfaces of the given objects.		1		2								2			2
Co5	Apply the concepts of isometric and perspective projection in engineering practice.	1	1	1							2					1

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118ESE02 BASIC CIVIL, ELECTRICAL, AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To gain knowledge about Civil Engineering Materials.
- To learn about Structural Components of Building.
- To learn the basics of electrical elements.
- To introduce the fundamental concepts of DC and AC circuits.
- To interpret the principle and characteristics of semiconductor devices.

PART-A (CIVIL)

UNIT I CIVIL ENGINEERING MATERIALS **9**

Civil Engineering Materials: Bricks, Stones, Sand, Cement, Concrete & Steel sections.
M-Sand and their types, Admixtures-Fibers and Fabrics, Superplasticizers - Selection of Materials.

UNIT II COMPONENTS OF BUILDING **9**

Component parts of the Building -Substructure (Foundation) Types, Bearing capacity, Requirement of Good Foundations.
Superstructure: Brick Masonry, Stone Masonry, Lintels, Roofing, Flooring, Plastering
Typical cross-section showing the Buildings in a Structure, Standard Legends and Insignia

PART-B (ELECTRICAL & ELECTRONICS)

UNIT III INTRODUCTION TO BASIC ELECTRICAL ELEMENTS **9**

Electrical circuit : passive elements - Resistor, Inductor and Capacitor; active elements- Current, Voltage, Power and Energy – Ohm's Law and limitations - Kirchhoff's Laws – relationship between current, voltage and power – Resistors in series, parallel and series -parallel circuits

UNIT IV FUNDAMENTALS OF DC AND AC CIRCUITS **9**

DC Circuits: Sources of Electrical Energy - Independent and Dependent Source, Source Conversion - Star –Delta conversion- Mesh and Nodal Analysis.
AC Circuits: Generation of sinusoidal - voltage, average - RMS value, form factor and peak factor- Phasor diagrams of R, L, C, combination of R-L, R-C and R-L-C circuits

UNIT V SEMICONDUCTOR DEVICES AND SWITCHING THEORY **9**

Semiconductor Devices - Overview of Semiconductors - basic principle, operation and characteristics of PN diode, zener diode, BJT, JFET -Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

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

CO1: Know the usage of surveying and properties of construction materials.
CO2: Understand the stress strain of various building and material such as substructure, road transport and bridge.
CO3: Recognize the different combinations of circuit elements and solving the circuit by applying basic circuital laws.
CO4: Acquire a good understanding of DC and AC circuits.
CO5: Demonstrate the characteristics of semiconductor devices.

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TEXT BOOKS

1. Ranganath G and Channankaiah, "Basic Engineering Civil & Mechanical", S.S.Publishers, 2014.
2. Ramamrutham. S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd, 3rd Edition reprint, 2013.
3. Muthusubramanian R, Salivahanan S, "Basic Electrical and Electronics Engineering", Tata McGraw Hill Education Private Limited, 2010.
4. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCE BOOKS

1. Shanmugasundaram. S and Mylsamy. K, "Basics of Civil and Mechanical Engineering", Cenage Learning India Pvt.Ltd, New Delhi, 2012.
2. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 3rd Edition, 2012.
3. B.L.Theraja, A.K.Theraja, "A Text Book of Electrical Technology, Volume I ", S.Chand and company Ltd., 2006.
4. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Know the usage of surveying and properties of construction materials.	3	1	2	2									3		1
Co2	Understand the stress strain of various building and material such as substructure, road transport and bridge.	1		1			2							3		1
Co3	Recognize the different combinations of circuit elements and solving the circuit by applying basic circuital laws.	3	1		2									3		1
Co4	Acquire a good understanding of DC and AC circuits.	2	1	2										3		
Co5	Demonstrate the characteristics of semiconductor devices.	2	1	2										3		1

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118CYP07 **ENGINEERING CHEMISTRY LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVE:

- Students will be conversant with the estimation of various compounds using volumetric and instrumental analysis.

LIST OF EXPERIMENTS

1. Estimation of Total hardness by EDTA
2. Determination of percentage of calcium in Lime Stone by EDTA
3. Estimation of chloride in water sample
4. Estimation of alkalinity of Water sample
5. Determination of DO in Water (Winkler's Method)
6. Determination of Rate of Corrosion of the given steel specimen by weight loss method (Without inhibitor)
7. Determination of Rate of Corrosion of the given steel specimen by weight loss method (With inhibitor)
8. Conduct metric titration (Simple acid base)
9. Conduct metric titration (Mixture of weak and strong acids)
10. Conduct metric titration using $BaCl_2$vs $Na_2\ SO_4$
11. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
12. PH titration (acid & base)
13. Determination of water of crystallization of a crystalline salt -Copper sulphate
14. Preparation of Bio-Diesel by Trans etherification method.

A minimum of TEN experiments shall be offered.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES:

CO1: Carry out the volumetric experiments and improve the analytical skills.
CO2: Understand the maintenance and usage of analytical instruments and thereby develop their skills in the field of engineering.
CO3: Understand the principle and handling of electrochemical instruments and Spectrophotometer
CO4: Apply their knowledge for protection of different metals from corrosion by using different inhibitors
CO5: Demonstrate the characteristics of PH Titration.

REFERENCE BOOKS:

1. Arthur I. Vogel's, "Quantitative Inorganic Analysis including Elementary Instrumental Analysis", ELBS, Group, 7th Edition, 2000.
2. Dr. K .Sivakumar, "Engineering Chemistry lab manual", S.S publishers, 2016.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Carry out the volumetric experiments and improve the analytical skills.	3	3								2			3		1
Co2	Understand the maintenance and usage of analytical instruments and thereby develop their skills in the field of engineering.	3	3		2									3		1
Co3	Understand the principle and handling of electrochemical instruments and Spectrophotometer	3	3		2	3		2			3			3		1
Co4	Apply their knowledge for protection of different metals from corrosion by using different inhibitors	3	3		3	2								3		1
Co5	Demonstrate the characteristics of PH Titration.	3	3								1			3		1

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118EPP07 **ENGINEERING PRACTICE LABORATORY**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To get the knowledge on welding techniques and its types.
- To do the fitting operation on a given material. (Specimen)
- To carry out sheet metal operation.
- To know the principle involved in plumbing work.
- To do the carpentry work on a given work piece.

LIST OF EXPERIMENTS

WELDING:

Study of Electric Arc welding and Gas welding tools and equipment's.

Preparation of Arc welding and Gas welding models:

i) Butt joint ii) Lap joint iii) T - joint.

FITTING:

Study of fitting tools and operations.

Preparation of fitting models: i) V-fitting ii) Square fitting

SHEET METAL WORK:

Study of sheet metal tools and operations

Preparation of sheet metal models: i) Rectangular Tray ii) Funnel

PLUMBING WORKS:

Study of pipeline joints and house hold fittings.

Preparation of plumbing models: Basic pipe connections with PVC and GI pipe fittings.

CARPENTRY:

Study of wooden joints and tools used in roofs, doors, windows, furniture.

Preparation of carpentry models:

i) Lap joint ii) Dovetail joint iii) T-Joint

DEMONSTRATION ON:

ELECTRICAL ENGINEERING PRACTICE

Study of Electrical components and equipments

Residential house wiring using switches, fuse, indicator, lamp and energy meter.

ELECTRONICS ENGINEERING PRACTICE

Study of Electronic components –Resistor, color coding, capacitors etc

Soldering practice –components soldering in simple electric circuit & testing continuity

COMPUTER HARDWARE AND SOFTWARE PRACTICE

Study of PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, Power Point and Publisher.

TOTAL HOURS: 45 PERIODS

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COURSE OUTCOMES

The students will be able to

CO1: Prepare simple Lap, Butt and T- joints using arc welding equipments.

CO2: Prepare the rectangular trays and funnels by conducting sheet metal operation.

CO3: Prepare the pipe connections and identify the various components used in plumbing.

CO4: Prepare simple wooden joints using wood working tools.

CO5: Demonstrate basic electrical, electronic and computer components based on their physical parameters and dimensions.

TEXT BOOKS

1. Ranganath. G & Channankaiah, "Engineering Practices Laboratory Manual", S.S. Publishers, 2014.
2. Jeyapoovan.T & Gowri S "Engineering Practice Lab Manual", Vikas publishing house pvt.ltd, 2016.

REFERENCE BOOKS

1. Kannaiah.P & Narayana.K.L, "Manual on Workshop Practice", Scitech Publications, 2015.
2. Ramesh BabuV, "Engineering Practices Laboratory Manual", VRB Publishers Private Limited, Chennai, Revised Edition, 2014.
3. Peter Norton, "Introduction to Computers", 7th Edition, Mc Graw Hill, 2010.
4. Bawa. H.S, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2009.
5. David Anfinson and Ken Quamme, "IT Essentials PC Hardware and Software Companion Guide", CISCO Press, Pearson Education, Third Edition, 2008.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Prepare simple Lap, Butt and T- joints using arc welding equipments.	1		2	2	1			1	1		1	1	1		2
Co2	Prepare the rectangular trays and funnels by conducting sheet metal operation.	2		2	2	1				1		1	1	1		2
Co3	Prepare the pipe connections and identify the various components used in plumbing.	1		1	2	1				1		1	1	1		2
Co4	Prepare simple wooden joints using wood working tools.	1		1	2	1				1		1	1	1		2
Co5	Demonstrate basic electrical, electronic and computer components based on their physical parameters and dimensions.	1		1	1	2				1		1	1	1		2

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218ENT01 **COMMUNICATIVE ENGLISH** **L T P C**
2 0 2 3

COURSE OBJECTIVES:

The Course prepares first semester Engineering and Technology students:

- To help learners develop their listening skills which will enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop grammar and vocabulary of a general kind by developing their reading skills

UNIT I **9**

Listening - conversation - Speaking – introducing oneself - exchanging personal information - Reading – comprehension - Writing - paragraph - Vocabulary Development - synonyms and antonyms - Language Development – consonants & vowels - phonetic transcription.

UNIT II **9**

Listening - telephonic conversation - Speaking – sharing information of a personal kind – greeting - taking leave - Reading – short stories – The Gift of the Magi, A Service of Love and The Last Leaf by O. Henry – Writing – developing hints - Vocabulary Development – everyday vocabulary - Language Development – British and American English - infinitive and gerund.

UNIT III **9**

Listening – class memory quiz - Speaking – impromptu - Reading – magazines – Writing – agenda - proposals - Vocabulary Development - important words used in speaking and writing - Language Development – types of sentences - information and emphasis.

UNIT IV **9**

Listening – interviews of famous persons - Speaking – story narration - Reading – case study – Writing – invitation letter - quotation letter - Vocabulary Development – listening and reading vocabulary - Language Development – cause and effect – purpose and function.

UNIT V **9**

Listening - a scene from a film - Speaking - role play - Reading – jigsaw – Writing – essay writing - Vocabulary Development- business vocabulary - Language Development - degrees of comparison – real English phrases.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

At the end of the course learners will be able to:

CO1: Comprehend conversations and talks delivered in English.
CO2: Participate effectively in formal and informal conversations; introduce themselves and their friends and express opinions in English.
CO3: Read short stories, magazines, novels and other printed texts of a general kind.
CO4: Write short paragraphs, essays, letters and develop hints in English.
CO5: Write reports and winning job applications.

TEXT BOOKS

1. Board of Editors. Using English A Coursebook for Undergarduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015.
2. Richards, C. Jack. Interchange Students' Book-2, New Delhi: CUP, 2015.
3. Uttham Kumar, N. Communicative English (with work book). Sahana Publications, Coimbatore, 2019.

REFERENCE BOOKS

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. New York: Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.
3. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013.
4. Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning, USA: 2007.
5. Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student's Book & Workbook). Cambridge University Press, New Delhi: 2005.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Comprehend conversations and talks delivered in English.				1					2	3	1		1		
Co2	Participate effectively in formal and informal conversations; introduce themselves and their friends and express opinions in English.									1	3	1				
Co3	Read short stories, magazines, novels and other printed texts of a general kind.									1	1	1				
Co4	Write short paragraphs, essays, letters and develop hints in English.									1	3					1
Co5	Write reports and winning job applications.			3					2				1			

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218MAT02 **ENGINEERING MATHEMATICS-II** **L T P C**
3 1 0 4

COURSE OBJECTIVES:

- To revise the concept of integral calculus and introduce Beta and Gamma functions.
- To understand double and triple integration concepts.
- To study vector calculus comprising of surface and volume integrals along with the classical theorems involving them.
- To learn analytic functions and their properties and also conformal mappings with few standard examples those have direct applications.
- To grasp the basics of complex integration and application to contour integration which is important for evaluation of certain integrals encountered in engineering problems.

UNIT I INTEGRAL CALCULUS **12**

Definite and indefinite integrals - Substitution rule – Techniques of integration –Integration by parts – Trignometric integrals - Trigonometric substitutions - Integration of rational functions by partial fractions – Integration irrational functions - Beta and Gamma functions.

UNIT II MULTIPLE INTEGRALS **12**

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

UNIT III VECTOR CALCULUS **12**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal, vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (Statement and applications only) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT IV ANALYTIC FUNCTIONS **12**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy– Riemann equation and Sufficient conditions (Statement and applications only) – Harmonic and orthogonal properties of analytic function (Statement and applications only) – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w= z+c, cz, 1/z, and bilinear transformation.

UNIT V COMPLEX INTEGRATION **12**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points –Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

TOTAL HOURS: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to

CO1: Apply the basic integration concepts and solve problems.
CO2: Determine the area and volume in 2-dimension and 3-dimension respectively using multiple integrals.
CO3: Expertise the concept of vector calculus and apply in core subjects.
CO4: Construct the analytic functions and conformal transformations of complex functions.
CO5: Evaluate the integrals using complex integration.

TEXT BOOK

1. Grewal. B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2017.

REFERENCE BOOKS

1. James Stewart, "Stewart Calculus", 8th edition, 2015, ISBN: 9781285741550 /1285741552.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", tenth edition, Wiley India, 2011.
3. P.Kandasamy, K.Thilagavathy, K.Gunavathy, "Engineering Mathematics for first year", S.Chand & Company Ltd., 9th Edition, New Delhi, 2014.
4. V.Prameelakaladharan and G.Balaji, "Engineering Mathematics - II", Amrutha marketing, Chennai, 2017.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Apply the basic integration concepts and solve problems.	3	2											3	3	2
Co2	Determine the area and volume in 2-dimension and 3-dimension respectively using multiple integrals.	3	3											3	3	3
Co3	Expertise the concept of vector calculus and apply in core subjects.	3	3											3	3	3
Co4	Construct the analytic functions and conformal transformations of complex functions.	3	2											3	3	2
Co5	Evaluate the integrals using complex integration.	3	3											3	3	3

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218EMT04 **ENGINEERING MECHANICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the vectorial and scalar representation of forces and moments.
- To understand the static equilibrium of particles and rigid bodies both in two dimensions.
- To understand the concepts of centroids and moment of inertia of composite sections.
- To understand the principle of work and energy.
- To enable the students to comprehend the effect of friction on equilibrium.

UNIT I BASICS & STATICS OF PARTICLES 12

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

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram-Types of supports and their reactions-Requirements of stable equilibrium-Moments and Couples, Moment of a force about a point and about an axis-Vectorial representation of couples-Varignon's theorem-Equilibrium of Rigid bodies in two dimensions- Equilibrium of Rigid bodies in three dimensions – Examples.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes-First moment of area and the centroid of sections - rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula, Second and product moments of plane area - Rectangle, triangle, circle from integration-T section, I section, Angle section, Hollow section by using standard formula, Parallel axis theorem and perpendicular axis theorem.

UNIT IV DYNAMICS OF PARTICLES 12

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

UNIT V FRICTION 12

Frictional force - Laws of Coloumb friction - Simple contact friction - Rolling resistance - Belt friction - Ladder friction - wedge friction.

TOTAL HOURS: 60 PERIODS

COURSE OUTCOMES

The students will be able to

CO1: Explain the differential principle applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
CO2: Find solution for problems related to equilibrium of particles.
CO3: Solve the Moment of inertia for different 2-D plane figures.
CO4: Analyze the forces in any structures.
CO5: Solve rigid body subjected to frictional forces.

TEXT BOOKS

1. Ramamrutham S, "Engineering Mechanics (S.I Units)", Dhanpat Rai Publications, 10th Edition, Reprint 2015.
2. Dr. Gujral I S, "Engineering Mechanics", Lakmi Publications, Second Edition, 2011.

REFERENCE BOOKS

1. Bhavikatti S, “Engineering Mechanics”, New Age International Publisher, 4th Edition, 2014.
2. Khurmi R S, “Engineering Mechanics”, S Chand Publisher, 20th Edition, 2012.
3. Dr. Bansal R K and Sanjay Bansal, “Engineering Mechanics”, Lakshmi Publication, 7th Edition, 2011.
4. Rajput R K, “Engineering Mechanics”, Dhanpat Rai Publications, 3rd Edition, 2005.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Explain the differential principle applies to solve engineering problems dealing with force, displacement, velocity and acceleration.		2											1		1
Co2	Find solution for problems related to equilibrium of particles.	1	1											2		
Co3	Solve the Moment of inertia for different 2-D plane figures.	1	2			1							1	1		1
Co4	Analyze the forces in any structures.	1	2	1	1	1							2	1		1
Co5	Solve rigid body subjected to frictional forces.	1	2	1										1		1

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218PPT05 PROBLEM SOLVING AND PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING **9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS **9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS **9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES **9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, date and time, errors and exceptions, handling exceptions, debugging, modules, packages; Illustrative programs: word count, copy file.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems
CO2: Read, write, execute by hand simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries.

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TEXT BOOKS

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOKS

1. John V Guttag, —Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-Disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, —Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Develop algorithmic solutions to simple computational problems	3	3	3												
Co2	Read, write, execute by hand simple Python programs.	3	3	3							1			1		
Co3	Structure simple Python programs for solving problems.	3	3	3	1				1			1				
Co4	Decompose a Python program into functions.	3	3	3												
Co5	Represent compound data using Python lists, tuples, dictionaries.	3	3	3												

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218BSE01 **MATERIAL SCIENCE** **L T P C**
2 0 0 2

COURSE OBJECTIVES:

- To study the basic theory of structure of crystalline materials.
- To understand the essential principles of electrical properties of materials.
- To get the better knowledge of Physics of semiconductor materials.
- Become proficient in dielectric and nano materials.
- To understand the essential concepts of modern engineering materials.

UNIT I CRYSTAL PHYSICS **9**

Introduction and structure of atoms – Crystal structure: The space lattice and Unit Cell - Crystal Systems and Bravais lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC, HCP and Diamond cubic structure – NaCl, ZnS structures (qualitative).

UNIT II CONDUCTING MATERIALS **9**

Conductors - Classical free electron theory of metals - Expression for electrical conductivity - Expression for Thermal conductivity - Wiedemann-Franz law - Lorentz number - Draw backs of classical theory - Quantum theory - Fermi distribution function - Effect of temperature on Fermi distribution function - Density of energy states - carrier concentration in metals.

UNIT III SEMICONDUCTING MATERIALS **9**

Intrinsic Semiconductors - direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors - Fermi level - Variation of Fermi level with temperature – Electrical conductivity of intrinsic semiconductors – band gap determination - Extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors (qualitative) - Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration - Electrical conductivity of extrinsic semiconductors.

UNIT IV DIELECTRIC MATERIALS AND NANOMATERIALS **9**

Dielectric materials: Dielectric constant – Dielectric loss - Electrical susceptibility- Electronic, ionic – orientational and space charge polarization – Frequency and temperature dependence of polarization – internal field – Claussius – Mosotti relation (derivation)

Nano materials: Synthesis-Plasma arcing- – Chemical vapour deposition – Electro deposition – Ball Milling – Properties of nanoparticles and their applications.

UNIT V NUCLEAR PHYSICS AND HEAT TRANSMISSION **9**

Nuclear fission-Nuclear fusion-nuclear reactors-classification-general features-efficiency-coolants moderators thermal reactors.

Heat conduction-Expression for thermal conductivity-Amount of heat flow through a plane wall in one direction-Determine the thermal conductivity –Lee's disc method for bad conductors.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will able to

CO1: Have the necessary understanding on the functioning of crystalline in solids of materials
CO2: Gain knowledge on classical and quantum electron theories, and energy band structures.
CO3: Acquire knowledge on basics of semiconductor physics and its applications in various devices.
CO4: Get knowledge on dielectric and nano materials and their applications.
CO5: Understand the basics of modern engineering materials.

TEXT BOOKS

1. Jasprit Singh, - Semiconductor Devices: Basic Principles, Wiley 2012.
2. Kasap, S.O. - Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
3. Jayaprakash R.N,-Physics for engineers, Dhanam publications, 2018.
4. Kittel, C. - Introduction to Solid State Physics. Wiley, 2005.
5. Theraja B.L - Basic Electronics Solid State, S. Chand & Company Ltd, 2004.

REFERENCE BOOK

1. Garcia, N. & Damask, A. —Physics for Computer Science Students. Springer-Verlag, 2012.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Have the necessary understanding on the functioning of crystalline in solids of materials	3	3	2	1									2		1
Co2	Gain knowledge on classical and quantum electron theories, and energy band structures.	3	3	1	1									3		1
Co3	Acquire knowledge on basics of semiconductor physics and its applications in various devices.	3	3	1	1									3		1
Co4	Get knowledge on dielectric and nano materials and their applications.	3	3	1	1									3		1
Co5	Understand the basics of modern engineering materials.	3	2	1	1									3		1

218PHP07 **ENGINEERING PHYSICS LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES:

- To understand the practical concepts of Interference and diffraction.
- To understand the concept of velocities of sound in different liquids.
- To get better knowledge of modulus of elasticity.
- To understand the concepts of thermal conductivity.
- To understand the concepts of viscosities of liquid

LIST OF EXPERIMENTS

1. (a) Determination of laser parameters – Wavelength.
   (b) Particle size determination using Diode Laser.
2. Determination of thickness of a thin wire-Air wedge method.
3. Determination of velocity of sound and compressibility of liquid- Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum-Spectrometer grating.
5. Determination of thermal conductivity of a bad conductor-Lee's disc method.
6. Determination of Young's modulus of the material –Non uniform bending.
7. Determination of viscosity of liquid – Poiseuille's method.
8. Spectrometer- Dispersive power of prism.
9. Determination of Young's modulus of the material - Uniform bending.
10. Tensional pendulum- Determination of Rigidity modulus.

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1: Understanding the moduli of elasticity by determining Young's modulus and Rigidity modulus of a beam and cylinder respectively.

CO2: Understanding the phenomenon of diffraction, dispersion and interference of light using optical component

CO3: Acquiring knowledge of viscosity by determining coefficient of viscosity of a liquid and measuring the parameters of ultrasound propagating through a liquid

CO4: Understanding the phenomenon of heat transfer through conductors and bad conductors by determining thermal conductivity.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Understanding the moduli of elasticity by determining Young's modulus and Rigidity modulus of a beam and cylinder respectively.	3	3	3	3	3								3		3
Co2	Understanding the phenomenon of diffraction, dispersion and interference of light using optical component	3	3	3	3	3								3		3
Co3	Acquiring knowledge of viscosity by determining coefficient of viscosity of a liquid and measuring the parameters of ultrasound propagating through a liquid	3	3	3	3	3								3		3
Co4	Understanding the phenomenon of heat transfer through conductors and bad conductors by determining thermal conductivity.	3	3	3	3	3								3		3

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218EPP08 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. To Implement python scripts using Variables and operators
2. To Demonstrate Operator precedence to evaluate an expression
3. Display grade of a student using elif statement
4. Implement Floyd triangle using for loop
5. Checks the given number is prime or not using while loop
6. Compute the GCD of Numbers using functions
7. Finding factorial of a given number using recursive function.
8. Takes a list of words and returns the length of longest one using strings
9. To perform linear and binary search using strings
10. To implement list as arrays (multiply 2 matrices)
11. To demonstrate use of list & related functions
12. To demonstrate use of tuple, set& related functions
13. To demonstrate use of Dictionary& related functions
14. Finding most frequent words in a text read from a file
15. Programs that take command line arguments (word count)

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

TOTAL HOURS: 45 PERIODS

COURSE OUTCOMES

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

CO1: Write, test, and debug simple Python programs.
CO2: Implement Python programs with conditionals and loops.
CO3: Develop Python programs step-wise by defining functions and calling them.
CO4: Use Python lists, tuples, dictionaries for representing compound data.
CO5: Read and write data from/to files in Python.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Write, test, and debug simple Python programs.	3	3	3												
Co2	Implement Python programs with conditionals and loops.	3	3	3				1				1				
Co3	Develop Python programs step-wise by defining functions and calling them.	3	3	3						1				1		
Co4	Use Python lists, tuples, dictionaries for representing compound data.	3	3	3	1											
Co5	Read and write data from/to files in Python.	3	3	3												

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
315MAT01	ENGINEERING MATHEMATICS III	3	1	0	4	50	50	100

OBJECTIVES:

1. To develop Z-transform techniques which analyze the discrete time signals.
2. To solve certain linear differential equations using the Laplace transform technique which has applications in control theory and circuit theory.
3. To introduce Fourier series analysis which is central to many applications in engineering.
4. To understand the boundary value problems and to obtain the solution using partial differential equations.
5. To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are aperiodic.

PRE-REQUISITES: Knowledge of Engineering Mathematics I and II are required.

UNIT I Z –TRANSFORM **12**

Z-transform - Elementary properties and applications– Inverse Z-transform – Convolution theorem (statement and applications only) – initial and final value theorems (statement and applications only) - Solution of difference equations by applying Z-transform using partial fractions, residue theorem and convolution theorem methods only.

UNIT III FOURIER SERIES **12**

Dirichlet's conditions – General Fourier series –Change of scale - Odd and even functions – Half -range Sine and Cosine series – Parseval's identify – Harmonic Analysis

UNIT III LAPLACE TRANSFORM **12**

Laplace transform – Conditions for existence – Basic properties (without proof) – Laplace Transform of elementary functions, derivatives and integrals, unit step functions, periodic function. Definition of Inverse Laplace transform – Convolution theorem (statement and applications only) – Initial and final value theorems (statement and applications only) – Solution of linear ordinary differential equations of second order with constant coefficient using Laplace transform techniques.

UNIT IV BOUNDARY VALUE PROBLEMS **12**

Classification of Partial Differential Equations – Method of separation of variables-Solutions of one dimensional wave equation and One-dimensional heat equations – Applications using Fourier series solutions in Cartesian coordinates - Steady state solution of two-dimensional heat equation

UNIT V FOURIER TRANSFORMS **12**

Fourier integral theorem – Fourier transform pair – Sine and Cosine transforms – Properties – Fourier Transform of simple functions – Convolution theorem applications – Parseval's identity applications.

TOTAL : 60 PERIODS

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COURSE OUTCOMES:

- Gaining the concept of analysis of linear discrete system using Z-transform approach.
- Applying Laplace transform techniques to solve ordinary differential equations which have an applications in many engineering fields.
- Describing an oscillating function which appears in a variety of physical problems by Fourier series helps them to understand its basic nature deeply.
- Acquiring the knowledge to construct partial differential equation for various physical and engineering real time problems and obtaining solution using Fourier series methods.
- Understanding the effect of Fourier transform techniques and their applications.

TEXT BOOK:

1. B.S. Grewal, 'Higher Engineering Mathematics', Khanna Publications, 43rd edition, 2016.

REFERENCES BOOKS:

1. T.Veerarajan, "Engineering Mathematics-III", Tata Mc-Graw Hill Publishing company, New Delhi, 2015.
2. V.Prameelakaladharan and G.Balaji, "Engineering Mathematics-III", Amrutha marketing, Chennai, 2015.
3. P.Kandasamy, K.Thilagavathy, K.Gunavathy, "Engineering Mathematics-III', S.Chand Publishers, 2015.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Gaining the concept of analysis of linear discrete system using Z-transform approach.	-	2	-	1	-	-	-	-	-	-	-	1	1	-	1
Co2	Applying Laplace transform techniques to solve ordinary differential equations which have an applications in many engineering fields.	2	1	-	1	-	-	-	-	-	-	-	1	-	2	-
Co3	Describing an oscillating function which appears in a variety of physical problems by Fourier series helps them to understand its basic nature deeply.	2	2	-	2	-	-	-	-	-	-	-	1	-	3	-
Co4	Acquiring the knowledge to construct partial differential equation for various physical and engineering real time problems and obtaining solution using Fourier series methods.	-	1	-	2	-	-	-	-	-	-	-	2	-	-	2
Co5	Understanding the effect of Fourier transform techniques and their applications.	-	1	-	2	-	-	-	-	-	-	-	2	-	-	2

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
315MET02	ENGINEERING THERMODYNAMICS	3	1	0	4	50	50	100

OBJECTIVES:

1. To understand the basic laws of thermodynamics.
2. To understand the concept of entropy and availability.
3. To analyze the performance of various thermodynamic cycles.
4. To know the properties of ideal and real gases.
5. To perform the calculations of air vapour mixtures using psychometric charts.

UNIT I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS 12

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 – applied to closed and open systems, Internal energy, Specific heat capacities, Enthalpy, Steady Flow Energy Equation applied to various thermal equipments.

UNIT II SECOND LAW OF THERMODYNAMICS 12

Second law of thermodynamics – Kelvin's – Planck and Clausius statement. Reversibility and Irreversibility. Carnot theorem, Carnot cycle, Reversed carnot cycle, Efficiency, Coefficient of Performance (COP). Thermodynamic temperature scale, Entropy, Clausius Inequality, Principles of Entropy Increase, Entropy change in different processes, Availability & Irreversibility: Availability of a flow and non-flow process, Effectiveness & Irreversibility, Second law of Efficiencies of processes and cycles.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 12

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, p-v, p-T, T-v, T-s, h-s diagrams, p-v-T surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes. Standard Rankine cycle - Reheat and Regenerative cycle.

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 12

Gas mixtures – properties ideal and real gases, Equation of state, Avagadro's Law, Vander Waal's equation of state, Compressability factor, Compressability chart – Dalton's law of partial pressure, Exact differentials, Tds relations, Maxwell's relations, Clausius Clapeyron equations, Joule – Thomson coefficient.

UNIT V PSYCHROMETRY 12

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

TOTAL: 60 Hours

(Use of standard steam tables, Mollier diagram, Psychometric chart and compressibility chart are permitted)

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COURSE OUTCOMES:

The students will be able to

- Understand the first law of thermodynamics and can apply it to open and closed systems.
- Comprehend the second law of thermodynamics and determine the efficiencies of engines.
- Acquire the knowledge to calculate specified parameters such as mass flow rate, work, heat transfer, entropy.
- Estimate thermodynamic properties of substances in gas or liquid state of ideal and real mixture.
- Analyze the performance of various gas power cycles and to study the psychometric process.

TEXT BOOKS:

1. Nag.P.K., "Engineering Thermodynamics", Fifth Edition, Tata McGraw-Hill Education, New Delhi, 2013.
2. Yunus A Cengel and Michael A Boles, "Thermodynamics – An Engineering Approach", 8th Edition, Tata McGraw Hill Education, 2015.
3. Er.R.K.Rajput, "Engineering Thermodynamics", Fourth Edition, Lakshmi Publications, 2016.

REFERENCE BOOKS:

1. Moran, Shapiro, Boether, Bailey, "Principles of Engineering Thermodynamics", Si version, Wiley Student, 8th Edition, 2015.
2. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
3. Rogers and Mayhew, "Engineering Thermodynamics", Longman Scientific, 4th Edition, 1992.
4. Holman.J.P., "Thermodynamics", 4th Edition, McGraw-Hill, 1988.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Understand the first law of thermodynamics and can apply it to open and closed systems.	2	3	-	-	-	-	-	-	-	1	1	-	2	-	-
Co2	Comprehend the second law of thermodynamics and determine the efficiencies of engines.	2	1	2	-	-	-	-	-	-	1	1	-	2	-	-
Co3	Acquire the knowledge to calculate specified parameters such as mass flow rate, work, heat transfer, entropy.	2	1	1	-	-	-	-	-	-	1	1	-	2	-	-
Co4	Estimate thermodynamic properties of substances in gas or liquid state of ideal and real mixture.	2	2	1	-	-	-	-	-	-	1	1	-	2	-	-
Co5	Analyze the performance of various gas power cycles and to study the psychometric process.	3	2	1	-	-	-	-	-	-	1	1	-	3	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
315MET03	FLUID MECHANICS AND MACHINERY	3	0	0	3	50	50	100

OBJECTIVES:

1. To familiarize with the properties of fluids and the applications of fluid mechanics.
2. To formulate and analyze the laws of fluid flow pattern and its related problem.
3. To understand the concept and types of flows using fluid measurements.
4. To understand the dimensional parameters and importance of dimensional analysis in various flow problems.
5. To understand the importance of various types of flow in pumps and turbines.

UNIT I INTRODUCTION **9**

Units & Dimensions. Properties of fluids – Specific gravity, Specific weight, Viscosity, Compressibility, Vapour pressure and gas laws – Capillarity and Surface tension. Flow characteristics: Concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS **9**

Laminar flow though circular conduits and circular annuli. Boundary layer concepts - Boundary layer thickness. Hydraulic and energy gradient. Darcy – Weisbach equation. Friction factor and Moody diagram. Commercial pipes - Minor losses. Flow though pipes in series and in parallel.

UNIT III DIMENSIONAL ANALYSIS **9**

Dimensions and units: Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters to the various flow problems.

UNIT IV ROTODYNAMIC MACHINES **10**

Elementary cascade theory, theory of turbomachines, Euler's equation, Classification of turbines – Heads and efficiencies – velocity triangles, Axial, Radial and Mixed flow turbines. Pelton wheel turbine, Francis turbine and Kaplan turbine – working principles, Centrifugal pump, Specific speed – unit quantities – performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT MACHINES **8**

Classification of positive displacement machines - Reciprocating pumps - Indicator diagrams, Work saved by air vessels. Rotory pumps - Working Principle and performance curves.

TOTAL: 45 Hours

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COURSE OUTCOMES:

The students will be able to

- Acquires the knowledge regarding fluid mechanics.
- Recognize the principles written in form of mathematical equations.
- Determine the significance of dimensional parameters that influence the flow in fluid mechanics.
- Understand the concept and working of turbines and pumps with its performance.
- Determine the performance parameters of centrifugal pump and reciprocating pump.

TEXT BOOKS:

1. Streeter. V. L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2010.
2. Rathakrishnan. E, "Fluid Mechanics", Prentice Hall of India (II Ed.), 2007.
3. Modi.P.N and Seth.S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2015.
4. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 9th Edition, Laxmi Publications (P) Ltd., New Delhi, 2017.

REFERENCE BOOKS:

1. Robert W Fox, Alan T. Mc Donald, Philip J Pritchard, "Introduction to Fluid Mechanics", Wiley, 2011.
2. Kumar. K.L., "Engineering Fluid Mechanics", (7th Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 2002.
3. Munson B.R., Young D.F. and Okiisi.T.H., "Fundamentals of Fluid Mechanics", John Wiley and Sons Inc., New York, 1998.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Acquires the knowledge regarding fluid mechanics.	2	2	2	-	-	-	-	-	-	1	-	-	3	-	2
Co2	Recognize the principles written in form of mathematical equations.	2	2	-	-	-	-	-	-	-	1	-	-	3	-	2
Co3	Determine the significance of dimensional parameters that influence the flow in fluid mechanics.	3	2	-	-	2	-	-	-	-	1	-	-	3	-	-
Co4	Understand the concept and working of turbines and pumps with its performance.	2	2	3	3	2	-	-	-	-	1	-	-	3	- -	1
Co5	Determine the performance parameters of centrifugal pump and reciprocating pump.	2	2	3	3	2	-	-	-	-	1	-	-	3	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
315MET04	MANUFACTURING TECHNOLOGY – I	3	0	0	3	50	50	100

OBJECTIVES:

1. To understand the basic concepts of sand casting technique and special casting techniques.
2. To understand the working principles, equipment's of different welding techniques.
3. To know the various operations and equipment requirements of hot and cold metal forming processes.
4. To understand the working principle and applications of different types of sheet metal processes.
5. To understand the working principles of different types of thermo plastic manufacturing methods.

UNIT I METAL CASTING PROCESSES 09

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making - Melting furnaces – Cupola, Electric Arc Furnace - Special casting processes – Shell, investment casting– Lost Wax process – Pressure die casting – Centrifugal casting – CO_2 process – Sand Casting defects – Inspection methods.

UNIT II JOINING PROCESSES 09

Fusion welding processes –Gas welding – Flame characteristics – Filler and Flux materials - Arc welding types - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, Seam welding, Percusion welding - Gas metal arc welding – Flux cored – Submerged arc welding – TIG welding – Principle and application of special welding processes - Electro slag welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing and soldering process –Filler materials and fluxes.

UNIT III BULK DEFORMATION PROCESSES 09

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

UNIT IV SHEET METAL PROCESSES 09

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 – Introduction to Explosive forming, Magnetic pulse forming, Peen forming, Super plastic forming.

UNIT V MANUFACTURING OF PLASTIC COMPONENTS 09

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Compression moulding, Transfer moulding - Typical industrial applications – Introduction to Blow moulding – Rotational moulding – Film blowing – Extrusion - Thermoforming - Bonding of Thermoplastics – Types of Adhesive bonding.

TOTAL: 45 Hours

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COURSE OUTCOMES:

The students will have ability to

- Explain the requirements, process, application and defects of sand casting and special casting processes.
- Explain the working principles and applications of different arc welding processes, special welding processes and defects associated with it.
- Select the suitable process for manufacturing of components among forging, rolling, drawing, extrusion and its types.
- Explain the principles and working of shearing, bending, drawing and forming in sheet metal.
- Judge the suitability of a plastic manufacturing process based on application requirements.

TEXT BOOKS:

1. Hajra Choudhury, "Elements of Workshop Technology Vol. I", Media Promotors Pvt Ltd., Mumbai, 2010.
2. Gowri S, P.Hariharan, and A.Suresh Babu, "Manufacturing Technology I", Pearson Education, 2008.

REFERENCE BOOKS:

1. Serope Kalpakjian, Steven R.Schmid, "Manufacturing Engineering and Technology", Pearson Education Inc. 7th Edition, 2013.
2. Rao P.N, "Manufacturing Technology", Tata McGraw-Hill Publishing Limited, IV Edition, 2013.
3. Jain R.K, "Production Technology", Khanna Publishers, 17th Edition, 2012.
4. Sharma P.C, "A Text Book of Production Technology", S. Chand and Company, IV Edition, 2009.
5. Rajput R.K, "A Text Book of Manufacturing Technology", Lakshmi Publications, 2007.
6. Beddoes.J and Bibby M.J, "Principles of Metal Manufacturing Processes", Elsevier, 2006.
7. Begman, "Manufacturing Process", John Wiley & Sons, VIII Edition, 2005.
8. Magendran Parashar B.S & R.K. Mittal, "Elements of Manufacturing Processes", Prentice Hall of India, 2005.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Explain the requirements, process, application and defects of sand casting and special casting processes.	3	-	-	-	-	-	-	-	-	-	-	-	2		
Co2	Explain the working principles and applications of different arc welding processes, special welding processes and defects associated with it.	3	2	1	3	3	-	-	-	-	-	-	-	3	-	-
Co3	Select the suitable process for manufacturing of components among forging, rolling, drawing, extrusion and its types.	3	3	2	3	3	-	-	-	-	-	-	-	3	-	1
Co4	Explain the principles and working of shearing, bending, drawing and forming in sheet metal.	3	1	2	3	3	-	-	-	-	-	-	-	3	-	2
Co5	Judge the suitability of a plastic manufacturing process based on application requirements.	3	2	1	2	-	-	-	-	-	-	-	-	2	2	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
315EEE06	ELECTRICAL DRIVES AND CONTROLS	3	0	0	3	50	50	100

OBJECTIVES:

1. To understand the stable steady-state operation and transient dynamics of a motor-load system and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.
2. To study and understand the operation of induction motor drives

PRE-REQUISITES: Nil

UNIT I ELECTRICAL CIRCUITS AND MACHINES **09**

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits. Construction of Dc machines, Single phase and three phase induction motors.

UNIT II DRIVE MOTOR CHARACTERISTICS **09**

Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves, Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors.

UNIT III STARTING METHODS **09**

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES **09**

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES **09**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

- Understood the stable steady-state operation and transient dynamics of a motor-load system.
- Analyzed the starting and braking methods of DC and AC drives.
- Understood the speed control methods of DC motors and induction motors.
- Learnt about relevant drive system for a given application with given specifications.

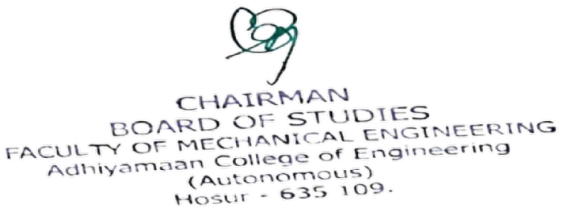
TEXT BOOKS:

1. Vedam Subrahmaniam, "Electric Drives (concepts and applications)", Tata McGraw-Hill, 2001
2. Nagrath.I.J. & Kothari.D.P, "Electrical Machines", Tata McGraw-Hill, 1998
3. N.K De and P.K Sen 'Electric Drives' Prentice Hall of India Private Ltd, 2002.

REFERENCE BOOKS:

1. Pillai.S.K "A first course on Electric drives", Wiley Eastern Limited, 1998.
2. M.D.Singh, K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 1998.
3. H.Partab, "Art and Science and Utilisation of electrical energy", Dhanpat Rai and Sons, 1994

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Understood the stable steady-state operation and transient dynamics of a motor-load system.	-	2	-	1	-	-	-	-	-	-	-	1	1	-	1
Co2	Analyzed the starting and braking methods of DC and AC drives.	2	1	-	1	-	-	-	-	-	-	-	1	-	2	-
Co3	Understood the speed control methods of DC motors and induction motors.	2	2	-	2	-	-	-	-	-	-	-	1	-	3	-
Co4	Learnt about relevant drive system for a given application with given specifications.	-	1	-	2	-	-	-	-	-	-	-	2	-	-	2



Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
315MEP07	FLUID MECHANICS AND MACHINERY LAB	0	0	4	2	50	50	100

OBJECTIVES:

1. To understand the importance and theory of fluid mechanics.
2. To gain the knowledge in flow measurements using different devices and also performance calculation related to losses in pipe.
3. To study the performance characteristics on pumps and turbine etc.
4. To predict the co-efficient of discharge for flow through pipes.
5. To provide practice in estimating friction losses.

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible pump.
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 45 Hours

COURSE OUTCOMES:

The students will be able to

- Measure flow through the orifice meter, venturimeter and rotometer.
- Acquire knowledge in flow through different pipes.
- Determine the friction loss through various pipes.
- Draw the characteristics curve for centrifugal, reciprocating, gear oil and submersible pump.
- Study the performance characteristics in different turbines.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Measure flow through the orifice meter, venturimeter and rotometer.	2	1	1	3	2	-	-	-	-	1	-	-	2	-	-
Co2	Acquire knowledge in flow through different pipes.	2	1	1	3	2	-	-	-	-	1	-	-	2	-	-
Co3	Determine the friction loss through various pipes.	2	1	1	3	2	-	-	-	-	2	-	-	2	-	1
Co4	Draw the characteristics curve for centrifugal, reciprocating, gear oil and submersible pump.	2	1	1	3	2	-	-	-	-	2	-	-	2	-	1
Co5	Study the performance characteristics in different turbines.	2	1	1	3	2	-	-	-	-	2	-	-	2	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
315MEP08	MANUFACTURING TECHNOLOGY LAB – I	0	0	4	2	50	50	100

OBJECTIVES:

1. To understand about basic machining processes.
2. To get practical knowledge on Lathe machine operations.
3. To gain the knowledge on foundry concepts.
4. To perform production of contour shapes on the given component.
5. To learn about brazing, injection moulding.

LIST OF EXPERIMENTS

1. Facing, plain turning and step turning.
2. Taper turning using compound rest, Tailstock set over, etc.
3. Single and Multi-start V- thread cutting and knurling.
4. Boring and internal thread cutting.
5. Mould with solid, split patterns.
6. Mould with loose-piece pattern.
7. Mould with Core.
8. Cold Forging.
9. Injection Moulding- for demonstration purpose.
10. Brazing - for demonstration purpose.

TOTAL: 45 Hours

COURSE OUTCOMES:

- The students are capable to perform plain turning, taper turning, thread cutting, knurling, drilling, reaming and tapping etc.
- Ability to know about the basic concepts of cold forging operations.
- Ability to know the concepts of foundry technology and to develop skills on sand casting.
- Students can get the knowledge on applications of Brazing operation.
- Students can demonstrate and fabricate different types of components using the machine tools.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Ability to know the concepts of foundry technology and to develop skills on sand casting.	1	1	2	3	-	-	-	-	-	-	-	-	2	-	-
Co2	Ability to know about the basic concepts of cold forging operations.	1	2	3	2	1	-	-	-	-	-	-	-	2	-	1
Co3	Students can demonstrate and fabricate different types of components using the machine tools.	1	1	3	2	1	-	-	-	-	-	-	-	2	-	2
Co4	The students are capable to perform plain turning, taper turning, thread cutting, knurling, drilling, reaming and tapping etc.	1	1	2	3	1	-	-	-	-	-	-	-	1	-	1
Co5	Students can get the knowledge on applications of Brazing operation.	1	1	2	3	1	-	2	-	-	-	-	-	2	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
315EEP09	ELECTRICAL DRIVES AND CONTROL LABORATORY	0	0	4	2	50	50	100

OBJECTIVES:

1. To provide exposure to the students with hands on experience on various electrical circuit laws and experiments.
2. To study the various characteristics of DC machines and transformer experimentally.
3. To study the various characteristics of AC machines experimentally.

LIST OF EXPERIMENTS

1. Verification of Kirchoff's laws.
2. Load test on DC Shunt & DC Series motor.
3. O.C.C & Load characteristics of DC Shunt and DC Series generator.
4. Speed control of DC shunt motor (Armature, Field control).
5. Load test on single phase transformer.
6. O.C & S.C Test on a single phase transformer.
7. Regulation of an alternator by EMF & MMF methods.
8. Load test on three phase squirrel cage Induction motor.
9. Speed control of three phase slip ring Induction Motor.
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Analyzed the characteristics of DC machines.
- Acquired knowledge to test different DC motors.
- Gained practical knowledge on transformer testing.
- Understood various tests on AC machines.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Analyzed the characteristics of DC machines.	-	2	-	1	-	-	-	-	-	-	-	1	1	-	1
Co2	Acquired knowledge to test different DC motors.	2	1	-	1	-	-	-	-	-	-	-	1	-	2	-
Co3	Gained practical knowledge on transformer testing.	2	2	-	2	-	-	-	-	-	-	-	1	-	3	-
Co4	Understood various tests on AC machines.	-	1	-	2	-	-	-	-	-	-	-	2	-	-	2

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
415SNT01	STATISTICS AND NUMERICAL METHODS	3	1	0	4	50	50	100

OBJECTIVES:

- To solve equations using direct and iterative methods, to introduce interpolation techniques and to study the principle of numerical differentiation and integration.
- To learn some of the methods of numerical solutions of ordinary differential equations with initial conditions.
- To introduce the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
- To expose to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Newton-Raphson method- Direct Methods-Gauss Elimination method-Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Eigen values of a matrix by Power method.

UNIT II INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 12

Newton's forward and backward difference interpolation - Lagrange's and Newton's divided difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

UNIT III NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Predictor-Corrector methods for solving first order equations: Milne's Method and Adam-Bashforth Method.

UNIT IV TESTING OF HYPOTHESIS 12

Sampling distributions - Tests for single Mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-square test for goodness of fit – Independence of attributes.

UNIT V DESIGN OF EXPERIMENTS 12

ANOVA - Completely randomized design – Randomized block design – Latin square design. Control charts for measurements ($\bar{x}$ and R-charts).

TOTAL : 60 PERIODS

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COURSE OUTCOMES:

At the end of the course the student will be able to

- Apply numerical methods such as direct, iterative and interpolation to solve algebraic or transcendental equations and system of equations.
- Appreciate numerical solutions for differential and integral calculus as a handy tool to solve problems.
- Implement numerical algorithms to find solutions for intial value problems for ordinary differential equations.
- Draw inference and decision making through hypothesis testing.

TEXT BOOKS:

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.
2. Miller and Freund., "Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2012.

REFERENCE BOOKS:

1. Richard L.Burden and J.Dougles Faires, "Numerical Analysis", Ninth Edition, BROOKS/COLE, Cengage.com., 2012. Visit www.cengage.com/international.
2. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th edition, 2007.
3. Veerarajan.T., "Probability, Statistics and Random Processes", Tata McGraw-Hill publishing company Limited, New Delhi, 2014.
4. S.S.Sastry, "Introductory Methods of Numerical Analysis", 5th Edition, Prentice Hall of India Private Ltd., New Delhi, 2012.
5. Gupta.S.C., & Kapoor,V.K., "Fundamentals of mathematical statistics", 11th edition, Sultan Chand & Sons publishers, New Delhi, 2013.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Apply numerical methods such as direct, iterative and interpolation to solve algebraic or transcendental equations and system of equations.	-	2	-	1	-	-	-	-	-	-	-	1	1	-	1
Co2	Appreciate numerical solutions for differential and integral calculus as a handy tool to solve problems.	2	1	-	1	-	-	-	-	-	-	-	1	-	2	-
Co3	Implement numerical algorithms to find solutions for intial value problems for ordinary differential equations.	2	2	-	2	-	-	-	-	-	-	-	1	-	3	-
Co4	Draw inference and decision making through hypothesis testing.	-	1	-	2	-	-	-	-	-	-	-	2	-	-	2

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
415MET02	ENGINEERING MATERIALS AND METALLURGY	3	0	0	3	50	50	100

OBJECTIVES:

1. To acquire knowledge on crystal structure and its deformation, equilibrium diagram of selected alloy systems.
2. To impart knowledge on heat treatment & properties of steel.
3. To learn testing procedures of various material testing machines.
4. To familiarize various metal & non-metals in engineering applications.
5. To gain knowledge of modifying various parameters for suitable applications of metals.

PRE-REQUISITES: Knowledge of Engineering Physics and Engineering Chemistry is required.

REVIEW (Not for Exam): **2**

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS **8**

Constitution of alloys – Solid solutions, substitutional and interstitial – Gibb's Phase rule, phase diagrams, Isomorphous, Eutectoid, Eutectic, Peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and Cast Iron, Microstructure, properties and applications.

UNIT II HEAT TREATMENT **9**

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –Normalising, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on TTT diagram, CCT - Hardenability, Jominy End quench test – Austempering, Martempering, Ausforming – Case hardening - Carburising, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening.

UNIT III MECHANICAL PROPERTIES AND TESTING **8**

Mechanism of plastic deformation, slip and twinning – Creep, Fatigue, Fracture – Testing of materials under tension, Compression and Shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, Fracture Toughness Tests.

UNIT-IV FERROUS AND NON FERROUS METALS **9**

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA - Maraging steels – Cast Irons - Grey, White, malleable, Spheroidal Graphite, Alloy cast irons, Copper and Copper alloys - Brass, Bronze and Cupronickel – Aluminum and Al-Cu Alloy – Precipitation hardening– Bearing alloys. Introduction to Powder Metallurgy.

UNITV NON-METALLIC MATERIALS **9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PS, PVC, PMMA, PC, PA, ABS, PTFE Polymers – Urea and Phenol Formaldehydes – Engineering Ceramics –Introduction to Fibre reinforced polymers.

TOTAL : 45 PERIODS

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COURSE OUTCOMES:

The students will be able to

- Knowledge about the basic structure of metal and non metal.
- Understand the heat treatment process.
- Select the required testing techniques for different materials.
- Gain knowledge on different class of materials and their applications.
- Know about ceramics and fibre reinforced polymers as well as its applications.

TEXT BOOKS:

1. Dieter G. E., "Mechanical Metallurgy", Mc Graw Hill Book Company, 2013.
2. William F Smith and Javad Hashemi, "Foundations of Materials Science & Engineering", McGraw Hill, 5th Edition, 2010.
3. Kenneth G.Budinski and Michael K.Budinski, "Engineering Materials Properties and Selection", Prentice-Hall of India Private Limited, 8th Indian Reprint, 2009.

REFERENCE BOOKS:

1. O.P. Khanna, "A Text book of Materials Science and Metallurgy", Dhanpat Rai Publications, 2014.
2. William D Callister and Jr. David G.Rethwisch, "Material Science and Engineering", John Wiley and Sons, 2013.
3. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt., Ltd., 2007.
4. Vijaya. M.S. and G. Rangarajan, "Material Science", Tata McGraw-Hill, 2007.
5. Sydney H.Avner, "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1997.
6. ASM Handbooks, American Society of Metals.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Knowledge about the basic structure of metal and non metal.	1	1	3	1	1	-	-	-	-	-	-	-	1	-	1
Co2	Understand the heat treatment process.	1	1	2	1	1	-	-	-	-	-	-	-	1	-	1
Co3	Select the required testing techniques for different materials.	1	2	2	1	1	-	-	-	-	-	-	-	2	-	1
Co4	Gain knowledge on different class of materials and their applications.	2	2	3	1	1	-	-	-	-	-	-	-	2	-	1
Co5	Know about ceramics and fibre reinforced polymers as well as its applications.	1	2	1	1	2	-	-	-	-	-	-	-	1	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
415MET03	THERMAL ENGINEERING	3	0	0	3	50	50	100

OBJECTIVES:

1. To understand various process in air standard cycles.
2. To understand the principles, working and performance of IC engines.
3. To impart knowledge on steam nozzles and turbines.
4. To understand the basic concepts in air compressors.
5. To study the basic principles of refrigeration systems.

PRE-REQUISITES: Knowledge of Engineering Thermodynamics is required.

UNIT I AIR STANDARD CYCLE **10**

Air standard cycles – Assumptions - Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency – Comparison of cycles -Actual and Theoretical PV diagram of four stroke and two stroke engines.

UNIT II INTERNAL COMBUSTION ENGINES **9**

Classification - Components and their function - Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines - Carburettor system, Diesel pump and injector system. Performance calculation - Comparison of petrol and diesel engine - Lubrication system and Cooling system - Battery and Magneto Ignition System – Exhaust gas analysis – pollution control norms.

UNIT III STEAM NOZZLES AND TURBINES **9**

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow.

Steam Turbines-Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, Governing of Steam Turbines.

UNIT IVAIR COMPRESSOR **9**

Classification and working principle of reciprocating air compressor, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency - Isentropic efficiency of reciprocating air compressors, Multi stage air compressor and Inter cooling -Work of multi stage air compressor.

Rotary compressors-Roots blower, Vane type, Centrifugal compressors and axial flow compressors (Description only).

UNIT V REFRIGERATION SYSTEMS **8**

Refrigerants -Vapour compression cycle- use of P-h chart, Effect of sub cooling and super heating – Performance calculations – working principle of vapour absorption system - Comparison between vapour compression and absorption systems

Construction and working of Ammonia – Water, Lithium bromide – water systems (Description only)

(Use of standard Refrigerant property data book, steam table, Mollier diagram, Psychrometric chart are permitted.)

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COURSE OUTCOMES:

Students will able to

- Calculate the mean effective pressure and air standard efficiency of different gas power cycles.
- Calculate the performance test on IC engine.
- Analyse flow through nozzle and to draw the velocity triangle for impulse and reaction turbine.
- Calculate the efficiency of reciprocating air compressor.
- Evaluate COP of vapour compression refrigeration systems.

TEXT BOOKS:

1. Rajput. R. K., "Thermal Engineering", Laxmi Publications (P) Ltd., 10th Edition, 2017.
2. Kothandaraman.C.P., Domkundwar.S, Domkundwar. A.V., "A Course in Thermal Engineering", Dhanpat Rai & sons, 9th Edition, 2014.

REFERENCE BOOKS:

1. Arora.C.P, "Refrigeration and Air Conditioning", Tata McGraw-Hill Publishers, 3rd Edition, 2013.
2. Ganesan V., "Internal Combustion Engines", Fourth Edition, Tata McGraw-Hill Publishers, 2012.
3. Sarkar, B.K, "Thermal Engineering" Tata McGraw-Hill Publishers, 2010.
4. Rudramoorthy, R, "Thermal Engineering ", Tata McGraw-Hill Publishers, New Delhi, 2010.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Calculate the mean effective pressure and air standard efficiency of different gas power cycles.	3	2	1	-	-	-	-	-	1	1	1	-	2	-	1
Co2	Calculate the performance test on IC engine.	3	2	1	-	-	-	-	-	1	1	1	-	2	-	1
Co3	Analyse flow through nozzle and to draw the velocity triangle for impulse and reaction turbine.	3	2	1	-	-	-	-	-	1	1	1	-	2	-	1
Co4	Calculate the efficiency of reciprocating air compressor.	3	2	1	-	-	-	-	-	1	1	1	-	2	-	1
Co5	Evaluate COP of vapour compression refrigeration systems.	3	2		-	-	-	-	-	1	1	1	-	2	-	1

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		L	T	P	C	CA	EA	Total
415MET04	STRENGTH OF MATERIALS	3	0	0	3	50	50	100

OBJECTIVES:

1. To understand the simple stresses and strains, thermal stresses and strains, biaxial stresses and strains in deformable bodies.
2. To gain the knowledge about shear force and bending moment.
3. To understand the concept of torsional strength, rigidity and flexibility of shafts and helical springs.
4. To understand the stresses and deflection in beams and columns.
5. To understand the stresses and deformation in cylindrical shells, spherical shells and inclined planes.

PRE-REQUISITES: Knowledge of Engineering Mechanics is required.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS **10**

Rigid and deformable bodies, Stresses and strains – Tensile, Compressive and Shear, Stress-strain curves, Hook's law, Factor of safety, Superposition principle, Deformation of simple and compound bars under axial loads, Thermal stresses and strains, Elastic constants, Strain energy, strain energy in uniaxial loads, Strain energy in the deformable member under uniaxial load.

UNIT II SHEAR FORCE AND BENDING MOMENT IN BEAMS **10**

Types of beams, Supports and loads, Shear force and bending moment in beams – Cantilever, Simply supported and overhanging beams.

Stresses in beams, Theory of simple bending, Section modulus for various beam sections, Shear stress in beams, Effect of shape of beam section on stresses.

UNIT III TORSION OF SHAFTS AND SPRINGS **9**

Analysis of torsion of circular bars, Shear stress distribution, Solid and Hollow circular shafts, Compound shafts, Stepped shafts, Power transmitted by shafts.

Closed-coil helical springs – Stresses and deflection under axial load, Wahl's factor, Design of helical coil springs, Stresses in helical coil springs under torsion loads.

UNIT IV DEFLECTION OF BEAMS AND COLUMNS **8**

Elastic curve of neutral axis of the beam, Evaluation of beam deflection and slope – Double integration method and Macaulay method.

Columns – End conditions, Equivalent length of a column, Euler's equation, Slenderness ratio, Rankine's formula for columns.

UNIT V BI-AXIAL STRESSES **8**

Stresses in thin cylindrical and spherical shells – Circumferential stress, longitudinal stress, Deformation in thin cylindrical and spherical shells subjected to internal pressure.

Biaxial stresses at a point, Stresses on inclined plane, Principal planes and stresses, Mohr's circle for biaxial stresses.

TOTAL : 45 PERIODS

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COURSE OUTCOMES:

The students will be able to calculate

- Stresses and strains in the machine members subjected to axial loads.
- Shear force, bending moment, bending stress and shear stress induced in beam.
- Deflection in beams, column, torsion in shafts and springs.
- Deflection for different types of beams and columns.
- Stresses and deformation in cylindrical, spherical shell and on an inclined plane.

TEXT BOOKS:

1. S. Ramamrutham and R. Narayan, "Strength of Materials", Dhanpat Rai and Sons, New Delhi, 18th Edition, 2018.
2. Beer, Johnson and Dewolf, "Mechanics of Materials", Sixth Edition, McGraw-Hill, 2013.

REFERENCES BOOKS:

1. S. S. Bhavikatti, "Strength of Materials", Vikas Publishing House, New Delhi, 2012.
2. R.K. Bansal, "Strength of Materials" Lakshmi publications (p) Ltd, New Delhi, 2010.
3. P. Egor Popov, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2009.
4. S.P. Timoshenko and D.H. Young, "Elements of Strength of Materials", Tata McGraw-Hill, Seventh Edition, New Delhi, 2009.
5. W.A. Nash, "Strength of Materials", Fourth Edition, Schaum's Outline Series, 2007.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Stresses and strains in the machine members subjected to axial loads.	2	2	3	1	-	-	-	-	-	-	-	-	2	-	-
Co2	Shear force, bending moment, bending stress and shear stress induced in beam.	2	1	2	1	-	-	-	-	-	2	-	-	2	1	-
Co3	Deflection in beams, column, torsion in shafts and springs.	2	2	3	2	-	-	-	-	-	-	-	-	2	-	-
Co4	Deflection for different types of beams and columns.	2	2	3	2	-	-	-	-	-	-	-	-	2	-	-
Co5	Stresses and deformation in cylindrical, spherical shell and on an inclined plane.	2	2	3	-	-	-	-	-	-	-	-	-	2	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
415MET05	MANUFACTURING TECHNOLOGY – II	3	0	0	3	50	50	100

OBJECTIVES:

1. To know the fundamentals of metal cutting like cutting forces, tool materials, tool life, surface finish (machinability).
2. To learn the parts and working principle of centre lathe and special purpose lathes.
3. To gain the knowledge about special purpose machines used in industrial application.
4. To study the abrasive processes and gear cutting.
5. Able to know about basic usage of CNC machines, its construction and learning about program.

PRE-REQUISITES: Knowledge of Manufacturing Technology I and Engineering Materials and Metallurgy is required.

UNIT I THEORY OF METAL CUTTING **9**

Introduction: Material removal processes, types of machine tools – theory of metal cutting: chip formation, orthogonal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES **9**

Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – Automats – single spindle, Swiss type, Automatic screw type, Multi spindle - Turret Indexing mechanism, Bar feed mechanism.

UNIT III SPECIAL MACHINES **9**

Reciprocating machine tools: Shaper, Planer, Slotter - Milling: types, milling cutters, operations - Hole making: drilling - Quill mechanism, Reaming, Boring, Tapping - Sawing machine: Hack saw, band saw, circular saw; broaching machines: broach construction – push, pull, surface and continuous broaching machines.

UNIT IV ABRASIVE PROCESSES AND GEAR CUTTING **9**

Abrasive processes: grinding wheel – specification and selection, types of grinding process – cylindrical grinding, surface grinding, Centreless grinding – Honing, Lapping, Super finishing, Polishing and Buffing, Gear cutting, Forming, Generation, Shaping, Hobbing.

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING **9**

Numerical control (NC) machine tools – CNC: types, constructional details, special features – design considerations of CNC machines for improving machining accuracy – Structural members – Slide ways –Linear bearings – Ball screws – Spindle drives and feed drives, Part Programming fundamentals – Manual programming – Computer Assisted Part Programming.

TOTAL : 45 PERIODS

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COURSE OUTCOMES:

The students will be able to

- Gain the knowledge on the fundamentals of metal cutting, merchant circle diagram, to solve tool life problems, types of wear, tool-tip temperature.
- Learn various types of centre lathe and special purpose lathes.
- Learn various types and operations of drilling machine, boring and reaming, broaching, shaping and planning, grinding, honing, lapping and super finishing operations.
- Learn the manufacturing processes of abrasive processes and gear cutting.
- Know the concepts of Part programming and about CNC machine tools.

TEXT BOOKS:

1. P.N. Rao, "Manufacturing Technology, Metal Cutting and Machine Tools", Tata McGraw–Hill, New Delhi, 3rd Edition, 2011.
2. Hajra Choudry, "Elements of Work Shop Technology – Vol. II", Media Promoters, 2010.
3. Shrawat N.S. and Narang J.S., "CNC Machines", Dhanpat Rai & Co., 2002.

REFERENCE BOOKS:

1. Milton C.Shaw, "Metal Cutting Principles", Oxford University Press, Second Edition, 2011.
2. P.N. Rao, "CAD/CAM Principles and Applications", Tata McGraw Hill, 3rd Edition 2011.
3. P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Co. Ltd, 2010.
4. Rajput R.K, "A Text Book of Manufacturing Technology", Lakshmi Publications, 2010.
5. Chapman. W. A. J and S.J. Martin, "Workshop Technology", Volume 3, Viva Books, 2006.
6. Serope KalpakJian, Steven R Schmid, "Manufacturing Engineering and Technology", Prentice Hall, 6th Edition, 2006.
7. HMT – "Production Technology", Tata McGraw-Hill, 23rd Edition, 2005.
8. M.P.Groover and Zimers Jr., "CAD/CAM", Prentice Hall of India Ltd., 2002.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Gain the knowledge on the fundamentals of metal cutting, merchant circle diagram, to solve tool life problems, types of wear, tool-tip temperature.	1	2	3	1	1	-	-	-	-	-	-	-	2	-	2
Co2	Learn various types of centre lathe and special purpose lathes.	1	1	2	2	1	-	-	-	-	-	-	-	1	-	2
Co3	Learn various types and operations of drilling machine, boring and reaming, broaching, shaping and planning, grinding, honing, lapping and super finishing operations.	1	2	3	1	1	-	-	-	-	-	-	-	2	-	1
Co4	Learn the manufacturing processes of abrasive processes and gear cutting.	1	1	3	1	1	-	-	-	-	-	-	-	2	-	1
Co5	Know the concepts of Part programming and about CNC machine tools.	1	3	2	1	1	-	-	-	-	-	-	-	1	-	2

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
415MET06	MACHINE DRAWING	2	0	4	4	50	50	100

OBJECTIVES:

1. To know the specifications and symbols of standard machine components used in machine drawing.
2. To study about the types of keys and joints.
3. To understand the assembly concepts.
4. To understand the concept of various tolerances and fits used for component design.
5. To understand and create the assembly drawings of machine components.

PRE-REQUISITES: Knowledge of Engineering Graphics is required.

INTRODUCTION: (Not for examination) **2**

Introduction to machine drawing. Review of dimensioning orthographic and isometric projections, Importance of sectional views - full section, half section and auxiliary sections.

PART – A

STANDARD CONVENTIONS **4**

Code of practice for engineering drawing: conventional representation of details - drilled and tapped holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves, chamfers, fillet radii and keyways.

Conventions to represent standard components - Bolts, Nuts, Washers, Screws, Cotters, Pins, Circlips, Bearings, Gears, Springs, Flanges and weldments.

KEYS AND JOINTS **6**

Keys – Parallel, Taper, Feather, Gib head and Woodruff key.

Riveted joints - Single and double riveted lap joints, Butt joints with single/double cover straps (Chain and zigzag using snap head riveters).

ASSEMBLY CONCEPTS **6**

Methods and concepts of assemblies - assembly requirements, Bill of materials, Methods of assembly - Bolts, Nuts, Studs, Screws and Pins, Methods of arresting motion of a member in an assembly.

ELEMENTS OF PRODUCTION DRAWING **6**

Limits, Fits - Types of fits, Tolerances-need, types, Representation of tolerances on drawing, Calculation of minimum and maximum clearances and allowances, Geometric tolerance - uses, Types of form and position tolerances, Symbols, Method of indicating geometric tolerances on part drawings. Surface finish symbols - methods of indicating the surface roughness. Blue print reading exercises. Making blue print drawing of production drawings.

PART – B

ASSEMBLY DRAWING PRACTICE: (Preparation of assembled view) **36**

Assembly drawing with sectioning and bill of materials from given part drawings of assemblies like Sleeve and Cotter Joint, Knuckle Joint, Universal coupling, Flange coupling (Protected type), Plummer Block (Pedestal Bearing), Swivel Bearing, Screw jack, Machine vice, Lathe tailstock, Petrol Engine piston and connecting rod.

TOTAL: 60 PERIODS

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Examination Scheme:
Two questions to be set from Part-A with either or choice and one question from Part-B.
The Part-A questions may be descriptive and/or drawing and Part-B question should be assembly drawing.
Student has to answer ONE 10 marks question and ONE 20 marks question from Part-A and ONE 70 marks question from Part-B.
PART-A (1 x 10 = 10 Marks, 1 x 20 = 20 Marks)
PART-B (1 x 70 = 70 Marks)

COURSE OUTCOMES:
The students will be able to

- Represent the conventions of standard machine components
- Use the different types of keys and joints for machine components
- Create the Bill of materials for drawing
- Represent the fits and tolerance in drawing
- Draw the assembled view of the part drawings of the assemblies.

TEXT BOOKS:

1. Bhatt N.D. and Panchal V.M., "Machine Drawing", Forty Seventh Edition, Charotar Publishing House Pvt. Ltd., 2012.
2. Gopalakrishna K.R., "Machine Drawing", Twenty First Edition, Subhas Stores, 2012.

REFERENCE BOOKS:

1. Basudeb Bhattacharyya, "Machine Drawing", Oxford University Press, 2011.
2. Narayana K.L., Kannaiah P and Venkata Reddy K, "Machine Drawing". Third Edition, New Age International (P) Limited Publishers, 2009.
3. Sidheswar N, Kannaiah P and Sastry V.V.S, "Machine Drawing", Tata McGraw Hill, 2006.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Represent the conventions of standard machine components	1	2	3	1	-	-	-	-	-	-	-	-	3	-	1
Co2	Use the different types of keys and joints for machine components	1	2	3	1	-	-	-	--	-	-	-	-	3	-	1
Co3	Create the Bill of materials for drawing	1	2	3	-	-	-	-	-	-	-	-	1	1	-	-
Co4	Represent the fits and tolerance in drawing	1	2	3	1	-	-	-	-	-	1	-	-	2	-	1
Co5	Draw the assembled view of the part drawings of the assemblies.	1	1	2	-	-	-	-	-	-	1	-	-	2	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
415MEP07	THERMAL ENGINEERING LABORATORY - I	0	0	4	2	50	50	100

OBJECTIVES:

1. To expertise in the various thermodynamic concepts and principles.
2. To conduct performance tests on a petrol engine and diesel engine, heat balance test, energy balance test on 4 stroke diesel engine.
3. To expertise in the computerized VCR and emission measurement in S.I engine.
4. To expertise in the computerized VCR and emission measurement in C.I engine.
5. To compare justification on conventional fuel with alternative fuel.

PRE-REQUISITES: Knowledge of Engineering Thermodynamics and Thermal Engineering are required.

LIST OF EXPERIMENTS

CYCLE – 1

1. Valve Timing Diagram and Port Timing Diagram.
2. Performance Test on 4-stroke S.I Engine.
3. Performance Test on 4-stroke C.I Engine.
4. Heat Balance Test on 4-stroke Diesel Engine.
5. Morse Test on Multi - cylinder Petrol Engine.
6. Retardation Test to find Frictional Power of a Diesel Engine.

CYCLE – 2

7. Performance Test on Computerised VCR S.I and C.I Engine.
8. Emission measurement in S.I and C.I Engine.
9. Determination of Viscosity of fuel oils.
10. Determination of Flash Point and Fire Point of fuel.
11. Boiler efficiency and energy balance sheet.
12. Performance Test on two stage Reciprocating Air Compressor.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will able to

- Draw the valve and port timing diagram.
- Perform experiments on the engine and draw the characteristics curve.
- Perform experiments on computerised VCR S.I and C.I Engine.
- Perform experiments on two stage Reciprocating Air Compressor and draw the characteristics curve.
- Perform experiments to determine the properties of fuels and oils.

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Draw the valve and port timing diagram.	1	2	-	2	2	1	-	-	2	1	-	-	2	-	1
Co2	Perform experiments on the engine and draw the characteristics curve.	2	2	-	2	2	1	-	-	2	1	-	-	2	-	1
Co3	Perform experiments on computerised VCR S.I and C.I Engine.	2	2	-	2	2	1	-	-	2	1	-	-	2	-	1
Co4	Perform experiments on two stage Reciprocating Air Compressor and draw the characteristics curve.	1	2	-	2	2	1	-	-	2	1	-	-	2	-	-
Co5	Perform experiments to determine the properties of fuels and oils.	1	2	-	2	2	1	-	-	2	1	-	-	2	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
415MEP08	MATERIAL TESTING AND METALLURGY LABORATORY	0	0	4	2	50	50	100

OBJECTIVES:

1. To understand the basic principles of strength of materials to the undergraduate students through a series of experiments.
2. To evaluate the mechanical properties of materials.
3. To learn the concept of testing of materials under untreated and heat treated conditions.
4. To understand the various microstructure of engineering materials by metallographic examination.
5. To study about various non – destructive testing methods.

PRE-REQUISITES: Knowledge of Strength of Materials is required.

LIST OF EXPERIMENTS

PART – A

1. Tension test on a mild steel rod.
2. Double shear test on Mild steel and Aluminium rods.
3. Torsion test on mild steel rod.
4. Impact test on metal specimen.
5. Hardness test on metals - Brinell and Rockwell Hardness Number.
6. Deflection test on beams.
7. Compression test on helical springs.

PART – B

8. Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray CI, SG iron, Brass, Bronze & composites.
9. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat – treated samples.
10. Non – destructive test experiments like,
    (a) Ultrasonic flaw detection
    (b) Magnetic crack detection
    (c) Dye penetration testing, to study the defects of Casted and Welded specimens.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

- The student will have the knowledge to perform various mechanical testing.
- The student will have the knowledge to prepare the specimens as per standard for mechanical testing.
- The student will be able to analyze the microstructure of various engineering materials.
- The students will have an ability to conduct experiment of materials under untreated and heat treated conditions.
- The student will have the knowledge of performing various non – destructive tests.

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The student will have the knowledge to perform various mechanical testing.	1	2	-	3	2	-	-	-	-	-	-	-	2	-	-
Co2	The student will have the knowledge to prepare the specimens as per standard for mechanical testing.	1	2	1	3	2	-	-	-	-	-	-	-	2	-	1
Co3	The student will be able to analyze the microstructure of various engineering materials.	1	2	-	3	2	-	-	-	-	-	-	-	2	-	1
Co4	The students will have an ability to conduct experiment of materials under untreated and heat treated conditions.	1	2	-	3	2	-	-	-	-	-	-	-	2	-	1
Co5	The student will have the knowledge of performing various non – destructive tests.	1	2	-	3	2	-	-	-	-	-	-	-	2	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
415MEP09	MANUFACTURING TECHNOLOGY LAB II	0	0	4	2	50	50	100

OBJECTIVES:

1. To know the machining operations on Shaper, Lathe, Milling, Drilling and Slotting.
2. To know about Milling Machine: Indexing methods, Cutting of gear tooth (Spur gear, Helical gear), face milling, grooving and cylindrical grinding operation.
3. To understand the Surface Grinding operations and cylindrical grinding machine.
4. To understand the working principles of Capstan and Turret lathes.
5. To understand the working principles of gear hobbing operation.

PRE-REQUISITES: Knowledge of Manufacturing Technology I and II are required.

LIST OF EXPERIMENTS

1. Two or more measurements in metal cutting experiment (Example: Shear Angle, Cutting Force, Tool Wear etc.)
2. One or More Exercises in Shaper, Slotter, Planner, Drilling, Milling Machines (Example: Round to Square, Dovetail in shaper, Internal keyway cutting in Slotter, Round to square in Planner, Drilling, Reaming and Tapping in Drilling machine, Gear Milling and Keyway milling in Milling machine.)
3. Two or More Exercises in Grinding / Abrasive machining (Example: Surface Grinding, Cylindrical Grinding.)
4. Two or More Exercises in Assembly of Machined Components for different fits. (Example: Parts machined using Lathes, Shapers, Drilling, Milling, and Grinding Machines etc.)
5. One or More Exercises in Capstan or Turret Lathes.
6. One or More Exercises in Gear Machining (Example: Gear Milling, Gear Hobbing etc.)

TOTAL : 45 PERIODS

COURSE OUTCOMES:

The students will be able to

- Calculate machining time, metal removal rate for all machining operation.
- Prepare the models with dimensional accuracy and tolerance using the special purpose machineries.
- Find suitable machining process for suitable applications.
- Perform Lathe, Milling and Drilling operations
- Perform Grinding, Milling and Drilling operations.

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Prepare the models with dimensional accuracy and tolerance using the special purpose machineries.	1	1	2	3	1	-	1	-	-	-	-	-	2	-	1
Co2	Knowledge about indexing method and gear cutting operation using milling machines.	1	2	2	3	1	-	-	-	-	-	-	-	2	-	2
Co3	Perform Grinding operations using surface and cylindrical grinding machines.	2	2	2	3	1	-	-	-	-	-	-	-	2	-	1
Co4	Understand working of capstan and turret lathes.	1	2	3	3	1	-	-	-	-	-	-	-	2	-	1
Co5	Perform the gear cutting operation using hobbing machine.	1	1	2	3	1	-	-	-	-	-	-	-	2	-	2

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
515MET01	METROLOGY AND INSTRUMENTATION	3	0	0	3	50	50	100

OBJECTIVES:

1. To comprehend the concept of measurement system and understanding the geometric dimensioning and tolerancing.
2. To know about linear and angular measurement.
3. To impart knowledge about advanced measurement system.
4. To know about the micrometer, gear testing machines.
5. To know about measurement of mechanical parameter by using different instrument and devices in practical applications.

PRE-REQUISITES: Knowledge of Engineering Physics is required.

UNIT I CONCEPT OF MEASUREMENT **9**

General concept - Generalised measurement system-Units and standards-measuring instruments: Definitions of sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration - Introduction to Dimensional and Geometric Toleranceing – interchangeability, Transducers-Types-L.V.D.T.

UNIT II LINEAR AND ANGULAR MEASUREMENT **9**

Definition of metrology-Linear measuring instruments: Vernier, Micrometer, Slip gauges and classification, Tool Makers Microscope - interferometery, optical flats, Comparators: limit gauges Mechanical, Pneumatic and Electrical comparators, applications. Angular measurements: -Sine bar, Sine center, Bevel Protractor and Angle Decker.

UNIT III FORM MEASUREMENT **9**

Measurement of screw threads: Thread gauges, floating carriage micrometer- measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine - radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

UNIT IV LASER AND 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- computer aided inspection.

UNIT V MEASUREMENT OF MECHANICAL PARAMETERS **9**

Force, torque, power: mechanical, pneumatic, hydraulic and electrical type-Pressure measurement - Flow: Venturi, Orifice meter, Rotameter, Pitot tube-Temperature: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor.

TOTAL: 45 Hours

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COURSE OUTCOMES:

The students will be able to

- Know about the working principle of generalized measurement system, the knowledge on calibration and definitions of various measurement terms.
- Know about the concepts of linear and angular measuring instruments.
- Know the concepts of gear measuring instruments, definitions of straightness, flatness, roundness terms.
- Gain knowledge on working principle of Laser devices and Coordinate measuring machine.
- Gain knowledge on how to measure the instrumentation parameters like force, power, torque, flow and temperature.

TEXT BOOKS:

1. Jain R.K., "Engineering Metrology", Khanna Publishers, 21st Edition, 2012.
2. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997.
3. D.S.Kumar, "Mechanical Measurements and Control", Metropolian Publisher, New Delhi, Revised and Enlarged, 2002.

REFERENCE BOOKS:

1. Thomas G.Beckwith, Roy D.Marangoni, John H.Lienhard V, "Mechanical Measurements", Pearson Education, 6th Edition, 2006.
2. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2005.
3. Donald P Eckman, "Industrial Instrumentation", CBS, 2004.
4. Tayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Know the generalized measurement system, the knowledge on calibration and definitions of various measurement terms.	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
Co2	Understand the concepts of linear and angular measuring instruments.	1	-	3	2	1	-	-	-	-	-	-	-	2	-	-
Co3	Know the concepts of gear measuring instruments, definitions of straightness, flatness, roundness terms.	2	-	3	1	2	-	-	-	-	-	-	-	3	-	1
Co4	Gain knowledge on working principle of Laser devices and Coordinate measuring machine.	2	-	3	2	3	-	-	-	-	-	-	-	2	-	-
Co5	Gain knowledge on how to measure the instrumentation parameters like force, power, torque, flow and temperature.	2	-	2	3	1	-	-	-	-	-	-	-	2	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
515MET02	HEAT AND MASS TRANSFER	3	0	0	3	50	50	100

OBJECTIVES:

1. To study about the basic concepts of heat transfer modes.
2. To analyze the relationship between fluid flow and convection heat transfer.
3. To study about the fundamental concepts of radiation heat transfer to include both black body radiation and gray body radiation.
4. To learn the thermal analysis and sizing of heat exchangers.
5. To study about the basic concepts of mass transfer and its applications.

PRE-REQUISITES: Knowledge of Engineering Thermodynamics and Fluid mechanics is required.

UNIT I CONDUCTION **14**

Introduction and basics of heat transfer– Modes of Heat Transfer – Conduction, Convection and Radiation – Effect of temperature on thermal conductivity of different solids, liquids and gases – Fourier's law of Conduction – Newton's Law of cooling– Derivation of generalized heat conduction equation in Cartesian and Polar coordinates and its reduction to specific cases – OneDimensionalSteady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical Systems – Composite Systems – Conduction with Internal Heat Generation– Critical radius of insulation – Extended Surfaces – Unsteady state Heat Conduction – Lumped system Analysis –Semi-Infinite and Infinite solids –Use of Heisler's Charts.

UNIT II CONVECTION **13**

Introduction to Convection Fundamentals – Velocity and Thermal boundary layer – Types of Convection –Dimensional analysis applied to forced and free convection– Dimensionless numbers and their physical significance–Forced Convection – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes – Free Convection – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS **12**

Boiling heat transfer – Pool boiling–Pool boiling curve–Flow boiling – Nusselt's theory of condensation– Condensation heat transfer, film condensation – Heat transfer correlations in boiling and condensation. Types of Heat Exchangers – Overall Heat Transfer Coefficient – Fouling Factors –Analysis of heat exchangers – LMTD Method and ε-NTU method.

UNIT IV RADIATION **11**

Introduction to Radiation – Absorptivity, Reflectivity and Transmissivity– black, white and grey body, emissive power and emissivity– Laws of radiation – Planck, Stefan-Boltzmann, Wein's displacement, Kirchhoff's law, Lambert's cosine law – Radiation heat exchange between black bodies – Shape factor–Heat exchange between non-black bodies– Infinite parallel planes and infinite long concentric cylinders– Radiation shield– Heat exchange between two grey surfaces– electrical analogy –Introduction to Gas Radiation.

UNIT V MASS TRANSFER **10**

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.

TOTAL : 60 Hours

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COURSE OUTCOMES:

The student will be able to

- Intrepret conduction, convection and radiation heat transfer.
- Solve problems involving steady-state and transient heat conduction in simple geometries.
- Determine values of the convection heat transfer co-efficient by applying empirical correlations.
- Analyze heat transfer performance by using the method of log mean temperature difference and heat exchanger effectiveness.
- Evaluate radiation heat transfer between black body and gray body surfaces.

TEXT BOOKS:

1. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International Publishers, 5th Edition, 2017.
2. Yunus A Cengel and Afshin J Ghajar, "Heat and Mass transfer" Tata McGraw-Hill, New Delhi, 5th Edition, 2015.

REFERENCE BOOKS:

1. Frank P. Incropera, David P. Dewitt, Theodore L. Bergman and Adrienne S Lavine, "Fundamentals of Heat and Mass Transfer", Wiley, 7th Edition, 2013.
2. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International Publishers, New Delhi, 4th Edition, 2012.
3. Nag P.K, "Heat and Mass Transfer", Tata McGraw-Hill Education, New Delhi, 3rd Edition, 2011.
4. Holman J.P and Souvik Bhattacharyya, "Heat Transfer", McGraw-Hill Education, 10th Edition, 2010.
5. Rudramoorthy R and Mayilsamy K, "Heat and Mass Transfer", Pearson Education, 2nd Edition, 2010.
6. Yadav R, "Heat and Mass Transfer", Central Publishing House, 4th Edition, 2004.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Understand the basic laws of heat transfer and account for the consequence of heat transfer in thermal analyses of engineering systems.	3	2	-	2	2	-	-	-	-	1	-	-	3	-	1
Co2	Solve problems involving steady-state and transient heat conduction in simple geometries.	2	2	-	2	2	-	-	-	-	1	-	-	3	-	2
Co3	Evaluate heat transfer coefficients for natural convection and forced convection inside ducts and over the surfaces.	2	2	-	2	2	-	-	-	-	1	-	-	3	-	2
Co4	Analyze heat transfer performance by using the method of log mean temperature difference and heat exchanger effectiveness.	2	2	-	2	2	-	-	-	-	1	-	-	3	-	1
Co5	Calculate radiation heat transfer between black body and gray body surfaces.	1	2	-	-	-	-	-	-	-	-	-	-	1	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
515MET03	KINEMATICS OF MACHINERY	3	1	0	4	50	50	100

OBJECTIVES:

1. To differentiate between machine, mechanism and structure.
2. To draw velocity and acceleration diagrams for different linkages.
3. To design cam profile for the desired follower motion.
4. To determine gear parameters and check for interference.
5. To synthesis linkages for different mechanisms.

PRE-REQUISITES: Knowledge of Engineering Mechanics is required

UNIT- I BASICS OF MECHANISMS **12**

Definitions – Link, Kinematic pair, Kinematic chain, Mechanism and Machine. Degree of Freedom – Mobility, Kutzbach criterion (Gruebler's equation), Grashoff's law, Kinematic Inversions of four bar chain and slider crank chain, Mechanical Advantage, Transmission angle.

Description of common Mechanisms - Offset slider mechanism, Quick return mechanisms, Pantograph, Straight line generators (Peaucellier and Watt mechanisms), Steering gear for automobile, Hooke's joint, Toggle mechanism, Ratchets and escapements, Indexing Mechanisms.

UNIT - II KINEMATIC ANALYSIS **12**

Analysis of simple mechanisms - Single slider crank mechanism and four bar mechanism, Graphical Methods for displacement, velocity and acceleration, Shaping machine mechanism, Coincident points, Coriolis acceleration, Analytical method of analysis - slider crank mechanism, and four bar mechanism. Approximate analytical expression for displacement, velocity and acceleration of piston of reciprocating engine mechanism.

UNIT- III KINEMATICS OF CAMS **12**

Classifications of Cams-Displacement diagrams - Parabolic, Simple harmonic and Cycloidal motions, Graphical construction of displacement diagrams and layout of plate cam profiles - circular arc and tangent cams, Pressure angle and undercutting.

UNIT - IV GEARS & GEAR TRAINS **12**

Classification of gears, Gear tooth terminology, Fundamental Law of toothed gearing and involute gearing, Length of path of contact and contact ratio, Interference and undercutting, Gear trains – Simple, compound, Epicyclic gear trains and Differentials.

UNIT-V SYNTHESIS OF LINKAGES **12**

Numbers and Dimensional synthesis- Functional generation, path generation and motion generation- Graphical methods-Two position synthesis of slider crank and four bar mechanism.

TOTAL: 60 Hours

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COURSE OUTCOMES:

The students will be able to

- Demonstrate the simple mechanisms with suitable examples.
- Determine displacement, velocity and acceleration of any point on a link in simple mechanism.
- Construct cam profile for various follower motions
- Describe law of gearing, types of gears, terminologies of spur gears and gear trains.
- Analyze and synthesis position, velocity and acceleration for various mechanisms

TEXT BOOKS:

1. Rattan S.S, "Theory of Machines", Tata McGraw Hill Education Pvt. Ltd., 4th Edition, 2017.
2. Ambekar A. G., Mechanism and Machine Theory, Prentice Hall of India, New Delhi, 2015.
3. UickerJ.J., Pennock G.R., Shigley J.E., "Theory of Machines and Mechanisms"(Indian Edition), Oxford University Press, 2010.

REFERENCE BOOKS:

1. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", Wiley-Eastern Ltd., New Delhi, 2007.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 2005.
3. Robert L.Norton, "Design of Machinery", Tata Mc Graw Hill, 2005.
4. Khurmi R.S, "Theory of Machines", S. Chand & Co. Ltd., New Delhi, 14th Edition, 2005.
5. Ramamurti,V.,' Mechanism and Machine Theory", Second Edition, Narosa Publishing House, 2005.
6. John Hannah and Stephens R.C, "Mechanics of Machines", Viva Low-Price Student Edition, 1999.
7. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1999.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Define the basic mechanisms for developing a machine.	3	2	2	-	-	-	1	-	-	-	-	-	3	-	2
Co2	Construct velocity and acceleration diagram for mechanism.	3	3	1	-	-	-	-	-	-	1	-	-	2	-	2
Co3	Construct cam profile for different follower motions.	3	3	1	1	-	-	-	-	-	-	1	-	1	-	2
Co4	Design the gear and gear trains in practical applications.	3	2	2	1	-	-	-	-	-	-	2	-	2	-	2
Co5	Design and synthesis mechanisms for specific type of relative motion.	2	2	-	1	-	-	-	-	-	-	-	-	2	-	2

Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
515MET04	DESIGN OF MACHINE ELEMENTS	3	1	0	4	50	50	100

OBJECTIVES:

1. To familiarize the various steps involved in the Design Process.
2. To acquire knowledge on standards and procedure for designing shaft and coupling.
3. To interpret the design of bolt, welded and riveted joint so as to meet desired needs within the realistic constraints.
4. To analyse the design of energy storing elements in order to perform safely with their intended functions
5. To impart the design principles to evaluate the bearings in order to satisfy the strength and functional requirements.

PRE-REQUISITES: Knowledge of Strength of Materials is required.

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 12

Introduction to the design process - factor influencing machine design, Selection of materials based on mechanical properties, Direct, Bending and torsional stress equations, Impact and shock loading, Calculation of principal stresses for various load combinations, Eccentric loading, Factor of safety, Theories of failure, Stress concentration, Design for variable loading - Soderberg, Goodman and Gerber relations.

UNIT II DESIGN OF SHAFTS AND COUPLINGS 12

Design of solid and hollow shafts based on strength, rigidity and critical speed, Design of keys, key ways and splines, Design of rigid couplings – Muff, Split muff and flange coupling, Design of flexible couplings - Bushed pin and Oldham coupling.

UNIT III DESIGN OF TEMPORARY AND PERMANENT JOINTS 12

Threaded fasteners, Design of bolted joints including eccentric loading, Knuckle joint, Cotter joints, Design of welded joints including eccentric loading, Riveted joints for structures including eccentric loading.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS 12

Various types of springs, Design of helical springs under compression and tension, Design of leaf springs, Design of flywheels considering stresses in rims and arms for engines and punching machines.

UNIT V DESIGN OF BEARINGS 12

Theory of lubrications, Sliding contact and rolling contact bearings, Design of hydrodynamic journal bearings, McKee's equations, Sommerfield number, Raimondi & Boyd graphs, Selection of rolling contact bearings.

TOTAL: 60 Hours

Note: (Use of P S G Design Data Book is permitted in the end semester examination)

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COURSE OUTCOMES:

The students will be able to

- Apply the concept of steady stresses in design of machine elements.
- Design shafts and couplings for various applications.
- Design temporary and permanent joints.
- Design various energy storing elements.
- Select bearings for specific applications.

TEXT BOOKS:

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", 10th Edition, Tata McGraw-Hill, 2015.
2. Bhandari V.B, "Design of Machine Elements", Third Edition, Tata McGraw-Hill Book Co, 2010.

REFERENCE BOOKS:

1. Orthwein W, "Machine Component Design", Jaico Publishing Co, digitized 2010.
2. Ugural A.C, "Mechanical Design - An Integrated Approach", McGraw-Hill Book Co, 2004.
3. Spotts M.F., Shoup T.E., "Design and Machine Elements", Pearson Education, 2004.
4. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Apply the concept of steady stresses in design of machine elements.	2	-	1	-	-	-	-	-	-	-	-	1	1	-	1
Co2	Design shafts and couplings for various applications.	2	1	-	1	-	-	-	-	-	-	-	1	-	2	-
Co3	Design temporary and permanent joints.	2	2	-	2	-	-	-	-	-	-	-	1	-	3	-
Co4	Design various energy storing elements.	-	1	-	2	-	-	-	-	-	-	-	2	-	-	2
Co5	Select bearings for specific applications.	-	-	-	-	-	2	-	-	-	1	-	-	-	1	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
515MET05	APPLIED HYDRAULICS AND PNEUMATICS	3	0	0	3	50	50	100

OBJECTIVES:

1. To familiar with applications, advantages of the fluid power engineering and transmission systems.
2. To learn the function of fluid power system in hydraulic system and components.
3. To know the function of fluid power system with control components, accessories of hydraulic systems.
4. To learn the function of fluid power system for pneumatic system and components.
5. To draw the invention of circuits for hydraulic and pneumatic power systems in the industrial applications.

PRE-REQUISITES: Knowledge of Engineering Physic I, Basics of Civil and Mechanical Engineering and Fluid Mechanics and Machinery are required.

UNIT I FLUID POWER PRINCIPLES AND FUNDAMENTALS 6

Introduction to Fluid power- Advantages and Applications- Types of fluid power systems – Fluid power symbols-Types of fluids- Properties of hydraulics fluids – Applications of Pascal's Law-Principles of flow –Work, Power and Torque-Darcy–Weisbach equation, Losses in pipe, valves and fittings .

UNIT II HYDRAULIC SYSTEMS AND COMPONENTS 9

Sources of Hydraulic power: Pumping theory – Pump classification- Variable displacement pumps for Gear pump, Vane pump and Piston pump Construction, working principle, advantages, disadvantages and Performance-Types of hydraulic cylinders- Linear cylinders, Rotary cylinders, construction, working principle, advantages, disadvantages and applications- Cushioning Mechanism in cylinder.

UNIT III CONTROL COMPONENTS, ACCESSORIES OF HYDRAULIC SYSTEMS 9

Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation, Applications – Types of actuation- Accessories: Reservoirs, Accumulators, Intensifiers and Pressure Switches- Applications.

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS 9

Properties of air-Compressors- (FRL)Filter, Regulator, Lubricator ,Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems and Proportional valves -Introduction the fluidics devices -Pneumatic logic circuits.

UNIT V HYDRAULIC AND PNEUMATIC CIRCUITS AND TROUBLESHOOTING 12

Hydraulic circuits: Regenerative (with accumulator devices), Fail-safe, Speed control, Sequence, Electro hydraulic circuits-Case studies of to draw the circuits of hydraulic system for the Shaping and Punching operation (with intensifier device).

Pneumatic circuits: Sequential circuit design for simple application (of two or three cylinders) using cascade method-Electro pneumatic circuits- Fluid power circuits failures and troubleshooting.

TOTAL: 45 Hours

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COURSE OUTCOMES:

- The students are able to comprehend the concept of fluid power systems and applications in industries.
- The students are able to select appropriate fluid power driving system and actuators for any given applications.
- The students are able to know about the use of control components, accessories of hydraulic systems.
- The students are able to gain knowledge on pneumatic system and components.
- An ability to design the hydraulic and pneumatic circuits and exposure of diagnose or troubleshoot the power systems.

TEXT BOOKS:

1. Majumdar, S.R., "Oil Hydraulics Systems- Principles and Maintenance", McGraw Hill, 2017.
2. Anthony Esposito," Fluid Power with Applications", Pearson Education, 2013.

REFERENCES BOOKS:

1. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", S. Chand & Co, 2013.
2. Srinivasan .R, "Hydraulic and Pneumatic controls", McGraw Hill, 2008.
3. Micheal J, Pinches and Ashby, J.G., "Power Hydraulics", Longman Higher Education, 1988.
4. Dudley, A Pease and John J Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
5. Anthony Lal, "Oil hydraulic in the service of industry", Allied publishers, 1982.

WEB REFERENCE:

www.nptel.ac.in

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The students are able to know the concept of fluid power systems and applications in industries.	3	1	3	-	3	-	1	-	3	-	3	-	3	-	1
Co2	The students are able to understand the working principle of hydraulic and pneumatic systems.	1	1	-	3	3	-	1	-	-	-	-	-	3	-	-
Co3	The students are able to understand the use of control components, accessories of hydraulic systems.	1	1	3	1	-	-	-	-	-	-	-	-	1	-	3
Co4	The students are able to understand the pneumatic system and components.	1	-	-	-	-	-	-	-	-	-	1	-	1	-	-
Co5	An ability to design practically the hydraulic and pneumatic circuits and exposure of diagnose or troubleshoot the power systems.	3	3	3	-	1	-	-	-	3	-	3	-	1	-	3

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
515MEP07	METROLOGY AND INSTRUMENTATION LABORATORY	0	0	4	2	50	50	100

OBJECTIVES:

1. To gain knowledge on the basic principles of measurements.
2. To learn the various linear and angular measuring equipments, their principle of operation and applications.
3. To learn about various methods of measuring Mechanical parameters.
4. To calculate least count of measuring equipments.
5. To know about the procedure of calibration for various measuring devices.

PRE-REQUISITES: Knowledge of Metrology and Instrumentation is required.

LIST OF EXERCISES

1. Calibration of Vernier / Micrometer / Dial Gauge.
2. Checking Dimensions of part using slip gauges.
3. Measurements of Gear Tooth Dimensions.
4. Measurement of Angle using Sine bar / Sine center / Tool makers microscope.
5. Measurement of Straightness and Flatness using Autocollimator.
6. Measurement of Thread parameters.
7. Setting up of Comparators for inspection (Mechanical / Pneumatic / Electrical).
8. Measurement of Temperature using Thermocouple / Pyrometer.
9. Measurement of Displacement.
10. Measurement of Force.
11. Measurement of Torque.
12. Measurement of Vibration / Shock.
13. Measurement of Dimensional attributes like Cylindricity, Circularity, Flatness, Straightness by using Coordinate Measuring Machine.

TOTAL: 45 Hours

COURSE OUTCOMES:

The students will be able to

- Perform calibration process for micrometer, dial gauge, vernier caliper.
- Perform experiments by using sine bar, gear tooth vernier caliper and tool makers microscope.
- Use autocollimator for straightness and flatness measurement and thermocouple for temperature measurement.
- Learn about coordinate measuring machine for linear and angular measurements.
- Identify sources of variability, error and uncertainties.

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Perform calibration process for micrometer, dial gauge, vernier caliper.	1	1	-	1	2	-	-	-	-	-	-	2	1	1	2
Co2	Perform experiments by using sine bar, gear tooth vernier caliper and tool makers microscope.	1	1	-	2	3	-	-	-	-	-	-	1	1	1	2
Co3	Use autocollimator for straightness and flatness measurement and thermocouple for temperature measurement.	1	1	-	2	1	-	-	-	-	-	-	1	1	1	2
Co4	Learn about coordinate measuring machine for linear and angular measurements.	1	-	-	3	3	-	-	-	-	-	-	3	1	1	2
Co5	Identify sources of variability, error and uncertainties.	1	-	1	1	-	-	-	-	-	-	-	1	1	1	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
515MEP08	THERMAL ENGINEERING LABORATORY - II	0	0	4	2	50	50	100

OBJECTIVES:

1. To demonstrate the concepts discussed in the heat transfer course.
2. To experimentally determine thermal conductivity and heat transfer coefficient through various materials.
3. To experimentally measure effectiveness of heat exchangers.
4. To conduct performance tests on refrigeration systems.
5. To determine emissivity of radiation surface with different surfaces namely polished, gray and metal black.

PRE-REQUISITES: Knowledge of Thermal Engineering is required.

LIST OF EXPERIMENTS

Conduction Mode Experiments

1. Heat transfer through composite wall.
2. Thermal Conductivity of insulating powder.
3. Thermal Conductivity measurement by guarded plate method.
4. Thermal Conductivity of pipe insulation using lagged pipe apparatus.
5. Thermal Conductivity of metal rod.

Convection Mode Experiments

6. Heat transfer from a pin-fin apparatus (Natural Convection).
7. Heat transfer from a pin-fin apparatus (Forced Convection).
8. Heat transfer in natural convection (Vertical cylinder).
9. Heat transfer in forced convection (Inside tube).

Radiation Mode Experiments

10. Emissivity measurement apparatus.
11. Stefan Boltzmann apparatus.

Experiments on applications of heat transfer

12. Effectiveness of parallel flow heat exchanger.
13. Effectiveness of counter flow heat exchanger.
14. Determination of heat transfer coefficient in shell and tube heat exchanger.
15. Determination of COP of a refrigeration system.

TOTAL : 45 Hours

COURSE OUTCOMES:

The students will be able to

1. Practically relate to concepts discussed in the heat transfer course.
2. Conduct various experiments to determine thermal conductivity of various materials.
3. Conduct performance tests and thereby improve effectiveness of heat exchangers.
4. Conduct performance tests and improve COP of refrigeration systems.
5. To determine the overall heat transfer coefficient for a composite wall.

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Practically relate to concepts discussed in the heat transfer course.	2	2	1	3	-	-	-	-	2	1	1	1	2	-	1
Co2	Conduct various experiments to determine thermal conductivity of various materials.	2	2	1	3	-	-	-	-	2	1	1	1	2	-	1
Co3	Conduct performance tests and thereby improve effectiveness of heat exchangers.	2	2	1	2	-	-	-	-	1	1	1	1	2	-	1
Co4	Conduct performance tests and improve COP of refrigeration systems.	2	3	-	1	-	-	-	-	2	1	-	-	2	-	1
Co5	To determine the overall heat transfer coefficient for a composite wall.	1	2	1	3	1	-	-	-	2	1	1	1	2	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
515MEP09	COMPUTER AIDED MACHINE DRAWING	0	0	4	2	50	50	100

OBJECTIVES:

1. To gain practical experience in handling 2D drafting and 3D modeling software systems.
2. To introduce students to the basics and standards of engineering drawing related to machines and components.
3. To make the students to understand and interpret drawings of machine components so as to prepare assembly drawings both manually and using standard CAD packages.
4. To familiarize the students with Indian standards on drawing practices and standard components.
5. To familiarize students with various limits, fits and tolerances.

PRE-REQUISITES: Knowledge of Engineering Graphics and Machine Drawing are required.

Introduction of 3D Modeling software – part modeling, assembly. **5**

Sectioning methods– full section, half section, partial or local section, revolved or superimposed section, removed section, aligned section, successive sections, thin sections.

Bill of Materials- preparation of bill of materials and tolerance data sheet

LIST OF EXPERIMENTS

Creation of 3D assembly model of following machine elements using 3D Modelling software

40

1. Cotter joints
2. Knuckle joint
3. Flanged Coupling
4. Universal Coupling
5. Screw Jack
6. Stuffing box
7. Plummer Block
8. Safety Valves
9. Non-return valves
10. Machine Vice
11. Lathe Tailstock
12. Piston and Piston rod
13. Connecting rod

TOTAL : 45 Hours

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COURSE OUTCOMES:

Student will be able to

- Acquire the knowledge of various standards and specifications about standard machine components.
- Develop 2D and 3D part models using modeling software.
- Prepare engineering drawing for industrial component using Indian standard code of practice.
- Prepare bill of materials for production drawings.
- Select, configure and synthesize mechanical components into assemblies.

REFERENCE BOOKS:

1. Gopalakrishna K.R., "Machine Drawing", Twenty First Edition, Subhas Stores, 2012.
2. Bhatt N.D. and Panchal V.M., "Machine Drawing", 49th Edition, Charotar Publishing House Pvt. Ltd., 2014.
3. Basudeb Bhattacharyya, "Machine Drawing", Oxford University Press, 2011.
4. Narayana K.L., Kannaiah P and Venkata Reddy K, "Machine Drawing ", 5th Edition, New Age International (P) Limited Publishers, 2016.
5. Sidheswar N, Kannaiah P and Sastry V. V. S, "Machine Drawing", Tata McGraw Hill, 2017.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Acquire the knowledge of various standards and specifications about standard machine components.	1	1	-	3	3	-	-	-	-	2	-	-	1	-	3
Co2	Develop 2D and 3D part models using modeling software.	1	1	-	3	3	-	-	-	-	2	-	-	1	-	3
Co3	Prepare engineering drawing for industrial component using Indian standard code of practice.	1	1	-	3	3	-	-	-	-	2	-	-	1	-	3
Co4	Prepare bill of materials for production drawings.	1	1	-	3	3	-	-	-	-	2	-	2	1	-	3
Co5	Select, configure and synthesize mechanical components into assemblies.	1	1	-	3	3	-	-	-	-	2	-	-	1	-	3

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
515MEE06	ADVANCED MANUFACTURING PROCESSES	3	0	0	3	50	50	100

OBJECTIVES:

1. To gain knowledge on advanced manufacturing processes and their applications.
2. To learn about mechanical energy based processes and its process parameters.
3. To know the electrical energy based processes and its process parameters.
4. To be familiar with chemical and electro-chemical energy based processes and its process parameters.
5. To identify the thermal energy based processes and its process parameters.

PRE-REQUISITES: Knowledge of Manufacturing Technology II is required.

UNIT I INTRODUCTION **5**

Introduction of Unconventional machining Processes - Need for Unconventional machining Processes - Classification – Design Considerations, Process economics – Introduction to Abrasives and Bond abrasives.

UNIT II MECHANICAL ENERGY BASED PROCESSES **10**

Abrasive Jet Machining (AJM) - Water Jet Machining (WJM) - Abrasive Water Jet Machining (AWJM) - Ultrasonic Machining. (USM). Working Principles - Equipments - Process parameters – Material Removal Rate - Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES **8**

Electro Discharge Machining (EDM) - Working Principle-Equipments-Process Parameters-Surface Finish and MRR- Electrode / Tool - Power and control Circuits-Tool Wear - Dielectric - Flushing - Wire cut EDM Process - Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES **12**

Chemical machining (CHM) and Electro-Chemical machining (ECM)-Etchants- Maskants-Techniques of applying maskants-Process Parameters - Surface finish and MRR-Applications. Principles of ECM-Equipments-Surface Roughness and MRR- Electrical circuits-Process Parameters-ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES **10**

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

TOTAL : 45 Hours

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COURSE OUTCOMES:

The students will be able to

- Demonstrate the basic operation of various unconventional manufacturing processes.
- Apply the knowledge of mechanical energy based processes in their projects and interpret the importance of different processes for various applications.
- Apply the knowledge of electrical energy based processes in their projects and to identify the various parameters and their influence on the performance of the processes.
- Explain the various chemical machining processes and its effects on environment.
- Explain thermal energy based processes like laser beam machining, electron beam machining and plasma arc machining, cutting and spraying.

TEXT BOOKS:

1. Vijay.K. Jain, "Advanced Machining Processes", Allied Publishers Pvt. Ltd., New Delhi, 2009.
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi, 1980.

REFERENCE BOOKS:

1. M Adithan, "Unconventional Machining Processes", Atlantic Publishers, 2009.
2. Serope KalpakJian, Steven R Schmid, "Manufacturing Processes for Engineering Materials", Pearson Education, 5th Edition, 2007.
3. Mc Geough, "Advanced Methods of Machining", Chapman and Hall, Springer, 1988.
4. Benedict. G.F., "Non traditional Manufacturing Processes", Marcel Dekker Inc., New York, 1987.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Understand the basic operation of various unconventional manufacturing processes.	3	-	2	-	2	1	1	-	-	-	-	-	3	-	1
Co2	Apply the knowledge of mechanical energy based processes in their projects and interpret the importance of different processes for various applications.	2	-	2	-	1	1	-	-	1	-	-	-	1	-	1
Co3	Apply the knowledge of electrical energy based processes in their projects and their influence on various parameters.	2	-	2	-	1	1	-	-	1	-	-	-	1	-	1
Co4	Gain knowledge on various chemical machining processes and its effects on environment.	2	-	2	-	1	1	-	-	1	-	-	-	1	-	1
Co5	Gain knowledge on thermal energy based processes like laser beam machining, electron beam machining and plasma arc machining, cutting and spraying.	2	-	2	-	1	1	-	-	1	-	-	-	1	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
615MET01	DYNAMICS OF MACHINERY	3	1	0	4	50	50	100

OBJECTIVES:

1. To understand the method of static force analysis and dynamic force analysis of mechanisms and machines.
2. To study the undesirable effects of unbalance in rotors and engines.
3. To study the free vibration and degree of freedom.
4. To understand the functions of forced vibration.
5. To understand the principles of governors and gyroscopes.

PRE-REQUISITES: Knowledge of Kinematics of Machinery is required.

UNIT I FORCE ANALYSIS AND FLYWHEELS **12**

Static force analysis of mechanisms, D ' Alemberts 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, Flywheels of engines and punch press.

UNIT II BALANCING **12**

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

UNIT III FREE VIBRATION **12**

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 free vibration, Whirling of shafts and critical speed, Torsional systems, Natural frequency of two and three rotor systems.

UNIT IV FORCED VIBRATION **12**

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

UNIT V MECHANISMS FOR CONTROL **12**

Governors - Types - Centrifugal governors, Gravity controlled and spring controlled centrifugal governors -Characteristics - Effect of friction - Controlling Force, Quality of governors - effect of friction. Gyroscopes, Gyroscopic couple, Gyroscopic stabilization, Gyroscopic effects in Automobiles, ships & Air planes.

TOTAL: 60 PERIODS

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COURSE OUTCOMES:

The student will be able to

- Predict the force analysis in mechanical system.
- Balance the static and dynamic balancing of rotating and reciprocating masses.
- Analyse the free vibration in single degree of freedom.
- Analyse force vibration caused by unbalancing, vibration transmissibility and isolation.
- Find the role of governors and gyroscopes used for speed control and stability control.

TEXT BOOKS:

1. Rattan.S.S, "Theory of Machines", Tata McGraw Hill Inc, 5th Edition, 2019.
2. Shigley J.E., Uicker J.J., & Pennock G.R., "Theory of Machines and Mechanisms", Oxford University Press, 5th Edition, 2016.

REFERENCES BOOKS:

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 2011.
2. Dr.R.K.Bansal and Dr.J.S. Brar, "Theory of Machines", Lakshmi Publications, New Delhi, 2011.
3. Gupta V.V.R, "Theory of Machines: Kinematics and Dynamics", I K International Publishing House (P) Ltd, New Delhi, 2010.
4. Ambekar A. G., "Mechanism and Machine Theory", Prentice Hall of India, New Delhi, 2007.
5. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory", Wiley-Eastern Limited, New Delhi, 2007.
6. P.L.Ballaney, "Theory of Machines and Mechanisms", 23rd Edition, Khanna Publications, New Delhi, 2003.
7. Sadhu Singh,"Theory of Machines", Pearson Education, 3rd Edition, 2011.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Predict the force analysis in mechanical system.	2	2	1	1	-	1	1	-	-	-	-	-	2	-	1
Co2	Balance the static and dynamic balancing of rotating and reciprocating masses.	2	2	1	2	-	-	-	-	-	-	-	-	1	-	1
Co3	Analyse the free vibration in single degree of freedom.	2	2	1	2	-	-	-	-	-	-	-	1	1	-	-
Co4	Analyse force vibration caused by unbalancing, vibration transmissibility and isolation.	2	3	1	2	-	-	-	-	-	-	-	1	1	-	2
Co5	Find the role of governors and gyroscopes used for speed control and stability control.	2	2	1	3	1	1	1	-	-	-	-	-	1	-	2

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
615MET02	GAS DYNAMICS AND JET PROPULSION	3	0	0	3	50	50	100

OBJECTIVES:

1. To understand the basic concepts of isentropic flows.
2. To understand the phenomenon of heat transfer and friction for flow through ducts.
3. To study the phenomenon of shock waves and its effects on flow.
4. To understand the thrust equation and how it is used in aircraft and rocket propulsion in an efficient way.
5. To study the applications of jet propulsion and rocket propulsion systems.

PRE-REQUISITES: Knowledge of Engineering Thermodynamics, Fluid Mechanics and Machinery, Thermal Engineering are required.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS **9**

Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves and Mach cone - Effect of Mach number on compressibility - Isentropic flow through variable ducts - Nozzle and Diffusers - Use of Gas tables.

UNIT II FLOW THROUGH DUCTS **9**

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) - variation of flow properties - Use of tables and charts - Generalised gas dynamics.

UNIT III NORMAL AND OBLIQUE SHOCKS **9**

Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl - Meyer relations - Use of table and charts - Applications.

UNIT IV JET PROPULSION **9**

Theory of jet propulsion - Thrust equation - Thrust power and propulsive efficiency - Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION **9**

Types of rocket engines - Propellants-feeding systems - Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity - Applications - space flights.

TOTAL : 45 PERIODS

Note: (Use of standard gas table book is permitted in the examination)

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COURSE OUTCOMES:

- The students will become familiar with basic fundamental equations of one dimensional flow of compressible fluid and isentropic flow of an ideal gas.
- The students will be able to acquire knowledge on the effects of heat transfer and friction flow through ducts.
- An ability to acquire the knowledge on flow parameters with normal and oblique shocks.
- An ability to understand the working concepts of the gas dynamics principles in the jet propulsions.
- An ability to study the working concepts of rocket propulsion and various propellants.

TEXT BOOKS:

1. H. Cohen, G.F.C. Rogers and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd., 7th Edition, 2019.
2. S.M. Yahya, "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 5th Edition 2016.

REFERENCE BOOKS:

1. G.P. Sutton, "Rocket Propulsion Elements", John Wiley & sons, New York, 9th Edition, 2016.
2. V. Babu, "Fundamentals of Gas Dynamics", ANE Books India, 2015.
3. V. Ganesan, "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 2010.
4. P. Hill and C. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison - Wesley Publishing Company, 2009.
5. Anderson J.D., "Modern Compressible flow", McGraw Hill, 3rd Edition, 2003.
6. S.L. Somasundaram, "Gas Dynamics and Jet Propulsions", New Age International Publishers, New Delhi, 1996.
7. A.H. Shapiro, "The Dynamics and Thermodynamics of Compressible Fluid Flow", John Wiley & sons, New York, 1983.
8. M.J. Zucrow, "Aircraft and Missile Propulsion", vol.1 & II, John Wiley & sons, 1975.
9. M.J. Zucrow, "Principles of Jet Propulsion and Gas Turbines", John Wiley & sons, New York, 1970.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The students will become familiar with basic fundamental equations of one dimensional flow of compressible fluid and isentropic flow of an ideal gas.	3	2	-	-	-	-	-	-	-	1	1	-	2	-	-
Co2	The students will be able to acquire knowledge on the effects of heat transfer and friction flow through ducts.	3	3	-	-	-	-	-	-	-	1	1	-	2	-	-
Co3	An ability to acquire the knowledge on flow parameters with normal and oblique shocks.	3	3	-	-	-	-	-	-	-	1	1	-	2	-	2
Co4	An ability to understand the working concepts of the gas dynamics principles in the jet propulsions.	2	1	-	-	-	-	-	-	-	1	1	-	2	-	-
Co5	An ability to study the working concepts of rocket propulsion and various propellants.	2	1	-	-	-	-	-	-	-	1	1	-	1	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
615MET03	DESIGN OF TRANSMISSION SYSTEMS	3	1	0	4	50	50	100

OBJECTIVES:

1. To understand the standards and procedure for designing flexible elements.
2. To understand the design of spur gears and parallel axis helical gears.
3. To understand the design of bevel, worm and cross helical gears.
4. To analyse the design of gear boxes in order to perform safely with their intended functions.
5. To study the design principles to evaluate the clutches and brakes in order to satisfy the strength and functional requirements.

PRE-REQUISITES: Knowledge of Kinematics of Machinery and Design of Machine Elements are required.

NOTE: Usage of Design Data Book is permitted in the end examination.

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS **12**

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.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS **12**

Gear Terminology, Speed ratios and number of teeth. 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, Parallel axis Helical Gears - Pressure angle in the normal and transverse plane, Equivalent number of teeth, forces and stresses. Estimating the size of the helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS **12**

Straight bevel gear - Tooth terminology, tooth forces and stresses, equivalent number of teeth, Estimating the dimensions of pair of straight bevel gears.

Worm Gear - Merits and demerits, Terminology, Thermal capacity, materials, forces and stresses, efficiency, estimating the size of the worm gear pair.

Cross helical Gear – Terminology, helix angles, Estimating the size of the pair of cross helical gears.

UNIT IV DESIGN OF GEAR BOXES **12**

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.

UNIT V DESIGN OF CLUTCHES AND BRAKES **12**

Design of plate clutches –Friction materials, Centrifugal clutch, axial clutches, Single plate clutch, multiple plate clutch, cone clutch and internal expanding rim clutch, Internal and external shoe brakes, Band brake, Disk brakes**.**

TOTAL : 60 PERIODS

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COURSE OUTCOMES:

The students will be able to

- Design and select pulleys, chain drives, rope drives and belt drives.
- Design and select spur gears and parallel axis helical gears.
- Design and select bevel, worm and cross helical gears.
- Design gear boxes.
- Design brakes and clutches.

TEXT BOOKS:

1. Bhandari, V.B., "Design of Machine Elements", 4th Edition Tata McGraw-Hill Publishing Company Ltd., 2017.
2. Shigley J.E., "Mechanical Engineering Design", 10th Edition, Tata McGraw-Hill, 2014.

REFERENCE BOOKS:

1. Hamrock B.J., Jacobson B., Schmid S.R., "Fundamentals of Machine Elements", Third Edition, CRC Press, 2013.
2. Sundararajamoorthy T. V and Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2007.
3. R. S. Khurmi & J. K. Gupta, "A Text book of Machine Design", Eurasia Publishing House, 2005.
4. Ugural A.C, "Mechanical Design, An Integrated Approach", McGraw-Hill, 2003
5. Prabhu. T.J., "Design of Transmission Elements", Fifth Edition, Mani Offset, Chennai, 2002.
6. Maitra G.M., and Prasad L.V., "Hand book of Mechanical Design", II Edition, Tata McGraw-Hill, 1985.

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.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Design and select pulleys, chain drives, rope drives and belt drives.	2	2	3	-	1	-	-	-	-	1	-	-	3	1	2
Co2	Design and select spur gears and parallel axis helical gears.	2	2	3	-	1	-	-	-	-	1	-	-	3	1	2
Co3	Design and select bevel, worm and cross helical gears.	2	2	3	-	1	-	-	-	-	1	-	-	3	1	2
Co4	Design gear boxes.	2	2	3	-	1	-	-	-	-	1	-	-	3	1	2
Co5	Design brakes and clutches.	2	2	3	-	1	-	-	-	-	1	-	-	3	1	2

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
615MET04	CAD/CAM/CIM	3	0	0	3	50	50	100

OBJECTIVES:

1. To study the computer aided design and drawing using popular software package.
2. To study the basics of manufacturing, DNC and CNC servo system.
3. To understand the components of computer integrated manufacturing.
4. To study the group technology and computer aided process planning in industry.
5. To understand the system of shop floor control and flexible manufacturing system in industry

PRE-REQUISITES: Knowledge of Manufacturing Technology II is required.

UNIT I INTRODUCTION OF COMPUTER AIDED DESIGN 09

Concept of Graphic Primitives- 2Dimensional Transformations and 3Dimensional Transformations (Concept) -Geometric Modeling, Concept and Types (Any Popular CAD Software) - Typical features of drafting package - Salient features of solid modeling- Understanding curve and Surface design.

UNIT II DNC AND CNC SERVO SYSTEM 09

Principle and operation of a CNC servo system- Direct Numerical Control (DNC), Objectives of DNC- Types of standard controllers (Only Industrial Purpose), Programming codes- Manual part programming of turning operation and milling operation(examples of turning, facing, taper, thread and rectangular and circular packet, drilling holes)

UNIT III COMPONENTS OF COMPUTER INTEGRATED MANUFACTURING 09

Computer Integrated Manufacturing: Concept and Technology, Role of the elements of CIM system, CASA/SME model of CIM, CIM II, Benefits – Communication matrix in CIM, Fundamentals of computer communication in CIM - CIM data transmission methods - Types of communication in CIM - Computer networking in CIM (LAN and MAP model) - OSI model seven layer -Network topologies: Types and advantages

UNIT IV GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 09

Group Technology (GT) – Part Families – Parts Classification and Coding systems (DCLASS , MICLASS and OPTIZ) -Facility design using GT - Benefits of GT- Concept of Cellular Manufacturing Process planning: Role of process planning in CAD/CAM Integration - Approaches to computer aided process planning, Structure of a process planning software, Variant approach and Generative approaches, CMPP systems

UNIT V SHOP FLOOR CONTROL AND INTRODUCTION TO FLEXIBLE MANUFACTURING SYSTEM 09

Components of shop floor data collection systems, shop floor control phases-Types of data collection systems- Automatic data collection system

Flexible Manufacturing System: Scopes, Components, Types, Workstation, Benefits, Material handling and Storage system, Layouts, Computer control systems

TOTAL :45 PERIODS

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COURSE OUTCOMES:

The students will be able to

- Use computer and popular CAD software's for modelling.
- Know the construction features of NC and CNC machines and the components.
- Gain the knowledge of computer integrated manufacturing.
- Develop knowledge on group technology and computer aided process planning.
- Utilize knowledge of flexible manufacturing system on shop floor in industries.

TEXT BOOKS:

1. Mikell. P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education, 4th Edition, 2016.
2. Radhakrishnan.P., Subramanyan.S. and Raju.V., "CAD/CAM/CIM", New Age International, 2012.

REFERENCE BOOKS:

1. P N Rao, "CAD/CAM Principles and Applications", TMH Publications, 3rd Edition, 2010.
2. Chris McMahon and Jimmie Browne, "CAD CAM Principles, Practice and Manufacturing Management", Pearson Education, Second Edition, 2005.
3. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall of India Pvt. Ltd., 2005.
4. Mikell. P. Groover and Emory Zimmers Jr.,"CAD/CAM", Prentice Hall of India Pvt. Ltd., 2003.
5. Krar.S, and Gill.A, "CNC Technology and Programming" , McGraw Hill Publishers, 1989.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Have ability to use computer and popular CAD software's for modelling.	3	-	2	-	3	-	1	-	1	-	1	-	3	-	2
Co2	Gain the knowledge of construction features of NC and CNC machines and the components.	1	-	3	-	2	1	1	-	1	-	-	-	1	-	3
Co3	Gain the knowledge of computer integrated manufacturing.	1	-	2	-	3	1	1	-	1	-	-	-	1	-	2
Co4	Understand about the knowledge of group technology and computer aided process planning.	1	1	2	-	2	1	1	-	1	-	-	-	2	-	2
Co5	Understand about the knowledge of flexible manufacturing system and shop floor control in industries.	1	1	2	-	2	1	1	-	2	-	-	-	2	-	3

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
615MEP07	DYNAMICS LABORATORY	0	0	4	2	50	50	100

OBJECTIVES:

1. To study the kinematics of different mechanisms.
2. To study the mass moment of inertia of body by experimentally.
3. To study the cam and its applications.
4. To study the natural frequency of vibratory systems.
5. To study the principles of governors and gyroscopic.

PRE-REQUISITES: Knowledge of Kinematics and Dynamics of Machinery is required.

LIST OF EXPERIMENTS

1	a) Study of gear parameters. b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2	a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms. b) Kinematics of single and double universal joints.
3	a) Determination of Mass moment of inertia of Fly wheel and Axle system. b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus. c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4	Motorized gyroscope - Study of gyroscopic effect and couple.
5	Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6	Cams - Cam profile drawing, Motion curves and study of jump phenomenon.
7	a) Single degree of freedom of Spring Mass System - Determination of natural Frequency and verification of Laws of springs - Damping coefficient determination. b) Multi degree of freedom of suspension system - Determination of influence coefficient.
8	a) Determination of torsional natural frequency of single and Double Rotor systems- Undamped and Damped Natural frequencies. b) Vibration Absorber - Tuned vibration absorber.
9	Vibration of Equivalent Spring mass system - undamped and damped vibration.
10	Whirling of shafts - Determination of critical speeds of shafts with concentrated loads.
11	(a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12	a) Transverse vibration of Free-Free beam - with and without concentrated masses. b) Forced Vibration of Cantilever beam - Mode shapes and natural frequencies. c) Determination of transmissibility ratio using vibrating table.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will have an ability to

- Demonstrate the principles of kinematics and dynamics of machinery.
- Determine mass-moment of inertia for simple bodies experimentally.
- Design the cam and follower for different applications.
- Analyze natural frequency of vibratory systems.
- Analyze governors and gyroscopes.

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Ability to demonstrate the principles of kinematics and dynamics of machinery.	-	2	-	1	-	-	-	-	-	-	-	1	1	-	1
Co2	Ability to determine mass-moment of inertia for simple bodies experimentally.	2	1	-	1	-	-	-	-	-	-	-	1	-	2	-
Co3	Ability to design the cam and follower for different applications.	2	2	-	2	-	-	-	-	-	-	-	1	-	3	-
Co4	Ability to analyse natural frequency of vibratory systems.	-	1	-	3	-	-	-	-	-	-	-	2	-	-	2
Co5	Ability to analyse governors and gyroscopes.	-	-	-	2	-	-	1	-	-	-	-	1	-	-	2

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
615MEP08	CAM LABORATORY	0	0	4	2	50	50	100

OBJECTIVES:

1. The students acquire practical knowledge about fundamentals of numerical control.
2. To know the types of CNC machines and the programming technique.
3. To understand the concepts of G and M codes.
4. To write the manual part programming to modern control systems. (Fanuc, Siemens etc)
5. To know the modern application of various CNC machines.

PRE-REQUISITES: Knowledge of CAD/CAM/CIM and Manufacturing Technology –II are required.

INTRODUCTIONS

1. Study of CNC lathe, milling
2. Study of international standards G-Codes, M-Codes
3. Program writing – Turning simulator – Milling simulator, IS practice – commands – menus

EXERCISE PRACTICE

CNC Lathe

1. Develop a part program for plain turning and simulate
2. Develop a part program for Facing turning and simulate
3. Develop a part program for Step turning and simulate
4. Develop a part program for taper turning and simulate
5. Develop a part program for Thread cutting and simulate
6. Develop a part program for drilling and simulate

CNC Milling

7. Develop a part program for drilling with dwell and simulate
8. Develop a part program for drilling with dwell and PCD and simulate
9. Develop a part program for Rectangular pocket and simulate
10. Develop a part program for circular pocket and simulate

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will able to know about

- PC based CNC machines and windows based CAM software packages has made CNC programming.
- Good aptitude for understand by the modern CNC control system in modern manufacturing system.
- Knowledge to prepare the CNC Part Programming Techniques and to perform the manufacturing operation.
- CAM software packages make it easy to translate CAD files into CNC programs which enable users to handle sophisticated jobs.
- Knowledge of programming codes used in industry.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	PC based CNC machines and windows based CAM software packages has made CNC programming.	1	1	3	3	1	-	-	-	1	2	1	-	1	-	2
Co2	Good aptitude for understand by the modern CNC control system in modern manufacturing system.	1	1	1	3	1	1	-	-	1	1	-	-	1	-	2
Co3	Knowledge to prepare the CNC Part Programming Techniques and to perform the manufacturing operation.	1	1	2	3	1	-	1	-	1	1	-	-	1	-	2
Co4	CAM software packages make it easy to translate CAD files into CNC programs which enable users to handle sophisticated jobs.	1	2	1	3	3	-	-	-	1	2	-	-	2	-	3
Co5	Knowledge of programming codes used in industry.	1	2	1	3	3	-	1	-	1	2	-	-	1	-	2

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
615MEE03	PRINCIPLES OF MANAGEMENT AND BUSINESS CONCEPTS	3	0	0	3	50	50	100

OBJECTIVES:

1. To gain knowledge on organization structure.
2. To understand the various types of business organizations.
3. To know the modern techniques in controlling.
4. To gain knowledge on various types of business activities.
5. To know about the marketing concepts.

UNIT I OVERVIEW OF MANAGEMENT AND PLANNING **10**

Definition of Management – Role of managers – Evolution of Management thoughts. Contribution of Taylor and Fayol, Functions of management – Types of business organizations.

Nature and purpose of planning – Planning process – Types of plans – Objectives – Management By Objective (MBO) Strategies – Types of strategies – Policies – Decision Making – Decision Making Process – Forecasting techniques.

UNIT II ORGANIZING AND DIRECTING **10**

Nature and purpose of organizing – Organization structure – Organisation Chart – Formal and informal groups of organization – Line and Staff authority – Departmentation – Span of control – Centralization and Decentralization – Delegation of authority – Selection and Recruitment – Orientation – Career Development – Career stages – Training – Performance Appraisal.

Creativity and Innovation – Management and Human facts – Motivation – Motivation Theories – Leadership Styles – Leadership theories – Communication – Barriers to effective communication – Electronic Media in Communication.

UNIT III CONTROLLING **7**

Process of controlling – Types of control – Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control – Quality Control – Planning operations, Modern Techniques in Controlling.

UNIT IV BUSINESS ENVIRONMENT **10**

Nature and purpose of business, classification of business activities: industry, commerce and trade, objectives of business and essentials of successful business, economic environment –basic problems of scarcity and choice, allocation of resources, opportunity cost, Business growth and measurement of size, International Environment-balance of trade, the trade gap and balance of payments, role and methods of trade protectionism, Business Ethics.

UNIT V ELEMENTS OF BUSINESS ACTIVITY **8**

Purchasing-choosing of suppliers, overview of stock control, production-scale of production, main features of job, mass and batch production systems, Marketing-concept and role of marketing, marketing mix, channels of distribution, Finance-sources of finance, assessing business performance.

TOTAL : 45 PERIODS

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COURSE OUTCOMES:

The students will be able to

- Understand the elements of effective management.
- Know about motivation theories.
- Gain the knowledge on managerial skills and business activities.
- Understanding of business concepts and its applications.
- Discuss and apply the planning, organizing and control process.

TEXT BOOKS:

1. P C Tripathi and P N Reddy, "Principles of Management", Tata Mc Graw Hill Pvt Ltd, 5th Edition, 2012.
2. Stephen P. Robbins and Mary Coulter, "Management", Pearson Education, 3rd Edition, 2011.

REFERENCE BOOKS:

1. Philip Kotler, "Marketing Management", Pearson Education, 15th Edition, 2015.
2. Charles W L Hill, Steven L McShane, "Principles of Management", McGraw Hill Education, Special Indian Edition, 2012.
3. Harold Koontz, Heinz Weihrich and Mark V Cannice, "Essentials of Management", Tata McGraw Hill, 9th Edition, 2012.
4. Andrew J.Dubrin, "Essentials of Management", Thomson Southwestern, 7th Edition, 2007.
5. Hellriegel, Slocum & Jackson, "Management - A Competency Based Approach", Thomson South Western, 10th Edition, 2002.
6. Gary Dessler, "Human Resource Management", 7th Edition, Prentice-Hall of India P.Ltd., Pearson, 1999.
7. Joel Dean, "Managerial Economics", Prentice Hall Pearson Education, 1992.
8. Rangarajan, "Principles of Macro Economics", Tata McGraw Hill, 1979.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Describe and discuss the elements of effective management.	1	1	-	-	-	1	-	-	-	-	-	-	1	2	-
Co2	Know about motivation theories.	1	2	-	-	-	-	-	2	-	-	-	-	-	1	-
Co3	Gain the knowledge on managerial skills and business activities.	1	1	-	-	-	-	-	1	3	2	2	-	1	1	-
Co4	Understanding of business concepts and its applications.	1	1	-	1	1	-	-	-	-	-	-	-	1	1	-
Co5	Discuss and apply the planning, organizing and control process.	1	2	3	-	-	-	-	-	-	1	-	-	1	1	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
615MEE09	ADDITIVE MANUFACTURING	3	0	0	3	50	50	100

OBJECTIVES:

1. To understand the rapid prototyping techniques in manufacturing.
2. To study the stereo lithography process and selective laser sintering.
3. To study the fused deposition modeling and solid ground curing.
4. To understand the laminated object manufacturing, concept modeler and laser engineered net shaping.
5. To applying rapid-prototyping techniques to the production of tooling (rapid tooling) that can be used in other manufacturing processes.

PRE-REQUISITES: Knowledge of CAD/CAM/CIM, Advanced Manufacturing Process are required.

UNIT I INTRODUCTION OF ADDITIVE MANUFACTURING 08

Need for the compression in product development- history of rapid prototyping systems, classification, benefits, limitations and applications- Basic information subtractive (conventional) manufacturing process vs. additive manufacturing process, working principle of basic process of 3Dimensional printing technology.

UNIT II STEREO LITHOGRAPHY PROCESS AND SELECTIVE LASER SINTERING 09

Stereo Lithography Process: Principle, Data Preparation, Process Parameters, Process Details, Data Files Machine Details and Applications-Selective Laser Sintering: Types, Principle of Operation, Process Parameters, Data Preparations and Applications.

UNIT III FUSED-DEPOSITION MODELING AND SOLID-GROUND CURING 09

Fused-Deposition Modeling: Principle, Process Parameters, Path Generation and Applications-Solid-Ground Curing: Principle, Process Parameters, Machine Details, and Applications.

UNIT IV LAMINATED-OBJECT MANUFACTURING, CONCEPT MODELER AND LASER-ENGINEERED NET SHAPING 09

Laminated-Object Manufacturing: Principle of Operation, Laminated object manufacturing Materials, Process Details and Applications-Concept Modeler: Principle, Thermo Jet Printer, Sanders Model Maker, 3-Dimensional Printing, Genesis Xs Printer, JP 5 System, Objects Quadra System-Laser engineered Net Shaping: Principle and Applications.

UNIT V DIRECT OR RAPID MANUFACTURING AND RAPID TOOLING AND CASE STUDIES 10

Basic concept of direct manufacturing- Rapid Tooling: Indirect Rapid Tooling, silicone rubber tooling, aluminium filled epoxy tooling, spray metal tooling, Direct Rapid Tooling: quick cast process, copper polyamide, sand cast tooling, laminated tooling -Case studies of additive manufacturing: automotive, industry, aerospace and medical.

TOTAL : 45 PERIODS

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COURSE OUTCOMES:

- The students will able to gain knowledge on rapid prototyping technique.
- The students will be able to gain knowledge about stereo lithography process and selective laser sintering.
- The students get sound knowledge on the processes like fused-deposition modeling and solid ground curing.
- The students get sound knowledge on the processes like laminated object manufacturing, concept modeler and laser engineered net shaping.
- The students can enhance their knowledge in rapid tooling and different software used for rapid prototyping like solid view.

TEXT BOOKS:

1. Pham. D. T. & Dimov. S. S., "Rapid Manufacturing", Verlag, London, 2011.
2. Paul. F. Jacobs, "Stereo lithography and other RP & M Technologies", SME, NY, 2010.

REFERENCE BOOKS:

1. Hari Prasad & K.S.Badrinarayanan, “Rapid Prototyping and Tooling”, SIP Pageturners, 2013.
2. Chee Kai Chua, Kah Fai Leong, Chu Sing Lim, “Rapid Prototyping Principles and Applications”, World Scientific Publishing Company, 2010.
3. Serope Kalpakjian, Steven R. Schmid, “Manufacturing Engineering and Technology”, Sixth Edition, Prentice Hall, 2009
4. Frank W. Lioli, “Rapid Prototyping and Engineering Applications”, CRC Press, 2008.
5. Terry Wohlers, "Wohlers Report 2006", Wohlers Associates, 2006.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The students will able to gain knowledge on rapid prototyping technique.	3	2	2	-	-	-	-	-	-	-	-	-	2	1	-
Co2	The students will be able to gain knowledge about stereo lithography process and selective laser sintering.	3	2	2	-	-	-	-	-	-	-	-	-	2	1	-
Co3	The students get sound knowledge on the processes like fused-deposition modeling and solid ground curing.	3	2	2	-	-	-	-	-	-	-	-	-	2	1	-
Co4	The students get sound knowledge on the processes like laminated object manufacturing, concept modeler and laser engineered net shaping.	2	3	2	-	1	-	-	-	-	-	-	-	2	2	-
Co5	The students can enhance their knowledge in rapid tooling and different software used for rapid prototyping like solid view.	2	2	2	2	3	-	-	-	-	-	-	-	2	2	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
615MEE12	NON DESTRUCTIVE TESTING AND MATERIALS	3	0	0	3	50	50	100

OBJECTIVES:

1. To understand principle behind various NDT techniques.
2. To study about NDT equipments and accessories.
3. To learn working procedures of various NDT techniques.
4. To know the applications and recent trends in NDT.
5. To know about the NDT techniques for flaw detection.

PRE-REQUISITES: Knowledge of Manufacturing technology and Material science are required.

UNIT I INTRODUCTION AND VISUAL INSPECTION TECHNIQUE 6

Introduction to various Non-destructive methods – Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for Visual inspection - Applications.

UNIT II LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING 10

Physical principles, procedure for liquid penetrant testing, Characteristics of penetrants - Developers, Penetrant testing methods – Applications, Principle of MPT, Magnetising procedure used for testing a component, Equipment used for MPT, Applications

UNIT III EDDY CURRENT TESTING AND ACOUSTIC EMISSION TESTING 10

Principles, Instrumentation for ECT, Various Techniques – High sensitivity Techniques, Single, Multi and high frequency ECT, Applications - Principle of AET, AE signal parameters, Applications.

UNIT IV ULTRASONIC TESTING 10

Introduction, Principle of operation, Types of Ultrasonic propagation – Ultrasonic probes. Types of Ultrasonic Transducers – Testing Techniques and Inspection methods – Pulse Echo, ABC scans, Transmission angle beam, Testing procedures and its applications.

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS 9

Basic principle, Effect of radiation of Film, Radiographic Imaging – Inspection Techniques – Single wall single image, Double wall Penetration & Multiwall Penetration technique – Comparison and selection of various NDT techniques.

TOTAL : 45 PERIODS

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COURSE OUTCOMES:

The students will be able to

- Apply scientific and technical knowledge to the field of non-destructive testing.
- Use the relevant non-destructive testing methods for various engineering practice.
- Analyse and interpret the defects to improve the overall quality of products.
- Develop their skills in inspection of the components.
- Increase overall reliability of the products by selection of suitable inspection techniques.

TEXT BOOKS:

1. J Prasad, and CGK Nair, "Non Destructive Test and Evaluation of Materials", Tata McGraw Hill, 2017.
2. Ravi Prakash, "Non Destructive Testing Techniques", New Age International, 1st Edition revised, 2010.

REFERENCE BOOKS:

1. Baldev Raj and B.Venkataraman, "Practical Radiography", Narosa Publishing House, 2004.
2. Baldev raj, T Jeyakumar, M. Thavasimuthu "Practical Non-Destructive Tesitng" Narosa Publishing house, New Delhi, 2002.
3. Krautkramer.J, "Ultra Sonic Testing of Materials", 1st Edition, Springer – Verlag Publication, New York, 1996.
4. Birchan.B, "Non-Destructive Testing", Oxford University Press, London, 1975.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Apply scientific and technical knowledge to the field of non-destructive testing.	3	2	-	-	3	-	1	-	1	-	-	-	3	-	1
Co2	Use the relevant LPT & MPT non-destructive testing methods for various engineering practice.	1	1	-	-	2	1	-	-	1	-	-	-	2	-	-
Co3	Analyse and interpret the defects to improve the overall quality of products from ECT & AET.	1	1	-	-	2	-	-	-	-	-	-	-	1	-	-
Co4	Develop their skills in inspection of the components using Ultrasonic testing.	1	1	-	-	2	1	-	-	1	-	-	-	1	-	-
Co5	Increase overall reliability of the products by selection of suitable inspection using Radiography techniques.	1	1	-	-	2	-	-	-	-	-	-	-	1	-	-

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Hosur - 635 109.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715MET01	MECHATRONICS AND ROBOTICS	3	0	0	3	50	50	100

OBJECTIVES:

1. To have knowledge on various types of sensors and transducer used in mechatronics system
2. To learn about the different system models and controllers used in mechatronics system.
3. To comprehend the concepts of electrical circuits and signal conditioning.
4. To learn the various types of grippers and selection of grippers.
5. To know about the basic concepts associated with the design and functioning and applications of Robots.

PRE-REQUISITES: Knowledge of Applied Hydraulic and Pneumatics and Engineering Mechanics are required.

UNIT I MECHATRONICS SENSORS AND TRANSDUCERS 9

Introduction to Mechatronics Systems, Measurement Systems, Control Systems - Microprocessor based Controllers, Sensors and Transducers, Performance Terminology, Sensors for Displacement, Position and Proximity, Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors, Selection of Sensors.

UNIT II SYSTEM MODELS AND CONTROLLERS 8

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational and Translational Systems, Electromechanical Systems, Hydraulic and 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.

UNIT III PROGRAMMING LOGIC CONTROLLERS AND DESIGN OF MECHATRONICS SYSTEM 10

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.

Stages in designing Mechatronics Systems, Traditional and Mechatronic Design, Possible Design Solutions, Autonomous mobile robot-Wireless surveillance balloon- Engine Management system- Automatic car park barrier.

UNIT IV ROBOT AND END EFFECTORS 9

Robot – Definition, Robot Anatomy, Co-ordinate Systems, Work Envelope, types and classification, Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load, Robot Parts and Functions, Need for Robots, Different Applications.

End Effectors, Grippers - Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers, Two Fingered and Three Fingered Grippers, Internal Grippers and External Grippers, Selection and Design Considerations.

UNIT V ROBOT KINEMATICS AND ROBOT PROGRAMMING 9

Forward Kinematics, Inverse Kinematics and Differences, Forward Kinematics and Inverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional).

Teach Pendant Programming, Lead through programming, Robot programming Languages - VAL Programming - Motion Commands, Sensor Commands, End effector commands, and Simple programs.

TOTAL : 45 Hours

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COURSE OUTCOMES:

- The students will be able to analyze mechatronics systems and different sensors used for displacement, position, velocity, motion, force, fluid pressure, temperature, etc
- The students acquire knowledge in system models of mechanical, electrical, fluid, thermal systems and continuous and discrete process controllers
- The students will be familiar with the basic structure of programmable logic controllers and in designing mechatronics systems
- The students will be able to acquire the knowledge of different types and classification of robots, end effectors and robot kinematics.
- The students will be able to gain the knowledge on robot programming languages.

TEXT BOOKS:

1. Bolton W, "Mechatronics- Electronic Control Systems in Mechanical and Electrical Engineering", Pearson Education, 6thEdition, Indian Reprint, 2015.
2. M.P.Groover, "Industrial Robotics - Technology, Programming and Applications", Tata McGraw-Hill, 2nd Edition, Special Indian Edition, 2012.

REFERENCE BOOKS:

1. Fu.K.S., Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 2008.
2. Rajput. R.K, "A Textbook of Mechatronics", S. Chand & Co, 2007.
3. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2007.
4. Lawrence J. Kamm, "Understanding Electro - Mechanical Engineering, An Introduction to Mechatronics", Prentice - Hall of India Pvt., Ltd., 1995.
5. Janakiraman.P.A.,"Robotics and Image Processing", Tata McGraw-Hill, 1995.
6. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1985.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The students will be able to understand mechatronics system and different sensors used for displacement, position, velocity, motion, force, fluid pressure, temperature, etc	2	-	-	-	1	-	1	-	-	-	-	-	2	-	1
Co2	The students acquire knowledge in system models of mechanical, electrical, fluid, thermal systems and continuous and discrete process controllers	1	-	3	-	-	-	-	-	-	-	-	-	2	-	1
Co3	The students will be familiar with the basic structure of programmable logic controllers and in designing mechatronics systems	1	1	2	1	2	-	-	-	-	-	-	-	2	-	2
Co4	The students will be able to acquire the knowledge of different types and classification of robots, end effectors and robot kinematics.	2	1	2	-	-	-	-	-	-	-	-	-	2	-	2
Co5	The students will be able to acquire the knowledge on robot programming languages.	-	1	1	-	2	1	1	1	-	-	-	-	2	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715MET02	FINITE ELEMENT ANALYSIS	3	0	0	3	50	50	100

OBJECTIVES:

1. To interpret the mathematical and physical principles underlying the Finite Element Analysis.
2. To acquire knowledge about the characteristics of various one dimensional elements for the problems being solved.
3. To explain about the finite element equations for simple and complex elements.
4. To learn how the finite element method is implemented in vibration analysis.
5. To develop finite element formulations of engineering problems from a variety of application areas including heat transfer and fluid flow analysis.

PRE-REQUISITES: Knowledge of Engineering Mathematics III, Strength of Materials, Engineering Thermodynamics, Dynamics of Machinery are required.

INTRODUCTION (Not for examination) **4**

Solution to engineering problems - Mathematical modeling - Discrete and Continuum modeling - need for numerical methods of solution - Relevance and scope of finite element methods - engineering applications of FEA.

UNIT I FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS 9

Weighted residual methods -General weighted residual statement - Weak formulation of the weighted residual statement - Piecewise continuous trial functions- Principle of stationary total potential - Rayleigh Ritz method - Piecewise continuous trial functions – Solution of equilibrium problems – Gaussian elimination method – Rayleigh Ritz method – Galerkin method.

UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS 9

General form of total potential for 1D applications - Generic form of finite element equations - linear bar element – Quadratic bar element -Nodal approximation - Development of shape functions - Element matrices and vectors - Example problems - Extension to plane truss- Development of Element equations - assembly - Element connectivity - Global equations - Solution methods - Beam element - Nodal approximation - Shape functions - Element matrices and vectors - Assembly - solution - Example problems.

UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS 9

Introduction - Approximation of geometry and field variable - 3 noded triangular elements - four noded rectangular elements - Higher order elements - Natural coordinates and coordinate transformations - Triangular and quadrilateral elements - Iso-parametric elements - Structural mechanics applications in 2 Dimensions - Elasticity equations - stress strain relations - plane problems of elasticity - Element equations - Assembly - Need for quadrature formule - transformations to natural coordinates - Gaussian quadrature - Example problems in plane stress, Plane strain and Axisymmetric applications.

UNIT IV DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD 9

Introduction - Vibrational Problems - Equations of motion based on weak form - Axial vibration of bars - Transverse vibration of beams - Consistent mass matrices and lumped mass matrices- element equations -Solution of eigen value problems - Vector iteration methods.

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UNIT V APPLICATIONS IN HEAT TRANSFER & FLUID FLOW ANALYSIS 9

Basic equation of steady state heat transfer and fluid flow problems – 1D finite element formulation – 1D heat transfer and fluid flow problems - Scalar variable problems in 2Dimensions - Applications to heat transfer in 2 Dimension.

TOTAL : 45 Hours

COURSE OUTCOMES:

Student will be able to

- Identify mathematical model for solution of common engineering problems
- Formulate one dimensional finite element equation for simple problems.
- Examine 2-D finite element continuum for structural applications
- Formulate and solve vibration problems using finite element techniques.
- Solve 1-D and 2-D heat transfer and fluid flow problems using finite element approach.

TEXT BOOKS:

1. Logan D.L., "A First Course in the Finite Element Method", 6th Edition, Thomson Learning, 2016.
2. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2012.

REFERENCE BOOKS:

1. Rao S.S, "The Finite Element Method in Engineering", Butterworth-Heinemann (An imprint of Elsevier), 6th Edition, 2018.
2. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International, 3rd Editions, 2017.
3. David V.Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition 2017.
4. Chandrupatla T.R. & Belagundu A.D., "Introduction to Finite Elements in Engineering", Pearson Education, New Delhi, 4th Edition, 2014.
5. K.J. Bathe, "Finite Element Procedures", Prentice-Hall India Pvt. Ltd., New Delhi, 2nd Edition, 2014.
6. Chennakesava R Alavela, "FEM: Basic Concepts and Applications", Prentice Hall India Pvt. Ltd, New Delhi, 2012.
7. Cook R.D., Malkus D.S., Plesha M.E., and Witt R.J., "Concepts and Applications of Finite Element Analysis", Wiley India (P) Ltd., New Delhi, 4th Edition, 2007.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Identify mathematical model for solution of common engineering problems	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
Co2	Formulate one dimensional finite element equation for simple problems.	2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
Co3	Examine 2-D finite element continuum for structural applications	2	3	1	-	-	-	-	-	-	-	-	-	2	-	-
Co4	Formulate and solve vibration problems using finite element techniques.	2	3	1	-	-	-	-	-	-	-	-	-	2	-	-
Co5	Solve 1-D and 2-D heat transfer and fluid flow problems using finite element approach.	2	3	-	-	-	-	-	-	-	-	-	-	2	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715MET03	POWER PLANT AND ENERGY ENGINEERING	3	0	0	3	50	50	100

OBJECTIVES:

1. To penetrate the various components, operations and applications of different types of power plants.
2. To gain the knowledge on steam power plants, steam generators their analyses on fuel and fluidized bed combustion, ash handling systems,
3. To findout the requirements for a Nuclear Power Plant, from sources to consumption.
4. To describe basic working principles of gas turbine and diesel engine power plants.
5. To know various methods for the Economics of Power Generation and list factors affecting the power plants.

PRE-REQUISITES: Knowledge of Basic of Civil and Mechanical Engineering is required.

UNIT I INTRODUCTION TO POWER PLANTS AND BOILERS 9

Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas turbine Power Plants. Combined Power cycles - Comparison and selection, Load duration Curves, Steam boilers and cycles - High pressure and Super Critical Boilers - Fluidised Bed Boilers.

UNIT II STEAM POWER PLANT 9

Fuel and ash handling, Combustion Equipment for burning coal, Mechanical Stokers. Pulveriser, Electrostatic Precipitator, Draught- Different Types, Surface condenser types, Cooling towers.

UNIT III NUCLEAR AND HYDEL POWER PLANTS 9

Nuclear Energy-Fission, Fusion Reaction, Types of Reactors, Pressurized water reactor, Boiling water reactor, Waste disposal and safety. Hydel Power plant- Essential elements, Selection of turbines, Governing of Turbines- Micro hydel developments.

UNIT IV DIESEL AND GAS TURBINE POWER PLANTS 9

Types of diesel plants, components, Selection of Engine type, applications-Gas turbine power plant- Fuels- Gas turbine material - Open and Closed cycles- Reheating - Regeneration and intercooling - Combined cycle.

UNIT V RENEWABLE ENERGY & ECONOMICS OF POWER PLANTS 9

Bio Energy, Biomass, Biogas, Source, Composition, Wind Energy, Wind Data and Energy Estimation - Wind Energy Conversion Systems, Geo thermal-OTEC- Tidal energy, Solar central receiver system (Solar Power Tower Plants). Cost of electric Energy- Fixed and operating costs- Energy rates- Types of tariffs- Economics of load sharing, Comparison of various power plants.

TOTAL : 45 Hours

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COURSE OUTCOMES:

The students will be able to

- Realize the importance of power requirement, generation and utilization in the present world energy scenario.
- Apply the knowledge gained by analyzing the steam power plants, steam generators and gas turbine power plants, to improve the efficiency and reduce the thermal losses.
- Analyze the processes and cycles followed in nuclear power plants and components used in the power plants and identify the losses to get better efficiency.
- Describe the working of various components of diesel power plant and Illustrate the working of gas turbine power plant and its components.
- Apply knowledge about economics of power generation and use of renewable energy.

TEXT BOOKS:

1. Nag P.K, "Power Plant Engineering", Tata McGraw- Hill, 4th Edition, 2017.
2. Arora S.C and Domkundwar S, "A Course in Power Plant Engineering", Dhanpat Rai, 8th Edition, 2016.

REFERENCE BOOKS:

1. R.K.Rajput, "Power Plant Engineering", Laxmi Publications, 5th Edition, 2016.
2. G.D.Rai, "An Introduction to Power Plant Technology", Khanna Publishers, 2015.
3. EI-Wakil M.M, "Power Plant Technology", Tata McGraw-Hill, 2013.
4. G.R,Nagpal , "Power Plant Engineering", Khanna Publishers, 2002.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Realize the importance of power requirement, generation and utilization in the present world energy scenario.	3	1	-	-	-	1	1	-	1	1	-	-	2	-	-
Co2	Apply the knowledge gained by analyzing the steam power plants, steam generators and gas turbine power plants, to improve the efficiency and reduce the thermal losses.	3	1	-	-	-	1	1	-	1	1	-	-	2	-	-
Co3	Analyze the processes and cycles followed in nuclear power plants and components used in the power plants and identify the losses to get better efficiency.	3	1	-	-	-	1	1	-	1	1	-	-	2	-	-
Co4	Describe the working of various components of diesel power plant and Illustrate the working of gas turbine power plant and its components.	3	1	-	-	-	1	1	-	1	1	-	-	2	-	-
Co5	Apply knowledge about economics of power generation and use of renewable energy.	3	1	-	-	-	1	1	-	1	1	-	-	2	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715MET04	COMPOSITE MATERIALS	3	0	0	3	50	50	100

OBJECTIVES:

1. To interpret the need of newer materials which are having better properties to suit with conventional materials.
2. To analyze the mechanics of laminated composites.
3. To analyze the different processing/ fabrication techniques of composite materials.
4. To identify the properties, advantages and disadvantages of the metal matrix composites.
5. To gain the knowledge of the advanced composite materials used in various applications.

PRE-REQUISITES: Knowledge of Engineering Chemistry is required.

UNIT I INTRODUCTION TO COMPOSITE MATERIALS 09

Definition, Need, Classification and Characteristics of composite materials– Fibrous composites, laminated composites, Particulate composites, Hybrid composites, Merits, demerits and applications of composite materials, Types of matrix and reinforcements, Properties of matrix and reinforcements.

UNIT II MECHANICS OF LAMINATED COMPOSITES 10

Stress-strain relationship for anisotropic and orthotropic materials, Unidirectional laminas – Rule of mixtures, Volume fraction and weight fraction, Fibre length and fibre orientation distribution, voids, Strength of orthotropic lamina, Failure criteria of orthotropic lamina, Macro mechanical behaviour of laminates, Interfacing bonding mechanics.

UNIT III FABRICATION OF COMPOSITES 09

Fabrication process–Open and closed mould process, Hand layup techniques, Vacuum bag molding – Auto clave method – Filament winding, Pultrusion, Pulforming, Thermo-forming, Injection molding, Blow molding, Curing, Machining, Recycling of PMC.

UNIT IV METAL MATRIX COMPOSITES 09

Commonly used Matrices, Basic Requirements in Selection of constituents, Fabrication process – Liquid metallurgy – Liquid metal impregnation technique, Pressure infiltration, Stir-casting, Squeeze casting, Powder metallurgy technique, Mechanical properties and Machinability of MMCs.

UNIT V ADVANCED COMPOSITES 08

Interface, Properties and Processing of Ceramic matrix composites, Carbon fibre composites, Carbon Carbon Composites, Multifilmentary super conducting composites, In-situ composites, Nano composites.

TOTAL: 45 Hours

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COURSE OUTCOMES:

- Students become aware of different composite materials, reinforcement materials, matrix materials and their usages.
- The students will have thorough knowledge of micro & macro structural analysis of orthotropic materials, derivation of equations and application to problem solving.
- The students will have knowledge about different fabrication techniques for polymer matrix composites.
- They will have demonstrate skill to evaluate properties and applications of metal matrix composite materials.
- The student will have knowledge on the advanced composite materials, their properties and applications.

TEXT BOOKS:

1. Chawla K.K., "Composite Materials Science and Engineering", Third Edition, Springer, 2013.
2. Mallick P.K., "Fibre Reinforced Composites", Third Edition, CRC Press, 2008.

REFERENCE BOOKS:

1. Mallick, P.K. and Newman. S., "Composite Materials Technology", Hanser Publishers, 2003.
2. Mathews F.L. and Rawlings R.D, "Composite Materials: Engineering and Science", CRC Press and wood head Publish Limited, 2002.
3. Harold Belofsky, "Plastics, Product Design and Process Engineering", Hanser Publishers, 2002.
4. Derek Hull, "An Introduction to Composite Materials", Second Edition, Cambridge University Press, 1996.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Students become aware of different composite materials, reinforcement materials, matrix materials and their usages.	2	-	1	-	-	-	-	-	-	1	-	1	1	-	-
Co2	The students will have thorough knowledge of micro & macro structural analysis of orthotropic materials, derivation of equations and application to problem solving.	2	3	1	-	-	-	-	-	-	-	-	1	2	-	-
Co3	The students will have knowledge about different fabrication techniques for polymer matrix composites.	1	-	2	-	-	-	-	-	-	-	-	1	2	-	2
Co4	They will have demonstrate skill to evaluate properties and applications of metal matrix composite materials.	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Co5	The student will have knowledge on the advanced composite materials, their properties and applications.	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-

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715MEP07	INTERNSHIP & TECHNICAL SEMINAR	L	T	P	C
		0	0	2	1

OBJECTIVES:

1. To make the students to get practical exposure and learn about various activities happening in the industries.
2. To make the students to learn about effective communication, presentation skills and report preparation.
3. To build the strength, team work spirit and self confidence in students life.
4. To develop skills in the application of theory to practical work situations.
5. To increase a student's strength of responsibility and good work habits.

GUIDELINES

- It is mandatory that each student should undergo internship / in-plant training in reputed industries for the duration of 2-3 weeks after second semester end examination. Then the student has to submit a hard copy of the training report not less than 10 pages. Also he / she has to give presentation on the training report for about 30 minutes.
- Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

EVALUATION

- The training report will be evaluated by the faculty in-charge.
- There is internal assessment and end examination.

TOTAL : 30 Hours

COURSE OUTCOMES:

- The students will have practical knowledge about various activities like process design, quality control that are takes place in industries.
- The students will have the skills about effective communication, presentation and report preparation.
- The students are able to improve their problem solving and critical thinking skills.
- The students are able to identify the professional standards.
- The students are able to create or modify the new technology policies.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The students will have practical knowledge about various activities like process design, quality control that are takes place in industries.	1	1	1	-	2	-	1	-	-	-	-	-	1	1	-
Co2	The students will have the skills about effective communication, presentation and report preparation.	-	-	-	-	-	-	-	-	2	3	1	1	-	-	1
Co3	The students are able to improve their problem solving and critical thinking skills.	1	-	-	1	-	-	-	-	-	-	2	-	1	2	-
Co4	The students are able to identify the professional standards.	-	-	-	-	-	3	1	2	1	-	-	2	-	3	-
Co5	The students are able to create or modify the new technology policies.	-	-	-	-	2	-	3	-	-	-	-	1	1	2	3

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715MEP08	MECHATRONICS LABORATORY	0	0	4	2	50	50	100

OBJECTIVES:

1. To know the basic working principle of hydraulic and pneumatic systems.
2. To interpret system drawings and design simple systems for sequential control systems involving valves and cylinders.
3. To develop the capability of design and implementation of pneumatic circuits for industrial automation / electro - pneumatic circuits for industrial automation.
4. To learn the virtual instrumentation software and its applications for automated measurement / monitoring.
5. To familiar with interfacing of electromechanical system to micro controllers.

PRE-REQUISITES: Knowledge of Basic Applied Hydraulic and Pneumatics, Mechatronics and Robotics are required

LIST OF EXPERIMENTS

1. Design and testing of Fluid Power Circuits to Control.
   (i) Velocity (ii) Direction and (iii) Force of single and double acting Actuators.
2. Design of circuits with logic sequence using Electro Pneumatic Trainer Kits.
3. Design and Simulation of basic Hydraulic, Pneumatic and Electric Circuits using Software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
5. Speed Control of AC & DC drives.
6. Servo Controller interfacing for DC motor.
7. PID controller interfacing.
8. Stepper motor interfacing with 8051 Micro controller.
   (i) Full step resolution (ii) Half step resolution.
9. Modeling and Analysis of Basic Electrical, Hydraulic and Pneumatic Systems using LAB VIEW.
10. Computerized Data Logging System with control for process variables like Pressure Flow and Temperature.

TOTAL : 45 Hours

COURSE OUTCOMES:

The students will be able to

- Identify the hydraulic and pneumatic systems employed in manufacturing industry.
- Apply the principles of Mechatronics and automation for the development of productive and efficient manufacturing systems.
- Use the engineering technique skills and modern engineering tools necessary for practical applications.
- Use design principles and develop conceptual, engineering design and fabrication of various components.
- Simulate the basic electrical, hydraulic and pneumatic system using simulation software.

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The students will be able to identify the hydraulic and pneumatic systems employed in manufacturing industry.	2	2	3	2	3	1	-	-	2	1	2	3	1	-	3
Co2	The students will have an ability to learn about how to apply the principles of Mechatronics and automation for the development of productive and efficient manufacturing systems.	3	2	2	1	2	-	-	-	1	1	2	1	1	2	1
Co3	The students will be able to use the engineering technique skills and modern engineering tools necessary for practical applications.	2	2	2	2	1	-	-	-	1	--	2	1	1	3	1
Co4	Students will use design principles and develop conceptual, engineering design and fabrication of various components.	3	1	2	2	2	-	-	-	2	1	2	2	1	-	2
Co5	The students will be able to simulate the basic electrical, hydraulic and pneumatic system using simulation software.	3	2	2	1	2	-	-	-	1	2	2	1	-	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715MEP09	CAE LABORATORY	0	0	4	2	50	50	100

OBJECTIVES:

1. To interpret design concepts to use the Finite Element Method software correctly and efficiently
2. To comprehend the types of element used, type of analysis done, interpretation of results, method of solving and analyzing a given problem.
3. To acquire the basic skills in using professional level finite element software, applied to structural and heat transfer components at various loading conditions.
4. To analyze a physical problem, develop experimental procedures for accurately investigating the problem, and effectively perform and document findings.
5. To simulate simple mechanisms using simulation software.

PRE-REQUISITES: Knowledge of Finite Element Analysis is required.

LIST OF EXPERIMENTS

A. ANALYSIS (SIMPLE TREATMENT ONLY) **37**

1. Stress Analysis of bars (Constant cross sectional area, Tapered area &Stepped bar).
2. Two Dimensional Truss analysis.
3. Stress Analysis of Beams (Cantilever, Simply supported, Fixed ends).
4. Stress Analysis of a Plate with a Circular Hole.
5. Stress Analysis of Rectangular L Bracket.
6. Stress Analysis of an Axi-symmetric Component.
7. Mode Frequency Analysis of Beams (Cantilever, Simply supported, Fixed ends).
8. Mode Frequency Analysis of a 2-D Component.
9. Harmonic Analysis of Beams.
10. Thermal Stress Analysis of a 2D Component.
11. Conductive Heat Transfer Analysis of a 2D Component.
12. Convective Heat Transfer Analysis of a 2D Component.

B. SIMULATION **8**

1. Simulation of Air conditioning system with Condenser Temperature and Evaporator Temperatures as input to get COP using C /MAT Lab.
2. Simulation of Cam and Follower Mechanism using C / MAT Lab.
3. Simulation of Four Bar Mechanism using C / MAT Lab.
4. Simulation of Slider Crank Mechanism using C / MAT Lab.

TOTAL : 45 Hours

COURSE OUTCOMES:

The students will be able to

- Select the method, meshing, analysis and optimize the given problem for structural and thermal applications.
- Conduct structural analyses and selected other analysis like normal modes/natural frequency analysis, harmonic analysis, steady-state heat conduction analysis.
- Use professional level finite element software to solve engineering problems in solid mechanics and heat transfer.
- Simulate simple kinematic mechanisms and air conditioning system using simulation software.
- Recognize sources of errors in FEA.

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Select the method, meshing, analysis and optimize the given problem for structural and thermal applications.	2	3	2	2	2	-	-	-	1	2	2	-	1	-	1
Co2	Conduct structural analyses and selected other analysis like normal modes/natural frequency analysis, harmonic analysis, steady-state heat conduction analysis.	2	3	1	2	2	-	-	-	2	1	2	-	1	-	1
Co3	Use professional level finite element software to solve engineering problems in solid mechanics and heat transfer.	2	3	2	2	2	-	-	-	2	-	2	-	1	-	1
Co4	Simulate simple kinematic mechanisms and air conditioning system using simulation software.	2	3	2	2	2	-	-	-	2	-	2	-	1	-	2
Co5	Recognize sources of errors in FEA.	2	2	1	2	2	-	-	-	-	-	1	-	1	-	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715MEP10	DESIGN AND FABRICATION PROJECT	0	0	4	2	50	50	100

OBJECTIVES:

1. To provide opportunity for the student to recollect the fundamental knowledge acquired during the earlier semesters and apply the same to real life problems and provide solution to the problems
2. To learn concepts, models, frameworks, and tools that engineering graduate need in a world where creativity and innovation is fast becoming a pre-condition for competitive advantage.
3. Each student will choose a nagging workplace problem or socially relevant problems and prove their understanding of fundamental concepts.
4. To give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them
5. To understand the basic steps of project planning, project management, Quality assurance, process management and their relationships

GUIDE LINES

1. The students in convenient groups of not more than 4 members have to take one small system for design and fabrication.
2. Every project workgroup shall have a guide who is the member of the faculty of the institution and if possible with an industrial guide also.
3. The system chosen may be a machine element (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.
4. The students are required to design and fabricate the chosen system in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

CONTINUOUS ASSESSMENT

1. The progress of the project is evaluated by a review committee consisting of a minimum of three members.
2. The review committee may be constituted by the Head of the Department.
3. The continuous assessment shall be made by conducting three reviews.

TOTAL : 90 Hours

COURSE OUTCOMES:

The students are able to

- Use design principles and develop conceptual design of various components
- Fabricate various components using different manufacturing tools
- Develop skills to be the effective members of team
- Have the knowledge of contemporary issues and modern practices
- Familiarize presentation, communication and team-work skills

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Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Use design principals and develop conceptual design of various components	2	3	2	-	-	1	1	-	1	-	-	-	3	-	3
Co2	Fabricate various components using different manufacturing tools	-	-	3	2	1	-	-	-	-	-	-	1	2	1	3
Co3	Develop skills to be the effective members of team	-	-	-	-	2	1	-	2	3	1	1	-	-	2	-
Co4	Have the knowledge of contemporary issues and modern practices	2	2	-	1	3	-	-	-	-	-	-	-	-	1	1
Co5	Practice presentation, communication and team-work skills	-	-	-	-	-	-	-	1	2	3	2	-	-	1	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
715MEE01	PROCESS PLANNING AND COST ESTIMATION	3	0	0	3	50	50	100

OBJECTIVES:

1. To know the use of work study leads to high productivity in a manufacturing unit.
2. To study the steps involved in conducting a method study and apply the principles of motion economics.
3. To know the importance of process planning in manufacturing environment.
4. To get knowledge on step by step procedures in the cost estimation of any product.
5. To learn the concept of pricing of material.

PRE-REQUISITES: Knowledge of Engineering Economics and Cost Analysis is required.

UNIT I WORK STUDY AND ERGONOMICS **10**

Method study - Definition - Objectives-Motion economy- Principles - Tools and Techniques- Applications - Work measurements- Purpose - Use - Procedure - Tools and techniques- Standard time -Ergonomics - principles - Applications.

UNIT II PROCESS PLANNING **10**

Definition - Objective - Scope - Approaches to process planning- Process planning activities - Finished part requirements- Operating sequences- Machine selection - Material selection parameters- Set of documents for process planning- Developing manufacturing logic and knowledge- Production time calculation - Selection of cost optimal processes.

UNIT III INTRODUCTION TO COST ESTIMATION AND BREAK EVEN ANALYSIS **7**

Objective of cost estimation- costing - Cost accounting- classification of cost- Elements of cost – Break Even Analysis – Basic assumptions – Problems on Break Even Analysis – Break Even chart – Managerial use of Break Even Analysis.

UNIT IV COST ESTIMATION AND PRICING **8**

Types of estimates - Methods of estimates - Data requirements and sources- Collection of cost- Allowances in estimation. Pricing practice – Full cost pricing – Marginal cost pricing – Going rate pricing – Bid pricing – Pricing for a rate of return.

UNIT V PRODUCTION COST ESTIMATION **10**

Estimation of material cost, Labour cost and over heads, Allocation of overheads - Estimation for different types of jobs. Internal rate of return – Payback period – Net present value – Calculations on Cost benefit analysis.

TOTAL : 45 Hours

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COURSE OUTCOMES:

- The students can make analyze on the techniques of work study and principles of ergonomics.
- The students will know the concept of process planning and cost estimation for various product and process of industry.
- The students will be familiar with types of estimation, pricing methods and production cost estimation.
- The student will have an ability to know about the calculations of finding internal rate of return, net present value and payback period.
- The students will have knowledge about estimation of production costs.

TEXT BOOKS:

1. T.R. Banga and S.C.Sharma, "Mechanical Estimating and Costing", Khanna Publishers, 18th Edition, 2019.
2. Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 2000.

REFERENCE BOOKS:

1. Varshney R.L and Maheshwari K.L., "Managerial Economics", S.Chand & Co., 2014.
2. Russell.R.S and Tailor, B.W, "Operations Management", Prentice Hall of India, 7th Edition, 2011.
3. Khan M.Y. and Jain P.K., "Financial Management", McGraw-Hill Publishing Co. Ltd, 6th Edition, 2011.
4. Kesavan R K, "Process Planning and Cost Estimation", New Age International (P) Ltd, 2009.
5. Dewett K.K and Jain J.D., "Elementary Economic Theory", S.Chand & Co., 2006.
6. Adithan M and Pabla B S, "Production Engineering Estimating and Costing", Konark Publishers, 1990

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The students understand the techniques of work study and principles of ergonomics.	2	3	1	-	1	-	1	-	1	-	-	1	2	-	1
Co2	The students will know the concept of process planning and cost estimation for various products and processes in industry.	1	2	1	-	1	-	-	-	1	-	-	1	1	-	1
Co3	The students will be familiar with types of estimation, pricing methods and production cost estimation.	1	2	-	-	-	-	-	-	1	-	-	2	2	-	-
Co4	The student will have an ability to know about the calculations of finding internal rate of return, net present value and payback period.	1	2	-	-	-	-	-	-	1	-	-	2	2	-	-
Co5	The students will have knowledge about estimation of production costs.	1	2	-	-	-	-	-	-	1	-	-	2	2	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
815MET01	AUTOMOBILE ENGINEERING	3	0	0	3	50	50	100

OBJECTIVES:

1. To understand the structure of vehicle chassis and engine components.
2. To understand the working of various engine auxiliary and emission system.
3. To impart knowledge about the various transmission system and their working.
4. To demonstrate the students about working principle of steering, suspension and braking systems.
5. To learn about the electrical systems and advances in automotive engineering.

PRE-REQUISITES: Knowledge of Basic of Civil and Mechanical Engineering is required.

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles, and need for a gearbox, components of engine-their forms, functions and materials. Vehicle construction - Chassis and body – Specifications, resistances to vehicle motion. Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters - Cooling system - Types - Water pumps - Radiators - Thermostats - Anti-freezing compounds.

UNIT II ENGINE AUXILIARY SYSTEMS AND EMISSION CONTROL SYSTEM 9

Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI-Automobile Emissions - Source of formation – Effects on human health and environment - Control techniques - Exhaust Gas Recirculation (EGR) - Catalytic converter - Emission tests and standards (Indian and Europe)

UNIT III TRANSMISSION SYSTEMS 9

Clutches - Function - Types - Single plate, Multiple plate and Diaphragm Clutch - Fluid coupling - Gearbox - Manual - Sliding - Constant - Synchromesh - Overdrive - Automatic transmission - Torque converter - Epicylic and Hydromatic transmission - Continuously variable transmission - Universal joint - Propeller shaft - Hotchkiss drive – Final drive - Rear axle assembly - Types -Differential - Need - Construction – Non-slip differential – Differential locks - Four wheel drive.

UNIT IV STEERING, SUSPENSION AND BRAKING SYSTEM 9

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers - Wheels and Tires - Construction - Type and specification - Tire wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System(ABS)

UNIT V AUTOMOBILE ELECTRICAL SYSTEMS AND ADVANCES IN AUTOMOBILE ENGINEERING 9

Battery-General electrical circuits-Dash board instrumentation - Passenger comfort - Safety and security - HVAC - Seat belts - Air bags - Automotive Electronics - Electronic Control Unit (ECU) - Variable Valve Timing (VVT) - Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP) Traction Control System (TCS) - Global Positioning System (GPS) - X-by-wire - Electric - Hybrid vehicle.

TOTAL : 45 PERIODS

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COURSE OUTCOMES:

The students will able to

- Understand the structure of vehicle chassis and engine component.
- Understand the working of various engine auxiliary and emission system.
- Impart knowledge about the various transmission systems and their working.
- Demonstrate about the working principle of steering, suspension and braking systems.
- Learn about the electrical systems and advances in automotive engineering.

TEXT BOOKS:

1. Dr. Kirpal Singh, "Automobile Engineering Vols 1 & 2 ", Standard Publishers Distributors, 13th Edition, New Delhi, 2014.
2. Srinivasan. S, "Automotive Mechanics", Tata McGraw Hill Publishers, 2nd Edition, New Delhi, 2003.

REFERENCE BOOKS:

1. Rajput R K, "A Text book of Automobile Engineering", Laxmi Publication, 2015.
2. Ganesan V, "Internal Combustion Engines", Third Edition, Tata McGraw-Hill, 2012.
3. Richard van Basshuysen, "Modern Engine Technology from A to Z", SAE International Publications, USA, 2007.
4. Martin W. Stockel and Martin T Stockel, "Auto Fundamentals", The Goodheart -Will Cox Company Inc, USA, 10th Edition, 2005.
5. Heinz Heisler, "Advanced Vehicle Technology", SAE International Publications USA, 2nd Edition, 2002.
6. Garret.T.K, Newton.K and Steeds.W, "Motor Vehicles", Butterworth-Heinemaan Publishers, 13th Edition, 2001.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Imparts knowledge on different types of chassis and identify suitable engine for different applications.	-	-	2	-	-	1	1	-	-	-	1	1	2	-	1
Co2	Develop knowledge on troubleshooting of engine auxiliary systems and emission control.	-	3	-	1	1	2	2	-	-	-	-	1	-	3	-
Co3	Equipped with knowledge on automatic transmission system.	-	2	1	-	1	-	-	-	-	-	1	1	-	3	-
Co4	Analyze the steering geometry, braking principle and suspension systems.	3	1	-	2	-	-	1	-	-	-	-	2	-	-	2
Co5	Identify the usage of Electrical vehicles and Hybrid vehicles.	2	-	-	-	1	-	-	-	2	-	2	-	2	-	3

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
815MEP04	PROJECT WORK	0	0	16	8	50	50	100

OBJECTIVES:

The objectives of the project are

1. To get an opportunity to synthesize knowledge from various areas of learning, and critically and creatively apply it to real life situations.
2. To acquire skills like collaboration, communication and independent learning, prepares them for lifelong learning and the challenges ahead.
3. To deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation or an analysis.
4. To use the engineering technical skills and modern engineering tools necessary for practical applications.
5. To document and present one's own work, for a given target group, with strict requirements on structure, format, and language usage.

GUIDELINES

1. The project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.
2. Every project work shall have a guide who is the member of the faculty of the institution.
3. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
4. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. The final report shall be typewritten form as specified in the guidelines.

EVALUATION

1. The progress of the project is evaluated by a review committee consisting of a minimum of three members.
2. The review committee may be constituted by the Head of the Department.
3. The continuous assessment shall be made by conducting three reviews.
4. The external assessment shall be done by one internal examiner and one external examiner (from other institution) by conducting oral examination.

TOTAL :45 PERIODS

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COURSE OUTCOMES:

The students will be able to

- Use the engineering technical skills and modern engineering tools necessary for practical applications.
- Use design principles and develop conceptual, engineering design and fabrication of various components.
- Take up any challenging practical problems and find solution by formulating proper methodology.
- Create the document of the project with correct format and structure.
- Gain Practical knowledge about various activities like processes, design, quality control that are taking place in industries.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Use the engineering technical skills and modern engineering tools necessary for practical applications.	2	3	1	-	2	-	-	-	-	-	-	-	3	2	3
Co2	Use design principles and develop conceptual, engineering design and fabrication of various components.	2	2	3	1	2	-	-	-	-	-	-	-	2	1	3
Co3	Take up any challenging practical problems and find solution by formulating proper methodology.	1	2	1	2	-	-	1	-	-	-	-	-	1	-	3
Co4	Create the document of the project with correct format and structure.	-	-	-	-	-	-	-	-	2	3	1	1	-	-	1
Co5	Gain Practical knowledge about various activities like processes, design, quality control that are taking place in industries.	2	1	2	-	1	-	1	1	-	-	-	-	-	1	1

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
815MEE04	INDUSTRIAL SAFETY AND HAZARDS MANAGEMENT	3	0	0	3	50	50	100

OBJECTIVES:

1. To know about safety and hazards regulations and also about industrial hygiene.
2. To know about the preventive and protective management from fires and explosion.
3. To know about hazard identification.
4. To gain the knowledge on leakage of liquids, vapours, gases, etc.
5. To prepare a case study on fire fighting and hazard management.

UNIT I FIRE AND EXPLOSION **10**

Introduction-Industrial processes and hazards potential, mechanical electrical, thermal and process hazards. Safety and hazards regulations, Industrial hygiene. Factories Act, 1948 and Environment (Protection) Act, 1986 and rules thereof. Shock wave propagation, vapour cloud and boiling liquid expanding vapours explosion (VCE and BLEVE), mechanical and chemical explosion, multiphase reactions, transport effects and global rates.

UNIT II RELIEF SYSTEMS **8**

Preventive and protective management from fires and explosion-inerting, static electricity passivation, ventilation and sprinkling, proofing, relief systems – relief valves, flares, scrubbers.

UNIT III TOXICOLOGY **10**

Hazards identification-toxicity, fire, static electricity, noise and dust concentration; Material safety data sheet, hazards indices- Dow and Mond indices, hazard operability (HAZOP) and hazard analysis (HAZAN).

UNIT IV LEAKS AND LEAKAGES **12**

Spill and leakage of liquids, vapors, gases and their mixture from storage tanks and equipment; Estimation of leakage/spill rate through hole, pipes and vessel burst; Isothermal and adiabatic flows of gases, spillage and leakage of flashing liquids, pool evaporation and boiling; Release of toxics and dispersion. Naturally buoyant and dense gas dispersion models; Effects of momentum and buoyancy; Mitigation measures for leaks and releases.

UNIT V CASE STUDIES **5**

Flixborough, Bhopal, Texas, ONGC offshore, HPCL Vizag and Jaipur IOC oil-storage depot incident; Oil, natural gas, chlorine and ammonia storage and transportation hazards.

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

Student will be able to

- Understand about safety and hazards regulations and also about industrial hygine.
- Understand preventive and protective management from fires and explosion.
- Understand hazard identification.
- Gain the knowledge on leakage of liquids, vapours, gases, etc.
- Prepare a case study on fire fighting and hazard management.

TEXT BOOK:

1. Crowl D.A. and Louvar J.F., "Chemical Process Safety: Fundamentals with Applications", 2nd Edition, Prentice Hall, 2001.

REFERENCE BOOKS:

1. Mannan S., "Lee's Loss Prevention in the Process Industries", Vol.I, 3rd Ed., Butterworth Heinemann, 2004.
2. Mannan S., "Lee's Loss Prevention in the Process Industries", Vol.II, 3rd Ed., Butterworth Heinemann, 2005.
3. Mannan S., "Lee's Loss Prevention in the Process Industries", Vol.III, 3rd Ed., Butterworth Heinemann, 2005.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	Shock wave propagation, mechanical and chemical explosion.	-	-	1	-	1	2	2	1	1	1	2	2	1	-	-
Co2	Ventilation and sprinkling, proofing and relief systems.	-	-	1	-	1	2	2	1	1	1	1	2	1	-	-
Co3	Hazards indices like Dow and Mond indices.	-	-	1	-	1	2	1	1	1	1	1	2	1	-	-
Co4	Mitigation measures for leaks and releases.	-	-	1	-	1	2	2	1	1	1	2	2	1	-	-
Co5	Chlorine and ammonia storage and transportation hazards.	-	-	1	-	1	1	2	1	1	1	1	1	1	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
815MEE09	TOTAL QUALITY MANAGEMENT	3	0	0	3	50	50	100

OBJECTIVES:

1. To understand the basic concepts of TQM and to know about various philosophies of TQM.
2. To know about the concepts of motivation, PDSA cycle and Kaizen.
3. To gain knowledge in old and new seven management tools and concepts like six sigma and bench marking.
4. To gain knowledge in implementation of QFD.
5. To know about the quality certificates such as ISO 9000 and ISO 14000.

PRE-REQUISITES: Knowledge of Principles of Management is required.

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM - TQM Framework - Philosophies of Deming, Juran and Crosby - Barriers to implement TQM.

UNIT II TQM PRINCIPLES **9**

Leadership - Strategic quality planning, Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition, Reward and Performance appraisal - Continuous process improvement - PDSA cycle, 5s, Kaizen - Supplier partnership - Partnering, Supplier selection and Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I **9**

The seven traditional tools of quality - New management tools - Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA – Stages and Types.

UNIT IV TQM TOOLS AND TECHNIQUES II **9**

Quality circles - Quality Function Deployment (QFD) – House of Quality - Taguchi quality loss function – Total Productive Maintenance - Concepts, improvement needs - Cost of Quality - Performance measures.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000- ISO 9000-2000 Quality System - Elements, Documentation and Quality auditing- QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

- The Student will get knowledge in the philosophies of management and basic concepts.
- The students will have an ability to gain the knowledge on leadership qualities and management tools of quality and statistical concepts.
- The students will be able to have exposure on concepts like Benchmarking and Failure Mode Effective Anaysis.
- The students will be able to gain knowledge on Quality Function Deployment and Total Productive Maintenance.
- The students will be able to gain knowledge on the Quality certification procedure on ISO 9000, QS14000 and information on auditing.

TEXT BOOKS:

1. Dale H.Besterfield, at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2012.
2. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2008.

REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, South-Western (Thomson Learning), 2010.
2. Janakiraman.B and Gopal. R.K, "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd, 1st Edition, 2007.
3. Oakland, J.S. "TQM - Text with Cases", Butterworth - Heinemann Ltd., Oxford, 3rd Edition, 2003.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The Student will get the knowledge on philosophies of management and basic concepts.	2	-	-	-	-	-	-	1	-	-	-	2	3	-	-
Co2	The students will have an ability to gain the knowledge on leadership qualities and management tools of quality and statistical concepts.	3	-	-	-	-	-	-	-	-	1	1	-	2	-	-
Co3	The students will be able to have exposure on concepts like Benchmarking and Failure Mode Effective Analysis.	2	-	3	-	1	-	-	-	-	-	1	-	3	1	-
Co4	The students will be able to gain knowledge on Quality Function Deployment, and Total Productive Maintenance.	2	-	3	-	1	-	-	-	-	-	1	-	3	1	-
Co5	The students will be able to gain knowledge on the Quality certification procedure on ISO 9000, QS14000 and information on Auditing can be obtained.	1	2	-	-	-	-	-	-	-	1	-	-	2	-	-

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Course Code	Course Title	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CA	EA	Total
815MEE14	ENTREPRENEURSHIP AND E-BUSINESS	3	0	0	3	50	50	100

OBJECTIVES:

1. The aim of the course is to provide the students, with an opportunity to gain the knowledge in the field of entrepreneur, entrepreneurship and management of resources.
2. The student learns the function, types, role of entrepreneur in economic growth of a country. And also studies the different stages of entrepreneurial process.
3. To gain the knowledge to start up small scale industries with the support (consultancy & finance) from government, institutes & others.
4. To impart motivation studies and training.
5. To study its need and source of finance related to entrepreneurships.

PRE-REQUISITES: Knowledge of Principles of Management and Business Concepts is required

UNIT I ENTREPRENEURSHIP **9**

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

UNIT II MOTIVATION **9**

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

UNIT III BUSINESS **9**

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

UNIT IV FINANCE AND ACCOUNTING **9**

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

UNIT V SUPPORT TO ENTREPRENEURS **9**

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

TOTAL : 45 PERIODS

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COURSE OUTCOMES:

- The students will understand the necessity of management in the field of engineering and it realizes the importance of entrepreneurship in the modern world.
- The students will have an ability to define, characteristics and role of SSI in economic Development. Impact of privatization and globalization on SSIs and understand the meaning of project and project identification.
- The students are well trained to analyze the parameters of project like project appraisal, identification of business Opportunities, market feasibility study, technical feasibility study etc.
- The students will be able to understand the motivation techniques and the financial analysis in entrepreneurships.
- Students will understand the concept of management as a science, art and profession and appreciate the role of planning in management.

TEXT BOOKS:

1. S.S.Khanka, "Entrepreneurial Development", S.Chand & Co. Ltd., Ram Nagar, New Delhi, Reprint, 2012.
2. Kuratko & Hodgetts, "Enterprenuership - Theory, Process and Practices", Cenagage learning, 8th Edition, 2012.

REFERENCE BOOKS:

1. Hisrich R D and Peters M P, "Entrepreneurship", 6th Edition, Tata McGraw-Hill, 2012.
2. Mathew J Mandimala, "Enterprenuership theory at cross roads: paradigms and praxis", Dream tech, 2nd Edition, 2006.
3. Rabindra N. Kanungo, "Entrepreneurship and Innovation", Sage Publications, New Delhi, 1998.
4. EDII, "Faulty and External Experts - A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.

Course Outcome		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Co1	The students will understand the necessity of management in the field of engineering and it realizes the importance of entrepreneurship in the modern world.	1	-	-	1	-	-	2	1	1	-	3	3	2	3	-
Co2	The students will have an ability to define, characteristics and role of SSI in economic Development. Impact of privatization and globalization on SSIs and understand the meaning of project and project identification.	3	-	-	-	-	-	3	-	-	-	3	2	-	3	-
Co3	The students are well trained to analyze the parameters of project like project appraisal, identification of business Opportunities, market feasibility study, technical feasibility study etc.	3	2	-	-	2	3	-	2	-	2	1	3	1	3	-
Co4	The students will be able to understand the motivation techniques and the financial analysis in entrepreneurships.	2	1	1	-	-	-	-	-	-	-	1	2	1	3	-
Co5	Students will understand the concept of management as a science, art and profession and appreciate the role of planning in management.	1	-	-	-	-	-	-	1	3	-	1	3	-	3	-