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**SEMMESTER – X**

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*Two weeks Industrial Training during holidays

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 223**
LIST OF ELECTIVES FOR B.E. MECHANICAL ENGINEERING (SANDWICH)

Elective I

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OBJECTIVES:
- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I
9+3
Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one’s leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II
9+3
Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Reading exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III
9+3
Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV
9+3
Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.
UNIT V
Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
Learners should be able to
• speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
• write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
• read different genres of texts adopting various reading strategies.
• listen/view and comprehend different spoken discourses/excerpts in different accents

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

WEBSITES:

TEACHING METHODS:
• Lectures
• Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
• Discussions
• Role play activities
• Short presentations
• Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.
EVALUATION PATTERN:

Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.
- Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

End Semester Examination: 80%

MA6151 MATHEMATICS – I

OBJECTIVES:
- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES
9+3

UNIT II SEQUENCES AND SERIES
9+3
UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS  9+3
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES  9+3

UNIT V MULTIPLE INTEGRALS  9+3

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
• This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

TEXT BOOKS:

REFERENCES:

PH6151 ENGINEERING PHYSICS – I  L  T  P  C
3  0  0  3

OBJECTIVES:
• To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I CRYSTAL PHYSICS  9
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)
UNIT II  PROPERTIES OF MATTER AND THERMAL PHYSICS  
Elasticity- Hooke’s law - Relationship between three modulii of elasticity (qualitative) – stress -strain diagram – Poisson’s ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young’s modulus by uniform bending- I-shaped girders

UNIT III  QUANTUM PHYSICS

UNIT IV  ACOUSTICS AND ULTRASONICS
Production of ultrasounds by magnetostriction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

UNIT V  PHOTONICS AND FIBRE OPTICS
Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TOTAL: 45 PERIODS

OUTCOMES:
• The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:
1. Arumugam M. Engineering Physics. Anuradha publishers, 2010

REFERENCES:
1. Searls and Zemansky. University Physics, 2009
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
OBJECTIVES:

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I  POLYMER CHEMISTRY  9
Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

UNIT II CHEMICAL THERMODYNAMICS  9
Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isocho re(problems).

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY  9

UNIT IV PHASE RULE AND ALLOYS  9

UNIT V NANOCHEMISTRY  9
Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

OUTCOMES:

- The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these
subjects for further learning.

**TEXT BOOKS:**

**REFERENCES:**

**GE6151 COMPUTER PROGRAMMING**

**OBJECTIVES:**
The students should be made to:
- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

**UNIT I INTRODUCTION**

**UNIT II C PROGRAMMING BASICS**

**UNIT III ARRAYS AND STRINGS**

**UNIT IV FUNCTIONS AND POINTERS**
UNIT V  STRUCTURES AND UNIONS
Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

OUTCOMES:
At the end of the course, the student should be able to:
- Design C Programs for problems.
- Write and execute C programs for simple applications.

TEXTBOOKS:

REFERENCES:

GE6152   ENGINEERING GRAPHICS
L T P C
2 0 3 4

OBJECTIVES:
- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I   PLANE CURVES AND FREE HAND SKETCHING
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

UNIT II   PROJECTION OF POINTS, LINES AND PLANE SURFACES
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.

UNIT III PROJECTION OF SOLIDS 5+9
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+9
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. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9
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.

COMPUTER AIDED DRAFTING (Demonstration Only) 3
Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
• perform free hand sketching of basic geometrical constructions and multiple views of objects.
• do orthographic projection of lines and plane surfaces.
• draw projections and solids and development of surfaces.
• prepare isometric and perspective sections of simple solids.
• demonstrate computer aided drafting.

TEXT BOOK:

REFERENCES:
Program using structures and unions.

Design and implement C programs for simple applications.

Develop recursive programs.

Programs with user defined functions

C Programming using Simple statements and expressions

Be familiar with the use of Office software.

Be exposed to presentation and visualization tools.

Be exposed to problem solving techniques and flow charts.

Be familiar with programming in C.

Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:

Search, generate, manipulate data using MS office/ Open Office

Presentation and Visualization – graphs, charts, 2D, 3D

Problem formulation, Problem Solving and Flowcharts

C Programming using Simple statements and expressions

Scientific problem solving using decision making and looping.

Simple programming for one dimensional and two dimensional arrays.

Solving problems using String functions

Programs with user defined functions – Includes Parameter Passing

Program using Recursive Function and conversion from given program to flow chart.

Program using structures and unions.

TOTAL : 45 PERIODS

OUTCOMES:

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

Apply good programming design methods for program development.

Design and implement C programs for simple applications.

Develop recursive programs.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.
OBJECTIVES:

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

**GROUP A (CIVIL & MECHANICAL)**

**I CIVIL ENGINEERING PRACTICE**

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE**

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.
GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 10
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV ELECTRONICS ENGINEERING PRACTICE 13
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

OUTCOMES:
- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos
MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL

1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
   (b) Digital Live-wire detector 2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

GE6163 PHYSICS AND CHEMISTRY LABORATORY – I  L T P C  0 0 2 1

PHYSICS LABORATORY – I

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS
(Any FIVE Experiments)

1. (a) Determination of Wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of Young’s modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster’s Bridge
OUTCOMES:
• The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee’s Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster’s bridge set up
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY- I

OBJECTIVES:
• To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
• To acquaint the students with the determination of molecular weight of a polymer by vacometry.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of DO content of water sample by Winkler’s method.
2. Determination of chloride content of water sample by argentometric method.
3. Determination of strength of given hydrochloric acid using pH meter.
4. Determination of strength of acids in a mixture using conductivity meter.
5. Estimation of iron content of the water sample using spectrophotometer.
   (1,10-phenanthroline / thiocyanate method).
7. Conductometric titration of strong acid vs strong base.

OUTCOMES:
• The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Iodine flask - 30 Nos
2. pH meter - 5 Nos
3. Conductivity meter - 5 Nos
4. Spectrophotometer - 5 Nos
5. Ostwald Viscometer - 10 Nos

Common Apparatus: Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)
OBJECTIVES:

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

UNIT I

9+3
Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using ‘emoticons’ as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. ‘can’) - Homophones (e.g. ‘some’, ‘sum’); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II

9+3
Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one’s friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students’ dialogues.

UNIT III

9+3
Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. ‘rock’, ‘train’, ‘ring’); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

UNIT IV

9+3
Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on
Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V
Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
Learners should be able to
• speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
• write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
• read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
• listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

Websites
2. http://owl.english.purdue.edu
TEACHING METHODS:
- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
- Project
- Assignment
- Report
- Creative writing, etc.
All the four skills are to be tested with equal weightage given to each.
✔ Speaking assessment: Individual presentations, Group discussions
✔ Reading assessment: Reading passages with comprehension questions graded following Bloom’s taxonomy
✔ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
✔ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom’s taxonomy.

End Semester Examination: 80%

MA6251 MATHEMATICS – II

OBJECTIVES:
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
- To 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.

UNIT I VECTOR CALCULUS 9+3
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) – Simple applications involving cubes and rectangular parallelopipeds.
UNIT II  ORDINARY DIFFERENTIAL EQUATIONS  9+3
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III  LAPLACE TRANSFORM  9+3

UNIT IV  ANALYTIC FUNCTIONS  9+3
Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+k, kz, 1/z, z², e^z and bilinear transformation.

UNIT V  COMPLEX INTEGRATION  9+3
Complex integration – Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula – Taylor’s and Laurent’s series expansions – Singular points – Residues – Cauchy’s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I  CONDUCTING MATERIALS  9

UNIT II  SEMICONDUCTING MATERIALS  9

UNIT III  MAGNETIC AND SUPERCONDUCTING MATERIALS  9
Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV  DIELECTRIC MATERIALS  9

UNIT V  ADVANCED ENGINEERING MATERIALS  9

TOTAL: 45 PERIODS

OUTCOMES:
- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I  WATER TECHNOLOGY  9
Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

UNIT II  ELECTROCHEMISTRY AND CORROSION  9

UNIT III  ENERGY SOURCES  9
Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H₂-O₂ fuel cell- applications.

UNIT IV  ENGINEERING MATERIALS  9
Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

UNIT V  FUELS AND COMBUSTION  9

TOTAL: 45 PERIODS
OUTCOMES:
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

REFERENCES:

GE6252 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

OBJECTIVES:
- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS
- Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS

UNIT IV DIGITAL ELECTRONICS
UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

OUTCOMES:
• ability to identify the electrical components explain the characteristics of electrical machines.
• ability to identify electronics components and use of them to design circuits.

TEXT BOOKS:

REFERENCES:

GE6253 ENGINEERING MECHANICS

OBJECTIVES:
• To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I  BASICS AND STATICS OF PARTICLES

UNIT II  EQUILIBRIUM OF RIGID BODIES
Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III  PROPERTIES OF SURFACES AND SOLIDS
Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas –
Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 60 PERIODS

OUTCOMES:
• ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
• ability to analyse the forces in any structures.
• ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

REFERENCES:

GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY L T P C 0 1 2 2

OBJECTIVES:
• To develop skill to use software to create 2D and 3D models.

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING
1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline 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 (e.g. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

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

TOTAL: 45 PERIODS

OUTCOMES:
- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pentium IV computer or better hardware, with suitable graphics facility</td>
<td>30 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Licensed software for Drafting and Modeling.</td>
<td>30 Licenses</td>
</tr>
<tr>
<td>3.</td>
<td>Laser Printer or Plotter to print / plot drawings</td>
<td>2 No.</td>
</tr>
</tbody>
</table>

GE6262                           PHYSICS AND CHEMISTRY LABORATORY – II

OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of Young’s modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid – Poiseuille’s method
4. Determination of Dispersive power of a prism – Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

OUTCOMES:
- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.
   a. (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY - II

OBJECTIVES:
- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Estimation of copper content of the given solution by EDTA method
4. Estimation of iron content of the given solution using potentiometer
5. Estimation of sodium present in water using flame photometer
6. Corrosion experiment – weight loss method
7. Conductometric precipitation titration using BaCl$_2$ and Na$_2$SO$_4$

TOTAL: 30 PERIODS

OUTCOMES:
- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

REFERENCES:
- Laboratory classes on alternate weeks for Physics and Chemistry.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Potentiometer - 5 Nos
2. Flame photo meter - 5 Nos
3. Weighing Balance - 5 Nos
4. Conductivity meter - 5 Nos

Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (30 Nos each)
OBJECTIVES:
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- 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  PARTIAL DIFFERENTIAL EQUATIONS  9+3
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 and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II  FOURIER SERIES  9+3

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  9+3
Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV  FOURIER TRANSFORMS  9+3

UNIT V  Z-TRANSFORMS AND DIFFERENCE EQUATIONS  9+3

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS:

REFERENCES:

MS6301 ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
4 0 0 4

OBJECTIVES:
- Use of AC & DC machines and perform speed control
- Use of different electronic device to design circuit
- Use of LIC to perform different boolean operation.

UNIT I INTRODUCTION
Ohms law - Kirchoff’s laws – solving simple, DC circuits – Single Phase AC circuits - power, power factor, Introduction to three phase system, Comparison of single phase and Three phase.

ELECTRIC DRIVES:
DC drives, DC motors, principle of operation, torque equation, power developed, speed-torque characteristics of series, shunt and compound motors, speed control-armature control, field control.

UNIT II AC DRIVES
AC machines, Three phase Induction motors, principle of operation, torque equation, speed-torque characteristics of Induction motors, cage and wound rotor types, single phase Induction motors-principle of operation, method of starting, types of single phase motors.

INDUSTRIAL APPLICATIONS:
Factors to be considered for selection of motors, determination of power rating of drive motors, selection of motors for cranes, machine tool applications, centrifugal pumps.

UNIT III ELECTRONIC DEVICES
Operation of PN junction diodes, VI characteristics, zener diode, BJT-types -CB, CE, CC configurations, input and output characteristics, JFET, difference between FET and BJT-working principle and characteristics. MOSFET- types, principle of operation and characteristics.

ELECTRONIC CIRCUITS:
(Qualitative analysis only) Half wave and full wave rectifier, capacitive filters, zener voltage regulator, RC- DMA Introduction to PLC, coupled amplifier, frequency response.

UNIT IV LINEAR INTERGATED CIRCUITS
Operational amplifiers, Ideal op-amp characteristics, Inverting and Non-inverting amplifier, op-amp applications - Adder- Subtractor, integrator, differentiator, comparator, zero crossing detector.

DIGITAL ELECTRONICS:
Number systems-binary, octal, hexadecimal, logic gates – AND,OR, NOT, NAND,NOR, XOR, XNOR, Half adder, full adder, subtractor, Flip flops, RS,JK,JK Master slave, D and T type, counters and shift registers.

UNIT V MICROPROCESSORS
Architecture of Intel 8085, addressing modes, instruction set, machine cycles, timing diagrams, memory diagrams, Memory Mapped I/O Mapped I/O – Stack and Subroutines, interrupts, DMA, introduction to programmable peripherals.

TOTAL (L:45+T:15): 60 PERIODS
OUTCOMES:
- Upon completion of this course the student can able to apply AC & DC machines and perform speed control and different electronic device to design circuit.

TEXT BOOKS :

REFERENCES:

ME6401 KINEMATICS OF MACHINERY L T P C
3 0 0 3

OBJECTIVES:
- To understand the basic components and layout of linkages in the assembly of a system/machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS 9

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

UNIT III KINEMATICS OF CAM MECHANISMS 9
UNIT IV    GEAR TRAINS AND GEAR TRAINS

UNIT V    FRICTION IN MACHINE ELEMENTS
Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes - Band and Block brakes.

OUTCOMES:
- Upon completion of this course, the students can apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.

TEXT BOOKS:

REFERENCES:

CE6306    STRENGTH OF MATERIALS
L T P C
3 1 0 4

OBJECTIVES:
To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I    STRESS, STRAIN AND DEFORMATION OF SOLIDS
UNIT II  TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM  9
Beams – types transverse loading on beams – Shear force and bending moment in beams –
Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending–
bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams –
Shear stress distribution.

UNIT III  TORSION  9
Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts–
Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs,
carriage springs.

UNIT IV  DEFLECTION OF BEAMS  9
Double Integration method – Macaulay’s method – Area moment method for computation of slopes
and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

UNIT V  THIN CYLINDERS, SPHERES AND THICK CYLINDERS  9
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and
deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation
in spherical shells – Lame’s theorem.

OUTCOMES:
• Upon completion of this course, the students can able to apply mathematical knowledge to
calculate the deformation behavior of simple structures.
• Critically analyse problem and solve the problems related to mechanical elements and analyse
the deformation behavior for different types of loads.

TEXT BOOKS:

REFERENCES:
2007.

MS6302  MACHINE ASSEMBLY DRAWING  L  T  P  C
3  1  0  4

OBJECTIVES:
• Use of drawing tools to show the assembly view of the component and mark suitable units, fir
tolerance data

UNIT I  INTRODUCTION  9
Introduction to machine drawing. Importance of sectional views. Computer-aided drafting
CONVENTIONS:
Code of practice for engineering drawing-conventional representation of details- drilled and tapped
holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves,
chamfers, fillet radii and keyways. Conventions to represent standard components-bolts, nuts,
washers, screws, cotters, pins, circlips, bearings, gears, springs and flanges.
UNIT II  ASSEMBLY CONCEPTS
Methods and concepts of assemblies-assembly requirements, Bill of materials. Methods of assembly-bolts, nuts, studs, screws and pins. Methods of arresting motion of a member in an assembly. Assembly and dismantling exercise of a typical assembly with emphasis on assembly sequence and appropriate fits.

UNIT III  FITS AND TOLERANCES

UNIT IV  ASSEMBLY DRAWING PRACTICE
Making free hand sketches of typical subassemblies-flange coupling, stuffing box, journal bearings, rolling element bearings, keyed joints, cotter joints, C clamp.

UNIT V  ASSEMBLY USING SOLID MODELING
Modeling and assembly using software-extracting views and sections. Drawing of assemblies-plummer block, machine vice, stop valve, screw jack, tail stock, cylindrical gear box, simple drill jig. Creation of bill of materials, calculation of mass and section properties, interference check between solids.

OUTCOMES:
- Upon completion of this course, the students can apply the drawing tools to show the assembly view of the component and mark suitable units, fit tolerance data

TEXT BOOKS:

REFERENCES:

MF6512  MACHINE DRAWING

OBJECTIVES:
- To train the students to prepare good and accurate drawing of various machine elements and assembly drawing of selected machine tool parts.

FUNDAMENTALS OF MACHINE DRAWING
Code of practice for Machine Drawing – Conventions, Abbreviation and Symbols
Sectional views – Types of sectional views
Selection of Fits and Tolerances – Method of placing limit dimensions.
BASIC MACHINE ELEMENTS
The required sectional view of the following machine elements are to be drawn as per the standards.
Threaded joints
Riveted joints
Welded joints
Key, Cotter and Pin joints
Shaft coupling
Bearing
Pipe joints
Gears
Surface finish and its representation

ASSEMBLY DRAWING
The assembly drawing of the following machine tool parts is to be drawn from the given detailed drawing.
Screw jack, machine vice, swivel bearing
Lathe tailstock, Lathe tool post, Tool head of a shaper
Drilling jig, Drilling machine spindle
Engine piston and connecting rod
Recirculating ball screw, LM guide ways,
Hydraulic and Pneumatic chuck of CNC machine.

OUTCOMES:
• Ability to develop engineering drawing for the industrial components using Indian Standard Code of Practice.

TEXT BOOK:

REFERENCES:

CE6315 STRENGTH OF MATERIALS LABORATORY
L T P C
0 0 3 2

OBJECTIVES
To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

LIST OF EXPERIMENTS
1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
10. Tempering- Improvement Mechanical properties Comparison
(i) Unhardened specimen
(ii) Quenched Specimen and
(iii) Quenched and tempered specimen.
11. Microscopic Examination of
(i) Hardened samples and
(ii) Hardened and tempered samples.

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to perform different destructive testing
- Ability to characteristic materials

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Torsion Testing Machine (60 NM Capacity)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Impact Testing Machine (300 J Capacity)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Brinell Hardness Testing Machine</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Rockwell Hardness Testing Machine</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Spring Testing Machine for tensile and compressive loads (2500 N)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Metallurgical Microscopes</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Muffle Furnace (800 C)</td>
<td>1</td>
</tr>
</tbody>
</table>

MS6311  ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY  L T P C
0 0 2 1

OBJECTIVES:
- To learn for conducting experiments involving electrical machines and Microprocessors and to analyse and interpret the results.

LIST OF EXPERIMENTS
1. Verification of Ohm’s law and Kirchhoff’s laws.
2. Load test on DC series motor.
3. Load test on three-phase induction motor.
4. Study of half wave and full wave rectifiers.
5. RC coupled transistor amplifier.
6. Applications of operational amplifier.
7. Study of logic gates and implementation of Boolean functions.
8. Implementation of binary adder/subtractor.
9. Study of programming of 8085 microprocessor
10. Interfacing a stepper motor with 8085 microprocessor

TOTAL: 30 PERIODS

OUTCOMES:
- Understanding the relation between electrical voltage, current and resistance.
- Ability to measure the performance of electrical machine like DC and AC motors.
- Visualizing the usage of logic gates and Microprocessor in motor control systems.

REFERENCE:
1. Laboratory Manual prepared by Department of Electrical and Electronics Engineering.
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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<tbody>
<tr>
<td>1</td>
<td>D. C. Motor Generator Set</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>D.C. Compound Motor</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Single Phase Transformer</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Three Phase Induction Motor</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Single Phase Induction Motor</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Three Phase Alternator Set</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Ammeter A.C and D.C</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>Voltmeters A.C and D.C</td>
<td>20</td>
</tr>
<tr>
<td>9</td>
<td>Watt meters LPF and UPF</td>
<td>12</td>
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<tr>
<td>10</td>
<td>Resistors &amp; Breadboards</td>
<td>1 set</td>
</tr>
<tr>
<td>11</td>
<td>Cathode Ray Oscilloscopes</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Dual Regulated power supplies</td>
<td>6</td>
</tr>
<tr>
<td>13</td>
<td>A.C. Signal Generators</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>Voltmeters D.C.</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>Ammeters D.C.</td>
<td>10</td>
</tr>
<tr>
<td>16</td>
<td>Resistors, Capacitors, Diodes</td>
<td>1 set</td>
</tr>
<tr>
<td>17</td>
<td>Transistors (BJT, JFET), SCR, Logic Gates</td>
<td>1 set</td>
</tr>
<tr>
<td>18</td>
<td>Stepper Motor, Interface Card and Power Supply</td>
<td>1 set</td>
</tr>
<tr>
<td>19</td>
<td>Probes</td>
<td>1 set</td>
</tr>
</tbody>
</table>

MS6312    INDUSTRIAL TRAINING I    L T P C
(PROCESS ENGINEERING AND ASSEMBLY TECHNOLOGIES) 0 0 0 2

Machining, assembly and process engineering - preparation of process sheets for spur gear - helical gear - sprockets - worm - worm wheel and rack - sequence of operations – machine tools used - speed and feed in each type of machine tool-setting time - operating time - cutting tools - Jigs and fixtures - gauges and instruments - study of assembly method for conventional lathe, pre assembly, sub-assembly and final assembly - study of assembly drawings - preparation of ration of loading sheets - assembly flow chart - assembly time - fits and tolerance between components - inspection methods – material flow diagrams.

MA6453    PROBABILITY AND QUEUEING THEORY    L T P C
3 1 0 4

OBJECTIVES:
• To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.
UNIT I  RANDOM VARIABLES  9 + 3
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II  TWO - DIMENSIONAL RANDOM VARIABLES  9 + 3
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables.

UNIT III  RANDOM PROCESSES  9 + 3

UNIT IV  QUEUEING MODELS  9 + 3
Markovian queues – Birth and Death processes – Single and multiple server queueing models – Little’s formula - Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging.

UNIT V  ADVANCED QUEUEING MODELS  9 + 3
Finite source models - M/G/1 queue – Polliczkek Khinchin formula - M/D/1 and M/E_k/1 as special cases – Series queues – Open Jackson networks.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
• The students will have a fundamental knowledge of the probability concepts.
• Acquire skills in analyzing queueing models.
• It also helps to understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.

TEXT BOOKS

REFERENCES

MS6401  INDUSTRIAL METALLURGY  L T P C
3  0  0  3

OBJECTIVES:
• To understand and learn the fundamental principles of metallurgy and material science and heat treatment processes of metals.
UNIT I CRYSTAL STRUCTURE: 9
BCC, FCC and HCP structure - unit cell –crystallographic planes and directions, miller indices-crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number

UNIT II MECHANICAL PROPERTIES AND TESTING: 9

NON DESTRUCTIVE TESTING:
Non Destructive Testing basic principles and testing method for Radiographic testing, Ultrasonic testing, Magnetic particle inspection and Liquid penetrant inspections, Eddy current testing.

UNIT III CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS: 9

UNIT IV HEAT TREATMENT: 9

UNIT V FERROUS MATERIAL: 9

NON FERROUS MATERIALS: Copper, Aluminium, Nickel, Magnesium, Titanium, Lead, Tin. Important alloys –their composition properties and applications.

NON METALLIC MATERIALS: Introduction to polymers, Composites and Ceramics.

SELECTION OF MATERIALS: Factors to be considered for selection of materials with specific examples. Cost data of metals and alloys.

TOTAL : 45 PERIODS

OUTCOMES:
- ability to relate crystal structure with material properties
- knowledge of material characterisation and testing
- ability to select suitable heat treatment method for improving mechanical properties.
- knowledge of selecting material for engineering application

TEXT BOOK:

REFERENCES:
OBJECTIVES:
- Solve problems related to the fundamental principles of fluid machinery and gas dynamics
- Solve turbo machinery problems from the statistical points of fluid mechanics
- Solve problem in the field of steam turbines gas dynamics

UNIT I  INTRODUCTION  9
Energy transfer between fluid and a rotor. Euler’s energy transfer equation. Components of energy transfer
DEGREE OF REACTION:
Impulse and reaction type, effect of blade angle on degree of reaction and energy transfer. Specific speed and its significance.

UNIT II  HYDRAULIC TURBINE  9

UNIT III  PUMPS  9
Radial flow, axial flow and mixed flow pumps - ideal and actual slip, performance calculation and determination of main dimensions. Cavitation in pumps, net positive suction head (NPSH), effect of speed. Fluid coupling and torque converter.
COMPRESSIONS:

UNIT IV  STEAM TURBINES  9
Types-single stage impulse and reaction type, 50% reaction. Flow through nozzles. Performance of single stage machine. Compounding of turbines.
GAS TURBINE:
Open cycle, closed cycle, methods of improving the efficiency of a simple cycle, multistage compression, inter-cooling, reheating and regeneration, effect of operating variables on thermal efficiency, work ratio.

UNIT V  GAS DYNAMICS  9
Mach number. Basics of Isentropic, Fanno and Rayleigh flows.
JET PROPULSION:
Turbojet-thrust, thrust power, propulsive efficiency, thermal efficiency, combustion chambers and afterburners.

OUTCOMES:
- Upon Completion of this course the students can able to apply the solve problems related to the fundamental principles of fluid machinery and gas dynamics and solve problem in the field of steam turbines gas dynamics.

TEXT BOOKS:
REFERENCES:

## - The course includes at least one assignment with mathematical modeling and / or simulation of a practical situation.

### ME6505 DYNAMICS OF MACHINES  L  T  P  C
  3  0  0  3

OBJECTIVES:
- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

UNIT I  FORCE ANALYSIS  9

UNIT II  BALANCING  9

UNIT III  SINGLE DEGREE FREE VIBRATION  9

UNIT IV  FORCED VIBRATION  9

UNIT V  MECHANISM FOR CONTROL  9

TOTAL : 45 PERIODS
OUTCOMES:
- Upon completion of this course, the Students can able to predict the force analysis in mechanical system and related vibration issues and can able to solve the problem.

TEXT BOOK:

REFERENCES:

MS6403 INSTRUMENTATION AND CONTROL SYSTEMS

OBJECTIVES:
- To impart knowledge on measurements and variables
- To introduce different parameters in environment and measuring techniques
- To teach the control system principle and build times response of different system

UNIT I TRANSDUCER VARIABLES AND MEASUREMENT SIGNALS
Three stages of generalized measurement system – mechanical loading – static characteristics of instruments- factors considered in selection of instruments – commonly used terms, error analysis and classification – sources of error – frequency response – displacement transducers – potentiometer, strain gauge – orientation of strain gauge, LVDT – variable reluctance transducers, proximity sensors, capacitance transducers, tacho generator; smart sensors, integrated sensors, radio telemetry, torque measurements, precision systems like video discs and drives, laser printer etc.,

UNIT II VIBRATION AND TEMPERATURE
Elementary accelerometer and vibrometer – seismic instrument for acceleration – velocity measurement, piezo electric accelerometer, temperature measurement-liquid in glass thermometer, pressure thermometer, resistance temperature detector, thermocouples and thermopiles, thermistor, total radiation pyrometer, optical pyrometer – temperature measuring problem in flowing fluid.
UNIT III  PRESSURE AND FLOW MEASUREMENT  
Manometer, elastic transducer, elastic diaphragm transducer – pressure cell, bulk modulus pressure gauge – Mc Leod gauge – thermal conductivity gauge, calibration of pressure gauge, flow measurement – turbine type meter, hotwire anemometer, magnetic flow meter; liquid level sensors, light sensors, selection of sensors.

UNIT IV  CONTROL SYSTEM PRINCIPLE  
Basic elements of control systems – open loop and closed loop control – elements of closed loop control system – introduction to sampled data, digital control and multivariable control systems. Elements of lead and lag compensation, elements of proportional, integral - derivative (PID) control.

MODELLING OF SYSTEMS: 

UNIT V  SYSTEM ANALYSIS  

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA): 
Overview, architecture, tools alarm, tag logging, history, report generation. Communication protocols of SCADA, interfacing SCADA with field devices. Distributed Control Systems (DCS), architecture, communication facilities, operator and engineering interfaces.

TOTAL: 60 PERIODS

OUTCOMES:
• Able to know the working principle of temperature, pressure, vibration, flowing sensors.
• Use of control system principle and use of the sensor to design close loop system.
• Develop mathematical model for mechanical and electrical system.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To impart skill in using various fluid flow measuring devices and to conduct performance tests and pumps and turbines.

LIST OF EXPERIMENTS:
1. Flow measurement using mouthpiece and orifice.
2. Calibration and comparison of instruments for measuring flow through pipes-orifice, venturi meter, water meter and rotameter.
3. Calibration and comparison of open channel flow measuring instruments- V-notch and rectangular notch.
4. Experiment on force induced on the vane due to impact of jets.
5. Model study in wind tunnel.
6. Performance test on single stage, multi stage and variable speed centrifugal pumps.
7. Load test on impulse water turbine.
8. Load test on reaction water turbine and cross flow turbine.
10. Performance test on centrifugal blower.

OUTCOMES:
- Able to understand the usage of flow measuring devices in conducting experiments of pipes and channels.
- Ability to calibrate flow meters, performance studies on pumps, turbines fans and blower.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orifice meter setup</td>
<td>1 no</td>
</tr>
<tr>
<td>2</td>
<td>Venturi meter setup</td>
<td>1 no</td>
</tr>
<tr>
<td>3</td>
<td>Rotameter setup</td>
<td>1 no</td>
</tr>
<tr>
<td>4</td>
<td>Pipe Flow analysis setup</td>
<td>1 no</td>
</tr>
<tr>
<td>5</td>
<td>Centrifugal pump/submergible pump setup</td>
<td>1 no</td>
</tr>
<tr>
<td>6</td>
<td>Reciprocating pump setup</td>
<td>1 no</td>
</tr>
<tr>
<td>7</td>
<td>Gear pump setup</td>
<td>1 no</td>
</tr>
<tr>
<td>8</td>
<td>Pelton wheel setup</td>
<td>1 no</td>
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<tr>
<td>9</td>
<td>Francis turbine setup</td>
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<tr>
<td>10.</td>
<td>Kaplan turbine setup</td>
<td>1 no</td>
</tr>
<tr>
<td>11.</td>
<td>Axial Flow fan</td>
<td>1 no</td>
</tr>
<tr>
<td>12.</td>
<td>Centrifugal blower</td>
<td>1 no</td>
</tr>
<tr>
<td>13.</td>
<td>Model wind tunnel setup</td>
<td>1 no</td>
</tr>
<tr>
<td>14.</td>
<td>V-notch &amp; rectangular notch set up</td>
<td>1 no</td>
</tr>
</tbody>
</table>

OBJECTIVES:
- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.
LIST OF EXPERIMENTS
1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
   b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
   c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
   b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies.
   b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
    b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
    c) Determination of transmissibility ratio using vibrating table.

TOTAL : 45 PERIODS

OUTCOME
• Ability to demonstrate the principles of kinematics and dynamics of machinery
• Ability to use the measuring devices for dynamic testing.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cam follower setup.</td>
<td>1 No.</td>
</tr>
<tr>
<td>2</td>
<td>Motorised gyroscope.</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Governor apparatus - Watt, Porter, Proell and Hartnell governors.</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Whirling of shaft apparatus.</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Dynamic balancing machine.</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Two rotor vibration setup.</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Spring mass vibration system.</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Torsional Vibration of single rotor system setup.</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td>Gear Models</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Kinematic Models to study various mechanisms.</td>
<td>1 No.</td>
</tr>
<tr>
<td>11</td>
<td>Turn table apparatus.</td>
<td>1 No.</td>
</tr>
<tr>
<td>12</td>
<td>Transverse vibration setup of a) cantilever b) Free-Free beam c) Simply supported beam.</td>
<td>1 No.</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To know about the conducting experiments or ferrous and non-ferrous metallic specimens for finding surface and substrate characterisation

LIST OF EXPERIMENTS:
1. a. Study of Metallurgical Microscope
   b. Specimen preparation for metallographic studies
2. Study of unetched Grey cast iron, SG iron and Malleable cast iron.
3. Study of etched Grey cast iron, SG iron and Malleable cast iron
4. Study of low carbon steel and medium carbon steel
5. Study of high carbon steel and white cast iron.
6. Study of hardened steel and case carburized steel
7. Study of tool steel and stainless steel.
8. Study of Al and Cu alloys
9. Inclusion rating
10. Case studies of Metallurgical failure analysis.

TOTAL: 30 PERIODS

OUTCOMES:
- Will be in a position to relate different material properties with composition, structure etc and enable to understand their engineering implications.
- Ability to use metallurgical microscope or stand and specimens and interpret the results with material properties.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Belt Grinder</td>
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</tr>
<tr>
<td>2</td>
<td>Emery Pad</td>
<td>1 no</td>
</tr>
<tr>
<td>3</td>
<td>Microscope – Binocular Optical</td>
<td>3 nos</td>
</tr>
<tr>
<td>4</td>
<td>Jominy Apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>5</td>
<td>Electric furnace with temperature control for heat treatment</td>
<td>1 no</td>
</tr>
<tr>
<td>6</td>
<td>Standard metallurgical specimens</td>
<td>1 set</td>
</tr>
<tr>
<td>7</td>
<td>Desicator</td>
<td>1 no</td>
</tr>
<tr>
<td>8</td>
<td>Microscope with image analyser</td>
<td>1 no</td>
</tr>
<tr>
<td>9</td>
<td>Orsat analysis apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>10</td>
<td>Electric Bunsen Burner</td>
<td>3 nos</td>
</tr>
<tr>
<td>11</td>
<td>Universal Foundry Sand</td>
<td>1 no</td>
</tr>
<tr>
<td>12</td>
<td>Standard Foundry Sand Test</td>
<td>1 no</td>
</tr>
<tr>
<td>13</td>
<td>Permeability tester</td>
<td>1 no</td>
</tr>
<tr>
<td>14</td>
<td>Hot air Oven</td>
<td>1 no</td>
</tr>
<tr>
<td>15</td>
<td>Single pan balance (0-1 kg range, 10mg accuracy)</td>
<td>1 no</td>
</tr>
<tr>
<td>16</td>
<td>Clay washer</td>
<td>1 no</td>
</tr>
<tr>
<td>17</td>
<td>Foundry sand sieve shakers</td>
<td>1 no</td>
</tr>
<tr>
<td>18</td>
<td>Constant current power supply (0-20v)</td>
<td>1 no</td>
</tr>
</tbody>
</table>
Visits to local industries will be arranged by the department to study the industrial practices.

Lectures by experts will be arranged to gain exposure to the trends in design, manufacturing and quality control in industries.

TOTAL : 30 PERIODS

Inspection and testing of lathes, pumps and motors - BIS specification for motors and pump sets - list of testing instrument - functions - foot mounting motor dimensions as per IS: 1231 - importance of name plate and identification of name plate details - trouble shooting of induction motors - type of routine test of induction motor as per IS: 7538 (Performance Calculations) 1) Measurement of stator resistance 2) High voltage test 3) Measurement of insulation resistance 4) Reduced voltage test 5) No load test 6) Full load test 7) Locked rotor test 8) Starting torque and starting current 9) Pull up torque 10) Pull out torque 11) Momentary over load test 12) Temperature rise test - Final inspection and testing for conventional lathes - Test charts - Inspection of the machine tool for BIS and IMTMA standard - Cutting test - Method of inspection testing - Gauges and instruments required - Accuracy requirements - Deviation observed - Study of inspection methods and preparation of inspection format for lathe bed - Head stock body - Tail stock body - Apron body - Threading and feed box - Gear box - Head stock spindle - Tail stock spindle - Gear - Lead screw - Feed shaft - Spine shaft. – Exposure to metrological aspects of components used for lathes, pumps and motors.

This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

UNIT I TESTING OF HYPOTHESIS

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t, \( \chi^2 \) and F distributions for testing means and variances – Contingency table (Test for Independence) – Goodness of fit.

UNIT II DESIGN OF EXPERIMENTS

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - \( 2^2 \) factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

UNIT IV  INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION  9+3
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.

UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  9+3

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
• It helps the students to have a clear perception of the power of statistical and numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

REFERENCES

MS6501  ECONOMICS FOR BUSINESS DECISIONS  L T P C
3 0 0 3

OBJECTIVES:
• To know and apply the economic theory of consumer demand
• To know the politicians of there Government intervention in market
• To know the pricing strategies

UNIT I  INTRODUCTION TO ECONOMICS:  8
CALCULATING PERCENT CHANGE AND COMPOUNDED GROWTH RATES:
Some Mathematical Concepts and Analytical Tools.

UNIT II  ECONOMIC THEORY OF CONSUMER DEMAND:  8
UNIT III    ECONOMIC THEORY OF THE FIRM (Cont’d):  13
MARKET STRUCTURE AND COMPETITION:


UNIT IV    INTRODUCTION TO MACROECONOMICS:  11
AGGREGATE EXPENDITURES AND FISCAL POLICY:

UNIT V    MONEY AND BANKING:  6
(Monetary Policy) Functions of Money - Value of Money - Objectives and instruments of Monetary Policy – Highlights of Current Monetary Policy – Banking – Types of Banks - Central Bank and Commercial Banks - Objectives and Functions of Central Bank and Various Types of Commercial Banks and Its Functions.
ECONOMIC GROWTH:  Meaning – Benefits and Costs of Growth.

TOTAL: 45 PERIODS

OUTCOMES:
• Upon completion of this course the student can able to apply the economic theory of consumer demand and pricing strategies.

TEXT BOOK:

REFERENCES:

ME6302 MANUFACTURING TECHNOLOGY – I  3 0 0 3

OBJECTIVES:
• To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I    METAL CASTING PROCESSES  9
Sand Casting : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces : Blast and Cupola Furnaces;  Principle of special casting
processes: Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO₂ process – Stir casting; Defects in Sand casting

UNIT II JOINING PROCESSES
Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.

UNIT III METAL FORMING PROCESSES

UNIT IV SHEET METAL PROCESSES

UNIT V MANUFACTURE OF PLASTIC COMPONENTS

TOTAL: 45 PERIODS

OUTCOMES:
• Upon completion of this course, the students can able to apply the students can able to use different manufacturing process and use this in industry for component production

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

UNIT I  BASIC CONCEPTS OF THERMODYNAMICS:
System, property, state and equilibrium, process and cycle, work, heat and other forms of energy. Zeroth law and application, first law statement, applications to closed and open systems, general energy equation and applications to thermal equipments.

UNIT II  SECOND LAW OF THERMODYNAMICS:
Statements-heat engines and heat pump, reversibility, Carnot cycle and Carnot theorem
ENTROPY:
Clausius theorem, Clausius inequality, principle of increase in entropy, T-S relations, availability and irreversibility

UNIT III  PROPERTIES OF PURE SUBSTANCE:
Pure substance, phase-change processes, property diagram for phase processes, properties table, Mollier chart.

VAPOUR POWER CYCLE:
Rankine and modified Rankine cycle, Reheat cycle, Regenerative cycle, Reheat- Regenerative cycle, Binary vapour cycle

UNIT IV  PROPERTIES OF IDEAL GASES AND REAL GASES:
Ideal gas equation, evaluation of work and heat, entropy changes, real gases, Van der Waals equation, compressibility - universal compressibility chart and general thermodynamic relations.

UNIT V  PSYCHROMETRY:
Properties – atmospheric air, psychrometry Chart.

THERMODYNAMIC CYCLES:
Air standard cycles-Otto cycle, Diesel cycle, Dual cycle, comparison of Otto, diesel, and Dual Cycle Brayton cycle.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- Upon completion of this course, the students can able to apply the Students can able to apply the Thermodynamic Principles to Mechanical Engineering application.
- Apply mathematical fundamentals to study the properties of steam, gas and gas mixtures.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I BASICS OF MEASUREMENT AND DEVICES:
Definition of metrology, economics of measurement, measurement as a comparative process, dimensional properties, terminology and accuracy of measurement, measuring errors, Abbe’s Principle, Principle of interferometry- flatness testing, optical interferometer, laser interferometer. Holography and speckle metrology.

UNIT II LINEAR MEASUREMENTS:
Material length standards –line and end measurement – calibration of end bars, datum and reference surfaces, surface plates, gauges – feeler gauges, micrometers, dial test indicator, slip gauges, care of gauge blocks, Comparators- mechanical, electrical, optical and pneumatic, optical projector.

GEOMETRICAL MEASUREMENT:
Angular measurement – plain vernier and optical protractors, sine bar, optical instruments, flatness, parallelism and roundness measurement, need for limit gauge, design of plug gague, Taylor’s principle, three basic types of limit gauges, surface texture, reasons for controlling surface texture, parameters used , specification of surface texture, drawing and symbols, Tomilson surface meter. CMM.

UNIT III METROLOGY OF MACHINE ELEMENTS:
Types of screw threads, terminology, proportions of ISO metric thread, measurement of major, minor and effective diameters. Gear terminology and standard proportions, spur gear measurement, checking of composite errors, base pitch measurement, clean room environment.

UNIT IV MACHINE INSTALLATION AND TESTING:
Equipment erection, commissioning, testing procedure for lathe, milling, continuous process line. First aid, safety precautions in installation of equipment, protocol for repair and testing, inspection check list.
UNIT V  STATISTICAL QUALITY CONTROL:
Process capability, steps in using control charts, basic principles of lot sampling – sampling inspection, single and double sampling, determination of sample size, OC curves, AOQ, ABC standards.
QUALITY CONTROL CHARTS:
Types, manufacturing specifications, p chart, np chart, c chart, u chart, X and R chart – solving problems using the charts. Design of tool for inspection, gauging design of plug, snap gauges, thread gauges. Gauge repeatability and reproducibility studies.  

TOTAL : 45 PERIODS

OUTCOMES:
• Upon completion of this course, the students can able to apply the Students can demonstrate different measurement technologies and use of them in Industrial Components.

TEXT BOOKS:

REFERENCES:

MS6511 SENSOR INTERFACE LABORATORY  L  T  P  C
0 0 2 1

OBJECTIVES:
• To illustrate the students on the interfacing aspects different sensors and usage of sensors for mechanical measurements and controls

LIST OF EXPERIMENTS:
1. Interfacing of Thermo couple, RTD and thermistor with PC
2. Interfacing of LVDT with PC
3. Interfacing of PFCV and Flow Sensor with PC
4. Interfacing of Piezo – electric accelerometer with PC and Microphone and performing order analysis
5. Inspection using Vision System
6. Measurement of force using proving ring
7. Measurement of strain using Wheatstone bridge and interface with PC
8. Control system exercise using PC- stepper motor level
9. Programming motion control system for robot using PC and acoustic sensors

TOTAL : 30 PERIODS

OUTCOMES:
• Develop skill of interfacing, acquiring and analyzing data from different sensors like LVDT, accelerometers, etc
• Ability to use sensors for measurement of force, flow and strain.
• Develop skill of robot programming and motion control programming

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. Temperature Sensors (Thermocouple, RTD, thermistor) with interfacing circuit compatible for PC control.
2. LUDT interfacing Circuit.
3. PFCV and Flow Sensor interfacing circuit.
4. Piezo-electric accelerometer with PC interfacing and Microphone.
7. Strain guges with wheatstone bridge circuit interface.
8. Stepper motor interface.
10. RFD indentification set up.
11. PCs for each experiment (10 Nos).

MF6511 METROLOGY LABORATORY

OBJECTIVES:
• To make the students understand the fundamental principles of measuring techniques by practicing exercises on various measuring instruments.

LIST OF EXPERIMENTS:

Contact methods:
   i) Linear and Angular measurement using Autocollimator.
   ii) Measurement of composite error using gear tester.
   iii) Calibration of optical comparator and measurement of dimension
   iv) Determining the accuracy of electrical and optical comparator.
   v) Measurement of taper angle using sine bar.
   vi) Measurement of various angles using Bevel Protractor.
   vii) Surface assessment using contact roughness tester.

Non-contact measurement techniques:
   x) Experiments in CMM.

OUTCOMES:
• Ability to use different metrological equipments and measure different parameters for quality impertion
• Use of the metrological equipments for quality control.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
Autocollimator, Gear Tester, Optical Comparator, Sine Bar, Bevel Protractor, Tool Makers Microscope, CMM, Contact roughness tester, Computers with necessary accessories.
OBJECTIVES:
- To expose in using the turning machine for various machining operations and to know about metal forming operations using press.

LIST OF EXPERIMENTS:
1. Facing and step turning operation
2. Drilling and taper turning
3. Grooving, chamfering and knurling
4. Thread cutting operation – external and internal
5. Field study involving actual measurement of cutting time in turning, drilling and comparing with theoretical calculations
6. Eccentric turning
7. Pin and bush assembly for $H_8 e_8$ clearance fit
8. Smooth contour machining
9. Demonstration of press operations
10. Dismantling and assembly of tailstock

TOTAL: 30 PERIODS

OUTCOMES:
- Ability to use lathe for various metal cutting operations like turning, boring, drilling etc.
- Ability to machine components to achieve specific fit.
- Understanding the applications of mechanical press in metal forming operations.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Centre Lathes</td>
<td>15 nos</td>
</tr>
<tr>
<td>2</td>
<td>Profile machining attachment for lathes</td>
<td>2 no</td>
</tr>
<tr>
<td>3</td>
<td>Precision boring machine</td>
<td>1 no</td>
</tr>
<tr>
<td>4</td>
<td>Radial Drilling Machine</td>
<td>1 no</td>
</tr>
<tr>
<td>5</td>
<td>small capacity sheet metal forming press</td>
<td>1 no</td>
</tr>
<tr>
<td>6</td>
<td>machine time measuring set up</td>
<td>1 no</td>
</tr>
</tbody>
</table>

MS6513 INDUSTRIAL TRAINING III (PRODUCT DEVELOPMENT AND QUALITY SYSTEMS) 0 0 0 2
Total product knowledge, reverse engineering and quality system skill (Mini Project- I), Detailed constructional knowledge of product assembly, sub assembly, components, Sequential assembly and disassembly procedure, capturing of all geometrical dimensions, drawings, tolerances, fits, form error, material of construction and to understand the product development skills for lathes, drilling machines, submersible pumps, mono block pumps& electric motors - Comparison of design construction of other makes for above products and analysis - To develop any new product with innovation & creativity - Report preparation, presentation and evaluation - Awareness of TQM, ISO9000, ISO14000 and other standards etc. - Process capability studies – Rejection analysis – Six sigma applications – Calibration needs – Calibration authorities – Records – Charts – Applications – Form error understanding and verification- Case studies in quality systems.
MA6468  PROBABILITY AND STATISTICS  L T P C  3 1 0 4

OBJECTIVES:
• This course aims at providing the required skill to apply the statistical tools in engineering problems.

UNIT I  RANDOM VARIABLES  9+3
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II  TWO-DIMENSIONAL RANDOM VARIABLES  9+3
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III  TESTING OF HYPOTHESIS  9+3
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV  DESIGN OF EXPERIMENTS  9+3
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT V  STATISTICAL QUALITY CONTROL  9+3
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
• The students will have a fundamental knowledge of the concepts of probability. Have knowledge of standard distributions which can describe real life phenomenon. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching. To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming.

UNIT I  THEORY OF METAL CUTTING  
Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II  TURNING MACHINES  
Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle:

UNIT III  SHAPER, MILLING AND GEAR CUTTING MACHINES  

UNIT IV  ABRASIVE PROCESS AND BROACHING  
Abrasive processes: grinding wheel – specifications and selection, types of grinding process–cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V  CNC MACHINING  
Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – wafer machining

OUTCOMES:

- The Students can able to use different manufacturing process and use this in industry for component production

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
• To familiarize the various steps involved in the Design Process
• To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
• To learn to use standard practices and standard data
• To learn to use catalogues and standard machine components
  (Use of P S G Design Data Book is permitted)

UNIT I  STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS  10

UNIT II  SHAFTS AND COUPLINGS  8
Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines – crankshafts - Rigid and flexible couplings.

UNIT III  TEMPORARY AND PERMANENT JOINTS  9
Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV  ENERGY STORING ELEMENTS AND ENGINE COMPONENTS  9
Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V  BEARINGS  9
Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

OUTCOMES:
• Upon completion of this course, the students can able to apply the Students can able to successfully design engine components

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
2. Robert C. Juvinall and Kurt M. Marshek,

ME6404 THERMAL ENGINEERING

OBJECTIVES:

- To integrate the concepts, laws and methodologies from the first course in thermo dynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

UNIT I GAS POWER CYCLES

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency - Comparison of cycles.

UNIT II INTERNAL COMBUSTION ENGINES


UNIT III STEAM NOZZLES AND TURBINES

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations –Governors.

UNIT IV AIR COMPRESSOR

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor

UNIT V REFRIGERATION AND AIR CONDITIONING


TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply the Students can understand different gas power cycles and use of them in IC and R & AC applications.
OBJECTIVES:

To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II PLANNING

UNIT III ORGANISING

UNIT IV DIRECTING

UNIT V CONTROLLING
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

OUTCOMES:

Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic
knowledge on international aspect of management

**TEXTBOOKS:**

**REFERENCES:**

**MS6611 MANUFACTURING PROCESS LABORATORY II**

**OBJECTIVES:**
- To introduce the metal machining machines like shaper, milling, grinding and gear cutting machines and to expose to measurements of forces in cutting processes

**LIST OF EXPERIMENTS:**
1. Internal and external dovetail machining using shaper
2. Experiment in spark erosion process
3. Experiment in surface grinding and cylindrical grinding processes
4. Experiment in tool grinding – single point and multi point tools
5. Experiment in spur gear milling
6. Experiment in keyway slotting
7. Experiment in spur gear shaping
8. Experiment in spline milling and pocket milling
9. Experiment in milling maximum square and hexagon on each end of M S Rod.

**TOTAL: 30 PERIODS**

**OUTCOMES**
- Trained to use machines for cutting different shapes in metals like slotting, gear tooth cutting, contour cutting, etc.
- Usage of grinding machines for finishing operations.
- Exposed to experiments on metal cutting machines

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Centre Lathes</td>
<td>2 nos</td>
</tr>
<tr>
<td>2</td>
<td>Turret and Capstan Lathes</td>
<td>1 No each</td>
</tr>
<tr>
<td>3</td>
<td>Horizontal Milling Machine</td>
<td>1 no</td>
</tr>
<tr>
<td>4</td>
<td>Vertical Milling Machine</td>
<td>1 no</td>
</tr>
<tr>
<td>5</td>
<td>Surface Grinding Machine</td>
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<tr>
<td>6</td>
<td>Cylindrical Grinding Machine</td>
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</tr>
<tr>
<td>7</td>
<td>Tool grinding machine</td>
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<tr>
<td>8</td>
<td>Shaper</td>
<td>2 nos</td>
</tr>
</tbody>
</table>
MS6612 THERMAL ENGINEERING LABORATORY L T P C 0 0 3 2

OBJECTIVES:
- To impart practical knowledge in IC engines, Compressors, Refrigeration and air conditioning and to conduct experiments as the engines under various operating conditions.

LIST OF EXPERIMENTS:
1. Experimental study on valve timing diagram in 4-stroke engine cut model
2. Experimental study on port timing diagram in 2-stroke engine cut model
3. Performance test on constant speed 4-stroke diesel engine
4. Variable speed test on multi-cylinder diesel engine
5. Heat balance test on 4-stroke diesel engine
6. Performance test on constant speed single cylinder petrol engine
7. Performance test on high pressure two stage reciprocating air compressor
8. Performance testing of boilers
9. IC engine performance evaluation using PC interface
10. Experiment of heating, ventilation and air conditioning unit
11. Experiment on Refrigeration tutor

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to demonstrate the working of IC Engines, Compressors and Refrigeration and Air conditioning systems.
- Ability to conduct performance tests on heat engines and the applications of data acquisition system in conducting experiments.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4-stroke and 2-stroke engine cut model</td>
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<tr>
<td>2</td>
<td>Refrigeration and Air Conditioning Equipments</td>
<td>1 set</td>
</tr>
<tr>
<td>3</td>
<td>Multi Cylinder Petrol Engine</td>
<td>1 set</td>
</tr>
<tr>
<td>4</td>
<td>multiCylinder Diesel Engine</td>
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<tr>
<td>5</td>
<td>Two Stroke Petrol Engine</td>
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<td>6</td>
<td>Two Stroke Diesel Engine Model</td>
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<td>7</td>
<td>Four Stroke Petrol Engine</td>
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<td>8</td>
<td>Four Stroke Diesel Engine Model</td>
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<tr>
<td>9</td>
<td>Two Stroke Petrol Engine Model</td>
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<tr>
<td>10</td>
<td>Experimental type low capacity boiler</td>
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<tr>
<td>11</td>
<td>mechanical &amp; electrical loading system for engines</td>
<td>1 set</td>
</tr>
<tr>
<td>12</td>
<td>data acquisition interface set up with for engines</td>
<td>1 set</td>
</tr>
<tr>
<td>13</td>
<td>Two stage reciprocating compressor with performance measuring system</td>
<td>1 no</td>
</tr>
</tbody>
</table>
MS6613  INDUSTRIAL TRAINING IV  
(DESIGN AND PRODUCTION OF CASTINGS)  
L T P C  0 0 0 2


MS6701  MECHATRONIC SYSTEM DESIGN  
L T P C  4 0 0 4

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  FUNDAMENTAL CONCEPTS OF INDUSTRIAL AUTOMATION:  
Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation. Introduction to HMI systems – text display, touch panels and integrated displays.

TRANSFER LINES AND AUTOMATED ASSEMBLY:  

UNIT II  PNEUMATIC CONTROL:  
Components, constructional details, filter, lubricator, regulator, constructional features, types of cylinders, control valves for direction, pressure and flow, air motors, air hydraulic equipments.

PNEUMATIC CONTROL SYSTEM DESIGN:  
General approach to control system design, symbols and drawings, schematic layout, travel step diagram, circuit, control modes, program control, sequence control, cascade method, Karnaugh-Veitch mapping.

UNIT III  PROGRAMMABLE LOGIC CONTROLLERS:  
Basic structure, input/output programming, timers, relays, counters, analogue input/output, interfacing with PC, pneumatic sequencing, control problem using PLC

PROGRAMMABLE AUTOMATION:  
Computer Numerical Control-basic theory, advantages of numerical control. Open and closed loop systems, information flow and coding theory. Classification of CNC machine tools. Special design features of CNC systems and features for lathes and machining centers. Drive system for CNC machine tools. Introduction to CIM; condition monitoring of manufacturing systems.
UNIT IV  
CNC PART PROGRAMMING  
9
Manual and computer aided part programming-G and M functions, canned cycles. Generation using 
CAM software

UNIT V  
ROBOTIC SYSTEMS:  
9
Basic structure of a robot–robot end effectors. Classification of robots–accuracy, resolution and 
repeatability of a robot. Drives and control systems–mechanical components of robots–sensors and 
vision systems. Transducers and sensors-tactile sensors, proximity sensors and range sensors, 
vision systems. Robot motion control and robot programming.

DESIGN OF MECHATRONIC SYSTEMS:
Stages in design, traditional and mechatronic design, possible design solutions. Case studies–pick 
and place robot, engine management system.

OUTCOMES:
• 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:
2. Wemer Depper and Kurt Stoll, “Pneumatic Application”, Kemprath Reihe, Vogel Buch Verlag 

REFERENCES:
2. Wemer Deppert and Kurt Stoll, “Pneumatic Application”, Kemprath Reihe, Vovel Verlag , 
Wurzburg, 1976.
2003.
8. Peter Smid, “CNC Programming Techniques: An Insider’s Guide to Effective Methods and 
9. Wisama Khalil and Etienne Dombre, “Robot Mainpulators Modeling, Performance Analysis and 
OBJECTIVES:
- To understand the mechanisms of heat transfer under steady and transient conditions.
- To understand the concepts of heat transfer through extended surfaces.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.
(Use of standard HMT data book permitted)

UNIT I CONDUCTION
9

UNIT II CONVECTION
9

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS
9

UNIT IV RADIATION
9

UNIT V MASS TRANSFER
9

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of this course, the students can able to apply the students can able to understand and apply different heat and mass transfer principles of different applications.

TEXT BOOK:

REFERENCES:
ME6601  DESIGN OF TRANSMISSION SYSTEMS  L  T  P  C  3  0  0  3

OBJECTIVES:
- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues (Use of P S G Design Data Book permitted)

UNIT I  DESIGN OF FLEXIBLE ELEMENTS  9
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  9
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  9

UNIT IV  GEAR BOXESES  9
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  9
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.

OUTCOMES:
- Upon completion of this course, the students can able to apply the students can able to successfully design transmission components used in Engine and machines.

TEXT BOOKS:
REFERENCES:

ME6603   FINITE ELEMENT ANALYSIS

OBJECTIVES:
- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I   INTRODUCTION

UNIT II   ONE-DIMENSIONAL PROBLEMS

UNIT III   TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS
UNIT IV  TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V  ISOPARAMETRIC FORMULATION

OUTCOMES:
• Upon completion of this course, the Students can able to understand different mathematical Techniques used in FEM analysis and use of them in Structural and thermal problem

TEXT BOOKS:

REFERENCES:

MS6711  HEAT AND MASS TRANSFER LABORATORY  L T P C
0 0 3 2

OBJECTIVES:
• To impart practical knowledge in conducting experiments using heat and mass transfer devices like tubes, tins etc. To make the students to understand different modes of heat transfer mechanisms

LIST OF EXPERIMENTS:
1. Experiment on Pin Fin apparatus
2. Experiment on natural convective heat transfer from vertical cylinder
3. Experiment on forced heat transfer inside tube
4. Determination of Stefan-Boltzmann constant
5. Determination of emissivity of grey surface
6. Effectiveness of parallel /counter flow heat exchanger
7. Experiment on boiling and condensation apparatus
8. Study on heat transfer in compressor and IC engine cylinder heads using finite element analysis software.

OUTCOMES:
• Understanding the various heat and mass transfer mechanisms using experiments.
• Ability to use FEA for analysis of Engine components.
**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Guarded plate apparatus</td>
<td>1 no</td>
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<tr>
<td>2</td>
<td>Lagged pipe apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>3</td>
<td>Natural convection-vertical cylinder apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>4</td>
<td>Forced convection inside tube apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>5</td>
<td>Pin-fin apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>6</td>
<td>Stefan-Boltzmann apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>7</td>
<td>Emissivity measurement apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>8</td>
<td>Parallel/counter flow heat exchanger apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>9</td>
<td>Finite element thermal loading analysis softwares licenses</td>
<td>5 nos</td>
</tr>
</tbody>
</table>

**ME6712 MECHATRONICS LABORATORY**

**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:**
2. Stepper motor interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
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.

**OUTCOMES:**
- 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.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic Pneumatic Trainer Kit with manual and electrical controls/PLC Control each</td>
<td>1 no</td>
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<tr>
<td>2</td>
<td>Basic Hydraulic Trainer Kit</td>
<td>1 no</td>
</tr>
<tr>
<td>3</td>
<td>Hydraulics and Pneumatics Systems Simulation Software</td>
<td>10 nos</td>
</tr>
<tr>
<td>4</td>
<td>8051 - Microcontroller kit with stepper motor and drive circuit sets</td>
<td>2 no</td>
</tr>
<tr>
<td>5</td>
<td>Image processing system with hardware &amp; software</td>
<td>1 no</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To expose the students in the usage of software for modeling and analysis of machine components.

LIST OF EXPERIMENTS:

1. Solid modeling of engineering components of a typical assembly and extraction of production drawings of the above components and assembly.
2. Determination of stresses and factor of safety in critical machine components by FEM and experimental validation of the results by strain measurement.
3. Dynamic analysis of chassis frame of an automobile.
4. Thermal analysis of IC engine components using FEA software.
5. Crash analysis of an automobile using FEA software.
10. Tolerance stack up using simulation software.

TOTAL: 45 PERIODS

OUTCOMES:

- Exposed to use CAD software for creating wire frame and solid models of machine parts
- Ability to conduct kinematic and dynamic simulations of mechanisms
- Knowledge in using softwares for Crash/Impact, flow analysis.
- Usage of FEA softwares in mechanical and thermal load analysis

Note:
Design/Selection of machine elements will be based on estimated loads and other design requirements collected by the student from field data with extensive support from manufacturers catalogues (wherever applicable).

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>3-D solid modeling CAD software</td>
<td>10 licences</td>
</tr>
<tr>
<td>2</td>
<td>Multibody kinematic and dynamic analysis software</td>
<td>5 licences</td>
</tr>
<tr>
<td>3</td>
<td>non linear / crash / impact analysis software</td>
<td>2 licences</td>
</tr>
<tr>
<td>4</td>
<td>metal forming / metal cutting simulation software</td>
<td>2 licenses</td>
</tr>
<tr>
<td>5</td>
<td>loading and strain measuring set up</td>
<td>1no</td>
</tr>
<tr>
<td>6</td>
<td>workstation configuration computers</td>
<td>15 nos</td>
</tr>
</tbody>
</table>

The mini-project involves the following:

- Preparing a project - brief proposal including
  - Problem Identification
  - A statement of system / process specifications proposed to be developed (Block Diagram / Concept tree)
  - List of possible solutions including alternatives and constraints
  - Cost benefit analysis
- Time Line of activities

- A report highlighting the design finalization [based on functional requirements & standards (if any)]

- A presentation including the following:
  - Implementation Phase (Hardware / Software / both)
  - Testing & Validation of the developed system
  - Learning in the Project

- Consolidated report preparation

**TOTAL: 45 PERIODS**

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
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</tr>
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<td>MS6714</td>
<td>INDUSTRIAL TRAINING V</td>
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<td>2</td>
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<td></td>
<td>(MANAGERIAL SKILLS, CREATIVITY, SOFT SKILLS, HRM)</td>
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<tbody>
<tr>
<td>MS6801</td>
<td>DESIGN FOR MANUFACTURE AND ASSEMBLY</td>
<td>3</td>
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</tbody>
</table>

**OBJECTIVES:**

- Apply the principle of gometric tolerance in assembly.
- Use of datum system for assembly
- Use of systematic assembly procedure for manufacturing assembly.

**UNIT I**

**DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY**

9

DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on cost basis, design for assembly, DFA index, Poka - Yoke principle; 6σ concept; design creativity.

**UNIT II**

**TOLERANCE ANALYSIS:**

9

Process capability, process capability metrics, Cp, Cpk , cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law.

**SELECTIVE ASSEMBLY:**

Interchangeable and selective assembly, deciding the number of groups, Model-I: group tolerances of mating parts equal; Model-II: total and group tolerances of shaft, control of axial play-introducing secondary machining operations, laminated shims, examples.
UNIT III DATUM SYSTEMS: 
Degrees of freedom, grouped datum systems-different types, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pin and hole, grouped datum system with spigot and recess pair and tongue-slot pair, computation of translational and rotational accuracy, geometric analysis and applications.

UNIT IV TRUE POSITION TOLERANCING THEORY: 
Comparison between co-ordinate and convention method of feature location, tolerancing and true position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, compound assembly, examples.

FORM DESIGN OF CASTINGS AND WELDMENTS:
Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – design considerations for plastic component manufacturing.

UNIT V TOLERANCE CHARTING TECHNIQUE:
Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples, design features to facilitate machining, datum features - functional and manufacturing, component design-machining considerations, redesign for manufacture, examples.

LEAN MANUFACTURING:
Need for lean concepts, different types of waste, metrics of manufacturing, an overview of value stream mapping- present state map, future state map, evaluation of benefits – Process FMEA, Design FMEA.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
• Upon completion of this course the student and able to apply the principle of geomatic tolerance in assembly, Use of datum system for assembly and use of systematic assembly procedure for manufacturing assembly.

TEXT BOOKS:

REFERENCES:

ME6015 OPERATIONS RESEARCH L T P C
3 0 0 3

OBJECTIVES:
- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS

UNIT III INVENTORY MODELS
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS
Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS

OUTCOMES:
- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems.

TEXT BOOK:

REFERENCES:
OBJECTIVES:
- Use of different manufacturing models.
- Use of line balancing approach to design automated lines.
- Use of group technology for equational layout planning

UNIT I  INTRODUCTION TO MANUFACTURING SYSTEMS AND MODELS:  9
Evolution of industrial engineering, fields and functions of industrial engineering. Types and principles of manufacturing systems, types and uses of manufacturing models, physical models, mathematical models, model uses, model building

UNIT II  DESIGN OF AUTOMATED LINES:  9
Assembly lines- Reliable serial systems, approaches to line balancing – COMSOAL and RPW, Transfer lines and general serial systems – paced lines without buffers. Flexible manufacturing systems- system components, Introduction to planning and control.

UNIT III  LAYOUT DESIGN :  9
Group technology- introduction, part classification and coding, assigning machines to groups- Rank order clustering algorithm, Facility layout – Sequential layout planning.

SUPPORTING COMPONENTS:
Machine setup and operation sequencing, Material handling systems-conveyor analysis, AGV systems. Warehousing-storage and retrieval systems, order picking.

UNIT IV  SIMULATION IN SYSTEM DESIGN:  9
Empirical simulation models- Event models, process models, simulation system, example manufacturing system

SYNCHRONIZATION MANUFACTURING:
Synchronization Vs Optimization, defining the structure, identifying the constraint, Exploitation, Buffer Management.

UNIT V  PRODUCTION PLANNING AND CONTROL:  9
Introduction, objectives, components of PPC, forecasting, product planning, loading and scheduling, dispatching, production control, material handling principles, case studies.

TOTAL : 45 PERIODS

OUTCOMES:
- Upon completion of this course the student can able to apply different manufacturing models, use of line balancing approach to design automated lines and use of group technology for equational layout planning

TEXT BOOKS:

REFERENCES:

## - The course includes atleast one assignment with mathematical modeling and / or simulation of a practical situation.

**MS6803**

**TOOL DESIGN**

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</table>

**OBJECTIVES:**

- To select suitable point cutting tool and multipoint cutting tool for machining process.
- Design Jigs and Fixtures for holding tool and work price respective.
- Use of suitable moulding for the design of die components.

**UNIT I**

**CUTTING TOOLS:**

Materials - properties, classification, selection, insert and coated tools, tool wear, tool life. Recent developments and applications.

**UNIT II**

**SINGLE POINT TOOLS:**

Nomenclature, types and styles, design and manufacture of HSS and carbide insert type tools for turning, boring, shaping, planning and slotting operations. Design of form tools. Tools and holders for CNC applications, tools for dry machining.

**MULTIPOINT CUTTERS:**

Nomenclature, classification and selection, construction methods, cutter setting, design and manufacture of drills, reamers, taps, dies, thread chasers, milling cutters, broaches, hobs and gear shaper cutters. Grinding-wheel specification and selection.

**UNIT III**

**JIGS:**

Degrees of freedom, principles of location and clamping, principles of jig design, fool proofing, elements of jigs, classification of jigs, design of jigs for drilling and reaming.

**FIXTURES:**

Principles of fixture design, locators and different types of clamps, elements of fixtures, provision for tool setting, design of fixtures for milling, turning, boring and grinding operations. Fixtures for turning centers and machining centers. Modular fixturing-concepts and applications.

**UNIT IV**

**PRESS TOOLS:**

Design and manufacture of die sets for sheet metal components - simple, compound and progressive dies for punching and blanking operations. Dies for drawing and bending operations. Selection of presses and tools.

**UNIT V**

**DESIGN OF INJECTION MOULDING AND DIE CASTING DIES:**

Product and mould, thermal considerations, design of two plate mould, runner and gate design, mould cooling and ejection, analysis of mould flow.

**SPECIAL TOOLS:**

Design of limit gauges. Tool maintenance and planning.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course the student can able to apply suitable moulding for the design of die components.

**TEXT BOOKS:**


REFERENCES:

MS6811 MANUFACTURING SYSTEMS LABORATORY L T P C
0 0 2 1

OBJECTIVES:
• To expose the students in using programs for manufacturing systems and shop floor simulation.

LIST OF EXPERIMENTS:
2. Solving inventory, scheduling lot sizing problems using manufacturing systems simulation software
3. Solving queuing problem and layout optimization using manufacturing systems simulation software
4. Project evaluation and review based on time and cost
5. Weibull reliability plot creation using component / product failure data
6. Line balancing using manufacturing systems simulation software
7. Current state and future state mapping using value stream mapping software
8. Process capability studies using statistical software
9. Analysis of DoE results using statistical software
10. Materials / process planning using ERP package
11. 5S practice / Poke Yoke for workplace improvement
12. Use of DFA software for evaluation of product design alternatives from assembly consideration.

TOTAL: 30 PERIODS

OUTCOMES:
• Knowledge in usage of softwares for solving optimizations problems involving manufacturing systems
• Exposed to applications of DOE, ERP etc in simulating the manufacturing systems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
Tora, Lindo, Lingo with solver suit, SPSS, Mini Tab, Design Expert, Met Lab, Arina Simulation software, WIT.
The depth of understanding of the courses studied by the students will be evaluated by a panel of faculty.

TOTAL: 30 PERIODS


OBJECTIVES:
To the study of nature and the facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12
Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 10
Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere -
formation of smog, PAN, acid rain, oxygen and ozone chemistry; Mitigation procedures: Control of particulate and gaseous emission, Control of SO₂, NOₓ, CO and HC) (b) Water pollution: Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III      NATURAL RESOURCES
10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV      SOCIAL ISSUES AND THE ENVIRONMENT
7

UNIT V      HUMAN POPULATION AND THE ENVIRONMENT
6

TOTAL : 45 PERIODS

OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
• Public awareness of environmental is at infant stage.
• Ignorance and incomplete knowledge has lead to misconceptions
• Development and improvement in std. of living has lead to serious environmental disasters
TEXT BOOKS:
   Education 2004.

REFERENCES:

MS6901 INDUSTRIAL PSYCHOLOGY AND WORK ETHICS L T P C
3 0 0 3

OBJECTIVES:
• To understand the behavior of self others and society.
• To understand the global work standards and ethical practices.

UNIT I INTRODUCTION TO INDUSTRIAL PSYCHOLOGY:
Definitions and Scope. Major influences on industrial Psychology. Performance Management:
Training and Development.

UNIT II INDIVIDUAL IN WORKPLACE:
Motivation and Job satisfaction, stress management. Organizational culture, Leadership and group
 dynamics.
WORK ENVIRONMENT AND ENGINEERING PSYCHOLOGY-FATIGUE:
Boredom, accidents and safety. Job Analysis, Recruitment and Selection – Reliability & Validity of
recruitment tests

UNIT III SOCIOLOGY:
A general over view scope of industrial sociology, industry and education, industry and family,
industry and social stratification.
INTRODUCTION TO ETHICS:
History and evolution of values and ethics in social work.

UNIT IV PROFESSIONAL STANDARDS:
Team work, communication, organizational skills and time management
LEGAL REQUIREMENTS:
Considerations for each jurisdiction that registers, certifies or licenses social workers

UNIT V ETHICAL PRACTICE AND SOCIETY:
Professional values and self-awareness about ethical professional behavior, ethical decision making
processes and dilemma examples

TOTAL : 45 PERIODS

OUTCOMES:
• ability to develop and demonstrate good inter personal relationship in an organisation.
• ability to handle human resources efficiently
• understanding the sociology, professional work standards and work ethics.
TEXT BOOKS:

REFERENCES:

MS6902 SOCIOLOGY AND GLOBAL ISSUES L T P C
3 0 0 3

OBJECTIVES:
• To understand the human behavior in societal context and to know the conceptual tools and methodology for the same.

UNIT I SOCIOLOGICAL PERSPECTIVE: 12
Social facts, causes, imagination, science, common sense and levels of organization. Interaction and social organization - frame work, statuses and roles, interaction process, social exchange, network and structure of society.
INDIVIDUAL AND SOCIETY:
Elements of culture, culture interaction and diversity. Dynamics of socialization, social class, agents, and secondary socialization

UNIT II SOCIAL GROUPS: 12
Characteristics, dynamics, types, individual commitment and group survival, techniques of formal organization. The effects of urbanization and community, population and society, dynamics of population change.
Politics, the state and war, the economy, business and work, social systems, social institution – the family, marriage, education goals, values and dilemmas. Transformation of society - Science and technology, growth, role, process of science, society and technologies. Collective behavior and social movement

UNIT III GLOBAL ISSUES – ENERGY: 7
The energy crisis, the effect of the energy crisis in less developed nations, climate change, the energy transition, nuclear power

UNIT IV GLOBAL ISSUES – THE ENVIRONMENT: 7
Awakening, the air, the water, the workplace, the use of natural resources.

UNIT V GLOBAL ISSUES – THE TECHNOLOGY: 7
Benefits of technology, short term and long term benefits, unanticipated consequences on the use of technology. Inappropriate use of technology, the threat of nuclear weapons. TOTAL : 45 PERIODS

OUTCOMES:
• able to study the interactions of people in society
• understanding the effects of societal history, group behavior studies on families etc
• relating the sociology with global issues like energy crisis, environmental pollution etc.
TEXT BOOKS:

REFERENCES:

MS6911 DESIGN AND FABRICATION PROJECT L T P C 0 0 4 2

OBJECTIVES:
• The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

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.

TOTAL : 60 PERIODS

OUTCOMES:
• Use of design principles and develop conceptual and engineering design of any components.
• Ability to fabricate any components using different manufacturing tools.

MS6912 INDUSTRIAL TRAINING VII (INDUSTRIAL VISIT AND COLLOQUIUM II) L T P C 0 0 0 2


MS6111 PROJECT WORK L T P C
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.

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.

MS6001 MANUFACTURE AND INSPECTION OF GEARS

OBJECTIVES:
- To know the different methods to make conical and cylindrical gear.
- Suitable selection of material for gear and perform heat treatment for his proving the properties
- To perform imputation of gears.

UNIT I INTRODUCTION TO GEARS:
Types of gears-classification, application of gears, gearbox, drawings for gears, gear production method an overview, types of blanks and blank preparation.

PRODUCTION OF CYLINDRICAL GEARS:
Procedure of cutting gears and obtainable quality in hobbing and gear shaping, cutter selection and work holding methods, setting calculations. Rack type gear shaping machine description and application. Internal gear cutting methods, CNC gear hobbing and gear shaping machines.

UNIT II PRODUCTION OF CONICAL GEARS:
Production of straight bevel gears by bevel gear generator, duplex rotary cutter method, Gleason Reva cycle method, spiral and hybrid bevel gear generation. Description of machine, cutter and machine setting.

UNIT III GEAR MATERIAL SELECTION AND HARDENING METHODS:
Properties of gear materials-non-metallic, non-ferrous and plastic gears, selection of material for power transmission, high speed application. Selection of material for worm and wheel. Hardening by through hardening, case hardening, induction hardening, flame hardening, nitriding and tuftriding, hardening defects.

GEAR FINISHING METHODS:
Gear finishing advantages, finishing of gears by grinding, shaving, lapping and honing methods, cold rolling of gears - description of process, machine, cutters and process parameters setting.

UNIT IV GEAR INSPECTION:
Type of gear errors-gear quality standards and allowable limits-tooth thickness, base tangent length measurement, pitch error, radial run out, involute profile error measurements methods and analysis, composite error measurement, computerized gear inspection, gear failure reasons and remedies.

UNIT V MODERN GEAR PRODUCTION METHODS: 11
Gear production by stamping, die casting, powder metal process, injection and compression moulding of plastic gears, cold and hot rolling. Mass production methods, shear speed shaping, gear broaching, Gleason G-TRAC – gear generation methods.
ECONOMICAL AND QUALITY PRODUCTION OF GEARS:
Gear production systems – batch production, gear production cells, lean and agile production practices, automobile gear and gear boxes, heavy engineering gear production, gear for instruments and appliances, process and cutter selection for quantity, cost and quality criteria.

TOTAL:45 PERIODS

OUTCOMES:
• Upon completion of this course the student can able to know the different methods to make conical and cylindrical gear and select material for gear and perform heat treatment for his proving the properties

TEXT BOOKS:

REFERENCES:

UNIT V SMART STRUCTURES, MATERIALS AND MICRO ACTUATORS 9

TOTAL: 45 PERIODS

OUTCOMES:
• Upon completion of this course the student can able to use of quality concepts parts, accuracy requirements of machine tools and use of latest machining process such as micro machining and micro fabrication.

TEXT BOOKS:

REFERENCES:

MS6002 IC ENGINE DESIGN L T P C
3 0 0 3

OBJECTIVES:
• To know about the principles of operation of IC engines and to design the IC engines.

UNIT I INTRODUCTION: 14
Principles, design of engine based on vehicle characteristics–engine capacity, calculation of bore and stroke length-balancing and vibration -critical speed and damping.

UNIT II CONNECTING ROD: 7

UNIT III CRANKSHAFT: 8

UNIT IV VALVE ACTUATING MECHANISM: 8
Design of valves – valve springs – tappet. Cam design-cam profile generation, cam shaft design. Rocker and rocker shaft design considerations, materials, manufacturing process, heat treatments.

UNIT V FLYWHEELS: 8
Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheel – stresses of rim flywheels, design of hubs and arms of flywheel, turning moment diagram.

**OUTCOMES:**
- ability to conduct static and dyynamic allways on IC engines.
- understanding the design procedures of IC engines parts like connecting roads, crankshaft and valve trains
- ability to select the fly wheel based engine specifications.

**TEXT BOOKS:**

**REFERENCES:**
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:

REFERENCES:

MS6003 BIOGAS ENGINEERING

OBJECTIVES:
- To get exposure on production, processing and application of Biogas.

UNIT I INTRODUCTION:

MATERIALS FOR BIOMETHANATION AND PRODUCTS OF METHANATION:

UNIT II BIO-REACTORS:
Types of bio-reactors- Constant pressure type reactors, Ganesh model, Pragathi model, Astra model, Jwala biogas plant, Batch digester, Manawat digester, German designs, plastic bag digesters, free fabricated steel/plastic digesters, Tunnel type digester, Maya Farms model, Large Farm biogas plants, Anaerobic Contact reactors, Anaerobic Filter reactors

UNIT III DESIGN, SELECTION, CONSTRUCTION AND OPERATION OF BIOGAS PLANTS:

UNIT IV PURIFICATION, SCRUBBING, COMPRESSION AND STORAGE OF BIOGAS:

UNIT V UTILISATION SYSTEMS OF BIOGAS:

OUTCOMES:
- knowledge of materials for biogas production and their by products.
- understanding the working of biogas reactors and bioplants / knowledge in design, construct and operate the biogas plants.
- visualising the applications biogases in power generation.

TEXT BOOKS:

REFERENCES:

MS6004 THEORY OF ELASTICITY AND PLASTICITY

OBJECTIVES:
- To understand and use the theory for electric and plastic behavioral analysis of metallic materials.

UNIT I ANALYSIS OF STRESS AND STRAIN:
Stress at a point, stress tensor, stress transformations, principal stresses, octahedral stress, equations of equilibrium, strain tensor, principal strains, strain-displacement relations, compatibility conditions.

UNIT II CONSTITUTIVE EQUATIONS:
General theory, generalized Hooke’s law, equations of elasticity, Mitchel-Beltrami and Navier equations, formulation of the general elasticity problem, boundary conditions.

UNIT III SOLUTION OF SOME SPECIAL BOUNDARY VALUE PROBLEMS:
Two dimensional problems in rectangular and polar co-ordinates, Airy’s stress function. A few representative 3D problems - torsion and bending of non-circular prismatic bars (Saint-Venant’s solution), membrane analogy.
UNIT IV PLASTICITY:
Plastic flow and its microscopic and macroscopic descriptions, continuum plasticity, stress-strain curves of real materials, definition of yield criterion, concept of a yield surface in principal stress space, yield criteria, tresca, Von Mises.

UNIT V PLASTIC STRAIN ANALYSIS:
Prandtl-Reuss and Levy-Mises equations, deformation in plane stress-yielding of thin sheet in biaxial and uniaxial tension. Plane strain deformation-stress tensor, hydrostatic and deviatoric components, plastic potential, plastic instability, work hardening, effective stress and effective strain, strain rates and temperature effects on flow stress.

TOTAL : 45 PERIODS

OUTCOMES:
- ability to define and calculate stress and strain under various loading conditions within elastic limit.
- understanding constitutive equations defining elastic properties of materials.
- able to model the materials in plastic zone and ability to conduct plastic strain analysis.

TEXT BOOKS:

REFERENCES:
UNIT II  LOSS FUNCTION:  6

UNIT III  ON-LINE QUALITY CONTROL:  12
On-line feedback quality control variable characteristics-control with measurement interval- one unit, multiple units-control systems for lot and batch production.
On-line process parameter control variable characteristics- process parameter tolerances- feedback control systems- measurement error and process control parameters.

UNIT IV  ON-LINE QUALITY CONTROL ATTRIBUTES CHARACTERISTICS:  12
Checking intervals- frequency of process diagnosis.
ON-LINE QUALITY CONTROL METHODS FOR PROCESS IMPROVEMENTS:
Production process improvement method- process diagnosis improvement method- process adjustment and recovery improvement methods.

UNIT V  QUALITY ENGINEERING AND TPM:  9
Preventive maintenance schedules- PM schedules for functional characteristics- PM schedules for large scale systems. Quality tools–fault tree analysis, event tree analysis, failure mode and effect analysis. ISO quality systems.

TOTAL : 45 PERIODS

OUTCOMES:
• ability to appreciate the importance of quality systems in engineering applications and identifying appropriate method for quality measurement
• usage of statistical tools to measure the quality, diagnose problems in quality and ability to suggest corrective methods.
• ability to estimate the losses due to in consistent quality
• understanding role of preventive maintenance as applied to process quality.

TEXT BOOKS:

REFERENCES:

MF6504  HYDRAULICS AND PNEUMATICS  L T P C
3 0 0 3

OBJECTIVES:
• This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.
UNIT I  FLUID POWER PRINCIPLES AND FUNDAMENTALS (REVIEW)  

UNIT II  HYDRAULIC SYSTEM AND COMPONENTS  

UNIT III  HYDRAULIC CIRCUITS  
Industrial hydraulic circuits- Regenerative, Pump Unloading, Double-pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-safe, Speed control, Hydrostatic transmission, Accumulators, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

UNIT IV  PNEUMATIC SYSTEM  
Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems. Introduction to Fluidics, Pneumatic logic circuits.

UNIT V  DESIGN OF HYDRAULIC AND PNEUMATIC CIRCUITS  

TOTAL: 45 PERIODS

OUTCOMES:
• Identify hydraulic and pneumatics components.
• Ability to design hydraulic and pneumatic circuits.

TEXT BOOK

REFERENCES
GE6084  HUMAN RIGHTS  L T P C  3 0 0 3

OBJECTIVES:
• To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

TOTAL : 45 PERIODS

OUTCOME:
• Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

ME6002  REFRIGERATION AND AIR CONDITIONING  L T P C  3 0 0 3

OBJECTIVES:
• To understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
• To provide knowledge on design aspects of Refrigeration & Air conditioning systems

UNIT I  INTRODUCTION
Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.
UNIT II  VAPOUR COMPRESSION REFRIGERATION SYSTEM  10

UNIT III  OTHER REFRIGERATION SYSTEMS  8
Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.

UNIT IV  PSYCHROMETRIC PROPERTIES AND PROCESSES  10
Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams.

UNIT V  AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION  12
Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls.

TOTAL: 45 PERIODS

OUTCOMES:
• Upon completion of this course, the students can able to demonstrate the operations in different Refrigeration & Air conditioning systems and also able to design Refrigeration & Air conditioning systems.

TEXT BOOK:

REFERENCES:

MG6089  SUPPLY CHAIN MANAGEMENT  L T P C
3 0 0 3

OBJECTIVES:
• To provide an insight on the fundamentals of supply chain networks, tools and techniques.

UNIT I  INTRODUCTION  5
Role of Logistics and Supply chain Management: Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

UNIT II  SUPPLY CHAIN NETWORK DESIGN  10

UNIT III LOGISTICS IN SUPPLY CHAIN
Role of transportation in supply chain – factors affecting transportation decision – Design options for transportation network – Tailored transportation – Routing and scheduling in transportation.

UNIT IV SOURCING AND COORDINATION IN SUPPLY CHAIN
Role of sourcing supply chain supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT V SUPPLY CHAIN AND INFORMATION TECHNOLOGY

TOTAL: 45 PERIODS

OUTCOMES:
• The student would understand the framework and scope of supply chain networks and functions.

TEXTBOOK:

REFERENCES:

RO6002 INDUSTRIAL DESIGN AND APPLIED ERGONOMICS

OBJECTIVES:
• To understand in developing concepts and specifications that optimise the value and appearance of products and systems.

UNIT I INTRODUCTION
Definition, human technological system, multidisciplinary engineering approach, human–machine system, manual, mechanical, automated system, human system reliability, conceptual design, advanced development, detailed design and development.

INFORMATION INPUT:
Input and processing, text, graphics, symbols, codes, visual display of dynamic information, auditory, tactual, olfactory displays, speech communications.

UNIT II HUMAN OUTPUT AND CONTROL
Physical work, manual material handling, motor skill, human control of systems, controls and data entry devices, hand tools and devices.

WORKPLACE DESIGN:
Applied anthropometry, workspace design and seating, arrangement of components within a physical space, interpersonal aspects of work place design, design of repetitive task, design of manual handling task, work capacity, stress, and fatigue.

UNIT III ENVIRONMENTAL CONDITIONS
Illumination, climate, noise, motion, sound, vibration, colour and aesthetic concepts.

BIOMECHANICS:
Biostatic mechanics, statics of rigid bodies, biodynamic mechanics, human body kinematics, kinetics, impact and collision.

UNIT IV BIOTHERMODYNAMICS AND BIOENERGETICS
Biothermal fundamentals, human operator heat transfer, human system bioenergetics, thermoregulatory physiology, human operator thermo regularity, passive operator, active operator, heat stress.

UNIT V HUMAN FACTORS APPLICATIONS
Human error, accidents, human factors and the automobile, organizational and social aspects, steps according to ISO/DIS6385, OSHA’s approach, virtual environments.

TOTAL :45 PERIODS

OUTCOMES:
- ability to design products by considering human engineering and environmental conditions.
- ability to layout the workplace for manufacturing products.
- understanding the mechanics of human body biothermodynamics and associated human related factors in product design.

TEXT BOOK:

REFERENCES:

MS6006 ADVANCED THEORY OF INTERNAL COMBUSTION ENGINES

OBJECTIVES:
- To learn different thermodynamics cycles used in IC engine
- To learn different injection systems
- To describe the properties of fuels and its role in combustion
- To manage the engine electronics system
- To discuss the engine emission and control the emission
UNIT I  CYCLE ANALYSIS:  
Operating cycles of S.I. and C.I. engines and Gas turbines - Comparison of Air standard cycle - Fuel air cycle and actual cycle.

SPARK IGNITION ENGINES:
Spark ignition Engine mixture requirements - Carburetion – Electronic fuel Injection systems –single point and multipoint injection.

UNIT II  COMPRESSION IGNITION ENGINES:  
Mechanical Injection System- Direct and indirect injection systems - Supercharging, Turbocharging

UNIT III  COMBUSTION OF FUELS:

UNIT IV  ENGINE ELECTRONICS:
Engine Management system, Measurement of Speed, Pressure, Temperature, air flow, exhaust oxygen sensor.

RECENT TRENDS:
Learn Burn Engines - Stratified charge Engines – Low heat rejection engines- Gasoline Direct Injection Engine - Homogeneous charge compression Ignition

UNIT V  ENGINE EMISSION AND THEIR CONTROL:  
Pollutant - Sources and types – HC emission- CO emission - formation of NOx - Particulate emissions – Aldehydes, sulphur, lead, phosphorus emission. Methods of controlling Emissions- Thermal converters, Catalytic converters and Particulate Traps, Exhaust Gas Recirculation (EGR), Charcoal Canister. Emission measurements techniques and Driving cycles

TOTAL : 45 PERIODS

OUTCOMES:
- able to describe the basic thermodynamics as applied to engine system
- ability to use mathematical knowledge to describe the combustion.
- ability to design engine systems
- ability to control engine emission

TEXT BOOKS:

REFERENCES:

98
OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT I INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society.
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.
**TEXTBOOK:**


**REFERENCES**

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

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**AT6071 MANUFACTURING OF AUTOMOTIVE COMPONENTS**

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**OBJECTIVES:**

- To impart knowledge on basic principle and production methods of automotive components.

**UNIT I CASTED ENGINE COMPONENTS**

Material selection and Manufacturing methods for Piston, Piston rings, Cylinder block, wet and dry liners, Engine head, Oil pan, Carburetors. Thermal barrier coating of Engine head and valves.

**UNIT II FORGED ENGINE COMPONENTS**

Material selection and Manufacturing methods for Crank shaft, Connecting rod, Cam shaft, valve, Piston pin, Push rod, Rocker arm, tappets, spark plug.

**UNIT III TRANSMISSION SYSTEM**


**UNIT IV VEHICLE CHASSIS**


**UNIT V RECENT DEVELOPMENTS**


**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course the student can able to use the basic principle and production methods of automotive components

**TEXT BOOK:**
REFERENCES:
2. Newton and steels, the motor vehicle, ELBS, 1990

OBJECTIVES:
• To apply the fundamentals of Gas dynamics and fluid dynamic in space propulsion
• To design propulsion systems in such as jet engines.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS:
Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility - Isentropic flow through variable area ducts - Nozzle and Diffusers – Use of Gas tables.

UNIT II FLOW THROUGH DUCTS:
Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) - Variation of flow properties - Use of tables and charts - Generalised gas dynamics.

UNIT III NORMAL AND OBLIQUE SHOCKS:
Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl – Meyer relations - Use of table and charts - Applications.

UNIT IV JET PROPULSION:
Theory of jet propulsion - Thrust equation - Thrust power and propulsive efficiency - Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines – Aircraft combustors.

UNIT V SPACE PROPULSION:
Types of rocket engines - Propellants - Ignition and combustion - Theory of rocket propulsion – Performance study - Staging - Terminal and characteristic velocity - Applications - Space flights.

OUTCOMES:
• ability to utilise the knowledge the fluid dynamics, gas dynamics and mathematical knowledge in space propulsion design
• demonstrate their knowledge in designing propulsion system such as turbo-jet, turbo fan, ramjet and scanjets integrate various new space propulsion system in designing future vehicle.

TEXT BOOK:

REFERENCES:

RO6001 LEAN MANUFACTURING L T P C 3 0 0 3

OBJECTIVES:
- To introduce the students the lean manufacturing concepts
- To understand group technology and use of it for part identification
- To teach the tools and method used in lean manufacturing
- To introduce concept of Total Productive Maintenance and other system

UNIT I INTRODUCTION: 14
LEAN MANUFACTURING CONCEPTS:
Value creation and waste elimination – seven types of waste – pull production - different models of pull production - the Kanban system-continuous flow-the continuous improvement process / Kaizen-Worker involvement. Design of Kanban quantities – Leveled production - tools for continuous improvement.

UNIT II GROUP TECHNOLOGY AND CELLULAR LAYOUT 7
JIT with cell manufacturing – part families- production flow analysis – Composite part concept- machine cell design – quantitative analysis – case studies – single piece flow

UNIT III VALUE STREAM MAPPING 7
The value stream– benefits mapping process - the current state map–mapping icons - mapping steps. VSM exercises - Takt time calculations.

UNIT IV LEAN MANUFACTURING TOOLS AND METHODOLOGIES 7
Standardized work–standard work sequence timing and working progress . Quality at source – Autonomination /Jidoka, Visual management system, Mistake proofing / Poka-Yoke. 5S technique – Elements and waste elimination through 5S, advantages and benefits - 5S-audit - visual control aids for improvement, flexible work force

UNIT V TOTAL PRODUCTIVE MAINTENANCE 10
Goals and benefits – Hidden factory, the six big losses, types of maintenance. Overall equipment effectiveness - pillars of TPM and implementation. Change over and set up timer education techniques. Temple of quality, OEE calculations.

TOTAL : 45 PERIODS

OUTCOMES:
- ability to implement lean manufacturing concepts in industries
- ability to group the parts
- ability to use the lean manufacturing tools and method
• ability to apply Total Productive Maintenance concepts in industries.

TEXT BOOKS:

REFERENCES:

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 selection 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:
• Upon completion of this course, the students can able to use the concepts of process planning and cost estimation for various products.
TEXT BOOKS:

REFERENCES:

MS6008 MODELLING AND SIMULATION OF INTERNAL COMBUSTION ENGINES

OBJECTIVES:
• To introduce modeling and simulation concept to study the characteristics of IC Engines.
• To study the combustion in CI Engine and study the inflame of the different propagation on characteristics.
• To model and simulate the combustion in IC engine and know the temperature pressure and develop spray models.

UNIT I INTRODUCTION:
First law and second law analysis, governing equation, conservation of mass, momentum and energy. Combustion in premixed flames - stages of combustion, flame propagation, rate of pressure rise, cycle-to-cycle variation, abnormal combustion - theories, effect of engine operating variables on combustion.

UNIT II COMBUSTION IN CI ENGINES:
Combustion in diffusion flames - droplet and spray combustion theory, stages of combustion, delay period, peak pressure, heat release, gas temperature, diesel knock.

UNIT III MODELING OF IC ENGINES:
Heat of reaction - \( H_{\text{rp}} \) & \( U_{\text{rp}} \) calculations, adiabatic, constant volume combustion, constant pressure combustion, temperature drop due to fuel vaporization, adiabatic flame temperature, mean effective pressure, torque and thermal efficiency at full throttle, part throttle and supercharged conditions. Spray models, flow models and combustion models.

UNIT IV SIMULATION OF IC ENGINES:
SI & CI engine simulation – air standard cycle, fuel-air cycle, progressive combustion cycle and actual cycle simulation – part throttle, full throttle and supercharged conditions.

UNIT V SIMULATION OF NEW ENGINE CONCEPTS:
Dual fuel engine, low heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine, controlled auto ignition engine.

TOTAL: 45 PERIODS

OUTCOMES:
- ability to develop mathematical model to simulation combustion in IC Engines and explain the characteristics.
- ability to design new engine using on simulation.

REFERENCES:

**MS6009 FAILURE ANALYSIS AND DESIGN**

**OBJECTIVES:**
- To introduce different failure Mechanisms and role of Materials and Design in failure
- To develop Mathematical model for different modes of fracture.
- To develop Mathematical model for dynamic fracture.
- To introduce different tools to analyse the fracture.

**UNIT I MATERIALS AND DESIGN PROCESS:**
Factors affecting the behavior of materials in components, effect of component geometry and shape factors, design for static strength, stiffness, designing with high strength and low toughness materials, designing for hostile environments, material processing and design, processes and their influence on design, process attributes, systematic process selection, screening, process selection diagrams, ranking, process cost.

**UNIT II FRACTURE MECHANICS:**
Ductile fracture, brittle fracture, Cleavage-fractography, ductile-brittle transition-Fracture mechanics approach to design-energy criterion, stress intensity approach, time dependent crack growth and damage
LINEAR ELASTIC FRACTURE MECHANICS:

**UNIT III ELASTIC PLASTIC FRACTURE MECHANICS:**
Crack tip opening displacement (CTOD), J integral, relationship between J and CTOD, DYNAMIC AND TIME-DEPENDENT FRACTURE:
Dynamic fracture, rapid loading of a stationary crack, rapid crack propagation, dynamic contour integral, Creep crack growth-C Integral, Visco elastic fracture mechanics, viscoelastic J integral
UNIT IV  DETERMINATION OF FRACTURE TOUGHNESS VALUES:  9
Experimental determination of plane strain fracture toughness, K- R curve testing, J measurement, CTOD testing, effect of temperature, strain rate on fracture toughness

UNIT V  FAILURE ANALYSIS TOOLS:  9
Reliability concept and hazard function, life prediction, life extension, application of poisson, exponential and Weibull distribution for reliability, bath tub curve, parallel and series system, MTBF,MTTR, FMEA definition-Design FMEA, Process FMEA, analysis causes of failure, modes, ranks of failure modes, fault tree analysis, industrial case studies/projects on FMEA.

TOTAL: 45 PERIODS

OUTCOMES:
- ability to carry out failure analysis and predict the root cause for the failure.
- ability to select suitable material for design.
- ability to use Mathematical knowledge to describe the different types of fracture.
- ability to use different characterization tools for failure analysis.

TEXT BOOKS:

REFERENCES:
Geometric relationship, axial flow pumps, design. Use of aerofoil data for impeller design, guide vane, pump casing.

FANS:
Fan laws, performance coefficients, effect of change in fan speed, density, series and parallel operation, fan design losses, blade shape, casing.

UNIT III PROPELLER FANS: 9
Cross flow fans, principle of operation, applications, regulation of volume flow, sources of vibration in fans, noise attenuation testing.

BLOWERS:
Types, centrifugal blower - design procedure, selection, performance, special applications, control of volume flow.

UNIT IV PERFORMANCE ESTIMATION: 9
Instrumentation test rig layout, measurement of pressure, temperature, use of hot wire anemometer, boundary layer probes, measurement of sound, different types and characteristics. COMPRESSORS: Different types of compressors - characteristic curves. Centrifugal compressor - multistage arrangement, blade design, types of diffusers, performance, series and parallel operation.

UNIT V AXIAL FLOW COMPRESSORS: 8
Cascade theory, efficiency, two dimensional cascade, velocity triangles and stage loading, stage reaction, losses, compressor-testing procedure.

DISC STRESSES AND CRITICAL SPEED:
Determination of disc stresses – sum and difference curves, Critical speeds of two bearing and three bearing shafts, torsional critical speeds

TOTAL : 45 PERIODS

OUTCOMES:
• ability to use mathematical skills and engineering principles to design rotating equipments like, mixed flow impeller, fans and compressors.

TEXT BOOKS:

IE6011 PRODUCT DESIGN AND DEVELOPMENT

OBJECTIVES:
• The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I INTRODUCTION 5
Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding

UNIT II CONCEPT GENERATION AND SELECTION 5

UNIT III PRODUCT ARCHITECTURE 10

UNIT IV INDUSTRIAL DESIGN 10

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 15

TOTAL: 45 PERIODS

OUTCOMES:
• The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved.

TEXT BOOK:

REFERENCES:
OBJECTIVES
The student should be made to:
• Be exposed to principles of mechanics.
• Learn the mechanics of physiological systems.
• Be familiar with the mathematical models used in the analysis of biomechanical systems

UNIT I   INTRODUCTION TO MECHANICS  9

UNIT II   BIOFLUID MECHANICS  9
Introduction, viscosity and capillary viscometer, Rheological properties of blood, laminar flow, Couette flow and Hagen-Poiseuille equation, turbulent flow. Cardiovascular system - biological and mechanical valves development, artificial heart valves testing of valves, Structure, functions, material properties and modeling of Blood vessels.

UNIT III   BIOSOLID MECHANICS  9
Hard Tissues: Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell & Voight models – anisotropy.

UNIT IV   BIOMECHANICS OF JOINTS AND IMPLANTS  9
Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, spinal column, hip knee and ankle.
Design of orthopedic implant, specifications for a prosthetic joint, biocompatibility, requirement of a biomaterial, characteristics of different types of biomaterials, manufacturing process of implants, fixation of implants.

UNIT V   MODELLING AND ERGONOMICS  9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Explain the mechanics of physiological systems.
• Analyze the biomechanical systems.
• Design orthopaedic applications.

TEXT BOOKS:
REFERENCES:

ME6014 COMPUTATIONAL FLUID DYNAMICS L T P C
3 0 0 3

OBJECTIVES:
- To introduce Governing Equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9

UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10
Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT IV FLOW FIELD ANALYSIS 9

UNIT V TURBULENCE MODELS AND MESH GENERATION 9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students can able
- To create numerical modeling and its role in the field of fluid flow and heat transfer
• To use the various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

TEXT BOOKS:

REFERENCES:

ME6501 COMPUTER AIDED DESIGN L T P C
3 0 0 3

OBJECTIVES:
• To provide an overview of how computers are being used in mechanical component design

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 9
Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations-homogeneous coordinates - Line drawing -Clipping- viewing transformation

UNIT II GEOMETRIC MODELING 9
Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep

UNIT III VISUAL REALISM 9

UNIT IV ASSEMBLY OF PARTS 9
Assembly modelling – interferences of positions and orientation – tolerance analysis-massproperty calculations – mechanism simulation and interference checking.

UNIT V CAD STANDARDS 9
Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchangeimages- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALSetc. - communication standards.

TOTAL : 45 PERIODS
Upon completion of this course, the students can able to use computer and CAD software’s for modeling of mechanical components

TEXT BOOKS:

REFERENCES:

ME6602 AUTOMOBILE ENGINEERING  L T P C
3  0  0  3

OBJECTIVES:
- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES
Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS
Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS
Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES
Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of this course, the students will be able to identify the different components in automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

TEXT BOOKS:

REFERENCES:

MS6011 VALUE ANALYSIS AND VALUE ENGINEERING

OBJECTIVES:
- To introduce the student the concept of value engineering and methodology to evaluate cost identification.
- To understand the different techniques to analyse the value.
- To understand the different phases in value engineering.

UNIT I CONCEPTS:

UNIT II TECHNIQUES:

UNIT III VALUE ENGINEERING IN JOB PLAN:

UNIT IV REENGINEERING PRINCIPLES

UNIT V CASE STUDIES:
9
OUTCOMES:

- discuss the concept and associated terminology of value engineering
- To demonstrate the implementation of different techniques to analyse the value of product.
- To demonstrate the cost evaluation of different practical components / machineries.

TEXT BOOKS:

REFERENCES:

CE6071 ADVANCED STRENGTH OF MATERIALS L T P C
3 0 0 3

OBJECTIVES:

- To analyse the stresses and deformations through advanced mathematical models.
- To estimate the design strength of various industrial equipments.

UNIT I ANALYSIS OF PLATES

UNIT II THICK CYLINDERS AND SPHERES
Equilibrium and compatibility conditions - Lame’s Theorem – Boundary conditions – distribution of radial and tangential stresses – compound cylinders – Interference fits - Stresses due to temperature distributions.

UNIT III ROTATING DISCS
Lame-Clayperon Theorem – radial and tangential stresses in discs due to centrifugal effects – boundary conditions – solid and hollow discs – Interference fit on shafts – Strengthening of the hub – residual stresses – Autofrettege – Discs of variable thickness – Disc profile for uniform strength.

UNIT IV BEAMS ON ELASTIC FOUNDATION
Infinite beam subjected to concentrated load – Boundary Conditions – Infinite beam subjected to a distributed load segment – Triangular load – Semi infinite beam subjected to loads at the ends and concentrated load near the ends – Short beams.

UNIT V CURVED BEAMS AND CONTACT STRESSES
Analysis of stresses in beams with large curvature – Stress distribution in curved beams – Stresses in crane hooks and C clamps – Contact Stresses – Hertz equation for contact stresses – applications to rolling contact elements.
OUTCOMES:
- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures. Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOKS:

REFERENCES

MS6012 VIBRATION AND NOISE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
- To introduce the fundamentals of vibration and noise
- To explain single, two and multi degrees of freedom vibration systems and their characteristics equations.
- To explain vibration techniques and control methods.
- To introduce concept of sound isolation

UNIT I INTRODUCTION:
Relevance of and need for vibrational analysis. Mathematical modeling of vibrating systems-discrete and continuous systems-single-degree of freedom systems, free and forced vibrations, various damping models.

UNIT II TWO DEGREES OF FREEDOM SYSTEMS:
Generalized co-ordinates, principal co-ordinates, derivation of equations of motion, co-ordinate coupling, Lagrange’s equation.

UNIT III MULTI DEGREES OF FREEDOM SYSTEMS:
Derivation of equations of motion, influence coefficients, orthogonality principle, calculation of natural frequencies by Raleigh, Stodala, Dunkerley, Holzer and matrix iteration methods, branched system, geared system.

TRANSIENT VIBRATION:
Impulse and arbitrary excitation, base excitation, Laplace transform formulation, response spectrum.

UNIT IV VIBRATION MEASUREMENT AND CONTROL:
Measurement of vibration, FFT analyzer. Methods of vibration control - excitation reduction at source, balancing of rigid, flexible and variable mass rotors. Dynamic properties and selection of structural
materials—viscoelastic polymers, vibration absorbers—tuned absorber, tuned and damped absorber (qualitative treatment only), untuned viscous damper, vibration isolation

UNIT V NOISE:

Properties of sound—sound level meter. Sound isolation—machine enclosures, silencers and mufflers. TOTAL: 45 PERIODS

OUTCOMES:

• ability to develop mathematical mode for vibrating system with one, two and multi degrees of freedom
• ability to measure the vibration and control
• ability to explain the sound isolation and use of machine enclosures for noise suppression.

TEXT BOOKS:


REFERENCES:


MS6013 MECHANICS OF COMPOSITE MATERIALS

OBJECTIVES:

• To introduce mechanics principle to composite materials and develop constitutive equations to predict properties.
• To discuss different processing techniques to develop components.
• To develop different micro mechanical models and study the stress—strain behaviour
• To introduce failure theories and develop macro mechanical theories for components.

UNIT I INTRODUCTION:

Modern materials in design, types, metals, polymers, ceramics, composites. Polymers-Classification, properties of thermo plastics, properties of thermo setting plastics, applications, merits and demerits. Classification of composites, Honey comb composites, advantages, applications. Matrix and their role, principal types of fibre and matrix materials.

UNIT II PROCESS AND CHARACTERISTICS OF COMPOSITES:

Manufacture of polymer matrix composites—Lay up and curing, open and closed mould processes, bag moulding, filament winding, pultrusion, pulforming, thermoforming, advantages and limitations of different processes. Manufacture of metal matrix and ceramic matrix composites. Advantages,
limitations and characteristics of ceramic and metal matrix composites.

UNIT III CONCEPTS OF SOLID MECHANICS: 8
Stress and strain, Strain Energy, Plane stress and plane strain, Generalized Hook’s Law for different types of materials, material symmetry, Engineering constants, coordinate transformation, thermal effects and moisture effects,

UNIT IV MICRO MECHANICAL BEHAVIOUR OF A LAMINA: 7
Volume and mass fractions, density and void content, evaluation of elastic moduli, ultimate strengths of a unidirectional lamina, coefficients of thermal and moisture expansion

UNIT V MACRO MECHANICAL BEHAVIOUR OF A LAMINA: 14
Hook’s Law for a two dimensional unidirectional lamina and angular lamina, evaluation of elastic moduli for unidirectional and angle lamina, engineering constants of unidirectional and angle lamina, strength failure theories.
MACRO MECHANICAL BEHAVIOUR OF A LAMINATE:
Laminate code, stress - strain behaviour in a laminate, Resultant forces and moments in a laminate, interlaminar stresses in laminates.

TOTAL : 45 PERIODS

OUTCOMES:
• ability to prepare composite
• ability to identify suitable material and reinforced for particular applilcations.
• ability to develop constitutive models to predict stress stains behaviour of lamination.
• ability to design composite structures.

TEXT BOOKS:

REFERENCES: