REGULATIONS – 2011

DEPARTMENT OF

MECHANICAL ENGINEERING

CURRICULUM AND SYLLABI OF

B.E. - MECHANICAL ENGINEERING
REGULATIONS 2011

CURRICULUM AND SYLLABI FOR FULL TIME

B.E. MECHANICAL ENGINEERING

SEMESTER – I

(Common to all B.E. / B.Tech. Degree Programmes)

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- * Common to all B.E. / B.Tech. Programmes
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### Notes
- The table includes the semester, course code, course title, and credit hours for both theory and practical courses.
- The total number of credits for each semester is 25.
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**Total Number of Credits:** 24

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**PRACTICAL**

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UNIT I

Suggested activities:
2. Changing sentences from active to passive voice & vice versa.
3. Skimming, cloze exercises, exercises transferring information from text to graphic form – bar charts, flow charts.
4. Writing descriptions using descriptive words & phrases, and technical vocabulary.
5. Role play, conversation exercises, discussions, oral reporting exercises.
Any other related relevant classroom activity.

UNIT II

Suggested Activities:
1. a. Vocabulary activities using prefixes and suffixes.
   b. Exercises using questions – asking & answering questions.
2. Scanning the text for specific information.
4. Discussion activities and exploring creative ideas.
Any other related relevant classroom activity.

UNIT III

Suggested activities:
1. Providing appropriate context for the use of tenses
2. Listening and note-taking
3. (a) Writing sentence definitions and instructions
   (b) Identifying the discourse links and sequencing jumbled sentences.
4. Speaking exercises, discussions, role play exercises using explaining, convincing and persuasive Strategies.
Any other related relevant classroom activity.

UNIT IV
Modal verbs and Probability – Concord subject verb agreement (Correction of errors) – Cause and effect expressions – Extended Definition – Speaking about the future plans.
Suggested activities:
1. a. Making sentences using modal verbs to express probability
   b. Gap filling using relevant grammatical form of words.
2. Writing extended definitions
3. Speaking – role play activities, discussions, extempore speaking exercises speculating about the future.
   Any other related relevant classroom activity

UNIT V

Suggested activities:
1. a) Sentence completion exercises using ‘If’ conditionals.
   b) Gap filling exercises using gerunds and present participle forms
2. Reading comprehension exercises.
3. Role play, discussion, debating and speaking activities for stating, discussing problems and suggesting solutions.
4. Writing letters to officials and to the editor in formal/official contexts.
   Any other related relevant classroom activity.

TOTAL: 60 PERIODS

AREAS TO BE COVERED UNDER DIFFERENT HEADINGS:

A) Language focus
1. Suffixes and Prefixes
2. Transformation of words from one form to another (Derivatives from root words)
3. Matching words & meanings (synonyms)
4. Compound nouns
5. Degrees of comparison
6. Active and passive voice-impersonal passive
7. Tenses: simple present, simple past, simple future, present continuous, past continuous, Present Perfect.
8. Modal verbs
9. ‘Wh’ Question forms
10. Conditional clause
11. Gerunds and infinitives
12. Expressing Cause and effect
13. Concord
14. Punctuation
15. Writing definitions

B) Reading
1. Reading in context
2. Skimming and scanning
3. Scanning the text for specific information
4. Reading and note-making
5. Intensive reading for making inferences
6. Reading comprehension
C) Listening:
1. Listening and transfer of information
2. Listening & note taking

D) Writing:
1. Transformation of information from graphical data to written form and from written form to graphical Form.
2. Paragraph writing – Description
3. Paragraph Writing – comparison and contrast.
4. Note-making
5. Writing Instructions
6. Jumbled sentences
7. Letter writing – Formal letters (Invitation, Accepting, Declining, Permission Letters)
   Letters to the editor

E) Speaking:
1. Discussing as a group and making oral reports,
2. Role play–Conversation techniques – convincing others
3. Creative thinking and speaking, Exploring creative ideas
4. Persuasive strategies
5. Speaking about the future plans
6. Extempore speech – Speaking exercises speculating about the future
7. Presentation of problems and solutions
8. Debates

TEXT BOOK:

REFERENCES:

Extensive Reading:
UNIT I  MATRICES  12

UNIT II  THREE DIMENSIONAL ANALYTICAL GEOMETRY  12

UNIT III  DIFFERENTIAL CALCULUS  12
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT IV  FUNCTIONS OF SEVERAL VARIABLES  12

UNIT V  MULTIPLE INTEGRALS  12
Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral.

TOTAL: 60 PERIODS

TEXT BOOK:

REFERENCES:
UNIT I  ULTRASONICS

UNIT II  LASERS

UNIT III  FIBER OPTICS & APPLICATIONS

UNIT IV  QUANTUM PHYSICS

UNIT V  CRYSTAL PHYSICS
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 – NaCl, ZnS, diamond and graphite structures – Polymorphism and allotropy – Crystal defects – point, line and surface defects – Burger vector.

TEXT BOOKS:

TOTAL: 45 PERIODS
REFERENCES:
UNIT I  WATER TECHNOLOGY

UNIT II  POLYMERS AND COMPOSITES

UNIT III  SURFACE CHEMISTRY

UNIT IV  NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES

UNIT V  ENGINEERING MATERIALS

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
UNIT I  INTRODUCTION TO COMPUTERS  9
Classification of Computers – Basic Computer Organization – Number Systems.

UNIT II  COMPUTER SOFTWARE  9
Computer Software – Types of Software – Software Development Steps – Internet Evolution – Basic
Internet Terminology – Getting connected to Internet – Applications.

UNIT III  PROBLEM SOLVING AND OFFICE AUTOMATION  9
Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode –Application
Software Packages – Introduction to Office Packages (not detailed commands for examination).

UNIT IV  INTRODUCTION TO “C”  9
Overview of “C” – Constants, Variables and Data Types – Operators and Expressions – Managing
Input and Output operators – Decision Making –Branching and Looping.

UNIT V  FUNCTIONS AND POINTERS  9
Handling of Character Strings – User-defined functions – Definitions – Declarations – Call by
reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor –
Developing a “C” Program : Some Guidelines.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
Education Inc. (2005).
UNIT I  PLANE CURVES AND FREE HAND SKETCHING  12
CURVES USED IN ENGINEERING PRACTICES:
Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of
cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the
above curves.
FREE HAND SKETCHING:
Representation of Three Dimensional objects – General principles of orthographic projection – Need
for importance of multiple views and their placement – First angle projection – layout views –
developing visualization skills through free hand sketching of multiple views from pictorial views of
objects.

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  12
Projection of points and straight lines located in the first quadrant – Determination of true lengths and
true inclinations – Projection of polygonal surface and circular lamina inclined to both reference
planes.

UNIT III  PROJECTION OF SOLIDS  12
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one
reference plane by change of position method.

UNIT IV  SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES  12
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane
and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of
simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces
of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  12
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated
prisms, pyramids, cylinders and cones. Combination of any two simple solids. Perspective projection
of prisms, pyramids and cylinders by visual ray method and vanishing point method.

TOTAL: 60 PERIODS

TEXT BOOK:

REFERENCES:
   (2008).
LIST OF EXERCISES
I. MS Office
   a) WORD PROCESSING
      1. Document creation, Text manipulation with Scientific notations.
      2. Table creation, Table formatting and Conversion.
   b) SPREAD SHEET
      1. Chart - Line, XY, Bar and Pie.
      2. Formula - formula editor.
      4. Sorting and Import / Export features.

II SIMPLE C PROGRAMMING
   1. Data types, Expression evaluation, Conditional statements.
   2. Arrays.
   4. Functions.

   TOTAL: 45 PERIODS

For programming exercises Flow chart and pseudocode are essential.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 60 STUDENTS

HARDWARE
   • LAN System with 66 nodes (OR) Standalone PCs – 66 Nos.
   • Printers – 3 Nos.

SOFTWARE
   • OS – Windows / UNIX Clone
   • Application Package – Office suite
   • Compiler – “C”
PHYSICS LABORATORY – I

LIST OF EXPERIMENTS

1. (a) Particle size determination using Diode Laser.
   (b) Determination of Laser parameters – Wavelength and angle of divergence.
   (c) Determination of acceptance angle in an optical fiber.
2. Determination of thickness of a thin wire – Air wedge method.
6. Determination of Hysteresis loss in a ferromagnetic material.

B. CHEMISTRY LABORATORY – I

LIST OF EXPERIMENTS

1. Estimation of hardness of Water by EDTA method.
2. Estimation of Copper in brass by EDTA method.
3. Determination of DO in water (Winkler’s method)
4. Estimation of Chloride in Water sample (Argentometric)
5. Estimation of alkalinity of Water sample
6. Determination of molecular weight and degree of polymerization using viscometry.
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
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
1. Study of Electronic components and equipments – Resistor colour coding, measurement of AC signal parameters (peak-peak value, rms value period, frequency) using CRO.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor for HWR and FWR.

REFERENCES:
AIM
To encourage students to actively involve in participative learning of English and to help them acquire communication skills.

OBJECTIVES
1. To help the students to develop listening skills for academic and professional purposes.
2. To help the students to acquire the ability of effective speaking in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help the students to improve their active and passive vocabulary.
5. To familiarize the students with different rhetorical functions of scientific English.
6. To enable the students to write letters and reports effectively in formal and business situations.

UNIT I
Technical Vocabulary – meanings in context, sequencing words, Articles – Prepositions, intensive reading and predicting content, Reading and interpretation, extended definitions, process description.

Suggested activities
1. Exercises on word formation using the prefix ‘self’ – Gap filling with preposition
   Exercises – Using sequence words
2. Reading comprehension exercise with questions based on inference – Reading heading and predicting the content – reading advertisements and interpretation
3. Writing extended definitions – Writing description of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future

UNIT II

Suggested Activities
1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) – Reading comprehension exercises with texts including graphic communication – Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categories data in tables.
3. Writing formal letters – quotations, placing orders, clarification, and complaint, Letter seeking permission for industrial visits, writing analytical paragraphs on different debatable issues.

UNIT III
Suggested Activities
1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word.
2. Speaking exercises involving the use of stress and intonation – Group discussions – analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, multiple choice questions.

UNIT IV 10

Suggested Activities
1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking – Role Play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – writing argumentative paragraphs – Writing formal letters – writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages

UNIT V 5
Speaking – Discussion of problems and solutions – Creative and critical thinking – writing an essay, Writing a proposal.

Suggested Activities
1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements

AREAS TO BE COVERED UNDER DIFFERENT HEADINGS
A. Language Focus
1. Technical vocabulary
2. Sequencing words
3. Articles
4. Prepositions
5. Word formation using prefixes
6. Phrases / Structure indicating purpose
7. Adverbs
8. Cause and effect expressions
9. Tense forms
10. Different grammatical forms of the same word
11. Numerical adjectives
12. Extended definitions

TOTAL 45 periods
B. Reading
   1. Intensive reading and predicting content
   2. Reading and interpretation
   3. Skimming
   4. Critical reading
   5. Reading comprehension exercises

C. Listening
   1. Correlating verbal and non-verbal communication
   2. Listening comprehension

D. Speaking
   1. Group Discussions
   2. Stress and intonation
   3. Role plays and giving oral instructions
   4. Discussion of problems and solutions

E. Writing
   1. Process description
   2. Formal letter writing
   3. Writing analytical paragraphs
   4. Report Writing
   5. Descriptive writing
   6. Argumentative paragraphs
   7. Letter of application
   8. Instructions
   9. Recommendations
   10. Checklists preparation
   11. Email Communication
   12. Writing critical essays
   13. Writing proposals

TEXT BOOK:

REFERENCES:

Extensive Reading:

*Note*:
The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.
UNIT I  ORDINARY DIFFERENTIAL EQUATIONS  12
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 II  VECTOR CALCULUS  12
Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and stoke’s theorem (excluding proofs) – Simple applications involving cubes and rectangular parallepipeds.

UNIT III  ANALYTIC FUNCTIONS  12
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w = z+c, cz, 1/z and bilinear transformation.

UNIT IV  COMPLEX INTEGRATION  12

UNIT V  LAPLACE TRANSFORM  12

TOTAL: 60 PERIODS

TEXT BOOK:

REFERENCES:
UNIT I  CONDUCTING MATERIALS

UNIT II  SEMICONDUCTING MATERIALS

UNIT III  MAGNETIC AND SUPERCONDUCTING MATERIALS

UNIT IV  DIELECTRIC MATERIALS

UNIT V  MODERN ENGINEERING MATERIALS

TEXT BOOKS:
2. Charles P. Poole and Frank J.Ownen, ‘Introduction to Nanotechnology’, Wiley India (2007) (for Unit V)
REFERENCES:
AIM
To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES
The student should be conversant with the principles of electrochemistry, electrochemical cells, emf and applications of emf measurements.
Principles of corrosion control.
Chemistry of Fuels and combustion.
Industrial importance of Phase rule and alloys.
Analytical techniques and their importance.

UNIT I  ELECTROCHEMISTRY  9

UNIT II  CORROSION AND CORROSION CONTROL  9

UNIT III  FUELS AND COMBUSTION  9

UNIT IV  PHASE RULE AND ALLOYS  9

UNIT V  ANALYTICAL TECHNIQUES  9

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:
OBJECTIVE

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I  BASICS & STATICS OF PARTICLES  12

UNIT II  EQUILIBRIUM OF RIGID BODIES  12

UNIT III  PROPERTIES OF SURFACES AND SOLIDS  12

UNIT IV  DYNAMICS OF PARTICLES  12

UNIT V  FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  12

TOTAL: 60 PERIODS

TEXT BOOK:

REFERENCES:
UNIT I  BASIC CIRCUITS ANALYSIS  

UNIT II  NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS  

UNIT III  RESONANCE AND COUPLED CIRCUITS  

UNIT IV  TRANSIENT RESPONSE FOR DC CIRCUITS  
Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. input (Sinusoidal).

UNIT V  ANALYSING THREE PHASE CIRCUITS  
Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4- wire circuits with star and delta connected loads, balanced & unbalanced loads – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL: 60 PERIODS

TEXT BOOKS:
REFERENCES:

UNIT I  CIRCUIT ANALYSIS TECHNIQUES  12

UNIT II  TRANSIENT & RESONANCE IN RLC CIRCUITS  12

UNIT III  SEMICONDUCTOR DIODES  12

UNIT IV  TRANSISTORS  12
Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V  SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only)  12
Tunnel diodes, PIN diode, varactor diode – SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:
(a) BEE202  BASIC ELECTRICAL & ELECTRONICS ENGINEERING  L T P C  4 0 0 4

(For Mechanical & Civil Branches)

UNIT I  ELECTRICAL CIRCUITS & MEASUREMENTS  12

UNIT II  ELECTRICAL MACHINES  12

UNIT III  SEMICONDUCTOR DEVICES AND APPLICATIONS  12

UNIT IV  DIGITAL ELECTRONICS  12

UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING  12

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:
UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS
leveling – determination of areas – illustrative examples.

UNIT II BUILDING COMPONENTS AND STRUCTURES

REFERENCES:
LIST OF EXPERIMENTS

1. UNIX COMMANDS

Study of Unix OS – Basic Shell Commands – Vi Editor.

2. SHELL PROGRAMMING


3. C PROGRAMMING ON UNIX

Dynamic Storage Allocation – Pointers – Functions – File Handling.

TOTAL: 45 PERIODS

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

- UNIX Clone Server – 1 No
- Nodes (thin client or PCs) – 33 Nos
- Printer – 3 Nos.

Software

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C
PHYSICS LABORATORY – II

LIST OF EXPERIMENTS
1. Determination of Young’s modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
5. Spectrometer dispersive power of a prism.
6. Determination of Young’s modulus of the material – uniform bending.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.

CHEMISTRY LABORATORY – II

LIST OF EXPERIMENTS
1. Conductometric titration (Simple acid base)
2. Conductometric titration (Mixture of weak and strong acids)
3. Conductometric titration using BaCl₂ Vs Na₂SO₄
4. Potentiometric Titration (Fe²⁺ Vs K₂Cr₂O₇)
5. pH Titration (Acid & Base)
6. Determination of water of crystallization of a crystalline salt (CuSO₄)
7. Estimation of Ferric ion by spectrophotometry.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
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 (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
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.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility – 30 Nos.
2. Licensed software for Drafting and Modeling – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 Nos.
LIST OF EXPERIMENTS

- Verification of ohm’s laws and kirchoff’s laws.
- Verification of Thevenin’s and Norton’s Theorem
- Verification of superposition Theorem
- Verification of maximum power transfer theorem.
- Verification of reciprocity theorem
- Measurement of self inductance of a coil
- Verification of mesh and nodal analysis.
- Transient response of RL and RC circuits for DC input.
- Frequency response of series and parallel resonance circuits.
- Frequency response of single tuned circuits.

TOTAL: 45 PERIODS
• Verification of KVL and KCL
• Verification of Thevenin and Norton Theorems.
• Verification of superposition Theorem.
• Verification of Maximum power transfer and reciprocity theorems.
• Frequency response of series and parallel resonance circuits.
• Characteristics of PN and Zener diode
• Characteristics of CE configuration
• Characteristics of CB configuration
• Characteristics of UJT and SCR
• Characteristics of JFET and MOSFET
• Characteristics of Diac and Triac.
• Characteristics of Photodiode and Phototransistor.

TOTAL: 45 PERIODS
UNIT I (Micro Skills I)                      4

Tasks (Type I): Lexical word identification
    A. Identifying the homophones/words with silent letters/often mispronounced words
    B. Identifying the missing words in native speech (Native accent)

Tasks (Type II): Decompressing structures
    A. Expanding sound units into word clusters (Ex: verbs with multiple auxiliaries/contracted forms)
    B. Identifying the constituent words in collocations/compound words/idiomatic phrases

UNIT II (Micro Skills II): Identifying tonal variations for meaning making                6

Tasks:
    A. Punctuating the script after listening to it.
    B. Marking word chunks/tone groups in transcript after listening to it.
    C. Marking syllable stress in words.
    D. Identifying tonal variations expressing rhetorical questions/ information seeking Questions / Exclamations / General statements.

UNIT III Content Comprehension and Making Inferences                12

Tasks:
    A. Listening and filling in the chart
    B. Multiple choice questions (Negative/factual)
    C. True/False questions
    D. Questions with multiple answers (choosing two/three correct answers)
    E. Matching information
    F. Filling the blanks (not more than three words)
    G. Comprehending the text organization

UNIT IV Listening and act                   8

Tasks:
    A. Locating spots in a map following the given directions
    B. Transferring data to graphs/diagrams/flow charts
    C. Diagram/Picture completing tasks
    D. Finding the answer through the process of elimination

TOTAL: 30 PERIODS
OBJECTIVES
The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I  FOURIER SERIES   (9L+3T)

UNIT II  FOURIER TRANSFORMS   (9L+3T)

UNIT III  PARTIAL DIFFERENTIAL EQUATIONS   (9L+3T)
Formation of partial differential equations – Lagrange’s linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   (9L+3T)
Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS   (9L+3T)

Lectures: 45   Tutorials: 15   Total: 60 Periods

TEXT BOOK

REFERENCES
OBJECTIVE

- To introduce the students the concepts of some basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and plastics component manufacture.

UNIT I METAL CASTING PROCESSES 9

UNIT II JOINING PROCESSES 9

UNIT III BULK DEFORMATION PROCESSES 9

UNIT IV SHEET METAL PROCESSES 9

UNIT V MANUFACTURING OF PLASTIC COMPONENTS 9

TEXT BOOKS
REFERENCES
OBJECTIVES

- To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behaviour of the simple physical systems.
- To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Principle of Psychrometry & Properties of pure substances.
- To enlighten the basic concepts of vapour power cycles.

UNIT I BASIC CONCEPT AND FIRST LAW 9(L)+3(T)
Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW 9(L)+3(T)
Second law of thermodynamics – Kelvin’s and Clausius statements of second law. Reversibility and irreversibility Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – availability.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9(L)+3(T)

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 9(L)+3(T)
Gas mixtures – properties ideal and real gases, equation state, Avagadro’s Law, Vander Waal’s equation of state, compressibility factor, compressibility chart – Dalton’s law of partial pressure, exact differentials, T-D relations, Maxwell’s relations, Clausius Clapeyron equations, Joule – Thomson coefficient.

UNIT V PSYCHROMETRY 9(L)+3(T)

Lectures: 45 Tutorials: 15 Total: 60

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

TEXT BOOKS

REFERENCES
OBJECTIVES

- The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- The applications of the conservation laws to flow through pipes and hydraulics machines are studied.

UNIT I INTRODUCTION  
Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS  

UNIT III DIMENSIONAL ANALYSIS  
Dimension and units: Buckingham’s II theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT IV ROTO DYNAMIC MACHINES  

UNIT V POSITIVE DISPLACEMENT MACHINES  

Lectures: 45  Tutorials: 15  Total: 60

TEXT BOOKS

REFERENCES:
OBJECTIVES

- To understand the concept of machines, mechanisms and related terminologies.
- To analyse a mechanism for displacement, velocity and acceleration at any point in a moving link.
- To understand the theory of gears, gear trains and cams.
- To understand the role of friction in drives and brakes.

UNIT I BASICS OF MECHANISMS 7(L)
Definitions – Link, Kinematic pair, Kinematic chain, Mechanism, and Machine - Degree of Freedom – Mobility - Kutzbach criterion (Gruebler’s equation) - Grashoff's law - Kinematic Inversions of four-bar chain and slider crank chain - Mechanical Advantage - Transmission angle.
Description of common Mechanisms - Offset slider mechanism as quick return mechanisms, Pantograph, Straight line generators (Peaucellier and Watt mechanisms), Steering gear for automobile, Hooke’s joint, Toggle mechanism, Ratchets and escapements - Indexing Mechanisms.

UNIT II KINEMATIC ANALYSIS 10(L)+5(T)
Analysis of simple mechanisms (Single slider crank mechanism and four bar mechanism) - Graphical Methods for displacement, velocity and acceleration; Shaping machine mechanism - Coincident points – Coriolis acceleration - Analytical method of analysis of slider crank mechanism and four bar mechanism. Approximate analytical expression for displacement, velocity and acceleration of piston of reciprocating engine mechanism.

UNIT III KINEMATICS OF CAMS 8(L)+3(T)
Classifications - Displacement diagrams - Parabolic, Simple harmonic and Cycloidal motions – Graphical construction of displacement diagrams and layout of plate cam profiles - circular arc and tangent cams - Pressure angle and undercutting.

UNIT IV GEARS 10(L)+4(T)
Classification of gears – Gear tooth terminology - Fundamental Law of toothed gearing and involute gearing – Length of path of contact and contact ratio - Interference and undercutting - Gear trains – Simple, compound and Epicyclic gear trains - Differentials.

UNIT V FRICTION 10(L)+3(T)
Dry friction – Friction in screw jack – Pivot and collar friction - Plate clutches - Belt and rope drives - Block brakes, band brakes.

Lectures: 45 Tutorials: 15 Total: 60

TEXT BOOKS

REFERENCES

BIS Codes of Practice/Useful Websites
1. IS 2458 : 2001, Vocabulary of Gear Terms – Definitions Related to Geometry

WEBSITE:  www.howstuffworks.com
OBJECTIVES

• To understand the basic concepts of different types of electrical machines and their performance.
• To study the different methods of starting D.C motors and induction motors.
• To study the conventional and solid-state drives

UNIT I INTRODUCTION 8(L)
Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II DRIVE MOTOR CHARACTERISTICS 9(L)
Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

UNIT III STARTING METHODS 8(L)
Types of D.C Motor starter –Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C.DRIVES 10(L)
Speed control of DC series and shunt motors – Armature and field control, Ward- Leonard control system - Using controlled rectifiers and DC choppers –applications.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C.DRIVES 10(L)
Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

Total: 45 Periods

TEXT BOOKS

REFERENCES
OBJECTIVE

- To gain hands on experience on working of general purpose machine tools and on various manufacturing processes.

UNIT I  LATHE

1.1. Facing, plain turning and step turning
1.2. Taper turning using compound rest, Tailstock set over, etc
1.3. Single and Multi-start V thread, cutting and knurling
1.4. Boring and internal thread cutting.

UNIT II  WELDING EXCERCISES

2.1. Horizontal, Vertical and Overhead welding.
2.2. Gas Cutting, Gas Welding
2.3. Brazing - for demonstration purpose

UNIT III  SHEET METAL WORK

3.1. Fabrication of sheet metal tray
3.2. Fabrication of a funnel

UNIT IV  PREPARATION OF SAND MOULD

4.1. Mould with solid, split patterns
4.2. Mould with loose-piece pattern
4.3. Mould with Core

UNIT V  PLASTIC MOULDING

5.1. Injection Moulding- for demonstration purpose

Total: 45

LIST OF EQUIPMENTS

1. Centre Lathe with accessories 15

2. Welding

2.1 Arc welding machine 04
2.2 Gas welding machine 01
2.3 Brazing machine 01

3. Sheet Metal Work facility

3.1 Hand Shear 300mm 01
3.2 Bench vice 05
3.3 Standard tools and calipers for sheet metal work 05

4. Sand moulding Facility

4.1 Moulding Table 05
4.2 Moulding boxes, tools and patterns 05

5. Plastic Moulding

5.1 Injection Moulding Machine 01
LIST OF EXPERIMENTS

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

LIST OF EQUIPMENT (for a batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submersible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup

Quantity: one each.

Total: 45
LIST OF EXPERIMENTS

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

LIST OF EQUIPMENT (for batch of 30 students)

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<tr>
<th>Equipment</th>
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<tbody>
<tr>
<td>1. DC Shunt motor</td>
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<tr>
<td>2. DC Series motor</td>
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<tr>
<td>3. DC shunt motor-DC Shunt Generator set</td>
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<tr>
<td>4. DC Shunt motor-DC Series Generator set</td>
<td>- 1</td>
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<tr>
<td>5. Single phase transformer</td>
<td>- 2</td>
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<tr>
<td>6. Three phase alternator</td>
<td>- 2</td>
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<tr>
<td>7. Three phase synchronous motor</td>
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<td>8. Three phase Squirrel cage Induction motor</td>
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<tr>
<td>9. Three phase Slip ring Induction motor</td>
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<tr>
<td>10. Single phase Induction motor</td>
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</tbody>
</table>

Total: 45
OBJECTIVES

- To improve the learners’ oral fluency in English
- To help the learners acquire the readiness to speak in English
- To develop the sub-skills required for paper presentations and group discussions
- To help the learners improve their vocabulary related to specific fields of technology
- To facilitate the development of the learners’ proficiency in meaningful interaction
- To provide them linguistic support for managing vital sub-functions of Communication

COURSE CONTENT:

A) Phonetic practice (7 hrs)

- English phonemes with special emphasis on the diphthongs
- Stress patterns for words that end with specific suffixes. 

B) Speech practice (8 hrs)

- Speaking on the themes by developing the hints provided.
  The themes are:
  1. Cloning
  2. Artificial satellites
  3. Renewable sources
  4. Telecommunication
  5. Cyber Revolution
  6. Space research
  7. Polythene pollution
  8. Fossil fuels
  9. Climate change
  10. Ecological threats
  11. Water resources
  12. Nuclear technology
  13. Scientific farming
  14. Thermal power plants
  15. Natural calamities
  16. Robotics
  17. Artificial intelligence
  18. Role of Fibre Optics
  19. Exploration of Mars
  20. Gas turbines

C) Group Quiz on technical aspects related to the themes (4hrs)

D) Language Functions (8 hrs)

1. comparing and contrast
2. reporting the conversation of others.
3. talking about future plans and intentions
4. giving reasons
5. expressing preferences
6. quantifying
7. expressing certainty and uncertainty
8. expressing opinions and impressions
9. making suggestions
10. expressing assumptions
11. evaluating options
12. hypothesing/deducing
13. defending a point of view

E) Seminar presentation on the themes allotted (18 hrs)

PROCEDURE:
A) Phonetic practice
All the speech sounds should be taught. The learners should be given drills in the pronunciation of at least 30 words for each sound. While practicing stress patterns, they should be encouraged to identify as many words as possible for each suffix ending.

B) Speech practice
Every student should be allowed to choose one theme to specialize in. (However not more than 4 students in a section can choose the same theme). The teacher has to prepare at least 4 hints development tasks on each theme and should provide chance to each learner to speak on those hints related to his/ her theme (5 minutes). The hints may be supplied to the students in advance. When a student speaks, the class should be encouraged to ask questions as well as note down the words related to the different fields.

C) Group Quiz on technical phrases related to the themes.
The class should be divided into groups that specialize on a particular theme. Each group should conduct a quiz (question & answer session) which will be answered by the other groups.

D) Language Functions
The teacher should build micro activities to develop the use of language required to handle these sub-functions of communication. In the process, the learners should get used to the linguistic elements needed for these functions.

E) Seminar presentation on the themes allotted
Each student should collect materials from books, journals and newspapers for his/her theme and prepare a short seminar paper. The presentation should be for 10 minutes. It should be followed ‘open house’ during which others should come forward to question, clarify, supplement or evaluate.

RECORD LAY OUT:
Every student has to maintain a record in which he/she has to incorporate the following details.
- First page containing learner details and the topic of specialization.
- Twenty words for each phoneme
- Twenty words with stress marks for each suffix ending
- Vocabulary list (technical words and compound words) related to the 20 themes identified for this semester.
- Three newspaper items, two journal items and three internet sources related to the special theme selected by the student. (To be pasted on the pages)
- The Quiz questions of the group with expected answers.
- The seminar paper presented by the learner with details about the open house.
- Notes of observation. (Details about any three seminar paper presentations by others)
- The record should be duly signed by the course teacher and submitted to the External Examiner for verification during the semester practicals.

P = 45 Total = 45
AIM
To provide the required skill to apply the statistical tools in engineering problems and give
procedures for solving numerically the different kinds of problems occurring in engineering
and technology

OBJECTIVES
To make the students
• Acquire knowledge of the concepts of statistical inference
• Get exposure to the basic concepts of numerical methods and their applications

UNIT I TESTING OF HYPOTHESIS (9L+3T)
Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small
samples) – Tests for single variance and equality of variances – Chi-square test for goodness of fit –
Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS (9L+3T)
Completely randomized design – Randomized block design – Latin square design - $2^2$ - factorial
design.

UNIT III SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS (9L+3T)
Newton-Raphson method- Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative
methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method – Eigen
values of a matrix by Power method.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION
AND NUMERICAL INTEGRATION (9L+3T)
Lagrange’s and Newton’s divided difference interpolation –Newton’s forward and backward
difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical
integration using Trapezoidal and Simpson’s 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (9L+3T)
Taylor’s series method - Euler’s method - Modified Euler’s method - Fourth order Runge-Kutta
method for solving first and second order equations - Milne’s predictor-corrector methods for solving
first order equations - Finite difference methods for solving second order equation.

Lectures: 45 Tutorials: 15 Total: 60 Periods

TEXT BOOKS
   Khanna Publishers, New Delhi, 2004(For units 3, 4 and 5).

REFERENCES
1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, “Probability and Statistics for Engineers
   Education Asia, New Delhi, 2006.
### BME401 HEAT AND MASS TRANSFER

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#### OBJECTIVE

- To identify the mode of heat transfer involved in real time applications.
- To calculate the rate of heat transfer using appropriate empirical laws.
- To understand the physical concepts of boiling and condensation.
- To learn the basic concepts involved in design of heat exchanger and understand the concepts of mass transfer.

#### UNIT I CONDUCTION


#### UNIT II CONVECTION


#### UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGES


#### UNIT IV RADIATION


#### UNIT V MASS TRANSFER


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**Lectures: 45 Tutorials: 15 Total: 60**

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**TEXT BOOKS**


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**REFERENCES**

OBJECTIVE
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) machine tool and CNC programming.

UNIT I THEORY OF METAL CUTTING 9(L)

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 9(L)
Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, Bar feed mechanism.

UNIT III OTHER MACHINE TOOLS 9(L)

UNIT IV ABRASIVE PROCESSES AND GEAR CUTTING 9(L)

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING 9(L)

Total: 45 Periods

TEXT BOOKS

REFERENCES
OBJECTIVE
To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials, so as to identify and select suitable materials for various engineering applications.

Review (Not for Exam):
Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9(L)

UNIT II HEAT TREATMENT 9(L)

UNIT III MECHANICAL PROPERTIES AND TESTING 9(L)
Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

UNIT IV FERROUS AND NON FERROUS METALS 9(L)

UNIT V NON-METALLIC MATERIALS 9(L)

Total: 45 Periods

TEXT BOOK

REFERENCES
OBJECTIVES

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses.

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II BEAMS - LOADS AND STRESSES

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow

UNIT III TORSION

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

UNIT IV BEAM DEFLECTION


UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr’s circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

Text Books


References

BEC406   ELECTRONICS AND MICROPROCESSOR  L T P C
  3 0 0 3

OBJECTIVE
- To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 805 Microprocessors.

UNIT I  SEMICONDUCTORS AND RECTIFIERS  9(L)
Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristics-Half wave and full wave rectifiers-Voltage regulation

UNIT II  TRANSISTORS AND AMPLIFIERS  12(L)
Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits-Class A, B and C amplifiers-Field effect transistor-Configuration and characteristic of FET amplifier-SCR, Diac, Triac, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

UNIT III  DIGITAL ELECTRONICS  9(L)
Binary number system-AND, OR, NOT, NAND, NOR circuits-Boolean algebra-Exclusive OR gate-Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

UNIT IV  8085 MICROPROCESSOR  9(L)
Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V  INTERFACING AND APPLICATIONS OF MICROPROCESSOR  6(L)
Basic interfacing concepts-Interfacing of Input and Output devices-Applications of microprocessor-Temperature control, Stepper motor control, traffic light control.

Total: 45 Periods

TEXT BOOKS

REFERENCES
OBJECTIVE

- 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.

LIST OF EQUIPMENTS (for a batch of 30 students)

- Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity
- Torsion Testing Machine (60 NM Capacity) 1
- Impact Testing Machine (300 J Capacity) 1
- Brinell hardness Testing Machine 1
- Rockwell Hardness Testing Machine 1
- Spring Testing Machine for tensile and compressive loads (2500 N) 1
- Metallurgical Microscopes 3
- Muffle Furnace (800°C)

Total: 45 Periods
OBJECTIVE

- To make the students understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using standard CAD packages.
- To familiarize the students with Indian Standards on drawing practices and standard components.

DRAWING STANDARDS


2-D DRAWINGS


CAD PRACTICE (USING APPLICATION PACKAGES)

Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, Assembly, basic principles of GD&T (geometric dimensioning & tolerancing)

ASSEMBLY DRAWING (MANUAL & USING APPLICATION PACKAGES)

Manual parts drawing and preparation of assembled views given part details for components followed by practicing the same using CAD packages.

Suggested Assemblies:


Lectures: 15 Practicals: 45 Total: 60

Use of standard CAD application packages is recommended from the point of view of requirement by industries. However to encourage our national efforts in indigenous development of software packages with focus on open source, students may be encouraged to work with “CollabCAD Software”, developed by:

National Informatics Centre (CAD Group), Govt. of India, A-Block, C.G.O. Complex, Lodhi Road, New Delhi 110003, 2003” www.collabcad.com

REFERENCES

EQUIPMENTS NEEDED (for a batch of 30 students)

1. **Computer System**
   - 17” Graphics Terminal
   - Pentium IV Processor
   - 80 GB HDD
   - 512 MB RAM
   - Advanced graphics accelerator
   - 30

2. **Laser Printer**
   - 01

3. **Plotter (A2 size)**
   - 01

**Software:**

30 seats of latest/recent versions of AutoCAD / CATIA / SOLIDWORKS / SOLID EDGE / NX / PRO-E / COLLAB CAD or equivalent software
OBJECTIVE
- To give a practical hand on exposure to students in the various metal cutting operations using commonly used machine tools

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

LIST OF EQUIPMENTS (For a batch of 30 students)

1. Centre Lathes - 2 Nos.
2. Turret and Capstan Lathes - 1 No
3. Horizontal Milling Machine - 1 No
4. Vertical Milling Machine - 1 No
5. Surface Grinding Machine - 1 No.
7. Shaper - 2 Nos.
8. Slotter - 1 No.
9. Planner - 1 No.
11. Tool Dynamometer - 1 No
12. Gear Hobbing Machine - 1 No
13. Tool Makers Microscope - 1 No

Total Number of Periods: P = 45
OBJECTIVES
• To improve the learners’ oral fluency in English
• To help the learners acquire the readiness to speak in English
• To develop the sub-skills required for paper presentations and group discussions
• To help the learners improve their vocabulary related to specific fields of technology
• To facilitate the development of the learners’ proficiency in meaningful interaction
• To provide them linguistic support for managing vital sub-functions of communication.

COURSE CONTENT:
A) Phonetic practice (7 hrs)
   All the English phonemes with special emphasis on the following
   1. /ae/ and /ei/
   2. /e/ and /i/
   3. First syllable and second syllable stress
   4. Three different ways of pronouncing ‘ed’ past tense endings eg. ‘played’, ‘walked’, ‘wanted’
   5. Correct pronunciation of commonly used words (A list of 1000 words will be suggested by the university)
   6. Silent letters

B) Speech practice (8 hrs)
   Speaking on the themes by developing the hints provided.
   The themes are:
   1. Indian space missions
   2. Converting agricultural wastes for useful purposes
   3. Developments in transportation
   4. Technology and agriculture
   5. Impact of global warming
   6. Desalination of water
   7. Technology for national security
   8. Industrial development and ecological issues
   9. Applications of nano technology
   10. Hazards of e-waste

C) Preparation of power point frames on the given topic (2 hrs)
   (Only pictures, graphs, equations should be given through power point and not the text of the presentation as such)

D) Language Functions (14 hrs)
   Reporting the conversation of others
   Using the third conditional
   Expressing agreement and disagreement
   Numerical expressions
   Describing manner and frequency
   Evaluating different standpoints
   Developing an argument
   Describing daily routines, events, and weather
D) Seminar presentation on the themes allotted using power point frames (14 hrs)

PROCEDURE:
A) Phonetic practice
The learners should be given drills in the pronunciation of at least 30 words for each sound. While practicing stress patterns, they should be encouraged to identify as many words as possible for each pattern.

B) Speech practice
Every student should be allowed to choose one theme to specialize in. (However not more than 7 students in a section can choose the same theme). The teacher has to prepare at least 4 hints development tasks on each theme and should provide chance to each learner to speak on those hints related to his/ her theme (5 minutes). The hints may be supplied to the students in advance. When a student speaks, the class should be encouraged to ask questions as well as note down the words related to the different fields.

C) Language Functions
The teacher should build micro activities to develop the use of language required to handle these sub-functions of communication. In the process, the learners should get used to the linguistic elements needed for these functions.

D) Seminar presentation on the themes allotted
Each student should collect materials from books, journals and newspapers for his/her theme and prepare a short seminar paper. The presentation should be for 10 minutes using power point frames. It should be followed by an ‘open house’ during which others should come forward to question, clarify, supplement or evaluate.

RECORD LAY OUT:
Every student has to maintain a record in which he/she has to incorporate the following details.

- First page containing learner details and the topic of specialization.
- Twenty words for each phoneme /ae/, /ei/, /i/ and /e/
- Fifty words with first syllable stress and fifty for second syllable stress (The learner will be required to pronounce some of these words during the practical exam)
- Vocabulary list (technical words and compound words) related to the 10 themes identified for this semester.
- Three newspaper items, two journal items and three internet sources related to the special theme selected by the student. (To be pasted on the pages)
- The seminar paper presented by the learner with a soft copy of the power point frames.
- Notes of observation. (Details about any two seminar paper presentations by others)
- The record should be duly signed by the course teacher and submitted to the External Examiner for verification during the semester practicals.

P = 45 Total = 45
OBJECTIVE:
At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and nongovernment organization in environment managements.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  14
Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – 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 –biogeographically 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  8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. 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 over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland /hill / mountain.

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT  7
From unsustainable to sustainable development – urban problems related to energy –water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non governmental organization-environmental ethics: Issues and possible solutions –climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism

UNIT V   HUMAN POPULATION AND THE ENVIRONMENT 6

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
• To integrate the concepts, laws and methodologies from the first course in thermodynamics 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 thermodynamic tables, Mollier diagram, Psychrometric chart and refrigerant property tables are permitted in the examination)

UNIT I  GAS POWER CYCLES  10
Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air Standard efficiency – Comparison of Otto, Diesel, Dual, Brayton cycles - Actual and theoretical PV diagram of four stroke and two stroke engines

UNIT II  INTERNAL COMBUSTION ENGINES  13
Classification , Components and their functions Valve timing diagram and Port timing diagram - Comparison of two stroke and four stroke engines – Working principle of simple carburetor, Properties of fuels used in engines – Combustion stages of SI and CI engines, Abnormal Combustion - Knocking and detonation, Scavenging and supercharging in engines, Diesel pump and injector system. - Comparison of petrol and diesel engine - Lubrication system and Cooling system - Battery and Magneto Ignition System – Performance calculation & Heat Balance Test - Formation and Control of exhaust emissions in SI and CI engines

UNIT III  STEAM NOZZLES AND TURBINES  12
Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow, Steam Turbines - Impulse and Reaction principles, compounding, degree of reaction, velocity diagram for simple and multi-stage turbines, speed regulations –Governors.

UNIT IV  RECIPROCATING AND ROTARY AIR COMPRESSORS  12
Reciprocating Compressor - Classification and working principle, work of compression with and without clearance, Volumetric efficiency,” Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –working principles of Rotary Compressors , Fan and blowers (Description only).

UNIT V  REFRIGERATION AND AIR CONDITIONING  13
Air refrigeration system - Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide –water systems (Description only) –Types & Properties of Refrigerants – Comparison between vapour compression and absorption systems. Psychrometry, Psychrometric chart, Psychrometry process-Types of Air conditioning systems - Requirements for comfort and industrial air-conditioning

TOTAL: 60 PERIODS

TEXT BOOKS:
REFERENCES:
5. NPTEL Lectures.
OBJECTIVES:

- To understand the method of static force analysis and dynamic force analysis of mechanisms.
- To study the undesirable effects of unbalances in rotors and engines.
- To understand the concept of vibratory systems and their analysis.
- To understand the principles of governors and gyroscopes.

UNIT I  FORCE ANALYSIS AND FLYWHEELS 12


UNIT II  BALANCING 12

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

UNIT III  FREE VIBRATION 12

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

UNIT IV  FORCED VIBRATION 12

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

UNIT V  MECHANISMS FOR CONTROL 12


L:45  T:15, TOTAL :60 PERIODS

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.

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 12

UNIT II DESIGN OF SHAFTS AND COUPLINGS 12
Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys, key ways and splines - Design of rigid and flexible couplings.

UNIT III DESIGN OF TEMPORARY AND PERMANENT JOINTS 12
Threaded fasteners - Design of bolted joints including eccentric loading, Knuckle joints – Design of welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS 12
Design of various types of springs, optimization of helical springs -- rubber springs -- Design of flywheels considering stresses in rims and arms for engines and punching machines.

UNIT V DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS 12
Sliding contact and rolling contact bearings -- Design of hydrodynamic journal bearings, McKee’s Equation, Sommerfield Number, Raimondi & Boyd graphs, -- Selection of Rolling Contact bearings - - Design of Seals and Gaskets -- Design of Connecting Rod and Design of crankshafts.

L: 45 T: 15 TOTAL :60 PERIODS

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

TEXT BOOKS:

REFERENCES:
STANDARDS:

OBJECTIVE:
- To understand the basic principles of measurements.
- To learn the various linear and angular measuring equipments, their principle of operation and applications.
- To learn about various methods of measuring Mechanical parameters.

UNIT I  CONCEPT OF MEASUREMENT 9
General concept – Generalized measurement system-Units and standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration- Introduction to Dimensional and Geometric Tolerancing - interchangeability,

UNIT II  LINEAR AND ANGULAR MEASUREMENT 9

UNIT III  FORM MEASUREMENT 9
Measurement of screw threads: Thread gauges, floating carriage micrometer- measurement of gear tooth thickness: constant chord and base tangent method- radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

UNIT IV  LASER AND ADVANCES IN METROLOGY 9

UNIT V  MEASUREMENT OF MECHANICAL PARAMETERS 9

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
OBJECTIVES:

- To know the advantages and applications of Fluid Power Engineering and Power Transmission System.
- To learn the Applications of Fluid Power System in automation of Machine Tools and others Equipments.

UNIT I  FUNDAMENTALS OF FLUID POWER SYSTEMS  

UNIT II  HYDRAULIC SYSTEM & COMPONENTS  

UNIT III  HYDRAULIC VALVES, PNEUMATIC SYSTEMS AND COMPONENTS  

UNIT IV  DESIGN OF HYDRAULIC & PNEUMATIC CIRCUITS  

UNIT V  LOGIC CONTROL SYSTEMS  
Advanced Control for Fluid Power Systems Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
OBJECTIVE:

- To attain practical knowledge in thermal engineering concepts especially in Internal Combustion Engine.

LIST OF EXPERIMENTS (Minimum 12 experiments to be conducted)

Valve Timing Diagram for 4-stroke Engine.
Port Timing Diagram for 2-stroke Engine.
Determination of oil Viscosity using Red Wood Viscometer.
Determination of oil Viscosity using Saybolt Viscometer.
Determination of Flash Point and Fire Point using Abel Apparatus.
Determination of Flash Point and Fire Point using Pensky Marten Apparatus.
Performance Test on 4-stroke slow Speed Diesel Engine Fitted with Mechanical Dynamometer.
Performance Test on 4-Stroke Diesel Engine fitted with AC Generator.
Performance Test on 4-Stroke Petrol Engine with Electrical Loading.
Performance Test on Variable Compression Ratio engine to find the effect of Compression ratio on Performance parameters.
Heat Balance Test on 4-stroke Diesel Engine fitted with DC Generator.

LIST OF EQUIPMENT (for a batch of 30 students)

1. I.C Engine – 2 stroke and 4 stroke model 1 set
2. Red Wood Viscometer 1 No.
3. Apparatus for Flash and Fire Point 1 No.
4. Four stroke Diesel Engine with mechanical loading. 1 No.
5. Four stroke Diesel Engine with hydraulic loading. 1 No.
6. Four stroke Diesel Engine with electrical loading. 1 No.
7. Multi-cylinder Petrol Engine 1 No.
9. Data Acquisition system with any one of the above engines 1 No.
10. Saybolt Viscometer 1 No.
OBJECTIVES:
• To be able to understand and handle design problems in a systematic manner.
• To gain practical experience in handling 2D drafting and 3D modeling software systems.
• To be able to apply CAD in real life applications.
• To understand the concepts G and M codes and manual part programming.
• To expose students to modern control systems (Fanuc, Siemens etc)
• To know the application of various CNC machines
• To expose students to modern CNC application machines EDM, EDM wire cut and Rapid Prototyping.

LIST OF EXPERIMENTS Minimum 12 Experiments to be conducted

CAD-Modeling
1. Part Drawing – Hinged Bearing
2. Part Drawing – Support Block
3. Three Dimensional Modeling and Assembly of Screw Jack
4. Three Dimensional Modeling and Assembly of Flange Coupling
5. Three Dimensional Modeling and Assembly of Plummer Block
6. Three Dimensional Modeling and Assembly of Universal Coupling
7. Three Dimensional Modeling and Assembly of Knuckle Joint

CAM – Manual Part Programming
1. Simple Turning
2. Thread Cutting
3. Multiple Turning
4. Contouring
5. Square Profile
6. Circular Interpolation
7. Peck Drilling

CNC Code Generation
1. Generation of CNC code for Lathe Operation
2. Generation of CNC code for Milling Operation
OBJECTIVES:
- To understand the construction and working principle of various parts of an automobile.
- To gain knowledge about alternate fuels for gasoline and diesel and their impact on performance, emission and combustion.

UNIT I VEHICLE STRUCTURE AND ENGINES
Types of automobiles, vehicle construction and different layouts, types of chassis, frame and body, resistances to vehicle motion and need for a gearbox, components of engine-their forms, functions and materials

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 types – transistorized coil ignition system, Capacitive discharge ignition system, Turbo and super chargers, Engine emission control by three way catalytic converter system.

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 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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To gain knowledge on the principles and procedure for the design of power Transmission Components.
- To understand the standard procedure available for Design of Transmission systems
- To learn to use standard data and catalogues.

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 12

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 12

UNIT III BEVEL, WORM GEARS AND CROSSED HELICAL GEARS 12

UNIT IV DESIGN OF GEAR BOXES 12

UNIT V DESIGN OF CAM, CLUTCHES AND BRAKES 12
Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches – axial clutches-cone clutches-internal expanding rim clutches-internal and external shoe brakes.

L:45 T:15, TOTAL: 60 PERIODS

(Note: Usage of P.S.G Design Data Book is permitted in the University examination)

TEXT BOOKS:

REFERENCES:
STANDARDS:

1. IS 4460: Parts 1 to 3: 1995, Gears – Spur and Helical Gears – Calculation of Load Capacity.
2. IS 7443 : 2002, Methods of Load Rating of Worm Gears
OBJECTIVES:
- To equip the students with the Finite Element Analysis fundamentals.
- To formulate the design problems into FEA.
- To perform engineering simulations using Finite Element Analysis.

INTRODUCTION (Not for examination) 5

UNIT I  FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS 8

UNIT II  ONE DIMENSIONAL FINITE ELEMENT ANALYSIS 12

UNIT III  TWO DIMENSIONAL FINITE ELEMENT ANALYSIS 14

UNIT IV  DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD 12

UNIT V  APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS 9
One dimensional and 2-dimensional heat transfer element – applications - Application of 2-D fluid mechanics problems.

TOTAL: 60 PERIODS

TEXT BOOK:
REFERENCES:
OBJECTIVES:

- To understand the basic difference between incompressible and compressible flow.
- To understand the flow through nozzles and diffusers.
- To understand the flow through constant area ducts with heat transfer and friction.
- To understand the phenomenon of shock waves and its effect on flow.
- To gain some basic knowledge about jet propulsion and Rocket Propulsion.

(Use of Approved Gas Tables is permitted in the examination)

UNIT I  BASIC CONCEPTS AND ISENTROPIC FLOWS  12
Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Mach number, critical Mach number and Crocco Number - Effect of Mach number on compressibility – Isentropic flow through variable area- Use of Gas tables.

UNIT II  FLOW THROUGH DUCTS  12
Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow), Isothermal Flow – variation of flow properties – Use of tables and charts.

UNIT III  NORMAL AND OBLIQUE SHOCKS  12
Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl- Meyer relations – Rankine-Hugoniot equation - Use of table and charts – Applications.

UNIT IV  JET PROPULSION  12
Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V  SPACE PROPULSION  12

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- Introduction to engineering ethics, which stresses analytical reasoning and emphasizes clear thinking regarding the application of professional ethical codes to specific cases.

UNIT I  ENGINEERING ETHICS  9

UNIT II  ENGINEERING AS SOCIAL EXPERIMENTATION  9
Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III  ENGINEER’S RESPONSIBILITY FOR SAFETY  9

UNIT IV  RESPONSIBILITIES AND RIGHTS  9

UNIT V  GLOBAL ISSUES  9

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
LIST OF EXPERIMENTS (Minimum 12 Experiments to be conducted)

1. Thermal conductivity of slab by two slab guarded hot plate method.
2. Thermal conductivity of insulating material using lagged pipe apparatus.
3. Heat transfer through composite walls.
4. Heat transfer from a pin-fin (natural & forced convection modes)
5. Heat transfer in forced convection.
7. Performance test on Vapour compression refrigeration system.
8. Performance test on LPG refrigeration system.
10. Performance test on Air Conditioning Test rig.
11. Performance test on two stage reciprocating air compressor
12. Performance test on Rotary Air compressor.

LIST OF EQUIPMENT (for a batch of 30 students)

1. Guarded plate apparatus – 1 No.
2. Lagged pipe apparatus – 1 No.
3. Natural convection-vertical cylinder apparatus – 1 No.
5. Pin-fin apparatus – 1 No.
7. Emissivity measurement apparatus – 1 No.
8. Parallel/counter flow heat exchanger apparatus – 1 No.
9. Single/two stage reciprocating air compressor – 1 No.
10. Refrigeration test rig – 2 Nos
11. Air-conditioning test rig – 1
12. Rotary Air Compressor
LIST OF EXPERIMENTS (Minimum 12 Experiments to be conducted)

1. Calibration of Vernier/Micrometer/Dial Gauge Checking
2. Measurements of Gear Tooth Dimensions
3. Measurement of Angle using sine bar/sine center
4. Measurement of straightness and flatness
5. Setting up of comparators for inspection Mechanical/Pneumatic/Electrical)
6. Measurement of Temperature using Thermocouple/Measurement of Displacement
7. Motorized gyroscope – Study of gyroscopic effect and couple.
8. Governor - Determination of range sensitivity, effort for Porter Governor.
9. Governor - Determination of range sensitivity, effort for Proell Governor.
10. Cams – Cam profile drawing.

LIST OF EQUIPMENT (For a batch of 30 students)

- Micrometer - 5
- Vernier Caliper - 5
- Vernier Height Gauge - 2
- Vernier depth Gauge - 2
- Slip Gauge Set - 1
- Gear ToothVernier - 1
- SineBar - 1
- Sine Center - 1
- Bevel Protractor - 1
- Profile Projector/Tool Makers Microscope - 1
- Mechanical/Electrical/Pneumatic Comparator - 1
- Autocollimator - 1
- Temperature Measuring Setup - 1
- Displacement Measuring Setup - 1
- Motorized gyroscope - 1
- Governor setup - 1
- Cam and follower arrangement - 1
- Whirling of shaft apparatus - 1
- Dynamic balancing apparatus - 1

Students should be familiar with the use of the following device/equipments depending upon availability.

1. Tachometers – Contact and non contact
2. Dial gauge
OBJECTIVES

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

UNIT I  INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM — Contributions of Deming, Juran and Crosby – Cost of Quality, Analysis Techniques for Quality Costs -Barriers to TQM.

UNIT II  TQM PRINCIPLES

UNIT III  TQM TOOLS & TECHNIQUES I

UNIT IV  TQM TOOLS & TECHNIQUES II

UNIT V QUALITY SYSTEMS

TEXT BOOKS

REFERENCES
OBJECTIVES

- To create awareness about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations.

UNIT I  LINEAR MODEL  12
The phases of OR study – Mathematical formulation of L.P. Problems. Graphical solution methods – The Simplex method - slack, surplus and artificial variables, two phase method, dual simplex method, degeneracy and procedure for resolving degenerate cases. (Introduction to Application software’s. – Not for Exams)

UNIT II  TRANSPORTATION, ASSIGNMENT AND TRAVELLING SALES MAN PROBLEMS  12

UNIT III  PERT-CPM TECHNIQUES AND INVENTORY MODEL  12
CPM - Network construction, determining critical path, floats, scheduling by network, project duration, PERT -variance under probabilistic models, prediction of date of completion, crashing of simple networks.
Types of Inventory- EOQ –ERL- Deterministic inventory problems – Price breaks - Stochastic inventory problems- selective inventory control techniques.

UNIT IV  REPLACEMENT AND SEQUENCING MODELS  12
Replacement of items that deteriorate with time – value of money changing with time – not charging with time – optimum replacement policy – individual and group replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with m machines.

UNIT V  QUEUING THEORY  12

TEXT BOOKS:

REFERENCES:
OBJECTIVES

• To gain knowledge about the concept of CAD.
• To gain knowledge on how computers are integrated at various levels of planning and manufacturing.

UNIT I  INTRODUCTION TO COMPUTER AIDED DESIGN  9
Output primitives – Point, Line, Circle drawing algorithms - Attributes of output primitives – 2D and 3D Geometric transformation – Scaling, Rotation, Translation. Two dimensional viewing –Line, Polygon, Curve and Text clipping algorithms

UNIT II  GEOMETRIC MODELING  9
Wire frame modeling -Mathematical representation of curves, wire frame models, wire frame entities. Surface Modeling -Mathematical representation of surfaces, Surface model, Surface entities, surface representation. Solid Modelling - Solid Representation - Boundary Representation (B-rep), Constructive Solid Geometry (CSG) and other methods.

UNIT III  COMPONENTS OF CIM  9
CIM as a concept and a technology, CASA/SME model of CIM, CIM II, benefits of CIM, communication matrix in CIM, fundamentals of computer communication in CIM – CIM data transmission methods – serial, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex. Types of communication in CIM – point to point (PTP), star and multiplexing. Computer networking in CIM – the seven layer OSI model LAN model, MAP model, network topologies – star, ring and bus, advantages of networks in CIM

UNIT IV  GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING  9

UNIT V  SHOP FLOOR CONTROL AND INTRODUCTION TO FMS  9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES:
OBJECTIVES

• To understand the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.

UNIT I  MECHATRONICS, SENSORS AND TRANSDUCERS  9

UNIT II  ACTUATION SYSTEMS  9

UNIT III  SYSTEM MODELS AND CONTROLLERS  9

UNIT IV  INTRODUCTION TO PROGRAMMING LOGIC CONTROLLERS  9

UNIT V  DESIGN OF MECHATRONICS SYSTEM  9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
LIST OF EXERCISES USING STANDARD FEA SOFTWARE

One dimensional

1. Structural analysis of a cantilever beam and bar.
2. Stress analysis of a simply supported beam
3. Structural analysis of a fixed beam

Two dimensional

1. Stress analysis of rectangular plate with hole
2. Stress analysis of an axisymmetric component
3. Structural analysis of an L bracket
4. Modal analysis of Different beam
5. Modal analysis of rectangular plate
6. Conductive heat transfer analysis of a rectangular plate
7. Combined conductive and convective heat transfer analysis of a rectangular plate
8. Thermal stress analysis of a rectangular beam
9. Transient conduction heat transfer analysis
10. Harmonic analysis of Cantilever beam

TOTAL: 45 PERIODS
LIST OF EXPERIMENTS

1. Design and testing of fluid power circuits to control
   (i) Velocity (ii) direction and (iii) force of single and double acting actuators.
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
5. Speed Control of AC & DC drives.
7. PID controller interfacing.
8. Stepper motor interfacing with 8051 Micro controller - Full step resolution
10. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW.
11. Computerized data logging system with control for process variables like pressure flow and temperature.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT (For a batch of 30 students)

1. Basic Pneumatic Trainer Kit with manual and electrical controls/PLC Control each - 1 No.
2. Basic Hydraulic Trainer Kit - 1 No.
4. 8051 - Microcontroller kit with stepper motor and drive circuit sets - 2 No.
5. LAB VIEW software with Sensors to measure Pressure, Flow rate, direction, speed, velocity and force seats - 2 No.
OBJECTIVE
- The objective of comprehension is to provide opportunity for the student to apply the knowledge acquired during the earlier semesters to real life problems which he/she may have to face in future as an engineer.

METHODOLOGY
- While learning as how to solve the real life problems, student will receive guidance from the faculty and also review various courses learnt earlier.
- Further this comprehension is to achieve an understanding of the fundamentals of contemporary manufacturing systems including materials, manufacturing process, product and process control, computer integrated manufacture and quality.
- The students work in groups and solve a variety of problems given to them.
- The problems given to the students should be of real like industrial problems selected by a group of faculty members of the concerned department.
- A minimum of three small problems have to be solved by each group of students.
- The evaluation is based on continuous assessment by a group of Faculty Members constituted by the professor in-charge of the course.

TOTAL: 45 PERIODS
OBJECTIVES

- To get the skills needed to successfully manage an organization.
- To understand concepts of strategic and tactical organizational planning.
- Implement employee motivational approaches and conflict management skills.
- To describe common performance appraisal processes.
- To understand group and team management, management development, and employee training.
- Describe concepts of controlling and control systems.

UNIT I  FOUNDATIONS

UNIT II  MANAGERS AND ENVIRONMENT

UNIT III  FUNCTIONAL AREA OF ORGANISATION

UNIT IV  MOTIVATION AND DIRECTIONS

UNIT V  CONTROLLING STRATEGIES

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
BME810

POWER PLANT ENGINEERING

L T P C
3 0 0 3

OBJECTIVE

• To understand the various components, operations and applications of different types of power plants

UNIT I

INTRODUCTION TO POWER PLANTS AND BOILERS

Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas turbine Power Plants Combined Power cycles
--- Steam boilers and cycles – High pressure and Super Critical Boilers – Fluidized Bed combustion and boilers

UNIT II

STEAM POWER PLANT

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

UNIT III

NUCLEAR AND HYDEL POWER PLANTS


UNIT IV

DIESEL AND GAS TURBINE POWER PLANT

Types of diesel plants, components, Selection of Engine type, applications-Gas turbinepower plant- Fuels- Gas turbine material – open and closed cycles- reheating – Regeneration and intercooling – combines cycle

UNIT V

UNCONVENTIONAL POWER PLANTS AND ECONOMICS

Geo thermal - OTEC – Wind power plant – Tidal – Solar central receiver system. Cost of electric Energy- Fixed and operating costs - Energy rates - Types tariffs - Economics of load sharing, comparison of various power plants. Load Curves

TOTAL: 45 PERIODS

TEXT BOOKS


REFERENCES

BGE801 ENGINEERING ECONOMICS AND COST ANALYSIS L T P C
3 0 0 3

OBJECTIVES
• To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.

UNIT I INTRODUCTION TO ECONOMICS

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

UNIT III CASH FLOW
Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method.

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

UNIT V DEPRECIATION

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVES

- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

TEAM WORK AND INCLUSION

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.

- Every project work shall have a guide who is the member of the faculty of the institution.
- Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
- 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.
- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
- This final report shall be typewritten form as specified in the guidelines.
- The continuous assessment shall be made as prescribed in the regulations.
OBJECTIVES:
- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

UNIT I  INTRODUCTION AND PROCESS CONTROL FOR VARIABLES  10
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation –Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart -process capability – process capability studies and simple problems. Six sigma concepts.

UNIT II  PROCESS CONTROL FOR ATTRIBUTES  8
Control chart for attributes –control chart for nonconforming– p chart and np chart –control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III  ACCEPTANCE SAMPLING  9

UNIT IV  LIFE TESTING - RELIABILITY  9

UNIT V  QUALITY AND RELIABILITY  9

Note: Use of approved statistical table permitted in the examination.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To provide knowledge on various refrigeration cycles, system components and refrigerants.
- To provide knowledge on design aspects of Refrigeration & Air conditioning Systems.

UNIT I  REFRIGERATION CYCLE  7

UNIT II  REFRIGERANTS AND SYSTEM COMPONENTS  10

UNIT III  PSYCHROMETRY  10
Psychrometric processes - use of psychrometric charts – Grand and Room Sensible Heat Factors – bypass factor – air washers, requirements of comfort air conditioning, summer and Winter Air conditioning.

UNIT IV  AIR CONDITIONING SYSTEMS  9

UNIT V  UNCONVENTIONAL REFRIGERATION CYCLES  9

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
• At the end of the course, the student are expected to Understand and analyze the pattern of renewable energy resources Suggest methodologies / technologies for its utilization Economics of the utilization and environmental merits

UNIT I   SOLAR ENERGY  9

UNIT II   WIND ENERGY  9

UNIT III  BIO – ENERGY  9

UNIT IV   OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY  9

UNIT V   HYDROGEN AND FUEL CELLS  9
Hydrogen, generation, storage, transport and utilization, Applications: power generation, transport – Fuel cells – technologies, types – economics and the power generation

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To recognize the laws of friction, mechanisms of friction, friction space, stiction, stick slip, and surface temperature.
- Appreciate the various modes of wear: (adhesive, delamination, fretting, abrasive, erosive, Corrosive, oxidational mild and severe), melt, and the wear-mechanism maps.
- Identify types of lubrication: boundary, solid-film, hydrodynamic, and hydrostatic lubrication.

UNIT I  SURFACES AND FRICTION  

UNIT II  WEAR  

UNIT III  LUBRICANTS AND LUBRICATION TYPES  

UNIT IV  FILM LUBRICATION THEORY  

UNIT V  SURFACE ENGINEERING AND MATERIALS FOR BEARINGS  

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- The student will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components

UNIT I    BASICS OF VIBRATION 9
Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT II   BASICS OF NOISE 9
Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III   AUTOMOTIVE NOISE SOURCES 9

UNIT IV   CONTROL TECHNIQUES 9
Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V   SOURCE OF NOISE AND CONTROL 9
Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

UNIT I  INTRODUCTION  

UNIT II MECHANICAL ENERGY BASED PROCESSES  

UNIT III ELECTRICAL ENERGY BASED PROCESSES  

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES  

UNIT V THERMAL ENERGY BASED PROCESSES  
Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques –Applications.

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- To introduce the process planning concepts to make cost estimation for various Products after process planning

UNIT I WORK STUDY AND ERGONOMICS

UNIT II PROCESS PLANNING

UNIT III INTRODUCTION TO COST ESTIMATION
Importance and aim of cost estimation - costing – cost accounting- classification of cost- Elements of cost.

UNIT IV COST ESTIMATION
Types of estimates – methods of estimates – data requirements and sources- collection of cost- allowances in estimation- Difference between costing and estimation.

UNIT V PRODUCTION COST ESTIMATION
Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs in forging and welding shops.

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
OBJECTIVES:
- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES

UNIT II JIGS AND FIXTURES
Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box., pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES

UNIT IV BENDING FORMING AND DRAWING DIES

UNIT V MISCELLANEOUS TOPICS
Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries.

(Use of PSG design Data Book permitted).

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To understand the fundamentals of composite material strength and its mechanical behavior.
- Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS MANUFACTURING


UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS


UNIT III LAMINA STRENGTH ANALYSIS


UNIT IV THERMAL APPLICATIONS


UNIT V ANALYSIS OF LAMINATED FLAT PLATES


TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To understand the various systems, principles, operations and applications of different
types of turbo machinery components.

UNIT I PRINCIPLES  9
Energy transfer between fluid and rotor-classification of fluid machinery,-dimensionless
parameters-specific speed-applications-stage velocity triangles-work and efficiency.

UNIT II CENTRIFUGAL FANS AND BLOWERS  9
Types- stage and design parameters-flow analysis in impeller blades-volute and diffusers, losses,
characteristic curves and selection, fan drives and fan noise.

UNIT III CENTRIFUGAL COMPRESSOR  9
Construction details, impeller flow losses, slip factor, diffuser analysis, losses and performance
curves.

UNIT IV AXIAL FLOW COMPRESSOR  9
Stage velocity diagrams, enthalpy-entropy diagrams, stage losses and efficiency, work done,
simple stage design problems and performance characteristics.

UNIT V AXIAL AND RADIAL FLOW TURBINES  9
Stage velocity diagrams, reaction stages, losses and coefficients, blade design principles, testing
and performance characteristics.

TOTAL: 45 PERIODS

TEXT BOOK:
   1996.

REFERENCES:
   1990.
   India Pvt. Ltd., 2002.
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.

PREREQUISITE:
Fundamental Knowledge of partial differential equations, Heat Transfer and Fluid Mechanics

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

UNIT II FINITE DIFFERENCE METHOD 9

UNIT III FINITE VOLUME METHOD (FVM) FOR DIFFUSION 9
Finite volume formulation for steady state One, Two and Three-dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank –Nicolson and fully implicit schemes.

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

UNIT V CALCULATION FLOW FIELD BY FVM 9
Representation of the pressure gradient term and continuity equation – Staggered grid –Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants. Turbulence models, mixing length model, Two equation (k-\( \varepsilon \)) models – High and low Reynolds number models.

TOTAL: 45 PERIODS

TEXT BOOKS:
REFERENCES:
OBJECTIVES:
- To learn and study the radiation principles with respective solar energy estimation
- To study the various collecting techniques of solar energy and storage
- To learn about PV technology principles and techniques of various solar cells / materials for energy conversion
- To learn economical and environmental merits of solar energy for variety of applications

UNIT I  SOLAR RADIATION  9

UNIT II  SOLAR FLAT PLATE COLLECTORS  9

UNIT III  SOLAR CONCENTRATING COLLECTORS  9

UNIT IV  PHOTOVOLTAIC SYSTEMS  9

UNIT V  APPLICATIONS OF SOLAR HEAT  9

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES
OBJECTIVE

- To gain some fundamental knowledge about nuclear physics, nuclear reactor, nuclear fuels, reactors and safe disposal of nuclear wastes.

UNIT I  NUCLEAR PHYSICS  9
Nuclear model of an atom-Equivalence of mass and energy-binding- radio activity-half life-neutron interactions-cross sections.

UNIT II  NUCLEAR REACTIONS AND REACTION MATERIALS  9
Mechanism of nuclear fission and fusion- radio activity- chain reactions- critical mass and composition nuclear Fuel cycles and its characteristics- uranium production and purification-Zirconium, thorium, beryllium.

UNIT III  REPROCESSING  9
Reprocessing: nuclear fuel cycles-spent fuel characteristics-role of solvent extraction in reprocessing solvent Extraction equipment.

UNIT IV  NUCLEAR REACTOR  9
Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding reactors-heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors.

UNIT V  SAFETY AND DISPOSAL  9

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- To study the basics and important applications of nano technology.

UNIT I INTRODUCTION
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS
Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES
Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, (dry Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS
Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V CHARACTERISATION TECHNIQUES
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

TOTAL: 45 PERIODS

TEXT BOOKS:

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

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

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

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

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

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

TEXT BOOKS:
REFERENCES:
OBJECTIVES:

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

UNIT I   PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING  10

UNIT II   MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE  9
Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repairs cycle - Principles and methods of lubrication – TPM.

UNIT III  CONDITION MONITORING  9
Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis

UNIT IV   REPAIR METHODS FOR BASIC MACHINE ELEMENTS  9
Repair methods for beds, slideways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V   REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT  8
Repair methods for Material handling equipment - Equipment records – Job order systems - Use of computers in maintenance.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:

- To enable the student to understand the several aspects of the design process and to apply them in practice. Also to train the student in the concept of product costing and other manufacturing economics in optimization of product design.

UNIT I       PRODUCT DESIGN AND DEVELOPMENT     8

UNIT II    ECONOMICS OF DESIGN       9
Breaks even point - Selection of optimal materials and processes – Material layout planning – Value analysis – Re-engineering and its impact on product development.

UNIT III   PRODUCT MODELING       9

UNIT IV  PRODUCT COSTING                 10
Bill of materials – Outline Process charts – Concepts of operational standard time - Work measurement by analytical estimation and synthesis of time – Budgets times – Labor cost and material cost at every stage of manufacture – W.I.P. costing

UNIT V   RECENT ADVANCES AND CONCEPTS IN PRODUCT DESIGN  9
Fundamentals of FEM and its significance to product design – Product life cycle management – Intelligent information system – Concept of Knowledge based product and process design.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the different types of stresses and their effects in pressure vessel.
- To understand the piping layout and the stresses acting on it.

UNIT I CYLINDRICAL SHELL AND VARIOUS CLOSURES
Membrane theory for thin shells, stresses in cylindrical, spherical and conical shells, dilation of above shells, general theory of membrane stresses in vessel under internal pressure and its application to ellipsoidal and torispherical end closures. Bending of circular plates and determination of stresses in simply supported and clamped circular plate. Introduction to ASME code and formulae

UNIT II JUNCTION STRESSES, OPENING AND REINFORCEMENTS
Discontinuity stresses. Stress concentration in plate having circular hole due to bi-axial loading. Theory of reinforced opening and reinforcement limits.

UNIT III SUPPORT DESIGN
Supports for vertical & horizontal vessels. Design of base plate and support lugs. Types of anchor bolt, its material and allowable stresses. Design of saddle supports.

UNIT IV BUCKLING IN VESSELS
Buckling of vessels under external pressure. Elastic buckling of long cylinders, buckling modes, collapse under external pressure. Design for stiffening rings. Buckling under, combined external pressure and axial loading.

UNIT V PIPING STRESS ANALYSIS

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
1. ASME Pressure Vessel and Boiler code, Section VIII Div 1 & 2, 2003.
2. American standard code for pressure piping , B 31.1
OBJECTIVES:

- To study combustion chambers and combustion process of S.I and C.I. engines.
- To update the knowledge in engine exhaust emission & its control and alternate fuels.
- To enable the students to understand the recent developments in IC Engines.

UNIT I  SPARK IGNITION ENGINES

UNIT II  COMPRESSION IGNITION ENGINES
Stages of combustion-normal and abnormal combustion – Factors affecting knock, Direct and Indirect injection systems, Combustion chambers, Turbo charging, Introduction to Thermodynamic Analysis of CI Engine Combustion process.

UNIT III  ENGINE EXHAUST EMISSION AND CONTROL
Formation of NOX , HC/CO mechanism, Smoke and Particulate emissions, Green House Effect, Methods of controlling emissions, Three way catalytic converter and Particulate Trap, Emission (HC, CO, NO and NOX) measuring equipments, Smoke and Particulate measurement, Indian Driving Cycles and emission norms

UNIT IV  ALTERNATE FUELS

UNIT V  RECENT TRENDS IN IC ENGINES

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:

• To learn the sizing of heat exchangers, thermal and mechanical stress analysis for various heat exchange applications.

UNIT I    DIFFERENT CLASSIFICATION OF HEAT EXCHANGERS     9
Parallel flow, counter flow and cross flow; shell and tube and plate type; single pass and multipass; once through steam generators etc;

UNIT II    PROCESS DESIGN OF HEAT EXCHANGERS     9
Heat transfer correlations, Overall heat transfer coefficient, LMTD, sizing of finned tube heat exchangers, U tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III    MECHANICAL DESIGN OF SHELL AND TUBE TYPE     9
Thickness calculation, Tubesheet design using TEMA formula, concept of equivalent plate for analyzing perforated analysis, flow induced vibration risks including acoustic issues and remedies, tube to tubesheet joint design, buckling of tubes, thermal stresses

UNIT IV    COMPACT AND PLATE HEAT EXCHANGER     9
Types – Merits and Demerits – Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations

UNIT V    CONDENSORS AND COOLING TOWERS     9
Design of surface and evaporative condensers – cooling tower – performance characteristics

TOTAL: 45 PERIODS

REFERENCES:

OBJECTIVES:

- To understand the basic concepts associated with the design and functioning and applications of Robots. To study about the drives and sensors used in Robots.
- To learn about analyzing robot kinematics and robot programming.

UNIT I  FUNDAMENTALS OF ROBOT  7

UNIT II  ROBOT DRIVE SYSTEMS AND END EFFECTORS  10

UNIT III  SENSORS AND MACHINE VISION  10

UNIT IV  ROBOT KINEMATICS AND ROBOT PROGRAMMING  10
Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom in 2 Dimensional, Four Degrees of Freedom in 3 Dimensional – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs

UNIT V  IMPLEMENTATION AND ROBOT ECONOMICS  8
RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
BME022  SOLAR PHOTOVOLTAIC FUNDAMENTALS AND APPLICATIONS  

OBJECTIVES:
To impart knowledge on
1. Capability of understanding the fundamentals of solar cells
2. Proficient to recognize various technology up gradations along with their benefits
3. Competent to design & analyze on-grid PV applications
4. Skilled to design & analyze off-grid PV applications
5. Ability to realize cost benefit analysis of PV installations

UNIT I  ESSENTIAL BASICS OF SOLAR CELL

UNIT II  COMMERCIAL AND DEVELOPING TECHNOLOGIES
Commercial technologies - Mono crystalline and Multi crystalline, Silicon - Wafer based Solar cell, Thin film solar cells – A-Si, Cd-Te and CIGS, Concentrated PV cells, Developing technologies – Organic cells, Dye sensitized cells.

UNIT III  SOLAR PV FOR ON-GRID APPLICATIONS

UNIT IV  SOLAR PV FOR OFF-GRID APPLICATIONS
Off-Grid stand alone PV system - System sizing – Module and Battery - Storage – Batteries for PV systems – Sun Tracking mechanism – Types of tracking – One-axis, Two-axis - Maximum power point tracking – Design and analysis - Performance evaluation and monitoring - Field visit – Off-grid PV system

UNIT V  COST BENEFIT ANALYSIS FOR SOLAR PV INSTALLATIONS

TEXT BOOK :

REFERENCE BOOKS:
2. “Solar Electricity: Engineering of Photovoltaic Systems” by Eduardo Lorenzo, PROGENSA.
4. www.pveducation.org
OBJECTIVES:
- Introduction to all aspects of marketing, including strategic marketing planning, marketing research, product planning and development, promotion planning, distribution and pricing.
- To provide an understanding of the theories of the marketing mix variables, and a practical application in the context of the marketing management cycle processes of research, planning, organization, implementation and control.

UNIT I  MARKETING PROCESS  9
Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

UNIT II  BUYING BEHAVIOUR AND MARKET SEGMENTATION  9
Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psychographic and geographic segmentation, process, patterns.

UNIT III  PRODUCT PRICING AND MARKETING RESEARCH  9
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV  MARKETING PLANNING AND STRATEGY FORMULATION  9
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V  ADVERTISING, SALES PROMOTION AND DISTRIBUTION  9
Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:

- To develop the entrepreneurship potential by providing requisite skills and knowledge to start a successful business enterprise.

UNIT I  ENTREPRENEURSHIP  9

UNIT II  MOTIVATION  9
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III  BUSINESS  9

UNIT IV  FINANCING AND ACCOUNTING  9

UNIT V  SUPPORT TO ENTREPRENEURS  9

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To provide the students with the concepts and techniques that are applied to the design, planning, control and improvement of manufacturing and service operating systems.

UNIT I INTRODUCTION TO PRODUCTION AND OPERATIONS MANAGEMENT

UNIT II FORECASTING, CAPACITY AND AGGREGATE PLANNING
Demand Forecasting – Need, Types, Objectives and Steps. Overview of Qualitative and Quantitative methods. Capacity Planning – Long range, Types, Rough cut plan, Capacity Requirements Planning (CRP), developing capacity alternatives. Aggregate Planning – Approaches, costs, relationship to Master Production schedule. Overview of MRP, MRP II and ERP.

UNIT III DESIGN OF PRODUCT, SERVICE AND WORK SYSTEMS

UNIT IV MATERIALS MANAGEMENT

UNIT V PROJECT AND FACILITY PLANNING

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
BGE002  INDUSTRIAL SAFETY ENGINEERING  L T P C
3 0 0 3

OBJECTIVE:
• To understand the basic concepts and Principles in the area Safety, health and hazards.

UNIT I  ACCIDENT INVESTIGATION AND ANALYSIS  9
Concept of an Accident, reportable and non reportable accidents, reporting to statutory authorities.
Principles of accident prevention-accident investigation and analysis-Unsafe act and unsafe condition-
Domino sequence-cost of accidents-permanent total disabilities, Permanent partial disabilities,
Temporary total disabilities-Calculation of frequency rate and severity rate of accidents.

UNIT II  ERGONOMICS AND HUMAN BEHAVIOUR  9
Introduction to ergonomics and its area of application in the work system. Anatomy, Posture and body
mechanics-low back pain, risk factors for musculoskeletal disorders in the work place-behavioral
aspects of posture - effectiveness. Individual differences, Factors contributing to personality, fitting
the man to the job. Motivation -job satisfaction - Frustration and conflicts, reaction to frustration,
emotion and frustration. Attitudes - determination of attitudes- changing attitudes.

UNIT III  HAZARDS AND THEIR CONTROL  9
Physical hazards-Noise, heat, vibration, ionizing and non ionizing radiations, and effects. Chemical
hazards-dusts, fumes, mist, vapor, fog, gases, types, concentration, exposure Vs dose, TLV.
Mechanical hazards. Engineering control methods- use of personal protective equipments.

UNIT IV  FIRE PREVENTION AND PROTECTION  9
Fire triangle-principles of fire extinguishing- various classes of fires- A, B, C, D types of fire
extinguishers- Industrial fire protection systems. Sprinklers- Fire hydrants- Alarm and detection
systems- other suppression systems- CO₂ system, foam system and DCP system.

UNIT V  SAFETY MANAGEMENT TECHNIQUES, EDUCATION AND TRAINING  9
Incident Recall Technique (IRT), disaster control, Job safety Analysis, Safety survey, safety
inspection. Safety training programs, seminars, conferences, competitions- method of promoting safe
practice- motivation- creating awareness, awards, celebrations, safety posters, safety displays, safety
incentive scheme- domestic safety and training.

TOTAL: 45 PERIODS

TEXT BOOKS:
Seller, New Delhi, 1989.
3. E.J.McCormick and M.S. Sanders “Human Factors in Engineering and Design”, TMH, New
Delhi, 1982.

REFERENCES: