1901MA104	Mathematics –I (Linear Algebra, Calculus and Partial differentiation) (ECE,MECH & BME)	L	T	P	C
		3	1	0	4

Aim of the course:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

PREREQUISITES: BASIC MATHEMATICS

Module 1: Matrices

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and Eigen vectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Module 2:Differential Calculus

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

Module 3: Integral Calculus

Double integration – Cartesian and polar coordinates – Change the order of Integration – Applications: Area of a curved surface using double integral – Triple integration in Cartesian co-ordinates – Volume as triple integral.

Module 3: Sequences and series:

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, Seriesfor exponential, trigonometric and logarithm functions.

Module 5: Partial Differentiation:

Partial derivatives, total derivative; Maxima, minima and saddle points; Method of Lagrange multipliers.

COURSE OUTCOMES Employability

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

CO1: Calculate the nature of the matrix using Orthogonal Transformation.

CO2: Develop the evolutes and envelopes of given curves by means of radius and centre of curvature.

CO3: Calculate the area and volume of a curve using double and triple integration.

CO4: Determine the nature of series using comparison, Ratio, Leibnitz tests.

CO5:Examine the maxima/minima for the given function with several variables by finding stationary points.

TEXT BOOKS:

REFERENCES (BOOKS):

1.Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2018.

2.G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

4.Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

5.D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

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1901PH101	INTRODUCTION TO MECHANICS (for Civil and Mechanical Engineering)	L	T	P	C
		3	0	0	3

Aim of the course: To make students understand and apply the knowledge in mechanics for engineering applications

PREREQUISITES:

Introduction to mechanics

Forces in Nature; Newton's laws and its completeness in describing particle motion; Solving Newton's equations of motion in polar coordinates and related problems

Vector mechanics of particles

Central forces: Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits, Application: Satellite manoeuvres

Five-term acceleration formula — Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum; Harmonic oscillator; Damped harmonic motion

Rigid body mechanics

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion;

Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples; Introduction to three-dimensional rigid body motion — (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor

Statics

Free body diagrams with examples on modelling of typical supports and joints; Condition for equilibrium in three- and two- dimensions; Friction: limiting and non-limiting cases.

COURSE OUTCOMES Employability | Entrepreneurship

Upon completion of this course, students will be able to

CO1: Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems

CO2: Extend all of concepts of linear kinetics to systems in general plane motion

CO3: Apply basic dynamics concepts of force, momentum, work and energy to apply in Newton's laws of motion

CO4: Apply Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments of forces

CO5: Apply the concepts of friction and conditions of equilibrium in two and three dimensions.

REFERENCES (BOOKS):

(i) Engineering Mechanics, 2nd ed. — MK Harbola
(ii) Introduction to Mechanics — MK Verma
(iii) An Introduction to Mechanics — D Kleppner & R Kolenkow
(iv) Principles of Mechanics — JL Synge & BA Gri*ths*
(v) Mechanics — JP Den Hartog
(vi) Engineering Mechanics - Dynamics, 7th ed. - JL Meriam
(vii) Mechanical Vibrations — JP Den Hartog
(viii) Theory of Vibrations with Applications — WT Thomson
(ix) An Introduction to the Mechanics of Solids, 2nd ed. with SI Units — SH Crandall, NC Dahl & TJ Lardner
(x) Engineering Mechanics: Statics, 7th ed. — JL Meriam
(xi)Engineering Mechanics of Solids — EP Popov

REFERENCES (WEBSITES):

1. https://www.edx.org/course/introduction-mechanics-part-1-ricex-phys-101-1x
2. https://learn.saylor.org/course/PHYS101
3. https://www.slideshare.net/KhanSaif2/1-introduction-to-mechanics-71503843

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1901GEX01	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common for all UG programmes, except BE- EEE)	L	T	P	C
		3	0	0	3

Aim of the course: To study about the fundamentals of Electrical, Electronics and Communication Engineering

PREREQUISITES:

COURSE CONTENTS

Introduction to DC and AC circuits: Ohms law - Kirchhoff's laws - Mesh analysis - Nodal analysis - Generation of AC waveforms - Analysis of R-L, R-C, R-L-C circuits - Introduction to three phase systems - Types of connections.

Electrical Machines: DC Generator, DC Motor, Transformer, Induction Motor: Working principle, construction and applications.

Measuring instruments: Classification of instruments; Voltmeter, Ammeter, Wattmeter, Energy meter, Multimeter, CRO: Principles and operation.

Semiconductor devices: V-I characteristics of PN junction diode and Zener diode; Rectifiers - Half wave and full wave rectifiers; BJT - configurations; Amplifiers & Oscillators: classification, operation and applications; SCR: Construction and V-I characteristics; Basic power converters (Block diagram approach only).

Digital systems: Boolean algebra - Reduction of Boolean expressions - De-Morgan's theorem - Logic gates - Implementation of Boolean expressions.

Communication Systems: Model of communication system - Analog and digital, Wired and wireless channel - Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system.

Electrical safety and wiring: Safety measures in electrical system - Safety devices - types of wiring - Wiring accessories-staircase, fluorescent lamps and corridor wiring - Basic principles of earthing - Types of earthing - layout of generation, transmission and distribution of power (Single line diagram).

COURSE OUTCOMES

Upon completion of this course, students will be able to

1. Solve very simple problems in DC and AC circuits
2. Explain the construction and principle of operation of DC and AC machines
3. Describe the operation of simple electrical measuring instruments
4. Elucidate the characteristics of diode, Zener diode, BJT, SCR and their applications
5. Implement Boolean expressions using logic gates
6. Explain the operation of functional blocks of various communication systems
7. Summarize the electrical safety systems and electrical wiring procedures

Employibility | Entrepreneurship

REFERENCES (BOOKS):

1. Smarajit Ghosh, —Fundamentals of Electrical and Electronics Engineering‖, 2nd Edition, PHI Learning, 2010.
2. R. Muthusubramaniam, S. Salaivahanan and K.A. Mureleedharan, —Basic Electrical Electronics and Computer Engineering‖, Tata McGraw Hill, 2004.
3. D.P. Kothari and I.J. Nagrath, -Theory and Problems of Basic Electrical Engineering‖, PHI learning, New Delhi, 2004.
4. J.B. Gupta, —Fundamentals of Electrical Engineering and Electronics‖, S.K. Kataria and Sons, Reprint 2012 Edition.
5. R.L. Boylestad and L. Nashelsky, —Electronic Devices and Circuit Theory‖, Pearson, 11th Edition, 2013.
6. George Kennedy and Bernard Davis, —Kennedy's Electronic communication Systems‖, McGraw Hill Education, 5th Edition, 2011.
7. Donald P. Leach, Albert Paul Malvino and Goutam Saha, —Digital Principles and Applications‖, McGraw-Hill Education, 8th Edition, 2014.

REFERENCES (WEBSITES):

4. https://nptel.ac.in/courses/108108076/
5. https://nptel.ac.in/downloads/108105053/

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1901GEX02	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

1. To develop in students, graphic skills for communication of concepts, ideas and design ofEngineering products.
2. To expose them to existing national standards related to technical drawings

MODULE I	CONCEPTS AND CONVENTIONS (Not for Examination)		5 Hours

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

MODULEII	PLANE CURVES AND FREE HAND SKETCHING			9 Hours

Basic Geometrical constructions, 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.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of Objects.

MODULEIII	PROJECTION OF POINTS, LINES AND PLANE SURFACES		9 Hours

Orthographic projection- principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

MODULEIV	PROJECTION OF SOLIDS			9 Hours

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

MODULE V	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	9 Hours

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

MODULE VI	ISOMETRIC AND PERSPECTIVE PROJECTIONS		9 Hours

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 45+5 HOURS

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Perform free hand sketching of basic geometrical constructions and multiple views of objects.

CO2: Do orthographic projection of lines and plane surfaces. Employibility / Entrepreneurship.

CO3: Draw projections and solids and development of surfaces.

CO4: Prepare isometric and perspective sections of simple solids.

CO5: Demonstrate computer aided drafting

REFERENCES:

1. Gopalakrishna K.R., —Engineering Drawing‖ (Vol. I&II combined), Subhas Stores, Bangalore,2016.

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1901GEX51	**CAD (COMPUTER AIDED DRAFTING) LAB** **(Common for all B.E./B.Tech. Programme)**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

List of Experiments: Employibility / Entrepreneurship.

Basics commands of a CAD software- two-dimensional drawing, editing, layering and dimensioning - coordinate Systems-Drawing practice - orthographic views of simple solids using CAD software.

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

Total: 45 Hours

References:

1. N.D. Bhatt, Machine Drawing, Charotar Publishing House Pvt. Ltd., 2014.
2. P.S. Gill, A Textbook of Machine Drawing, Katson books, 2013.
3. R.K. Dhawan, A Textbook of Machine Drawing, S. Chand,2012.
4. K.C. John, Textbook of Machine Drawing, PHI Learning Pvt. Ltd.,2009.

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1901GEX52	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY (Common for all UG programmes)	L	T	P	C
		-	-	2	1

Aim of the course : To apply the fundamentals of Electrical and Electronics Engineering

PREREQUISITES:

1. Experiments related to verification of Ohm's law and Kirchhoff's laws
2. Experiments involving logic gates
3. Fan and light control using regulators
4. Design of 6V regulated power supply
5. Energy conservation demonstration experiment using energy meter
6. Waveform generation and calculation of rms and average values
7. IC 555 and IC 741 based experiments
8. Experiments in earthing
9. Staircase wiring and residential building wiring
10. Speed control of DC shunt motor

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO1: Design and analyze electronic circuits
CO2: Test digital logic gates
CO3: Control lights and speed of motors
CO4: Measure electrical parameters using instruments
CO5: Generate waveforms
CO6: Construct different wiring schemes.

Employability / Entrepreneurship.

REFERENCES (BOOKS):

1. Edward Hughes, — Electrical Technology,‖, Pearson Education
2. D.P. Kothari and Nagrath — Basic Electronics‖,MH Education 2013.
3. Paul Scherz and Simon Monk —Practical Electronics for inventors‖ Mc Graw Hill Publications 2013.

REFERENCES (WEBSITES):

1. https://nptel.ac.in/courses/122106025/

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1901HSX51	COMMUNICATION SKILLS LAB (Common for all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

Course Overview:

English- being the foremost global language has its domination in internationally sensitive domains such as science and technology, business and commercial relation, education and diplomatic relationships, politics and administration and so on. It is the language of corporate India, a passport for better career, better pay, and advanced knowledge and for communication with the entire world. In higher education, English is the prevalent prestigious language. Careers in any area of business communication or within the government, or in science and technology require fluency in English

The basic idea behind offering English as a practical subject at the undergraduate level is to acquaint students with a language that enjoys currency as a lingua franca of the globe. For prospective engineers nothing could be more useful or productive than being able to reach out to the world of technology. In the ELCS lab the students are trained in Communicative English Skills, phonetics, word accent, word stress, rhythm and intonation, making effective oral presentations - both extempore and Prepared-seminars, group discussions, presenting techniques of writing, role play, telephonic skills, asking and giving directions, information transfer , debates, description of person, place, objects etc; . The lab encourages students to work in a group, engage in peer-reviews and inculcate team spirit through various exercises on grammar, vocabulary, listening and pronunciation games, etc

Objectives :

- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking.
- To train students to use language appropriately for interviews, group discussion and public speaking
- To help the students to cultivate the habit of reading passages from the computer monitor, thus provides them the required facility to face computer-based competitive exams such as GRE, TOEFL, GMAT etc.
- To train them to face interviews with confidence and enable them to prepare resume with cover letter.
- To prepare them to use communicative language and participate in public speaking.
- To initiate them into greater use of the computer in power point presentation preparation, report Writing and e-mail writing etc.
- To initiate them into greater use of the computer in power point presentation preparation, report Writing and e-mail writing etc.
- To expose the Students to participate in group discussions, debates with ease.

List of Exercises :

I	**Activities on Fundamentals of Listening and Inter-personal Communication**			**6 Hours**
	Listening to conversation, listening to technical presentation- listening to online video conferencing ,interviews and webinars -starting a conversation - responding appropriately and relevantly - using appropriate body language - Role Play in different situations & Discourse			
II	**Activities on Reading Comprehension**			**6 Hours**
	General Vs Local comprehension- reading for facts- guessing meanings from context-Scanning-skimming and inferring meaning- critical reading & effective googling- TOFEL,IELTS-reading online journals.			

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III	**Activities on Writing Skills**			**6 Hours**
	Structure and presentation of different types of writing - letter writing - Resume writing- e- correspondence - Proposal writing - Technical report writing - Portfolio writing - planning for writing - improving one's writing			
IV	**Activities on Presentation Skills**			**6 Hours**
	Oral presentations (individual and group) through JAM sessions – presentation on online platform (webinars, online meeting) - seminars -PPTs and written presentations through posters- projects- report- e-mails- assignments etc.- creative and critical thinking.			
V	**Activities on Soft Skills**			**6 Hours**
	Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation-Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews-Time management-stress management –paralinguistic features- Multiple intelligences – emotional intelligence – spiritual quotient (ethics) – intercultural communication – creative and critical.			
				TOTAL: 30 HOURS

Course Outcomes (COs): Skill Development

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

CO1: Compose grammatically correct sentences for oral as well as written communication.
CO2: Interpret perfectly after paying attention to an audio on any theme.
CO3: Organize formal presentations effectively.
CO4: Explain the content of any written or visual material.
CO5: Generate technical and non-technical documents with appropriate contents and context.
CO6: Monitor, analyse and adjust their own communication.

REFERENCES:

1. Raman, Meenakshi and Sangeetha Sharma, —Technical Communication: Principles and Practice‖, Oxford University Press, New Delhi, 2011.
2. Sudha Rani, D , —Advanced Communication Skills Laboratory Manual‖ , Pearson Education 2011.
3. Paul V. Anderson ,—Technical Communication‖,. Cengage Learning pvt. Ltd. New Delhi,2007.
4. —English Vocabulary in Use series‖, Cambridge University Press 2008.
5. —Management Shapers Series‖ ,Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Rizvi and Ashraf M., —Effective Technical Communication‖, Tata McGrawHill,New Delhi, 2005.
7. Jones, D, -The Pronunciation of English‖, CUP, . Cambridge,2002.

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1901PHX51	**ENGINEERING PHYSICS LAB**	L	T	P	C
	,Employability	0	0	2	1

List of Experiments:

1. Determination of wavelength of various colours of mercury spectrum using Laser grating
2. Determination of velocity of liquids using ultrasonic interferometer
3. Determine the dispersive power of a prism using spectrometer
4. Determine the unknown resistance of the given wire using Carey-Foster"s Bridge
5. Determine the band gap of the given semiconductor
6. Determine the acceptance angle and particle size using Laser
7. Torsional pendulum – Rigidity modulus of a steel wire
8. Thickness of a thin wire – Air Wedge
9. Measurement of Young"s modulus – Uniform and Non-uniform bending
10. Thermal conductivity –Lee"s Disc method

Total: 30 Hours

References:

1. „Practical Physics", R.K. Shukla, Anchal Srivastava, New age international (2011)
2. „B.Sc. Practical Physics", C.L Arora, S. Chand &Co. (2012)

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1901MA204	ENGINEERING MATHEMATICS – II (Calculus, Ordinary Differential Equations and Complex Variable)	L	T	P	C
		3	2	0	4

Aim of the course: This course focuses on acquiring sound knowledge of techniques involved in application of differentiation, form through Laplace transforms acquaint with the concepts of multiple integrals, needed for problems in all engineering disciplines, develop an understanding of the standard techniques of Analytic functions by satisfying CR equations so as to enable the student to apply them with confidence, in application areas such as Computer Graphics, Robotic Automations, Computer Vision Problems, Simulations and also make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

PREREQUISITES: Laplace Transforms, solving differential equations

MODULE I LAPLACE TRANSFORM **12Hours**

Laplace Transform – Conditions for existence – Transform of Elementary Functions – Basic Properties – Transform of Unit step function and Impulse function – Transform of Periodic function – Inverse Laplace Transform – Convolution Theorem (excluding Proof) – Initial and Final value Theorems – Solution of Linear ODE of Second order with constant coefficient using Laplace Transform techniques.

MODULE II VECTOR CALCULAS **12 Hours**

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 (excluding proofs) –Applications of the above theorems to find surface area of a closed region and volume of cube and parallel piped.

MODULE III ORDINARY DIFFERENTIAL EQUATIONS **12 Hours**

Second order linear differential equations with variable coefficients, method of variation of parameters.

MODULE IV COMPLEX VARIABLE – DIFFERENTIATION **12 Hours**

Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; Conformal mappings, Mobius transformations.

MODULE V COMPLEX VARIABLE– INTEGRATION **12 Hours**

Contour integrals, Cauchy Integral formula (without proof), Taylor"s series, zeros of analytic functions, singularities, Laurent"s series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

TOTAL: 60 HOURS

COURSE OUTCOMES

Employibility | Entrepreneurship

CO1 : Apply Laplace Transform in solving Boundary value problems of second order ODE(K3)
CO2 :Compute surface and volume integral in vector field (K3)
CO3 : Solve the higher order differential equations (K3)
CO4 : Construct Analytic functions and trace the image of a region using transformation (K3)
CO5 : Solve complex integrals (K3)

TEXT BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

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1901CH203	MATERIAL CHEMISTRY (for MECHANICAL ENGINEERING)	L	T	P	C
		3	0	0	3

Aim of the course: Material chemistry course is designed to provide chemistry and its application to the mechanical engineering students. The course is a combination of the theoretical concepts and its application in lab. It includes the study of applications of boilers and its effects, thermodynamics, corrosion principles, alloys and fuels and engineering materials as their theoretical parts. The course is designed very efficiently, specifically to support the mechanical programme through chemistry .

PREREQUISITES: Knowledge of chemistry in higher secondary level

MODULE-I BOILER

Boiler - Boiler Types, boiler compounds - boiler troubles- Sources, hard & soft water-Degree of hardness and its estimation (EDTA method)– Water Quality Parameters. boiler feed water-requirements - softening of hard water -external treatment –demineralization, Zeolite process internal treatment- desalination of sea water –reverse osmosis- Domestic water treatment

MODULE-II THERMODYNAMICS

Thermodynamics- – terms, Entropy as a thermodynamic quantity, entropy changes in isothermal expansion of an ideal gas, reversible and irreversible processes, physical transformations, work & free energy functions, Helmholtz and Gibbs free energy functions, Gibbs-Helmholtz equation, Clapeyron-Clausius equation & its applications, Van't Hoff isotherm and applications

MODULE-III CORROSION AND PROTECTIVE COATING

Corrosion And Protective Coating- Corrosion – types-chemical, electrochemical corrosion (galvanic, differential aeration) - Factors influencing corrosion -corrosion control – material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Protective coatings: Thermal Spray, Electroplating of gold and electroless plating of nickel. Paints - Constituents and Functions. Estimation of iron.

MODULE-IV ALLOYS AND PHASE RULE

Alloys and Phase Rule -Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process

MODULE-V FUELS AND ENGINEERING MATERIALS

Fuels and Engineering Materials- Fuel-Introduction- classification of fuels, carbonization-manufacture of metallurgical coke (Otto Hoffmann method)-Refining of petroleum- manufacture of synthetic petrol (Bergius process)- natural gas- compressed natural gas (CNG)- producer gas- water gas. Combustion- calorific value - Flue gas analysis (ORSAT Method). Fundamentals of nano chemistry, nano materials, synthesis, properties and application. Lubricants –types- application

COURSE OUTCOMES

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

CO1: Describe the boiler troubles in terms of water quality Employability | Entrepreneurship

CO2: Describe the principles thermodynamics to predict the feasibility of a reaction in thermal engineering.

CO3: Discuss the corrosion , its mechanism and preventive measures.

CO4: Describe the principles phase rule in alloys in manufacturing procedures.

CO5: Discuss of combustion of fuels and its calorific value

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TEXT BOOKS:

1. 1 Dara.S, Umare.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New delhi 2010.
3. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New Age
4. Kumar Mehta P. and Paulo J. M. Monteiro, (2014), Concrete: Microstructure, Properties and Materials, 4th Edition, McGraw-Hill, New Delhi.
5. Shetty. M. S., (2017), Concrete Technology, S. Chand and Company Ltd, New Delhi.
6. Neville. A. M, (2012), Properties of Concrete, Pearson, New Delhi.
7. ACI 211.1-91 Reapproved 2009, Standard Practice for selecting Proportions for Normal, Heavyweight, and Mass Concrete, USA

REFERENCES (WEBSITES):

1. https://www.ccdc.cam.ac.uk/solutions/csd-system/components/csd/
2. onlinelibrary.wiley.com/doi/10.1002/9780470661345.smc107/pdf

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1901GEX03	PROGRAMMING FOR PROBLEM SOLVING (Common for all B.E./B.Tech Programme)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1.To prepare students to comprehend the fundamental concepts
2.To demonstrate fine grained operations in number system
3.To gain exposure in programming language using C
4.To develop programming skills using the fundamentals and basics of C Language

MODULE I	INTODUCTION TO PROGRAMMING	9 Hours

Components of Computers and its Classifications- Problem Solving Techniques – Algorithm- Flowchart– Pseudo code – Program-Compilation -Execution

MODULE II	BASICS OF C PROGRAMMING	9 Hours

Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/output statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives.

MODULE III	ARRAYS AND STRINGS	9 Hours

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – Example Program: Matrix Operations - String operations

MODULE IV	FUNCTIONS AND POINTERS	9 Hours

Introduction to functions: Function prototype, function definition, function call, Built-in functions – Recursion – Example Program – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference

MODULE V	STRUCTURES & FILE PROCESSING	9 Hours

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Dynamic memory allocation -Files – Types - File processing: Sequential access, Random access -Command line arguments

TOTAL: 45 HOURS

FURTHER READING:

Object Oriented Programming Approach.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Describe basic concepts of computers
CO2: Paraphrase the operations of number system
CO3: Describe about basic concepts of C-Language
CO4: Understand the code reusability with the help of user defined functions
CO5: Analyze the structure concept, union, file management and preprocessor in C language

Employibility / Entrepreneurship.

REFERENCES:

1. Paul Deitel and Harvey Deitel, —C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, —Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, —Computer Fundamentals and Programming in C‖, Dorling Kindersley(India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.

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1901ENX01	ENGLISH FOR ENGINEERS Skill Development	L	T	P	C
	(Common for all B.E./B.Tech. Programme)	3	0	0	3

MODULE I FOCUS ON LANGUAGE (Vocabulary and Grammar) 9 Hours

Vocabulary -The Concept of Word Formation - Prefixes- Suffixes- Synonyms – Antonyms - Grammar - Articles- Preposition- Adjective-Adverb-Connectives -Tenses (present, past & future) - Conditional Clauses - Active voice –passive voice and Impersonal passive voice - Wh- Questions.

MODULE II LISTENING SKILLS 9 Hours

Listening-Types of Listening -listening to short or longer texts- listening and Note taking- -formal and informal conversations- telephonic etiquettes- narratives from different sources. - Correlative verbal and nonverbal communication - listening to panel members (how to response to panel members after listening panel members) – listening to facing online interviews (or) interviews on video conferencing mode - listening webinars.

MODULE III SPEAKING SKILL 9 Hours

Speaking - Stress and intonation –Communication skills- Role of ICT in Communication, -Process of communication- oral presentation skills- verbal and non verbal communication-individual and group presentations- impromptu presentation- public speaking- Group discussion- speaking to the panel members (online interviews , video conferencing, online meeting and webinars.

MODULE IV READING SKILLS 9 Hours

Reading– Intensive Reading –Predicting the content -Comprehending general and technical articles -Cloze reading - Inductive reading- Short narrative and descriptions from newspapers – Skimming and scanning-reading and interpretation-critical reading interpreting and transferring graphical information- sequencing of sentences-analytical reading on various Projects.

MODULE V WRITING SKILLS 9 Hours

Writing- Precise writing –Summarizing- Interpreting visual texts (pie chart, bar chart, picture, advertisements etc., - Proposal writing (launching new units or department in a institution or industry & to get loan from bank) -Report writing (accident, progress, project, survey, Industrial visit)- job application- e- mail drafting- letter writing (permission, accepting and decaling)- e.mail drafting instructions – recommendations –checklist- uses of Print and electronic media (internet, fax, mobile, interactive video and teleconferencing, computer) e-governance.

TOTAL: 45 HOURS

REFERENCES:

1. Raman, Meenakshi and Sangeetha Sharma, "Technical Communication: Principles and Practice", Oxford University Press, New Delhi, 2011.
2. Rizvi and Ashraf M., "Effective Technical Communication", Tata McGraw-Hill, New Delhi, 2005.
3. G. Radhakrishna Pillai, "English for Success", Central Institute of English and Foreign Languages", Emerald Publishers ,Hyderabad, 2003
4. Jones, D, "The Pronunciation of English", CUP, . Cambridge,2002.

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1901GE201	ENGINEERING EXPLORATION	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating ill-defined problems.
- Undergo several design challenges and work towards the final design challenge
- **Apply Design Thinking on the following Streams to**
  Project Stream 1: Electronics, Robotics, IOT and SensorsProject Stream 2: Computer Science and IT ApplicationsProject Stream 3: Mechanical and Electrical tools
  Project Stream4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

HOW TO PURSUE THE PROJECT WORK?

- The first part will be learning-based-masking students to embrace the methodology byexploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessaryskills as designers and learning about complementary material for human-centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and finalpresentation to be presented.
- The teams start with **Design Challenge** and go through all the phases more in depth fromcoming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges,usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by thefaculty.

TASKS TO BE DONE:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify adesign challenge.

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1901CHX51	ENGINEERING CHEMISTRY LAB	L	T	P	C
		0	0	2	1

Aim of the course: Engineering Chemistry laboratory course is designed to provide basic chemistry and its application to the first year engineering students. The course includes the study of applications of water quality chemistry, identification of acidic and alkaline nature of water,molecular weight determination and explaining the principles behind each experiments.

List of Practical Experiments

1. Determination of total, temporary & permanent hardness of water by EDTA method
2. Determination of strength of given hydrochloric acid using pH meter
3. Estimation of iron content of the given solution using potentiometer
4. Estimation of sodium present in water using flame photometer
5. Corrosion experiment – weight loss method
6. Determination of molecular weight of a polymer by viscometry method
7. Conductometric titration of strong acid Vs strong Base
8. Estimation of dissolved oxygen in a water sample/sewage by Winklers method.
9. Comparison of alkalinities of the given water samples
10. Determination of concentration of unknown colored solution using spectrophotometer
11. Determination of percentage of copper in alloy
12. Determination of ferrous iron in cement by Spectrophotometry method
13. Adsorption of acetic acid on charcoal
14. Determination the flash point and fire point of a given oil using Pensky martine closed cup apparatus
15. Determination the calorific value of solid fuels
16. Determination the structural of the compound using chemo software.

COURSE OUTCOMES Employibility / Entrepreneurship / Skill Development

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

CO1: Measure the hardness and alkalinity of given water sample
CO2: Find the amount and percentage of iron in unknown sample using EMF and photometric methods
CO3: Determine the amount of strong acid present in the given sample using PH metric and conductometric methods
CO4: Determine the amount of dissolved oxygen and heavy metal present in the given sample
CO5: Determine the molecular weight of the given polymer

TEXT BOOKS:

1. Experimental organic chemistry, Daniel R. Palleros, John Wiley & Sons, Inc., New Yor (2001)
2. "Engineering Chemistry", Jain & Jain, 15th edition, Dhanpat Rai Publishing company, New Delhi.
3. Vogel"s Textbook of practical organic chemistry, Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R LBS Singapore (1994).
4. LBS Singapore (1994). Kolthoff I.M., Sandell E.B. et al Mcmillan, Madras 1980.

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1901GE253	BASIC WORKSHOP AND MANUFACTURING PRACTICES LAB (Common to Civil, EEE and MECH.)	L	T	P	C
		0	0	2	1

List of Experiments Employibility | Entrepreneurship.

1. Forming of simple object in sheet metal using suitable tools.(Example: Dust Pan, Rectangular tray and Cone making)
2. Prepare V (or) Half round (or) Square (or) Dovetail joint from the given mild Steel flat.
3. Fabrication of a simple component using thin and thick plates using arc welding. (Example: Butt , Lap and T - Joints)
4. Making a simple component using carpentry power tools.(Example: Cross Lap, T-Lap and Dove tail joints)
5. Construct a household pipe line connections using pipes, Tee joint, four way joint, elbow, union, bend, Gate valve and Taps.

TOTAL: 30 Hours

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1901GEX52	COMPUTER PROGRAMMING LAB	L T P C 0 0 2 1

(Common for all B.E./B.Tech. Programme)

Employability | Entrepreneurship

List of Experiments:

1. Working with word and style sheets
2. Write a C program to implement basic concepts
3. Write a C program to implement Decision Making and Branching statements
4. Write a C program to implement looping statements
5. Write a C program to implement Arrays
6. Write a C program to implement Strings
7. Write a C program to implement pointers
8. Write a C program to implement Structures
9. Write a C program to work with files in C

References:

Total: 45 Hours

1. Paul Deitel and Harvey Deitel, —C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, —Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, —Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
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1901HSX51	COMMUNICATION SKILLS LAB (Common to all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

Skill Development

List of Experiments:

1. **Activities on Fundamentals of Listening and Inter-personal Communication (6)**
   Listening to conversation, listening to technical presentation- listening to online video conferencing ,interviews and webinars -starting a conversation - responding appropriately and relevantly - using appropriate body language - Role Play in different situations & Discourse Skills- using visuals.
2. **Activities on Reading Comprehension (6)**
   General Vs Local comprehension- reading for facts- guessing meanings from context- Scanning- skimming and inferring meaning- critical reading & effective googling- TOFEL,IELTS-reading online journals.
3. **Activities on Writing Skills (6)**
   Structure and presentation of different types of writing - letter writing - Resume writing-e-correspondence - Proposal writing - Technical report writing - Portfolio writing - planning for writing - improving one's writing.
4. **Activities on Presentation Skills (6)**
   Oral presentations (individual and group) through JAM sessions – presentation on online platform (webinars, online meeting) - seminars -PPTs and written presentations through posters- projects- report- e-mails- assignments etc.- creative and critical thinking.
5. **Activities on Soft Skills (6)**
   Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation-Concept and process, pre- interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews-Time management-stress management –paralinguistic features- Multiple intelligences – emotional intelligence – spiritual quotient (ethics) – intercultural communication – creative and critical.

Total: 30 Hours

References:

1. Raman, Meenakshi and Sangeetha Sharma, "Technical Communication: Principles and Practice", Oxford University Press, New Delhi, 2011.
2. Sudha Rani, D , "Advanced Communication Skills Laboratory Manual" , Pearson Education 2011.
3. Paul V. Anderson ,"Technical Communication",. Cengage Learning pvt. Ltd. New Delhi, 2007.
4. "English Vocabulary in Use series", Cambridge University Press 2008.
5. "Management Shapers Series" ,Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Rizvi and Ashraf M., "Effective Technical Communication", Tata McGrawHill, New Delhi, 2005.

Jones, D, "The Pronunciation of English", CUP, . Cambridge,2002.

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1901GE252	ENGINEERING INTELLIGENCE II	L	T	P	C
		0	0	2	1

Prerequisite: Engineering Intelligence - I

MODULE I	**VOCABULARY BULIDING**	**6 Hours**
Parts of Grammar- SVA- Art of Writing- word building activities		
MODULEII	**COMMUNICATION WORKSHOP**	**6 Hours**
Story Telling- Newspaper Reading-Extempore.		
MODULEIII	**INTERPERSONAL SKILLS**	**6 Hours**
Personality Development - Creativity and innovation –Critical Thinking and Problem Solving – Work Ethics-Technical Skill Vs Interpersonal Skills		
MODULEIV	**LEADERSHIP& EMPLOYABILITY SKILLS**	**6 Hours**
Levels of Leadership-Making of leader-Types of leadership-Transactions Vs Transformational Leadership – Exercises - Industry Expectations & Career Opportunities- Recruitment patterns.		
MODULE V	**RESUME BUILDING**	**6 Hours**
Importance of Resume- Resume Preparation - introducing onself		
TOTAL: 30 HOURS		

SKILL DEVELOPMENT

Course Outcomes:

On the successful completion of the course, students will be able to CO1: Understand various vocabulary building activites

CO2: Use various communication skill workshop for reading and writing. CO3: Apply interpersonal skill to motivate creating and innovating skills

CO4: Apply various leadership and employability skill to get career opportunities CO5: Prepare resume with necessary components

REFERENCES:

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxfor Publishers.

2. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007.

3. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017.

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1701MA301	ENGINEERING MATHEMATICS III (Common to B.E - Civil, CSE, EEE, Mech	L 3	T 2	P 0	C 4

PREREQUISITE :

1. Engineering Mathematics I
2. Engineering Mathematics II

COURSE OBJECTIVES:

1. To introduce Fourier series analysis and applications in Engineering, apart from its use in solving boundary value problems.
2. To acquaint the student with Fourier transform techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I FOURIER SERIES **12 Hours**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis – Simple Applications

UNIT II FOURIER TRANSFORMS **12 Hours**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Formation of partial differential equations – Singular integrals — Solutions of standard types of first order partial differential equations – Lagrange's linear equation — Linear partial differential equations of second order with constant coefficients of homogeneous type- Applications

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Classification of PDE – Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT V Z – TRANSFORMS AND DIFFERENCE EQUATIONS **12 Hours**

Z - transforms – Elementary properties – Inverse Z – transform (using partial fraction and residues) – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transform.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Linear Algebra
2. Numerical Solution of non-homogeneous partial differential equations

COURSE OUTCOMES: Employability.

On the successful completion of the course, students will be able to

CO1 Use Fourier series analysis which is central to many applications in engineering
CO2 Apply Fourier transform techniques used in wide variety of situations
CO3 Compute the solution of partial differential equations
CO4 Solve boundary value problem using partial differential equation
CO5 Apply Z transform techniques for discrete time systems

REFERENCES:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd , 2007
4. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, New Delhi, 2008.
5. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
6. www.nptelvideos.in/2012/11/mathematics-iii.html

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1701ME301 **ENGINEERING THERMODYNAMICS** **L T P C**
3 2 0 4

UNIT I INTRODUCTION AND ZEROTH LAW OF THERMODYNAMICS **12 Hours**

Macroscopic and Microscopic approaches, Definitions and concepts- heat, work, thermodynamic equilibrium, system and types, surroundings, Properties- intensive and extensive properties, Path and point functions, Energy- macroscopic and microscopic modes of energy, Thermodynamic processes and cycle, State postulate, Zeroth law of thermodynamics- temperature scale, perfect gas scale.

UNIT II FIRST LAW OF THERMODYNAMICS **12 Hours**

First law of thermodynamics, I law for Closed systems - constant pressure process, constant volume process, constant temperature process, adiabatic process, polytropic process, throttling process. I law for open systems -Steady state flow processes, Steady flow energy equation (SFEE), Application of SFEE-turbines and compressors, nozzles and diffusers, throttling valves, heat exchangers.

UNIT III SECOND LAW OF THERMODYNAMICS **12 Hours**

Limitations of I law of thermodynamics, Second law of thermodynamics- Kelvin - Planck and Clausius statements, Heat Engine, heat pump and refrigerator, Reversibility and irreversibility- irreversible and reversible processes, Carnot's principles, Carnot cycle, Carnot engine, Thermodynamic temperature scale, Clausius inequality, Entropy- principle of entropy increase, Availability & irreversibility – Introduction about third law of thermodynamics.

UNIT IV PROPERTIES OF PURE SUBSTANCES **12 Hours**

Thermodynamic properties of fluids. Pure substance-phases - Phase change processes, Property diagrams - pressure-volume (P-v), pressure-temperature (P-T), temperature volume (T-v), temperature entropy (T-s) and enthalpy-entropy (h-s) diagrams. Steam tables - Problems on flow and non-flow processes.

UNIT V GAS MIXTURES AND PSYCHROMETRIC PROPERTIES **12 Hours**

Thermodynamics of ideal gas mixture- mixture of ideal gas, mixture of perfect gases, Dalton's law ofpartial pressure, Amagat's law, Thermodynamics properties, Ideal gas – equation of state, Van derWaals equation and compressibility chart.Psychrometric properties and processes – Psychrometric chart.

FOR FURTHER READING – SEMINAR – CPS **Total: 60 Hours**

Thermodynamic property relations- Maxwell relations, TDS equations, The Clapeyron equation, Joule- Thompson expansion.

COURSE OUTCOMES: Employability.

	Competency	Cognitive level
CO1	Understand concepts and principles of thermodynamics.	**Understand**
CO2	Utilize first law of thermodynamics for closed and open systems.	**Apply**
CO3	Use second law of thermodynamics for heat Engine, heat pump and refrigerator.	**Apply**
CO4	Explain thermodynamic properties of pure substances and its phase change processes.	**Understand**
CO5	Determine properties of gas mixtures.	**Understand**
CO6	Make use of psychometric properties in Air conditioning process.	**Apply**

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1702ME302 ENGINEERING MATERIALS AND METALLURGY **L T P C**

3 0 0 3

PREREQUISITE :

1. Materials Science

2. Fundamentals of Mechanical Engineering

COURSE OBJECTIVES:

1. To provide knowledge on physical metallurgy of metals through the study of phase diagrams.

2. To study the properties and applications of various metals and alloys used in engineering industries.

3. To expose various heat treatment processes of steels.

4. To study the properties and applications of polymers and ceramics.

5. To impart knowledge on mechanical properties evaluation and testing methods of engineering materials.

UNIT I PHASE DIAGRAMS AND CONSTITUTION OF ALLOYS **9 Hours**

Alloys, Solid solutions - Phase diagram, phase rule, lever rule, Binary phase diagram -Isomorphous, eutectic, peritectic, eutectoid reactions - Iron-Carbon phase diagram - Metallography, microstructure.

UNIT II ENGINEERING METALS AND ALLOYS **9 Hours**

Classification of Engineering materials - Ferrous metals -Plain carbon steel (low, medium and high carbon steels), microstructure/composition, properties, applications - Alloy steels, effect of alloying additions on steels - stainless steels, High Strength Low Alloy Steels (HSLA), maraging and tool steels - Cast iron - grey, white, malleable, spheroidal graphite cast iron, microstructure, properties, applications – Non-ferrous metals - Nickel, Copper, Titanium, Aluminium, Magnesium, Zinc alloys, properties and applications - Bearing materials.

UNIT III HEAT TREATMENT OF STEELS **9 Hours**

Purpose of heat treatment - Annealing (stress relief, recrystallization, spheroidizing) -Normalizing - Hardening and Tempering, Isothermal transformation diagrams (T-T-T diagrams), Cooling curves superimposed on T-T-T diagrams (martensite and bainite phase formation) -Hardenability, Jominy end quench test, Case hardening processes, carburizing, nitriding, carbontiriding, cyaniding, flame hardening, induction hardening.

UNIT IV INTRODUCTION TO POLYMERS AND ENGINEERING CERAMICS 9 Hours

Polymers - Plastics and elastomers - Thermoplasts and thermosets, properties and applications (polyethylene, polypropylene, polyurethane, polystyrene, poly vinylchloride, polymethyl methacrylate, polyethylene terapthalate, polycarbonate, polyamide, acrylonitrile butadiene styrene, polyamide, polyamideimide, polypropyleneoxide, polypropylene sulphide, polyetheretherketone, polytetrafluroethylene, urea formaldehyde, phenol formaldehyde, polyester, nylon, epoxy) – Rubber and its types - Types of Ceramics and applications.

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UNIT V MECHANICAL PROPERTIES AND MATERIALS TESTING **9 Hours**

Elastic and plastic deformation, slip and twinning - Tensile test, stress-strain behavior of ductile and brittle materials - Stress-strain behaviour of elastomers – Visco elasticity - Compression test – Hardness and testing methods -Impact test - Fatigue test, Stress vs number of cycles (S-N) curve, endurance limit, factors affecting fatigue - Creep test, creep curves -Types of fracture - Fracture toughness – Three crack propagation modes.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Review on Super alloys, Shape memory alloys, Composite Materials, Case studies in Metallurgical failure analysis.

COURSE OUTCOMES: Employability.

On the successful completion of the course, students will be able to

CO1 Understand phase diagrams of different engineering materials.

CO2 Recognize the properties and applications of various metals and alloys.

CO3 Identify appropriate heat treatment processes for the given applications.

CO4 Awareness on various non metals, its manufacturing techniques and various applications.

CO5 Test the mechanical properties of the given materials for real-time applications.

CO6 Understand phase diagrams of different engineering materials.

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1702ME303 **FLUID MECHANICS AND MACHINERY** **L T P C**
3 0 0 3

Course Objectives

1. To study the fluid laws, properties and measurements.
2. To expose various fluid flow measuring devices and calculate the flow losses in pipes.
3. To learn the concept of dimensional analysis and model analysis.
4. To impart knowledge on various types of hydraulic turbines and performance curves.
5. To gain knowledge on working principles and performance analysis of fluid pumps.

UNIT I INTRODUCTION TO FLUID AND FLUID MOTION **7 Hours**

Fluid- Fluid mechanics -Laws of Fluid Mechanics-Properties of fluid and its Application-Types of fluid Types of fluid Flow-Measurement of Pressure-U-tube and differential manometer- Measurement of velocity using Discharge -Flow characteristics-Momentum -continuity equation.

UNIT II FLUID DYNAMICS AND FLUID FLOW OVER CONDUITS **11 Hours**

Forces acting on a fluid element- Eulers and Bernoulli theorem Application in internal and external flows measuring instruments - Major losses and Minor losses in pipes using standard charts and tables pipes in series and pipes in parallel. - Darcy Weisbach equation. Identification of laminar and turbulent flow in closed conduits, flow in circular pipe.

UNIT III DIMENSIONAL AND MODEL ANALYSIS **9 Hours**

Need for dimensional analysis dimensional analysis using Buckingham pi theorem - Similitude types of similitude - Dimensionless parameters- application of dimensionless parameters Model analysis through Reynolds and Froudes Model law.

UNIT IV HYDRAULIC TURBINES **9 Hours**

Definition of turbine Classification -Types of head and efficiencies of turbine-Impulse turbine - Reaction turbine-Francis turbine, Kaplan turbine - working principles and velocity triangle- Work done by water on the runner Specific speed - unit quantities performance curves.

UNIT V HYDRAULIC PUMPS **9 Hours**

Definition -Centrifugal pump Classification Construction working principle and velocity Triangle Definition of heads-Losses and efficiencies-Multistage Centrifugal pump-Specific speed Priming and cavitation effects of centrifugal pump. Reciprocating pump Classification Working Principle Coefficient of discharge and slip-Indicator diagram (Descriptive treatment only).

FOR FURTHER READING – SEMINAR – CPS **Total: 45 Hours**

Case study simple experiments /analyzing the properties of fluid Analyzing the torcelli equation by a simple experiment

COURSE OUTCOMES: Employability | Entrepreneurship

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

	Competency	Cognitive level
CO1	Explain various properties of fluids and flow measurements.	Understand
CO2	Calculate the energy losses in pipes.	Apply
CO3	Explain the dimensional analysis of fluids.	Understand
CO4	Determine the performance characteristics of hydraulic turbines.	Apply
CO5	Calculate the performance characteristics of hydraulic pumps.	Apply

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1702ME304 **STRENGTH OF MATERIALS** **L T P C**

3 0 2 4

Course Outcomes (COs):

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

Employability / Entrepreneurship

	Competency	Cognitive level
CO1	Calculate various stresses and strain of rigid and deformable bodies.	Understanding
CO2	Determine shear force and bending moments for various beams.	Understanding
CO3	Measure torsional strength of a circular shaft	Applying
CO4	Measure stiffness and modulus of rigidity for helical springs.	Applying
CO5	Measure the slope and deflection of beams.	Applying
CO6	Calculate the strssses of cylinderical and spherical shells.	Understanding

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS **6 Hours**

Introduction to material properties. Stresses and strains due to axial force, shear force, impact force and thermal effect-stepped and composite bars-uniformly varying cross section. Stress-strain curve for ductile and brittle materials Hooke-law - Factor of safety Poisson-ratio. Elastic constants and their relationship.

UNIT II ANALYSIS OF STRESSES IN TWO DIMENSIONS **6 Hours**

State of stresses at a point- Normal and shear stresses on inclined planes - Principal planes and stresses Plane of maximum shear stress - Mohrs -circle for biaxial stress with shear stress. Hoop and longitudinal stresses in thin cylindrical and spherical shells - Changes in dimensions and volume.

UNIT III LOADS AND STRESSES IN BEAMS **6 Hours**

Types of beams- Supports and Loads, Shear force and Bending Moment in beams, Cantilever, simply supported and overhanging beams - Point of contra flexure. Theory of simple bending - bending and shear stress - stress variation along the length and section of the beam, Section modulus.

UNIT IV DEFLECTION OF BEAMS AND COLUMNS **6 Hours**

Slope and Deflection of cantilever, simply supported ,Double integration method and Macaulay's method. Columns- types- Equivalent length Euler and Rankine formulae- Slenderness.

UNIT V TORSION IN SHAFT AND HELICAL SPRING **6 Hours**

Analysis of torsion of circular solid and hollow shafts-stepped shaft-compound shaft- Shear stress distribution, angle of twist and torsional stiffness. Closed coil helical spring- stresses and deflection under axial load-Maximum shear stress in spring section.

FOR FURTHER READING – SEMINAR – CPS **Total 60 Hours**

:

Fatigue, shear flow, shear center, thick wall pressure vessels and bending of curved beams. Open coil spring -stresses and deflection.

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EXPERIMENT 1 **2 Hours**

Find the hardness of the material using Rockwell hardness tester.

EXPERIMENT 2 **2 Hours**

Calculate the hardness of the material using Brinell hardness tester.

EXPERIMENT 3 **2 Hours**

Experimentally calculate the strain energy of a material subjected to impact loading.(Izod testing)

EXPERIMENT 4 **4 Hours**

Experimental analysis of an axial bar under tension to obtain the stress strain curve and the strength.

EXPERIMENT 5 **2 Hours**

Determine the Young-modulus and stiffness of a metal beam through load deflection curve.

EXPERIMENT 6 **4 Hours**

Experimentally calculate the compressive strength of the materials.

EXPERIMENT 7 **2 Hours**

Experimental analysis of a bar under shear stress strain curve and the strength.

EXPERIMENT 8 **4 Hours**

Experimentally calculate the strain energy of a material subjected to impact loading.(Charpy testing)

EXPERIMENT 9 **4 Hours**

Determination of spring constant through load vs deflection curve.

EXPERIMENT 10 **4 Hours**

Experimental analysis of a bar under torsion to obtain stiffness and angle of twist.

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Reference(s)

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India Learning Pvt. Ltd, New Delhi, 2010.
S.S. Rattan, Strength of Materials, Tata McGraw Hill, Delhi, Second Edition, 2011.
3. D. K. Singh, Mechanics of Solids, Pearson Education New Delhi, 2006.
4. F. P. Beer and R. Johnston, Mechanics of Materials, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, Third edition,2002.
5. 5.B. K. Sarkar, Strength of Materials, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi, Second Reprint, 2007.
6. http://www.nptel.ac.in/courses/Webcourse-contents/IITROORKEE/strength%20of%20materials/homepage.htm

1702ME305	MANUFACTURING TECHNOLOGY – I	L	T	P	C
		3	0	0	3

PREREQUISITE :

Fundamentals of Mechanical Engineering

COURSE OBJECTIVES:

1. To study the sand casting and few special casting processes.
2. To learn various metal joining processes.
3. To provide the knowledge on various bulk deformation processes.
4. To expose knowledge on sheet metal and special forming processes.
5. To learn the various moulding and forming processes of plastics.

UNIT I CASTING PROCESSES **9 Hours**

Introduction to production processes and its classifications - Pattern - Types, Materials and Allowances. Moulding sand - Types, Properties and Testing. Moulding machines and its types. Melting furnaces - Cupola and Induction. Fettling and cleaning. Sand casting defects. Special casting processes - Shell moulding, Die casting, Centrifugal casting and Investment casting.

UNIT II METAL JOINING PROCESSES **9 Hours**

Introduction to welding processes and its classifications - Principle of Gas welding and its flames - Principle of arc welding - Electrodes, Fluxes and filler materials. Principle of Resistance welding - Spot, butt and seam. Principle of Gas metal arc welding, Submerged arc welding, Tungsten Inert Gas welding, Plasma arc welding, Thermit welding, Electron beam welding and Friction welding - Weld defects - Brazing and soldering.

UNIT III BULK DEFORMATION PROCESSES **9 Hours**

Introduction - Hot and cold working of metals - Forging processes - Open and close die forging, Forging equipment and operations. Rolling - Types of Rolling mills, shape rolling operations, Tube piercing and Defects. Principle of Extrusion and its types. Principle of rod and wire drawing.

UNIT IV SHEET METAL FORMING AND SPECIAL FORMING PROCESSES **9 Hours**

Introduction - Shearing, bending and drawing operations - Stretch forming operations - Principle of special forming processes - Hydro forming, Rubber pad forming, Metal spinning, Explosive forming, Magnetic pulse forming, Peen forming and Super plastic forming.

UNIT V MOULDING AND FORMING OF PLASTICS **9 Hours**

Introduction to plastics - Moulding of Thermoplastics - Principle and applications of Injection moulding and its types, Blow moulding, Rotational moulding, Thermoforming and Extrusion. Moulding of Thermosets - Principle and applications of Compression moulding and Transfer moulding Bonding of Thermoplastics - Fusion and solvent methods.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Automation in moulding - Underwater welding - Sequence of operations for producing a fan blade - Production of thermoplastic film, Inspection methods.

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COURSE OUTCOMES: Employability / Entrepreneurship.

On the successful completion of the course, students will be able to

CO1	Produce simple components using sand casting process,moulding machines and melting furnaces.
CO2	Explain the principle of special casting processes and defects in sand casting.
CO3	Use various metal joining processes (Arc welding,Gas welding,Brazing and Soldering).
CO4	Explain the various metal forming processes(forging,rolling,drawing and extrusion).
CO5	Produce simple sheet metal components using sheet metal operations and also describe the principle of advanced sheet metal processes.
CO6	Elaborate concepts of advanced moulding techniques to manufacture plastic components.

REFERENCES

1. P. N. Rao, Manufacturing Technology vol. I, Tata McGraw-Hill Publishing Company rivate Limited, New Delhi, 2010.
2. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi, 2013
3. J. P. Kaushish, Manufacturing Processes, Prentice Hall of India Learning Private Limited, New Delhi, 2013
4. P.C. Sharma, Manufacturing Technology - I, S Chand and Company Private Limited, New Delhi, 2010
5. S K Hajra Choudhury, Elements of Workshop Technology - Vol. I, Media Promoters & Publishers Private Limited, Mumbai,2013.
6. http://nptel.ac.in/courses/112107144/1.

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1702ME351	MACHINE DRAWING	L	T	P	C
		1	0	2	2

UNIT I LIMITS, FITS AND TOLERANCES **5 Hours**

Limit System- Tolerance, Limits, Deviation, Actual Deviation, Upper Deviation, Lower Deviation, Allowance, Basic Size, Design Size, Actual Size. Fits- Types, Tolerances of Form and Position- Form and Position Variation, Geometrical Tolerance, Tolerance Zone, Indicating Geometrical Tolerances. Indication of Surface Roughness, Standard Abbreviations and Symbols used in industries.

UNIT II SECTIONAL VIEWS **5 Hours**

Sections- Hatching of Sections, Cutting Planes, Revolved or Removed Section, Sectional Views- Full Section, Half Sections and Auxiliary Sections- Conventional Representation-One-view, Two-view and three view Drawings.

UNIT III INTRODUCTION TO MACHINE ELEMENT DRAWINGS **5 Hours**

Drawing standards and Designation of Bolts, nuts, screws, keys, pins, Rivets, Welded Joints Dimensioning of Welds, Belt Driven Pulleys, Chain and Gears Drives

UNIT IV ASSEMBLY DRAWINGS AND SECTIONAL VIEWS **8 Hours**

Preparation of manual parts drawing and assembled sectional views from orthographic part drawings, Automobile components - stuffing box, Machine Tool Parts – plummer block, Joints – knuckle joints, Couplings – Protected type flanged coupling, Bearings – swivel bearing, Preparation of Bill of materials and tolerance data sheet.

UNIT V REAL PRODUCTS TO MACHINE DRAWING CONVERSION **7 Hours**

Preparation of manual parts drawing and assembled sectional views from real time products- Internal combustion engine parts - connecting rod, couplings – universal coupling, machine tool parts – tailstock, Automobile components – screw jack, stuffing box - Commercial products - Preparation of Bill of materials and tolerance data sheet.

TOTAL: 30 HOURS

REFERENCES:

1. N.D. Bhatt, Machine Drawing, Charotar Publishing House Pvt. Ltd., 2014.
2. P.S. Gill, A Textbook of Machine Drawing, Katson books, 2013.
3. R.K. Dhawan, A Textbook of Machine Drawing, S. Chand,2012.
4. K.C. John, Textbook of Machine Drawing, PHI Learning Pvt. Ltd.,2009.
5. http://nptel.ac.in/syllabus/112106075/

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Course Outcomes (COs): Employability.

CO Number	Competency
CO1	Use limits, fits and tolerances in real world problems. (K3)
CO2	Apply different sectional views in drawings. (K3)
CO3	Recognize the drawing notations of standard machine elements. (K2)
CO4	Draw the assembly drawing. (K3)
CO5	Draw the detailed drawing of given components. (K3)
CO6	Prepare Bill of materials and tolerance data sheet for given components. (K3)

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1702ME352 MANUFACTURING TECHNOLOGY LAB - I **L T P C**
0 0 2 1

PREREQUISITE :

Fundamentals of Mechanical Engineering

COURSE OBJECTIVES:

1. To provide exposure to the students with hands on experience of centre lathe and Capstan lathe.
2. To provide exposure to the students with hands on experience of various taper, thread cutting and eccentric operations.
3. To provide exposure to the students with hands on experience of various fit, (push, pull, clearance) operations and measurement of cutting forces.

LIST OF EXPERIMENTS:

1. Taper Turning using Tailstock set over method
2. Taper Turning using Compound rest method
3. External Thread cutting
4. Internal Thread Cutting
5. Eccentric Turning
6. Knurling
7. Push fit
8. Clearance fit
9. Force fit
10. Measurement of cutting forces in turning process
11. Simple turning using capstan lathe.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS:

1. Drilling and tapping
2. Grooving operation

COURSE OUTCOMES: Employability | Entrepreneurship.

On the successful completion of the course, students will be able to

CO1 Use lathe machine to manufacturing eccentric turning operations.
CO2 Use lathe machine to manufacturing Various tapper turning operations.
CO3 Use various different machine tools for finishing operations of simple step turning in capstan lathe.
CO4 Use lathe machine to manufacturing thread cutting operations.
CO5 Experience on various fits operations in lathe machines.
CO6 Lathe tool dynamometer for measuring the cutting forces.

REFERENCES:

1. P. N. Rao, Manufacturing Technology vol. I, Tata McGraw-Hill Publishing Company rivate Limited, New Delhi, 2010.
2. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi, 2013.
3. J. P. Kaushish, Manufacturing Processes, Prentice Hall of India Learning Private Limited, New Delhi, 2013.
4. P.C. Sharma, Manufacturing Technology - I, S Chand and Company Private Limited, New Delhi, 2010.
5. S K Hajra Choudhury, Elements of Workshop Technology - Vol. I, Media Promoters & Publishers Private Limited, Mumbai, 2013.
6. http://nptel.ac.in/courses/112107144/1.

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1704ME353-TECHNICAL SEMINAR I

COURSE OBJECTIVES:

1. To develop self-learning skills of utilizing various technical resources to make a technical presentation. 2. To promote the technical presentation and communication skills.

3. To impart the knowledge on intonation, word and sentence stress for improving communicative competence, identifying and overcoming problem sounds.

4. To promote the ability for Interacting and sharing attitude.

5. To encourage the commitment-attitude to complete tasks.

The students are expected to make two presentations on advanced topics (recent trends) related to II year/ III semester subjects. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Students are encouraged to use various teaching aids such as power point presentation and demonstrative models.

TOTAL: 30 HOURS

COURSE OUTCOMES: Skill Development

On the successful completion of the course, students will be able to

CO1	Identify and utilize various technical resources available from multiple fields.
CO2	Improve the technical presentation and communication skills.
CO3	Improve communicative competence.
CO4	Interact and share their technical knowledge.
CO5	Understand and adhere to deadlines and commitment to complete the assignments.

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1702ME354 FLUID MECHANICS AND MACHINERY LAB L T P C

0 0 2 1

PREREQUISITE :

Fundamentals of Mechanical Engineering

COURSE OBJECTIVES:

1. To demonstrate the principles of fluid mechanics
2. To measure the energy losses in a pipe flow.
3. To perform characteristic study on impulse, reaction and axial flow turbines.
4. To perform characteristic study on positive displacement pumps.
5. To perform characteristic study on non-positive displacement pumps.

LIST OF EXPERIMENTS:

1. Experimental verification of Bernoulli's theorem in a pipe flow.
2. Measurement of flow rate using venturimeter and calculate the coefficient of discharge
3. Measurement of flow rate using orificemeter and calculate the coefficient of Discharge.
4. Performance test on tangiantial flow impulse (Pelton wheel) turbine against constant head
5. Performance test on Francis turbine against constant head.
6. Performance test on reaction (Kaplan) turbine against constant head.
7. Performance characteristics of a reciprocating pump
8. Performance characteristics of a gear pump
9. Performance test on centrifugal pump
10. Performance test on submersible pump
11. Determination of loss of head in different pipes (major loss) and fittings (minor loss) for various flow rates.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS:

1. Measurement of coefficient of friction in flow through pipes

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COURSE OUTCOMES: Employability.

On the successful completion of the course, students will be able to

1. Understand the various basic experience in flow of measurements.
2. Measure the major and minor losses associated in a pipe flow.
3. Experimental verification of Bernoulli's theorem in a pipe flow.
4. Perform the characteristics study on impulse ,reaction and axial turbine.
5. Perform the characteristics study on different types of water pumps.
6. Perform the characteristics study on gear oil pump.

REFERENCES:

1. R.K.Bansal, A Textbook of Fluid Mechanics and Machinery, Laxmi Publications Ltd., New Delhi, Revised Ninth edition, 2014.

2. Bruce R Munson , Donald F Young, Theodore H Okiishi and Wade W. Huebsch, Fundamentals of Fluid Mechanics, John Wiley & Sons, Sixth edition 2009.

3. Pijush K Kundu and Ira M Cohen, Fluid Machines, Academic Press, Burlington, United states of america, 2010.

4. Yunus Cengel and John Cimbala, Fluid Mechanics Fundamentals and Application, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi 2009.

5. Robert and W Fox, Introduction to Fluid Machines, John Wiley Eastern Pvt. Ltd., New Delhi, 6th edition ,2006.

6. http://nptel.ac.in/courses/112105182/

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1704GE351	LIFE SKILLS : SOFT SKILLS (Common to all B.E / B.Tech Degree Programmes)	L	T	P	C
		0	0	2	0

PREREQUISITE :

1. Technical English
2. Communicative English

COURSE OBJECTIVES:

1. To develop the students basic soft skills and enable them to get a job.
2. To develop the students' interpersonal skills and to enable them to respond effectively.
3. To develop the students selling skills and to enable them to apply in their interview process.
4. To develop the students' Corporate Etiquettes and enable them to respond effectively.
5. To develop the students' learning by practice of giving different situations.

UNIT I INTRODUCTION TO SOFT SKILLS **6 Hours**

Soft Skills an Overview - Basics of Communication – Body Language – Positive attitude –Improving Perception and forming values – Communicating with others.

UNIT II TEAM Vs TRUST **6 Hours**

Interpersonal skills – Understanding others – Art of Listening - Group Dynamics – Networking - Individual and group presentations - Group interactions – Improved work Relationship .

UNIT III SELLING ONESELF **6 Hours**

How to brand oneself – social media – job hunting – Resume writing – Group Discussion – Mock G.D - .Interview skills – Mock Interview

UNIT IV CORPORATE ETIQUETTES **6 Hours**

What is Etiquette – Key Factors – Greetings – Meeting etiquettes – Telephone etiquettes – email etiquettes – Dining etiquettes – Dressing etiquettes – Rest room etiquettes – Life etiquettes.

UNIT V LEARNING BY PRACTICE **6 Hours**

1. My family. Myself. 2. Meeting people. Making Contacts. 3. A city. Getting about town. 4. Our flat. Home life.5. Travelling. Going abroad. 6. Going through Customs. 7. At a hotel. 8. Shopping. 9. Eating out. 10. Making a phone call. 11. A modern office.12 Discussing business.

TOTAL: 30 HOURS

ASSSESSMENT PATTERN

1. Two assignments (2 x 25 marks = 50 marks)
2. Pragmatic assessment (50 marks)

COURSE OUTCOMES: Skill Development -

On the successful completion of the course, students will be able to

CO1 Communicate effectively in their business environment.
CO2 Improve their interpersonal skills which are mandatory in a corporate world.
CO3 Brand themselves to acquire a job.
CO4 Involve in corporate etiquettes.
CO5 Survive in the different situations.

REFERENCES:

1. Dr.K.Alex, 'Soft Skills' Third Edition, S.Chand & Publishing Pvt Limited, 2009
2. Aruna Koneru, 'Professional Communication' Second Edition, Tata McGraw-Hill Education, 2008
3. D.K.Sarma, 'You & Your Career' First Edition, Wheeler Publishing & Co Ltd, 1999
4. Shiv Khera 'You Can Win' Third Edition, Mac Millan Publisher India Pvt Limited, 2005

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1702MA403	NUMERICAL METHODS AND STATISTICS	L T P C
	(Common to B.E - Civil, EEE and Mech.)	3 2 0 4

PREREQUISITE:

1. Engineering Mathematics I 2.Engineering Mathematics II 3.Engineering Mathematics III

COURSE OBJECTIVES:

1.To sole the engineering problem, by use of numerical tools

2.To understand the concept of interpolation

3.To analyze the population and samples using statistics techniques

UNIT I INTERPOLATION AND APPROXIMATION 12 Hours

Interpolation with unequal intervals - Lagrange's interpolation – Newton"s divided difference interpolation – Interpolation with equal intervals – Newton"s forward and backward difference formulae.

UNIT II NUMERICAL DIFFERENTIATION 12 Hours

Approximation of derivatives using interpolation polynomials-Taylor"s series method – Euler"s method - Modified Euler"s method - Fourth order Runge-Kutta method for solving first order equations

Unit III NUMERICAL INTEGRATION 12 Hours

Numerical integration using Trapezoidal, Simpson"s 1/3 rule – Romberg"s method - Two point and three Point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson"s 1/3 rules.

UNIT IV SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 12 Hours

Solution of algebraic and transcendental equations - Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel

UNIT V TESTING OF HYPOTHESIS 12 Hours

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit

TOTAL: 60 HOURS

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FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1.Finding Eigen value using power method 2.Cubic Spline

COURSE OUTCOMES: Skill Development

After completion of the course, Students will be able to

CO1: To find the intermediate values, when huge amounts of experimental data are involved. CO2: To solve first order differential equation using Numerical methods

CO3: To perform Integration using Numerical methods

CO4: To solve algebraic and transcendental Equations numerically CO5: Analyses the statistical data

REFERENCES:

1. Johnson R.A.Gupta C. B, Miller and Freunds Probability and statistics for Engineers, 7th edition ,Pearson Education,2007

2. Grewal B.S and Grewal J.S, Nummerical methods in Engineering and Science, 6th edition, Khanna Puplishers,2004

3. Walpole R.E. Myers S.L ,Ye.K, Probability and statistics for Engg and scientists, 8th edition Pearson education,2007

4. Gerald C.F Wheatley P.O, Applied Numerical Analysis, 6th edition ,Pearson education Asia 2006

5. Nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html

6. www.learnerstv.com/Free-maths-video lectures - ltv348-page1.html

7. www.indiastudychannel.com

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1702ME401 **THERMAL ENGINEERING** **L T P C**
3 2 0 4

UNIT I GAS POWER CYCLES **12 Hours**

Air standard cycles -Otto, Diesel and Dual Calculation of mean effective pressure and air standard efficiency. Gas turbine power plant cycle, Brayton cycle, expression for efficiency, work ratio.

UNIT II INTERNAL COMBUSTION ENGINES **12 Hours**

Internal combustion engines - Classification - Components and functions - Comparison. Valve Timing diagram and port timing diagram - Fuel supply systems - Ignition Systems Lubrication system and cooling system. Performance calculation, Heat balance sheet preparation- Air-fuel ratio calculation- Knocking and detonation.

UNIT III STEAM NOZZLES AND TURBINES **12 Hours**

Flow of steam through Nozzles-Shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and reaction principles- Compounding of Turbines - velocity diagrams for simple and multistage turbines- Speed regulations- Governors.

UNIT IV AIR COMPRESSOR **12 Hours**

Classification and working Principle-Work of compression with and without clearance, volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling, Work of multistage air compressor. Rotary compressors- Centrifugal, vane and roots blowers

UNIT V REFRIGERATION AND AIR-CONDITIONING **12 Hours**

Vapour compression refrigeration cycle Effect of superheat, sub cooling of refrigerant, performance calculations. Working principle of vapour absorption system- Ammonia, water, Lithium bromide water systems (Elementary treatment only), and comparison between vapour compression and absorption systems. Cooling load calculations, Concept of RSHF, GSHF, ESHF, Air conditioning systems.

Reference(s)

1. Kothandaraman.C.P., Domkundwar.S. and A.V. Domkundwar., A course in Thermal Engineering, Dhanpat Rai & Sons, Fifth edition, 2002.
2. C. P. Kothandaraman, Steam Tables, New Age International Private limited, 2007.
3. R. S. Khurmi & J. K. Gupta, Refrigeration Tables with Chart, S Chand & Company Limited, New Delhi, 2008.
4. Yunus A. Cengel, Michael A. Boles, Thermodynamics An Engineering Approach, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2008.
5. Mahesh M. Rathore, Thermal Engineering, Tata McGraw - Hill Education Private Limited, New Delhi, 2011.
6. http://nptel.ac.in/courses/112106133/

COURSE OUTCOMES: Employability.

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

Cos	Competency	Cognitive level
CO1	Calculate mean effective pressure and air standard efficiency of various gas power cycles.	Apply
CO2	Determine the performance characteristics of internal combustion engines.	Apply
CO3	Describe the performance characteristics of steam nozzles and steam turbines.	Understand
CO4	Calculate the performance characteristics of air compressors.	Apply
CO5	Calculate the performance characteristics of refrigeration and air conditioning systems.	Apply
CO6	Design a suitable air conditioning system by cooling load calculation.	Apply

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1702ME402	MEASUREMENTS AND METROLOGY	L	T	P	C
		2	0	2	3

PREREQUISITE:

1. Engineering Physics
2. Basic Mathematics

COURSE OBJECTIVES:

1. To study the concepts of measurement and characteristics of instruments.
2. To learn the procedure for various linear and angular measurements.
3. To provide knowledge on measurement of gear and thread terminologies using suitable instruments.
4. To study the use of laser and advances in metrology for linear geometric dimensions.
5. To expose the measuring procedure to measure the mechanical parameters using suitable instruments

UNIT I CONCEPT OF MEASUREMENT **4 Hours**

Introduction: Definition, Objectives, Elements of Measuring System, Accuracy and Precision - Units and Standards - Characteristics of measuring instrument: Sensitivity, Stability, Interchangeability, Range of accuracy, Readability, Reliability, Backlash, Repeatability and Reproducibility – Calibration - Errors in Measurement: Static and dynamic errors - Care of Measuring Instruments.

UNIT II MEASUREMENT OF MECHANICAL PARAMETERS **6 Hours**

Measurement of Force - Principle, analytical balance, platform balance, proving ring. Torque - Prony brake, hydraulic dynamometer. Measurement of Power: Linear and Rotational - Pressure Measurement: Principle, use of elastic members, Bridgeman gauge, Mcleod gauge, Pirani gauge - Temperature Measurement: bimetallic strip, thermocouples, metal resistance thermometer, pyrometers.

UNIT III LINEAR AND ANGULAR MEASUREMENTS **6 Hours**

Linear Measurements: Vernier Caliper, Vernier Height and Depth Gauges, Micrometer and depth micrometer, Slip gauge, limit gauge and its classification - Comparator: Mechanical, Pneumatic and Electrical types - Angular Measurements: Bevel protractor, Sine bar, Angle Decker, Autocollimator.

UNIT IV FORM MEASUREMENT **8 Hours**

Thread Measurement: Terminologies, Errors - External Thread Measurement: Pitch Gauge, Tool Maker's microscope, Floating Carriage micrometer with One, Two and Three wires - Internal Thread Measurement: Taper Parallels and Rollers method.Gear Measurement: Terminologies, Errors, Gear Tooth Vernier caliper, Profile Projector, Base pitch measuring instrument, David Brown Tangent Comparator, Involutes tester, Parkinson Gear Tester - External and Internal Radius measurements - Roundness measurement: Circumferential confining gauge, Assessment using V block and Rotating centres.

UNIT V LASER AND ADVANCES IN METROLOGY **6 Hours**

Interferometer: NPL Flatness, Laser, Michelson - Computer Aided Inspection - Digital Devices - Machine Vision System - Coordinate Measuring Machine: Basic concept, Types, Constructional features, Probes, Accessories - Surface Roughness Measurement - Straightness Measurement - Squareness Measurement - Machine Tool Metrology.

LIST OF EXPERIMENTS: **30 HOURS**

1. Comparing the accuracy of Vernier Caliper, Vernier Height Gauge, Vernier Depth Gauge and Micrometer to check the various dimensions of a given specimen.
2. Checking the dimensional limits of ten similar components using Mechanical Comparator.
3. Measurement of taper angle of a given specimen by using Sinebar.
4. Measurement of screw thread specifications by Floating Carriage Micrometer.
5. Measurement of gear tooth specifications by using Gear Tooth Vernier Calliper.
6. Measurement of gear tooth specifications by using Tool maker microscope.
7. Measurement of gear tooth specifications by using Profile projector.
8. Differentiate the work piece by its Surface Roughness value.
9. Measurement of force using Force Measuring Setup.
10. Measurement of Straightness of a given job by using Autocollimator.
11. Temperature measurement by using Thermocouple.
12. Measurement of Torque using Torque Measuring Setup.
13. Measurement of Displacement using LVDT.
14. Measurement of bore diameter using Telescopic Gauge.

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TOTAL: 30 HOURS

1702ME402 MEASUREMENTS AND METROLOGY LABORATORY

LTPC

0021

LIST OF EXPERIMENTS:

1. Comparing the accuracy of Vernier Caliper, Vernier Height Gauge, Vernier Depth Gauge and Micrometer to check the various dimensions of a given specimen.
2. Checking the dimensional limits of ten similar components using Mechanical Comparator.
3. Measurement of taper angle of a given specimen by using Sinebar.
4. Measurement of screw thread specifications by Floating Carriage Micrometer.
5. Measurement of gear tooth specifications by using Gear Tooth Vernier Caliper.
6. Measurement of gear tooth specifications by using Tool Maker's Microscope
7. Differentiate the work piece by its Surface Roughness value
8. Measurement of Straightness of a given job by using Autocollimator
9. Temperature measurement by using Thermocouple.
10. Measurement of force using Force Measuring Setup.
11. Measurement of Torque using Torque Measuring Setup
12. Measurement of Displacement using LVDT.
13. Measurement of bore diameter using Telescopic Gauge
14. Measurement of gear tooth specifications by using Profile projector

Total:30 Hours

REFERENCES:

1. Jain R.K., —Engineering Metrology‖, Khanna Publishers, 2005
2. Alan S. Morris, -The Essence of Measurement‖, Prentice Hall of India, 1997
3. Beckwith, Marangoni, Lienhard, -Mechanical Measurements‖, Pearson Education,2006.
4. Donald Deckman, -Industrial Instrumentation‖, Wiley Eastern, 1985.

COURSE OUTCOMES: Employability.

CO1	Measure the linear dimensions using Vernier calliper, Vernier Height Gauge, Vernier Depth Gauge,
CO2	Make use of a comparator to check the limits of given components.
CO3	Measure the taper angle using Sinebar and Bevel Protractor.
CO4	Make use of Gear tooth Vernier, profile projector, Tool Maker's Microscope and floating Carriage Micrometer to check the gear and threat parameters.
CO5	Perform the surface finish measurement using surface roughness tester.
CO6	Measure the mechanical parameters of using suitable measuring setups.

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1702ME403	KINEMATICS OF MACHINES	L	T	P	C
		2	2	0	3

PREREQUISITE:

1. Engineering Mechanics

2. Engineering Graphics

3. Engineering Mathematics

COURSE OBJECTIVES:

1. To impart the knowledge on the concept of simple mechanisms.

2. To provide knowledge on kinematic analysis of simple mechanisms.

3. To study and construct the cam profile for the various types of follower motion.

4. To learn the kinematics terminologies of spur gear and calculate speed ratio of various types of gear train.

5. To introduce the concept of friction drives in kinematic of machines.

UNIT I FUNDAMENTALS OF MECHANISMS **12 Hours**

Basic Terminology - Kinematic link, Pair, joints, Structure, Machine, Degree of freedom, Grubler&Kutzbach Criterion - Inversions of four bar mechanism, Mechanical advantage - Transmission Angle, Inversion of single slider and double slider crank mechanisms. Common Mechanisms - Straight line mechanism, Dwell mechanism.

UNIT II KINEMATIC ANALYSIS OF MECHANISMS **12 Hours**

Relative velocity of kinematic link, Rubbing Velocity of kinematic pair, Construction of velocity and acceleration diagram by graphical method (Relative Velocity Method), Four bar mechanism, slider crank mechanisms and complex mechanism.

UNIT III CAM AND FOLLOWER MECHANISMS **12 Hours**

Introduction - Terminology, Classifications, Types of follower motion - Uniform Velocity Motion, Simple Harmonic Motion, Uniform Acceleration and Retardation Motion and Cycloidal Motion- Construction of cam profile - Knife edge follower, Roller and flat faced follower.

UNIT IV GEAR AND GEAR TRAIN **12 Hours**

Gears - Terminology, Law of gearing, Length of path of contact, Length of arc of contact, contact ratio- Interference and undercutting. Gear trains- Speed ratio, train value. Simple gear train, compound gear train, Epicyclic gear train- speed calculation by tabular method.

UNIT V FRICTION DRIVES **12 Hours**

Introduction-Friction clutch, types -single plate, Multi plate and cone clutch. Flat Belt Drives Velocity, slip, creep and Centrifugal effect of belt, length of open and cross belt drives, Maximum power transmitted, ratio of driving tension in flat belt drives - V Belt drives.

TOTAL: 60 HOURS

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FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Intermittent motion mechanisms - calculation of velocity and acceleration of two and four-wheel vehicle.

2. Cam mechanism in milling machine - Automotive transmission gear trains - Gear train in ships and aero planes.

3. Application Ropes and chain drives.

COURSE OUTCOMES: Employability.

After completion of the course, Students will be able to

CO1:	Differentiate the basic machine mechanisms.	K2
CO2:	Calculate velocity and acceleration of machine mechanisms.	K2
CO3:	Construct the cam profile for different types of follower motion.	K3
CO4:	Describe the kinematic terminologies of spur gear and calculate speed ratio of various types of gear train.	K2
CO5:	Solve the amount of power transmitted by friction drives.	K2
CO6:	Utilize mechanism for new machine development.	K3

REFERENCES:

1. S. S. Rattan, Theory of Machines, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi, 2014.

2. J. J. Uicker, G. R. Pennock and J. E. Shigley, Theory of Machines and Mechanisms, Oxford University Press, New York,2011.

3. Ballaney P L, Theory of Machines and Mechanisms, Khanna Publishers, New Delhi, 2005.

4. Sadhu Singh, Theory of Machines, Pearson Education, Second Edition, 2012.

5. Rao J S and Dukkipati, Mechanism and Machine Theory, Wiley- Eastern Ltd., New Delhi, 2006.

6. http://nptel.ac.in/courses/112104121/1

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1702ME404	Design of Machine Elements	L	T	P	C
		3	2	0	4

Course Objectives

- To learn the design procedure of machine elements subjected to simple and variable loads.
- To study the design procedure of shafts and couplings.
- To provide knowledge on the design of bolted and welded joints.
- To provide knowledge on the design of helical, leaf and torsional springs subjected to constant and variable loads.
- To study the selection procedure of sliding and rolling contact bearings.

UNIT I	STEADY AND VARIABLE STRESSES	12 Hrs

Introduction to the design process - Design of straight and curved beams – „C" Frame and Crane hook. Stress concentration - Design for variable loading - Soderberg, Goodman, Gerber methods and combined stresses - Theories of failure.

UNITII	DESIGN OF SHAFTS AND COUPLINGS	12 Hrs

Design of shafts based on strength, rigidity and critical speed. Design of rigid flange coupling - Design of flexible coupling.

UNIT III	DESIGN OF JOINTS	12 Hrs

Design of bolted joints - stresses due to static loading, eccentrically loading. Design of welded joints - Butt and Fillet welded Joints - Strength of parallel and traverse fillet welded Joints.

UNIT IV	DESIGN OF SPRINGS	12 Hrs

Types, End connections and design parameters. Design of helical springs - Circular and noncircular wire - Concentric springs. Design of leaf and torsional springs under constant and varying loads.

UNIT V	DESIGN OF BEARINGS	12 Hrs

Types and selection criteria - Design of journal bearings - Design of rolling contact bearing Ball and roller bearing.

	Total:	60 Hrs

Course Outcomes (COs): Employability.

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

	Competency	Cognitive level
CO1	Calculate stress concentration of plate under simple and variable loadings.	Understand
CO2	Design the parameters of different types of couplings.	Apply
CO3	Design the solid and hollow shafts for various engineering applications.	Apply
CO4	Design the bolted and welded joints subjected to static and variable load conditions.	Apply
CO5	Estimate the parameters of helical, leaf and torsional springs subjected to variable loads.	Understand
CO6	Design a suitable bearing for various applications.	Apply

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1702ME405 **MANUFACTURING TECHNOLOGY -II**

L T P C

3 0 0 3

PREREQUISITE:

1. Engineering Physics
2. Engineering Chemistry
3. Fundamentals of Mechanical Engineering
4. Manufacturing Technology-1

COURSE OBJECTIVES:

1. To learn the metal cutting theory and calculate the forces involved in it.
2. To study construction, working and operations of centre, semi-automatic and automatic lathes.
3. To provide the knowledge on construddction, working of milling and gear cutting machines.
4. To impart knowledge on construction, working and operations of reciprocating, drilling and boring machines.
5. To provide knowledge on construction, working of broaching, grinding and few fine finishing proceses.

UNIT I METAL CUTTING THEORY **9 Hours**

Introduction - Orthogonal, Oblique Cutting and types of chip formation. Mechanisms of metal cutting - Shear plane, Stress, Strain and cutting forces. Merchants Circle - Deriving the forces, calculations. Cutting tool - Properties, materials, wear, single point tool nomenclature, tool life and its calculations. cutting fluids - Types and its properties.

UNIT II LATHE, SEMI AUTOMATS AND AUTOMATS **9 Hours**

Introduction - Types- Centre Lathe - Construction, specification, operations. Mechanisms - Head stock driven using all geared type and thread cutting. Work holding devices - Centres, chucks, carrier with catch plate and face plates. Calculation of machining time - Capstan and turret lathes - Introduction, turret indexing and bar feeding mechanism. Automats - single spindle, multi spindle and their types

UNIT III MILLING MACHINE AND GEAR CUTTING MACHINES **9 Hours**

Milling - Introduction, types, up milling, down milling, operations, and nomenclature of plain milling cutter. Indexing - simple and differential indexing methods. Gear cutting-gear milling, gear shaper and gear hobber.

UNIT IV RECIPROCATING MACHINES, DRILLING AND BORING MACHINES **9 Hours**

Shaper, Planer and Slotter - Introduction, types, specification and quick return mechanisms. Drilling - Introduction, types, construction of universal drilling machine, specification, types of drills and nomenclature of twist drill. Introduction to horizontal boring machine.

UNIT V BROACHING AND FINISHING PROCESSES **9 Hours**

Broaching - Introduction, types and tool nomenclature. Finishing processes - Grinding -Introduction, types, grinding wheel- specification, selection, glazing, loading, dressing and truing. Fine finishing processes - Honing, lapping, polishing, buffing and super finishing.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Select proper Machines and list the sequence of operations to produce the components – External threaded shafts with key way, Hexagonal bolt and Hexagonal nut.

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REFERENCES:

1. J. P. Kaushish, Manufacturing Processes, Prentice Hall India Learning Private Limited., NewDelhi, 2013.
2. Serope Kalpakjian and Steven R Schmid, Manufacturing Engineering and Technology,Pearson Education Limited., New Delhi, 2013.
3. P. N. Rao, Manufacturing Technology- Metal Cutting and Machine Tools, Tata McGrawHillPublishing Company Private Limited., New Delhi, 2013
4. S. K. HajraChoudhury, Elements of Workshop Technology. Vol. II, Media Promoters Private Limited., Mumbai, 2013.
5. P.C Sharma, Manufacturing Technology - II, S. Chand & Company Limited. New Delhi, 2012.

COURSE OUTCOMES: Employability -

After completion of the course, Students will be able to

CO	Course Outcomes	BL
CO1	Explain the mechanisms of metal cutting, cutting tool materials, tool wear and cutting fluids.	K2
CO2	Discuss about the constructional features of different types of lathe parts and their operations.	K2
CO3	Describe the construction and working of milling and gear cutting machine.	K2
CO4	Illustrate the various types of reciprocating, drilling and boring machines.	K2
CO5	Describe the construction and working of broaching and finishing process.	K2
CO6	Measure the metal removal rate of the work piece in various speeds.	K3

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1702ME451	THERMAL ENGG. LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

1. To learn the port timing and valve timing diagram of two stroke and four stroke internal combustion engines.
2. To study the fuel properties, performance and emission characteristics of IC engines.
3. To study the performance of IC engine on retardation.
4. To study the performance of two stage reciprocating air compressor.
5. To study the performance of refrigeration and air conditioning system

EXPERIMENT 1 **4 Hours**

Experimental study on port timing and valve timing diagram of IC engines.

EXPERIMENT 2 **4 Hours**

Experimental study on flash point, fire point of the given oil sample.

EXPERIMENT 3 **2 Hours**

Detrmination of dynamic viscosity of the given using Red wood viscometer

EXPERIMENT 4 **2 Hours**

Experimental study of performance test on 4-Stroke Petrol engine.

EXPERIMENT 5 **2 Hours**

Experimental study of performance on 4-Stroke diesel engine with mechanical loading.

EXPERIMENT 6 **2 Hours**

Experimental study of performance on 4-Stroke diesel engine with electrical loading

EXPERIMENT 7 **2 Hours**

Experimental study of performance on 4-Stroke diesel engine with hydraulic loading.

EXPERIMENT 8 **2 Hours**

Heat balance test on 4-Stroke diesel engine with mechanical loading.

EXPERIMENT 9 **2 Hours**

Morse test on multi-cylinder petrol engine.

EXPERIMENT 10 **2 Hours**

Retardation test on 4-Stroke diesel engine with mechanical loading

EXPERIMENT 11 **2 Hours**

Experimental study on performance of two stage reciprocating air compressor.

EXPERIMENT12 **2 Hours**

Experimental study on determination of Coefficient of Performance of refrigerationsystem

EXPERIMENT13 **2 Hours**

Experimental study on determination of Coefficient of Performance of Air-conditioning system.

FOR FURTHER READING – SEMINAR – CPS **Total 30Hours**

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Course Outcomes (COs) Employability | Entrepreneurship

After completion of the course, Student will be able to

1. Analyze the valve and port timing diagram .
2. Analyze the characteristic and performance of IC Engines.
3. Analyze the performance of Two Stage Air Compressor.
4. Conduct morse test in petrol engines.
5. Determine flash and fire point of various fuels.
6. Analyze the Performance of refrigeration system.

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1702ME452
MANUFACTURING TECHNOLOGY LABORATORY – II

L T P C
0 0 2 1

PREREQUISITE :

1. Workshop Practice Laboratory
2. Manufacturing Technology I Lab

COURSE OBJECTIVES:

1. To learn the metal cutting theory and calculate the forces involved in it.
2. To study construction, working and operations of centre, semi-automatic and automatic lathes.
3. To provide the knowledge on construction, working of milling and gear cutting machines.
4. To impart knowledge on construction, working and operations of reciprocating, drilling and boring machines.
5. To provide knowledge on construction, working of broaching, grinding and few fine finishing processes.

LIST OF EXPERIMENTS:

1. Contour milling using vertical milling matching.
2. Spur gear cutting in milling machine.
3. Gear generation in hobbing machine.
4. Gear generation in gear shaping machine.
5. Horizontal surface grinding.
6. Cylindrical grinding.
7. Tool angle grinding with tool and Cutter Grinder.
8. Measurement of cutting forces in Milling.
9. Square Head Shaping.
10. Hexagonal Head Shaping.
11. Vertical surface grinding.
12. Make a v-block using planner machine

Total: 60 Hours

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :

1. Select proper Machines and list the sequence of operations to produce the components.
2. External threaded shafts with key way, Hexagonal bolt and Hexagonal nut.

COURSE OUTCOMES: Employability

After completion of the course, Student will be able to

CO1	Produce of spur gear by using universal milling machine, gear hobbing machine, gear shaping machine.
CO2	Do the surface grinding operation using horizontal grinding machine, vertical grinding machine, cylindrical grinding machine
CO3	Produce a single point tool using tool and cutter grinder
CO4	Use the planner machine & vertical milling machine to perform contour, key way operation.
CO5	Measure the cutting force using milling tool dynamometer.
CO6	Do the square head shaping and hexagonal head shaping using shaper machine

REFERENCES:

1. J. P. Kaushish, Manufacturing Processes, Prentice Hall India Learning Private Limited., New Delhi, 2013.
2. SeropeKalpakjian and Steven R Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi, 2013.
3. P. N. Rao, Manufacturing Technology- Metal Cutting and Machine Tools, Tata McGraw Hill Publishing Company Private Limited., New Delhi, 2013
4. S. K. HajraChoudhury, Elements of Workshop Technology. Vol. II, Media Promoters & Publishers Private Limited., Mumbai, 2013.
5. P.C Sharma, Manufacturing Technology - II, S. Chand & Company Limited, New Delhi, 2012.
6. http://nptel.ac.in/courses/112105126

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1704GE451	LIFE SKILLS: VERBAL ABILITY	L	T	P	C
		0	0	2	0

PREREQUISITE:

Technical English – I and II

COURSE OBJECTIVES:

1. To help students comprehend and use vocabulary words in their day to day communication.
2. To apply appropriate reading strategies for interpreting technical and non-technical documents used in job-related settings.
3. To ensure students will be able to use targeted grammatical structures meaningfully and appropriately in oral and written production.
4. To enable the students to arrange the sentences in meaningful unit and to determine whether constructions rely on active or passive voice.
5. To apply the principles of effective business writing to hone communication skills.

UNIT I VOCABULARY USAGE **6 Hours**

Introduction - Synonyms and Antonyms based on Technical terms – Single word Substitution – Newspaper, Audio and video listening activity.

UNIT II COMPREHENSION ABILITY **6 Hours**

Skimming and Scanning – Social Science passages – Business and Economics passages – latest political and current event based passages – Theme detection – Deriving conclusion from passages.

UNIT III BASIC GRAMMAR AND ERROR DETECTION **6 Hours**

Parallelism – Redundancy – Ambiguity – Concord - Common Errors – Spotting Errors – Sentence improvement – Error Detection FAQ in Competitive exams.

UNIT IV REARRANGEMENT AND GENERAL USAGE **6 Hours**

Jumble Sentences – Cloze Test - Idioms and Phrases – Active and passive voice – Spelling test.

UNIT V APPLICATION OF VERBAL ABILITY **6 Hours**

Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette – Report Writing - Proposal writing – Essay writing– Indexing –Market surveying.

Total: 30 Hours

ASSESSMENT PATTERN

1. Two assignments (2 x 25 marks = 50 marks)
2. Pragmatic assessment (50 marks)

COURSE OUTCOMES: SKILL DEVELOPMENT

After completion of the course, Student will be able to

CO1: Use new words in their day to day communication.
CO2: Gather information swiftly while reading passages.
CO3: Students are proficient during their oral and written communication.
CO4: Rearrange the sentences and able to identify the voice of the sentence.
CO5: Students use their knowledge of the best practices to craft effective business documents

REFERENCES:

1. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017.
2. R S Aggarwal and Vikas Aggarwal, Quick Learning Objective General English, S.Chand Publishing House, 2017.
3. Dr.K.Alex , Soft Skills, S.Chand Publishing House, Third Revise Edition, 2014.
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition, 2007.

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1701MA502	OPERATIONS RESEARCH	L	T	P	C
		2	2	0	3

UNIT I INTRODUCTION TO LINEAR PROGRAMMING (LPP) 9 Hours

Introduction to Applications of Operations Research in functional areas of Management. Linear Programming-Formulation, Solution by Graphical and Simplex methods (Primal - Penalty, Two Phase), Dual simplex method. Principles of Duality.

UNIT II TRANSPORTATION AND ASSIGNMENT MODELS 9 Hours

Transportation Models – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Solution by MODI-Assignment Models- Solution by Hungarian method-Travelling Salesman problem.

UNIT III NETWORKS AND INVENTORY MODELS 9 Hours

Scheduling by PERT and CPM - Inventory Models – EOQ and EBQ Models (With and without shortages), Quantity Discount Models.

UNIT IV GAME THEORY AND REPLACEMENT MODELS 9 Hours

Game Theory-Two-person Zero sum games-Saddle point, Dominance Rule, Methods of matrices, graphical and LP solutions. Replacement Models-Individuals replacement Models (With and without time value of money) – Group Replacement Models.

UNIT V QUEUING THEORY MODELS 9 Hours

Queuing Theory - single and Multi-channel models – infinite number of customers and infinite calling source. (M/M/1) :(∞/FCFS), (M/M/S) :(∞/FCFS); (M/M/1) :(N/FCFS), (M/M/S) :(N/FCFS)- Simple Problems

TOTAL: 45 HOURS

REFERENCES:

1. Hamdy A Taha, Introduction to Operations Research, Pearson, 9th Edition, 2014.
2. Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008.
3. G. Srinivasan, Operations Research – Principles and Applications, PHI, 2007.
4. Kalavathy S, Operations Research, Second Edition, Vikas Publishing House, 2004.
5. N. D Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 2010.
6. nptel.ac.in/courses/112106134/1

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Course Outcomes (COs): Employability.

CO Number	Competency
CO1	Formulate linear programming problems, interpret the solutions to solve industrial problems. (K2)
CO2	Make use of transportation and assignment techniques for optimization.(K3)
CO3	Use critical path analysis and programming evaluation review techniques to complete the project at minimum cost in short duration. (K3)
CO4	Utilize Inventory models to optimize the inventory cost in business problems. (K3)
CO5	Construct the Game model and replacement model for enhancing operational efficiency. (K3)
CO6	Calculate steady state system performance characteristics for Queuing Models. (K2)

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1702ME501 HEAT AND MASS TRANSFER

UNIT I CONDUCTION **12**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – Fourier Law of Conduction - General Differential equation of Heat Conduction — Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.

UNIT II CONVECTION **12**

Basic Concepts –Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – 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 – Dimensional Analysis – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

12

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers – Heat Exchanger Analysis – LMTD Method and NTU - Effectiveness – Overall Heat Transfer Coefficient – Fouling Factors.

UNIT IV RADIATION

12

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoffs Law –Black Body Radiation –Grey body radiation -Shape Factor Algebra – Electrical Analogy – Radiation Shields

UNIT V MASS TRANSFER **12**

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

Text / Reference Books

Sl. No.	Title of the Book	Author(s)	Publisher
TEXT BOOKS			
T1	Fundamentals of Engineering Heat and Mass Transfer	Sachdeva R C.	New Age International, 1995.
T2	"Fundamentals of Heat and Mass Transfer		McGraw-Hill Book Co., 1994
REFERENCES			
R1	Heat and Mass Transfer	. Yadav R	Central Publishing House, 1995
R2	Heat Transfer	Ozisik M.N	McGraw-Hill Book Co., 1994

COURSE OUTCOMES Employability.

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

	Competency	Cognitive level
CO1	Calculate heat transfer rate in steady and unsteady state of heat conduction.	K3
CO2	Calculate convective heat transfer rate for external and internal flow.	K3
CO3	Determine heat transfer rate for boiling and condensation process and heat exchangers.	K3
CO4	Calculate the emissivity and radiation heat transfer .	K3
CO5	Estimate mass transfer rate for diffusive mass transfer.	K2
CO6	Estimate mass transfer rate for convective mass transfer.	K2

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1702ME502 COMPUTER AIDED DESIGN **L T P C**
3 0 0 3

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS **9**

Product cycle, Sequential and Concurrent Engineering, CAD - Architecture, Tools, applications - Coordinate systems - Two and Three Dimensional Transformations - Translation - Scaling - Rotation, Windowing - clipping and Viewing.

UNIT II GEOMETRIC MODELING **9**

Representation of curves - Hermite, Bezier, B-Spline and rational curves - Surface Modeling - surface patch - Bezier and B spline surface. Solid Modelling - Boundary representation and Constructive Solid Geometry.

UNIT III VISUAL REALISM **9**

Hidden line removal algorithm - Priority and Area oriented algorithms. Hidden Surface removal algorithm - Depth buffer and Warnock's algorithms. Hidden solid removal algorithm, Ray Tracing algorithm, Shading and Coloring - types.

UNIT IV ASSEMBLY OF PARTS **9**

Assembly modeling - Interference of Positions and orientations - CAD Tolerance Analysis - geometrical Mass Properties - degree of freedom - Constraints and Simulation concepts.

UNIT V DATA EXCHANGE FORMATS **9**

Database Management System - CAD Standards File types - IGES, PDES, Database – Structures - Types, STEP Files. Communication Standards - File Transfer between CAD and CAM package.

TOTAL: 45 Periods

OURSE OUTCOMES Employability.

Comp	Competency	Cognitive level
CO1	Use various concepts of CAD, computer graphics and transformations.	Apply
CO2	Prepare various geometric models using curves, surfaces and solids.	Apply
CO3	Use various visual realism methods (shading, colouring and animation).	Apply
CO4	Do assembly modeling and tolerance analysis.	Apply
CO5	Use various computer graphics standards.	Apply
CO6	Use various Data Exchange Formats.	Apply

Text / Reference Books

Sl. No.	Title of the Book	Author(s)	Publisher
TEXT BOOKS			
T1	"Mastering CAD/CAM"	Ibrahim Zeid,	Tata McGraw- Hill, 2008.
T2	"Computer Graphics",	Amarendra N Sinha and Arun D Udai,	second reprint, Tata McGraw Hill Education (P) Ltd 2009.
REFERENCES			
R1	Geometric Modeling	Michael E. Mortenson,	Third edition, Industrial Press, 2006.
R2	Mathematical Elements for computer Graphics	Rogers,	Tata Mcgraw Hill Education Private Limited, 200
R3	"Computer Graphics: A Practical Approach, Concepts, Principles, Case Studies"	Rajiv Chopra,	First Edition, S.Chand and Company Ltd., 2011.
REFERENCE WEBSITES			
1	http://nptel.ac.in/courses/Webcoursecontents/IITDelhi/Computer%20Aided%20Design%20&%20ManufacturingI/index.ht		
2	http://ocw.mit.edu/courses/mechanical-engineering/2-158j-computational-geometry-spring-2003/calendar/		

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1702ME503		DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
			3	2	0	4

UNIT I	DESIGN OF FLEXIBLE ELEMENTS (12)

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT II	SPUR GEARS AND PARALLEL AXIS HELICAL GEARS (12)

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for 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: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV	GEAR BOXES (12)

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

UNIT V	CAMS, CLUTCHES AND BRAKES (12)

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches- Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

FOR FURTHER READING – SEMINAR – CPS	Total:	60 Hrs

Reference(s)

1. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. C.S.Sharma, Kamlesh Purohit, "Design of Machine Elements", Prentice Hall of India, Pvt. Ltd., 2003.
5. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements", 2nd Edition, Tata McGraw-Hill Book Co., 2006.
6. http://nptel.ac.in/courses/108102047/

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COURSE OUTCOMES: Employability

	Competency	Cognitive level
CO1	Design the belt drives (flat belt, V- belt), chain drive, rope drives, belt drive, pulleys and chain sprockets.	K3
CO2	Solve the problem of spur and straight helical gear based on strength and wear consideration.	K3
CO3	Solve the problem of bevel and worm gear based on strength and wear consideration.	K3
CO4	Construct the various gear boxes (sliding mesh, constant mesh, multispeed) through geometric progression, standard step ratio, ray diagram, kinematics layout.	K3
CO5	Design of cam using basic knowledge acquired earlier studies.	K3
CO6	Design of Clutches and internal - external shoe brakes from using basic knowledge acquired earlier studies.	K3

K1-Remember K2- Understanding K3-Apply K4-Analyze K5-Evaluate K6-Create

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1702ME551 HEAT TRANSFER LABORATORY

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS:

1. Determination of thermal conductivity of insulating powder.	**4 Hours**
2. Determination of thermal conductivity of guarded hot plate.	**4 Hours**
3. Determination of thermal conductivity of materials in lagged pipe.	**4 Hours**
4. Determination of heat transfer co-efficient through composite wall.	**2 Hours**
5. Determination of heat transfer co-efficient by natural convection.	**2 Hours**
6. Determination of heat transfer co-efficient by forced convection.	**2 Hours**
7. Determination of heat transfer co-efficient in a parallel and counter flow heat exchanger.	**2 Hours**
8. Determination of heat transfer co-efficient and effectiveness from Pin-Fin by natural convection.	**2 Hours**
9. Determination of heat transfer co-efficient and effectiveness from Pin-Fin by forced convection.	**2 Hours**
10. Determination of Stefan-Boltzmann constant.	**2 Hours**
11. Determination of emissivity using emissivity apparatus.	**2 Hours**
12. Determination of performance in a fluidized bed cooling tower	**2 Hours**

Total: 30 Hours COURSE OUTCOMES

Employabi lity.

At the end of the course students will be able to

	Competency	Cognitive level
CO1	Measure the heat transfer phenomena predict the relevant coefficient.	Applying
CO2	Experiment with mechanisms of heat transfer under steady and transient conditions.	Applying
CO3	Make use of thermal analysis and sizing of heat exchangers and also understand the basic Concepts of mass transfer.	Applying
CO4	Do experimentation heat exchanger, conduction heat transfer apparatus.	Applying
CO5	Do experimentation heat exchanger, convection and radiation heat transfer apparatus.	Applying
CO6	Perform the concepts and to design of heat transfer through extended surfaces.	Applying

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1702ME552 **COMPUTER AIDED DESIGN LABORATORY** **L T P C**
3 2 0 4

3D GEOMETRIC MODELLING

List of Experiments

1. Introduction of 3D Modelling software
2. Create the part model of mechanical components

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

1. Flange Coupling
2. Plummer Block
3. Screw Jack
4. Universal Joint
5. Machine Vice
6. Stuffing box
7. Safety Valves
8. Non-return valves
9. Connecting rod
10. Piston
11. Crankshaft

* Students may also be trained in manual drawing of some of the above components

Total: 30 Hours

Course Outcomes (COs): Employability.

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

	Competency	Cognitive level
CO1	Prepare the 3D assembly model of flange coupling and Plumber block	Apply
CO2	Prepare the 3D assembly model of screw jack and universal joint.	Apply
CO3	Prepare the 3D assembly model of machine vice and stuffing box	Apply
CO4	Prepare the 3D assembly model of safety valve and non return valve.	Apply
CO5	Prepare the 3D assembly model of connecting rod and piston.	Apply
CO6	Prepare the 3D assembly model of crank shaft.	Apply

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1704ME553	MINI PROJECT I (Design and Fabrication)	L	T	P	C
		0	0	2	1

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device / system / component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department

Employability | Entrepreneurship | Skill Development ~~Total~~: **30 Hours**

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1704GE551	LIFE SKILLS: APTITUDE – I	L	T	P	C
		0	0	2	1

PREREQUISITE :

Technical English – I and II

COURSE OBJECTIVES:

1. To brush up problem solving skill and to improve intellectual skill of the students
2. Tobeabletocriticallyevaluatevariousreallifesituationsbyresortingto AnalysisOf key issues and factors
3. To be able to demonstrate various principles involved in solving mathematical problems And thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students
5. To augment logical and critical thinking of Student

COURSE OUTCOMES: Skill Development.

After completion of the course, Student will be able to

CO 1 - Understand about number system.
CO2 - Gather information about ratio and proportion, averages
CO3 - Discuss about percentages, profit and loss
CO4 –Describe about coding and decoding, direction sense
CO5 – Understand the number and letter series number

UNIT I INTRODUCTION TO NUMBER SYSTEM, BASIC SHORTCUTS OF ADDITION, MULTIPLICATION,DIVISION **6 Hours**

Classification of numbers – Types of Numbers - Divisibility rules - Finding the units digit - Finding remainders in divisions involving higher powers - LCM and HCF Models - Fractions and Digits – Square, Square roots – Cube, Cube roots – Shortcuts of addition, multiplication, Division.

UNIT II RATIO AND PROPORTION, AVERAGES **6 Hours**

Definition of Ratio - Properties of Ratios - Comparison of Ratios - Problems on Ratios - Compound Ratio - Problems on Proportion, Mean proportional and Continued Proportion Definition of Average - Rules of Average - Problems on Average - Problems on Weighted Average - Finding average using assumed mean Method.

UNIT III PERCENTAGES, PROFIT AND LOSS **6 Hours**

Introduction Percentage - Converting a percentage into decimals - Converting a Decimal into a percentage - Percentage equivalent of fractions - Problems on percentages - Problems on Profit and Loss percentage- Relation between Cost Price and Selling price - Discount and Marked Price - Two different articles sold at same Cost Price - Two different articles sold at same Selling Price - Gain% / Loss% on Selling Price.

UNIT IV CODING AND DECODING, DIRECTION SENSE **6 Hours**

Coding using same set of letters - Coding using different set of letters - Coding into a number - Problems on R-model - Solving problems by drawing the paths - Finding the net distance travelled - Finding the direction - Problems on clocks - Problems on shadows - Problems on direction sense using symbols and Notations.

UNIT V NUMBER AND LETTER SERIES NUMBER AND LETTER ANALOGIES, ODD MAN OUT **6 Hours**

Difference series - Product series - Squares series - Cubes series - Alternate series - Combination series - Miscellaneous series - Place values of letters - Definition of Analogy - Problems on number analogy - Problems on letter analogy - Problems on verbal analogy - Problems on number Odd man out - Problems on letter Odd man out - Problems on verbal Odd man out

Total: 30 Hours

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1701MGX01	PROFESSIONAL ETHICS	L	T	P	C
		3	2	0	4

Course Objectives

1. To understand Human values, ethical theory, codes of ethics, work place responsibilities and rights.
2. To understand engineering experimentation, global issues and contemporary ethical issues.
3. To understand personal ethics, legal ethics, cultural associated ethics and engineer's responsibility.

UNIT I HUMAN VALUES **12 Hours**

Morals and Ethics - Honesty - Integrity - Values - Work Ethic - Civic Virtue - Respect for Others - Living Peacefully - Caring and Sharing - Self-Confidence - Courage - Co-operation - Commitment – Empathy

UNIT II ENGINEERING ETHICS AND PROFESSIONALISM **12 Hours**

Scope of 'Engineering Ethics'- Variety of moral issues - Types of inquiry - Accepting and sharing responsibility - Ethical dilemmas - Moral autonomy - Kohlberg's and Gilligan's theory - Consensus and controversy - Profession and Professionalism - Models of Professional Roles - Right action theories - Senses of corporate responsibility - Codes of ethics: Importance - justification - limitation - Abuse - Sample codes NSPE - IEEE - Institution of Engineers (India).

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **12 Hours**

Engineering as experimentation - Engineers as responsible experimenters - Balanced outlook on law - Cautious optimism - Safety and risk - Assessing and reducing risk - Safe exits - The Challenger case study - Bhopal Gas Tragedy - The Three Mile Island and Chernobyl.

UNIT IV WORKPLACE RESPONSIBILITIES AND RIGHTS **12 Hours**

Fundamental Rights - Responsibilities and Duties of Indian Citizens - Teamwork - Ethical corporate climate - Collegiality and loyalty - Managing conflict - Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime - Professional rights - Employee rights

UNIT V GLOBAL ISSUES **12 Hours**

Multinational corporations: Technology transfer and appropriate technology - International rights promoting morally just measures - Environmental ethics: Engineering, ecology - economics - Human and sentient centred - and bio and eco centric ethics - Computer ethics and internet - Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership.

FOR FURTHER READING – SEMINAR – CPS **Total 60 Hours**

:

1. Sample code of ethics like IETE, ASME, ASCE, Indian Institute of Materials Management.
2. Virtues for life

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Course Outcomes (COs)

Entrepreneurship / Skill Development.

1. Articulate engineering ethics theory with sustained lifelong learning to strengthen autonomous engineering decisions.
2. Be an example of faith, character and high professional ethics, and cherish the workplace responsibilities, rights of others, public's welfare, health and safety.
3. Contribute to shape a better world by taking responsible and ethical actions to improve the environment and the lives of world community.
4. Fortify the competency with facts and evidences to responsibly confront moral issues raised by technological activities, and serve in responsible positions of leadership.
5. Be Proficient in analytical abilities for moral problem solving in engineering situations through exploration and assessment of ethical problems supported by established experiments.
6. Develop concepts based on moral issues and enquiry.

Reference(s)

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2014.
2. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi, 2012.
3. R S Naagarazan, A text book on professional ethics and human values, New age international limited, New Delhi,2006.
4. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States, 2005.
5. http://www.slideworld.org/slidestag.aspx/human-values-and-Professional-ethics.

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1702ME601 **FINITE ELEMENT ANALYSIS** L T P C
2 2 0 3

UNIT I INTRODUCTION **(12)**

Relevance and scope of finite element methods -strain vs displacement relations - natural and essential boundary conditions - Rayleigh Ritz - Galerkin method - FEM procedure - Discretisation of domain-element shapes, types, size, location and numbers.

UNIT II ONE-DIMENSIONAL (1D) ELEMENTS **(12)**

Coordinate system types-global, local and natural shape function of 1D bar element -Finite element formulation - stiffness matrix, load vector, boundary condition and assembly of global equation-1D bar element and two node truss element- problems in 2D truss, Introduction to beam element.

UNIT III TWO-DIMENSIONAL (2D) ELEMENTS **(12)**

Shape function for linear triangular element-Finite element formulation- Constant Strain Triangular (CST) element -plane stress, plane strain -axisymmetric elements - problems.

UNIT IV HEAT TRANSFER APPLICATIONS **(12)**

NShape function for 1D and 2D triangular element heat conduction - stiffness matrix, load vector and assembly of global equation for 1D and 2D triangular element heat conduction, heat generation with convective boundary conditions for linear element.

UNIT V HIGHER ORDER AND ISOPARAMETRIC ELEMENTS **(12)**

Selection of order of polynomial-linear, simplex, complex and multiplex elements. Iso, Sub and Super parametric element. Shape functions for a 2-D four nodded and eight nodded Isoperimetric rectangular element using natural coordinate system - problems. Gaussian quadrature method-problems.

TOTAL : 45 PERIODS

Text / Reference Books

Sl. No.	Title of the Book	Author(s)	Publisher
TEXT BOOKS			
T1	Finite Element Method in Engineering	S. S. Rao	Elsevier India, 2005
T2	Finite Element Analysis	P.Seshu	PHI Learning Private limited, Delhi, 2014
REFERENCES			
R1	Concepts and Applications of Finite Element Analysis	Robert D. Cook, S. David, Malkucs Michael E. Plesha	John Wiley, New Delhi, 2007.
R2	Introduction to Finite Elements Engineering	T. R. Chandrupatla and A. D. Belegundu	Pearson Education, New Delhi, 2002.
R3	Finite Element Analysis	S. S. Bhavikati	New Age International Publishers, 2005.

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REFERENCE WEBSITES	
1	www.wikipedia.com
2	www.NPTEL.com
3	www.castle.net

Course Outcomes (COs): Employability.

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

Comp	Competency
CO1	Explain steps involved in FEA and the types of functional approximation method.
CO2	Use FEA for solving one dimensional structural problem.
CO3	Make use of FEA for solving two dimensional problems.
CO4	Solve heat transfer applications problems.
CO5	Determine the solution techniques for higher order elements
CO6	Determine the solution techniques for iso-parametric elements

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1702ME602	GAS DYNAMICS AND JET PROPULSION	L	T	P	C
		2	2	0	3

UNIT I COMPRESSIBLE FLOW FUNDAMENTALS 12 Hours

Introduction to compressible flow - Integral and differential forms of conservation equations, velocity of sound, Mach number, various regimes of flow, wave propagation, Mach cone and Mach angle- Stagnation state - stagnation enthalpy, stagnation temperature, stagnation pressure and stagnation density - critical state - reference velocities, reference Mach number. Effect of Mach number on compressibility.

UNIT II FLOW THROUGH VARIABLE AREA DUCTS 12 Hours

Isentropic flow through variable area ducts - effect of area change on flow parameters, area ratio as a function of Mach number, impulse function, mass flow rate equations, chocking flow, effect of back pressure on performance of convergent and De lavel nozzle.

UNIT III FLOW THROUGH CONSTANT AREA DUCTS 12 Hours

Flow in constant area ducts with friction (Fanno flow) Governing equations, fanno curves and Fanno flow equations, variation of flow properties, variation of Mach number with duct length. Flow in constant area ducts with simple stagnation temperature change (Rayleigh Flow) - Governing equations, Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer in Rayleigh flow.

UNIT IV FLOW WITH NORMAL SHOCK 12 Hours

Governing equations - variation of flow properties like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock - Prandtl equation - Rankine Hugonoit equation. Impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with normal shock - normal shock in Fanno and Rayleigh flows.

UNIT V AIRCRAFT AND ROCKET PROPULSION 12 Hours

Aircraft propulsion - types of jet engines, energy flow through jet engines. Performance of turbo jet engines - thrust, thrust power, propulsive and overall efficiencies - thrust augmentation in turbo jet engine. Ram jet, Scram jet and Pulse jet engines. Rocket Propulsion - Classification of rocket engines. Propellants - solid, liquid and hybrid propellants, rocket engines thrust equation, effective jet velocity, specific impulse. Rocket engine performance.

TOTAL: 60 HOURS

FOR FURTHER READING/SEMINAR/CBS

Case Study: Advanced Aircraft Engines, select Fuel for Air-craft engines.

REFERENCES:

1. Hill. P. and C. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison – Wesley Publishing company, 1992.
2. Zucrow. N.J., "Aircraft and Missile Propulsion", Vol.1 & II, John Wiley, 1975.
3. Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.
4. Sutton. G.P., "Rocket Propulsion Elements", John wiley, New York,1986,.
5. Shapiro. A.H.," Dynamics and Thermodynamics of Compressible fluid Flow", John Wiley, New York,1953.
6. Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 1999.
7. Somasundaram. PR.S.L., "Gas Dynamics and Jet Propulsions", New Age International Publishers, 1996.
8. Babu. V., "Fundamentals of Gas Dynamics", ANE Books India, 2008.

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COURSE OUTCOMES

Employability.

At the end of the course students will be able to

CO1	Employ the basic concepts of compressible fluid flow.
CO2	Employ the concepts of isentropic flow through variable area ducts.
CO3	Calculate flow properties in fanno flow and rayleigh flow.
CO4	Determine various flow parameters for normal shock waves..
CO5	Utilize thrust equation for performance calculation of various jet engines.
CO6	Utilize thrust equation for performance calculation of rocket engines

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1702ME603	DYNAMICS OF MACHINES	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge in dynamic analysis of simple mechanism and design of flywheel.
- To provide knowledge on balancing of rotating and reciprocating masses.
- To study the working principle of governor and gyroscope.
- To learn the concept of free and forced vibration.
- To learn the concept of transverse and torsional vibration

UNIT I DYNAMIC FORCE ANALYSIS OF MECHANISMS **9 Hours**

Principle of superposition, Condition for dynamic analysis, Dynamic analysis of four bar & slider crank mechanism - Engine force analysis.Turning moment diagram for steam & IC Engine. Energy stored in flywheel, Dimension of flywheel rim, Flywheel in punching press.

UNIT II BALANCING **9 Hours**

Introduction - Static balancing and dynamic balancing, Balancing of Rotating mass several masses in same and different plane. Balancing of reciprocating mass Swaying couple, Tractive force, Hammer Blow. Balancing of coupled locomotives.

UNIT III GOVERNOR AND GYROSCOPE **9 Hours**

Governor Terminology, working principle, Types - Watt, Porter and Proell governor, Characteristics of Governor-sensitiveness, Hunting, Ichoronisn, Stability. Gyroscope- Gyroscopic effect, gyroscopic couple, gyroscopic effect on aero planes and naval ships.

UNIT IV FUNDAMENTAL OF VIBRATION **9 Hours**

Introduction-Terminology, Classification, elements of vibration, free undamped vibration, Free Damped vibration (Viscus Damping) - Damping ratio and logarithmic decrement. Force damped vibration - Magnification factor. Vibration isolation and transmissibility.

UNIT V TRANSVERSE AND TORSIONAL VIBRATION **9 Hours**

Transverse vibration of shafts and beams Shaft carrying several loads, whirling of shafts. Torsional vibration- effect of inertia on torsional vibration-Torsionally equivalent Shaft, single rotor, two rotors and three rotors system.

FOR FURTHER READING – SEMINAR – CPS **Total 45 Hours**

:

Turning moment balancing of W, V8, V12 engine, Instruments for dynamic measurements, vibration and noise standards, Mutifilar systems.

Course Outcomes (COs)

Employability.

After completion of the course students will be able to

1. Prepare the force-motion relationship in components subjected to external forces.
2. Calculate the inertia effect on standard mechanisms.
3. Determine the undesirable effects of unbalances resulting from prescribed motions in mechanism.
4. Determine the effect of dynamics of undesirable vibrations.
5. Calculate the characteristics of a mechanisms used for speed control and stability control.
6. Determine the performance of gyroscope in various applications (Automobiles, ships and planes).

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1702ME651 **DYNAMICS OF MACHINES LABORATORY** **L T P C**

0 0 2 1

Course Objectives:

1. To supplement the principles, learn to kinematics and Dynamics of Machinery.
2. To understand how certain measuring devices are used for dynamic testing.
3. To study the working principle of governor and gyroscope.
4. To learn the concept of free and forced vibration.
5. To learn the concept of transverse and torsion vibration.

List of Experiments:

1. Determination of mass moment of inertia of axisymmetric bodies using turn table apparatus
2. Determine the characteristics and effort of Watt, Porter Proell and Hartnell Governors
3. Exercise on Balancing of reciprocating masses.
4. Exercise on Balancing of four rotating masses placed on different plane.
5. Analyze the gyroscopic effect using Gyroscope and verify its laws.
6. Determination of critical speed of shaft with concentrated loads by Whirling of shaft & vibration table apparatus.
7. Determine the moment of inertia of object by Bifilar suspension, Trifilar & method of oscillation.
8. Kinematic analysis of cam model, Epicycle gear train and differential model.
9. Determination of natural frequency of single degree of freedom system & two rotor system.
10. Determine the frequency of forced vibration using Cantilever beam.

TOTAL – 30 Hrs

Course Outcomes: Employabi lity.

1. Measure the mass moment of inertia of axisymmetric objects using Turn table apparatus, bi-filar suspension and compound pendulum. (K3)
2. Experiment with vibrations and balancing of rotating and reciprocating masses in dynamic balancing machine. (K3)
3. Make use of Watt, Porter, Proell and Hartnell governors for determination of range sensitivity. (K3)
4. Do experimentation of the critical speed of shaft under the given load conditions. (K3)
5. Perform the torsional natural frequency of single and double rotor systems. (K3)
6. Make use of whirling of shaft for determination of critical speed of a shaft with concentrated loads. (K3)

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1704GE651	LIFE SKILLS: APTITUDE -II	L	T	P	C
		0	0	2	1

Skill Development

COURSE OUTCOMES:

1. To brush up problem solving skill and to improve intellectual skill of the students.
2. To be able to critically evaluate various real life situations by resorting to Analysis of key issues and factors.
3. To be able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students.
5. To augment logical and critical thinking of Students.

UNIT I PARTNERSHIP, MIXTURES AND ALLEGATIONS, PROBLEM ON AGES, SIMPLE INTEREST, COMPOUND INTEREST **6 Hours**

Introduction Partnership - Relation between capitals, Period of investments and Shares- Problems on mixtures - Allegation rule - Problems on Allegation – Problems on ages - Definitions Simple Interest - Problems on interest and amount - Problems when rate of interest and time period are numerically equal - Definition and formula for amount in compound interest - Difference between simple interest and compound interest for 2 years on the same principle and time period.

UNIT II BLOOD RELATIONS, , CLOCKS, CALENDARS **6 Hours**

Defining the various relations among the members of a family - Solving Blood Relation puzzles - Solving the problems on Blood Relations using symbols and notations - Finding the angle when the time is given - Finding the time when the angle is known - Relation between Angle, Minutes and Hours - Exceptional cases in clocks - Definition of a Leap Year - Finding the number of Odd days - Framing the year code for centuries - Finding the day of any random calendar date.

UNIT III TIME AND DISTANCE, TIME AND WORK **6 Hours**

Relation between speed, distance and time - Converting kmph into m/s and vice versa - Problems on average speed - Problems on relative speed - Problems on trains - Problems on boats and streams - Problems on circular tracks - Problems on races - Problems on Unitary method - Relation between Men, Days, Hours and Work - Problems on Man-Day-Hours method - Problems on alternate days - Problems on Pipes and Cisterns.

UNIT IV DATA INTERPRETATION AND DATA SUFFICIENCY **6 Hours**

Problems on tabular form - Problems on Line Graphs - Problems on Bar Graphs - Problems on Pie Charts - Different models in Data Sufficiency - Problems on data redundancy

UNIT V ANALYTICAL AND CRITICAL REASONING **6 Hours**

Problems on Linear arrangement - Problems on Circular arrangement - Problems on Double line-up - Problems on Selections - Problems on Comparisons - Finding the Implications for compound statements -

Finding the Negations for compound statements- Problems on assumption - Problems on conclusions - Problems on inferences - Problems on strengthening and weakening of arguments.

TOTAL: 30 HOURS

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1704ME653	MINI PROJECT II (Design and CAD modeling)	L	T	P	C
		0	0	2	1

GUIDELINE FOR REVIEW AND EVALUATION:

The students may be grouped into 2 to 4 and work under a project supervisor. The device / system / component(s) to be designed and developed using modeling software, may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the soft copy of the model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report examined by the internal examiner constituted by the Head of the Department.

Employability | Entrepreneurship | Skill Development **Total: 30 Hours**

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1704ME654	INDUSTRIAL VISIT PRESENTATION	L	T	P	C
		0	0	2	1

In order to provide the experiential learning to the students, shall take efforts to arrange at least two industrial visit / field visits in a year. A presentation based on Industrial visits shall be made in this semester and suitable credit may be awarded.

ASSESSMENT PATTERN : Continuous Assessment (100 Marks)

Distribution of marks for Continuous Assessment	**Mark**
Test	40
Presentation / Quiz / Group Discussion	40
Report	20
Total	**100**

Grades (Excellent / Good / Satisfactory / Not Satisfactory)

Employability | Entrepreneurship | Skill Development.

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1702ME652	COMPUTER AIDED ANALYSIS LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

LIST OF EXPERIMENTS

1. Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of plate with hole.
4. Stress analysis of axisymmetric components.
5. Thermal stress analysis of conduction boundary.
6. Thermal stress analysis of mixed boundary.
7. Model analysis of Beams.
8. Harmonicanalysis of simple systems.
9. Plane stress analysis of plate.
10. Stress analysis of 3D beam.
11. Stress analysis of bracket.

Total: 30 Hours

Course Outcomes (COs): Employability | Entrepreneurship

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

	Competency	Cognitive level
CO1	Examine Stress and deflection analysis of beams with different conditions and link	Apply
CO2	Examine Stress analysis of plate with hole, brackets .	Apply
CO3	Establish thermal analysis of plates with conduction boundary and mixed boundary.	Apply
CO4	Establish modal analysis of beams.	Apply
CO5	Establish harmonic analysis of beams.	Apply
CO6	Examine Stress analysis of Axi-symmetric component.	Apply

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1704GE451	LIFE SKILLS: VERBAL ABILITY	L	T	P	C
		0	0	2	-

PREREQUISITE:

Technical English – I and II

COURSE OBJECTIVES:

1. To help students comprehend and use vocabulary words in their day to day communication.
2. To apply appropriate reading strategies for interpreting technical and non-technical documents used in job-related settings.
3. To ensure students will be able to use targeted grammatical structures meaningfully and appropriately in oral and written production.
4. To enable the students to arrange the sentences in meaningful unit and to determine whether constructions rely on active or passive voice.
5. To apply the principles of effective business writing to hone communication skills.

UNIT I VOCABULARY USAGE **6 Hours**

Introduction - Synonyms and Antonyms based on Technical terms – Single word Substitution – Newspaper, Audio and video listening activity.

UNIT II COMPREHENSION ABILITY **6 Hours**

Skimming and Scanning – Social Science passages – Business and Economics passages – latest political and current event based passages – Theme detection – Deriving conclusion from passages.

UNIT III BASIC GRAMMAR AND ERROR DETECTION **6 Hours**

Parallelism – Redundancy – Ambiguity – Concord - Common Errors – Spotting Errors – Sentence improvement – Error Detection FAQ in Competitive exams.

UNIT IV REARRANGEMENT AND GENERAL USAGE **6 Hours**

Jumble Sentences – Cloze Test - Idioms and Phrases – Active and passive voice – Spelling test.

UNIT V APPLICATION OF VERBAL ABILITY **6 Hours**

Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette – Report Writing - Proposal writing – Essay writing– Indexing –Market surveying.

Total: 30 Hours

ASSESSMENT PATTERN

1. Two assignments (2 x 25 marks = 50 marks)
2. Pragmatic assessment (50 marks)

COURSE OUTCOMES: Skill Development

After completion of the course, Student will be able to

CO1: Use new words in their day to day communication.
CO2: Gather information swiftly while reading passages.
CO3: Students are proficient during their oral and written communication.
CO4: Rearrange the sentences and able to identify the voice of the sentence.
CO5: Students use their knowledge of the best practices to craft effective business documents

REFERENCES:

1. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017.
2. R S Aggarwal and Vikas Aggarwal , Quick Learning Objective General English, S.Chand Publishing House, 2017.
3. Dr.K.Alex , Soft Skills, S.Chand Publishing House, Third Revise Edition, 2014.
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition, 2007.

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ME6701 **POWER PLANT ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS **10**

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS **10**

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS **7**

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

UNIT IV POWER FROM RENEWABLE ENERGY **10**

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS **8**

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.
- Analyse and solve energy and economic related issues in power sectors.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw - Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw - Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, "Power Plant Engineering", 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw - Hill, 1998.
4. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.

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ME6702 **MECHATRONICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION **12**

Introduction to Mechatronics - Systems - Concepts of Mechatronics approach - Need for Mechatronics - Emerging areas of Mechatronics - Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers - LVDT - Capacitance sensors - Strain gauges - Eddy current sensor - Hall effect sensor - Temperature sensors - Light sensors

UNIT II 8085 MICROPROCESSOR AND 8051 MICROCONTROLLER **10**

Introduction - Architecture of 8085 - Pin Configuration - Addressing Modes -Instruction set, Timing diagram of 8085 - Concepts of 8051 microcontroller - Block diagram,.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE **8**

Introduction - Architecture of 8255, Keyboard interfacing, LED display -interfacing, ADC and DAC interface, Temperature Control - Stepper Motor Control - Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER **7**

Introduction - Basic structure - Input and output processing - Programming - Mnemonics - Timers, counters and internal relays - Data handling - Selection of PLC.

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN **8**

Types of Stepper and Servo motors - Construction - Working Principle - Advantages and Disadvantages. Design process-stages of design process - Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Engine Management system - Automatic car park barrier.

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

TEXT BOOKS:

1. Bolton, "Mechatronics", Printice Hall, 2008
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Smaili.A and Mrad.F , "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2007.
4. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.

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5. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall of India, 2007.
6. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

ME6703 COMPUTER INTEGRATED MANUFACTURING SYSTEMS **L T P C 3 0 0 3**

OBJECTIVES:

- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION **10**

Brief introduction to CAD and CAM - Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM - Concurrent Engineering-CIM concepts - Computerised elements of CIM system -Types of production Manufacturing models and Metrics - Mathematical models of Production Performance - Simple problems - Manufacturing Control - Simple Problems - Basic Elements of an Automated system - Levels of Automation - Lean Production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING **10**

Process planning - Computer Aided Process Planning (CAPP) - Logical steps in Computer Aided Process Planning - Aggregate Production Planning and the Master Production Schedule - Material Requirement planning - Capacity Planning- Control Systems-Shop Floor Control-Inventory Control - Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) Simple Problems.

UNIT III CELLULAR MANUFACTURING **9**

Group Technology(GT), Part Families - Parts Classification and coding - Simple Problems in Opitz Part Coding system - Production flow Analysis - Cellular Manufacturing - Composite part concept - Machine cell design and layout - Quantitative analysis in Cellular Manufacturing - Rank Order Clustering Method - Arranging Machines in a GT cell - Hollier Method - Simple Problems.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) **8**

Types of Flexibility - FMS - FMS Components - FMS Application & Benefits - FMS Planning and Control- Quantitative analysis in FMS - Simple Problems. Automated Guided Vehicle System (AGVS) - AGVS Application - Vehicle Guidance technology - Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS **8**

Robot Anatomy and Related Attributes - Classification of Robots- Robot Control systems - End Effectors - Sensors in Robotics - Robot Accuracy and Repeatability - Industrial Robot Applications - Robot Part Programming - Robot Accuracy and Repeatability - Simple Problems.

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the student can able to understand the use of computers in process planning and use of FMS and Robotics in CIM

TEXT BOOK:

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age

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International (P) Ltd, New Delhi, 2000.

REFERENCES:

1. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
2. Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach" Chapman & Hall, London, 1995.
3. Rao. P, N Tewari &T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.

GE6757 TOTAL QUALITY MANAGEMENT L T P C 3 0 0 3

OBJECTIVES:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality-- Dimensions of product and service quality - Basic concepts of TQM - TQM Framework Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus--Customer orientation, Customer satisfaction, Customer complaints, Customer retention Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, 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, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) Taguchi quality loss function - TPM - Concepts, improvement needs Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

TOTAL: 45 PERIODS

OUTCOMES: Employability.

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.

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2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

ME6005 PROCESS PLANNING AND COST ESTIMATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I INTRODUCTION TO PROCESS PLANNING **10**

Introduction- methods of process planning-Drawing interpretation-Material evaluation - steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES **10**

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION **8**

Importance of costing and estimation -methods of costing-elements of cost estimation -Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION **8**

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION **9**

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

TOTAL: 45 PERIODS

OUTCOMES: Employability

- Upon completion of this course, the students can able to use the concepts of process planning and cost estimation for various products.

TEXT BOOKS:

1. Peter scalon, "Process planning, Design/Manufacture Interface", Elsevier science technology Books, Dec 2002.

REFERENCES:

1. Ostwalal P.F. and Munez J., "Manufacturing Processes and systems", 9th Edition, John Wiley, 1998.
2. Russell R.S and Tailor B.W, "Operations Management", 4th Edition, PHI, 2003.
3. Chitale A.V. and Gupta R.C., "Product Design and Manufacturing", 2nd Edition, PHI, 2002.

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ME6010 **ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I FUNDAMENTALS OF ROBOT **6**

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 their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic GrippersVacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION **12**

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications-Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING **13**

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS **5**

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations Economic Analysis of Robots.

TOTAL: 45 PERIODS

OUTCOMES: Employability

- Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS:

1. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003.

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ME6711 **SIMULATION AND ANALYSIS LABORATORY** **L T P C 0 0 3 2**

OBJECTIVES:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS

A. SIMULATION

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using Multibody Dynamic software

B. ANALYSIS

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi - symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

TOTAL: 45 PERIODS

OUTCOMES: Employability | Entrepreneurship.

- Upon completion of this course, the Students can model, analyse and simulate experiments to meet real world system and evaluate the performance.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Computer Work Station	15
2	Color Desk Jet Printer	01
3	Multibody Dynamic Software Suitable for Mechanism simulation and analysis	15 licenses
4	C / MATLAB	5 licenses

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ME6712 **MECHATRONICS LABORATORY** **L T P C**
0 0 3 2

OBJECTIVES:

- To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

LIST OF EXPERIMENTS:

1. Assembly language programming of 8085 - Addition - Subtraction - Multiplication - Division - Sorting - Code Conversion.
2. Stepper motor interface.
3. Traffic light interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
6. Study of hydraulic, pneumatic and electro-pneumatic circuits.
7. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
8. Study of PLC and its applications.
9. Study of image processing technique.

TOTAL : 45 PERIODS

OUTCOMES: Employability.

- Upon completion of this course, the students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	NAME OF THE EQUIPMENT	Qty.
1	Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each	1 No.
2	Basic Hydraulic Trainer Kit	1 No
3	Hydraulics and Pneumatics Systems Simulation Software	10 No
4	8051 - Microcontroller kit with stepper motor and drive circuit sets	2 No
	Image processing system with hardware & software	1 No.

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ME6713 **COMPREHENSION** **L T P C**
0 0 2 1

OBJECTIVES:

- To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

METHOD OF EVALUATION:

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

TOTAL : 30 PERIODS

OUTCOMES: SKILL DEVELOPMENT

- ability to understand and comprehend any given problem related to mechanical engineering field.

MG6863 **ENGINEERING ECONOMICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making.

UNIT I INTRODUCTION TO ECONOMICS **8**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics - Engineering efficiency, Economic efficiency, Scope of engineering economics--Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING **10**

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications -Time value of money, Single payment compound amount factor Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW **9**

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS **9**

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

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UNIT V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TOTAL: 45 PERIODS

OUTCOMES : EMPLOYABILITY.

- Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions.

TEXT BOOKS:

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES:

1. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2011.
4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

ME6016 ADVANCED I.C ENGINES **L T P C**
3 0 0 3

OBJECTIVES:

To understand the underlying principles of operation of different IC Engines and components.
To provide knowledge on pollutant formation, control, alternate fuel etc.

UNIT I SPARK IGNITION ENGINES 9

Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

UNIT II COMPRESSION IGNITION ENGINES 9

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – ... motion - Introduction to Turbocharging.

UNIT III POLLUTANT FORMATION AND CONTROL 9

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.

UNIT IV ALTERNATIVE FUELS 9

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS 9

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

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TOTAL : 45 PERIODS

OUTCOME: Employability.

Upon completion of this course, the students can able to compare the operations of different IC Engine and components and can evaluate the pollutant formation, control, alternate fuel

TEXT BOOKS:

Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002.
Ganesan, "Internal Combustion Engines", II Edition, TMH, 2002.

REFERENCES:

1. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., Dhanpat Rai & Sons 2007.
2. Duffy Smith, "Auto Fuel Systems", The Good Heart Willcox Company, Inc., 1987.
3. Eric Chowenitz, "Automobile Electronics", SAE Publications, 1995

IE6605 PRODUCTION PLANNING AND CONTROL

L	T	P	C
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OBJECTIVES:

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION 9

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

UNIT II WORK STUDY 9

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

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

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

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems Line of balance - Flow production scheduling-Batch production scheduling-Product sequencing - Production Control systems-Periodic batch control-Material requirement planning kanban - Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

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

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TOTAL: 45 PERIODS

OUTCOMES: Employability

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

1. Martand Telsang, "Industrial Engineering and Production Management", First edition, S. Chand and Company, 2000.
2. James.B.Dilworth,"Operations management - Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition 1992.

REFERENCES:

1. Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Edition, John Wiley and Sons, 2000.
3. Kanishka Bedi, " Production and Operations management", 2nd Edition, Oxford university press, 2007.
4. Melynk, Denzler, " Operations management - A value driven approach" Irwin Mcgraw hill.
5. Norman Gaither, G. Frazier, "Operations Management", 9th edition, Thomson learning IE, 2007
6. Jain. K.C & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 1990.
7. Chary. S.N. "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.
8. Upendra Kachru, "Production and Operations Management - Text and cases", 1st Edition, Excel books 2007.

ME6811 **PROJECT WORK** **L T P C**
0 0 12 6

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Employability | Entrepreneurship | Skill Development

TOTAL: 180 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

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