# 2017

# SYLLABUS SCHEME

## B. TECH IN MECHANICAL ENGINEERING

VEER MADHO SINGH BHANDARI
UTTARAKHAND TECHNICAL UNIVERSITY

SHIVALIK
COLLEGE OF ENGINEERING

EVALUATION SCHEME & SYLLABUS

W.E.F. ACADEMIC SESSION 2009-10

# SCHEME OF EXAMINATION

# &

# SYLLABI

# for

## B.Tech I$^{st}$Year (Common to All B.Tech Courses)

## (Effective from the session: 2009-2010)

**Uttrakhand Technical University,Dehradun**

# UTTRAKHANDTECHNICAL UNIVERSITY, DEHRADUN
## STUDY AND EVALUATION SCHEME
## B.Tech I$^{st}$Year (Common to All B.Tech Courses)
## (Effective from the session: 2009-2010)
### Year: I, Semester-1

| S.No | Course Code | Subject | Periods | | | EVALUATION SCHEME | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SESSIONAL EXAM | | | External Exam. | Subject Total | |
| | | | L | T | P | CT | TA | Total | | | |
| 1 | TMA 101 | Mathematics - I | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 | 4 |
| 2 | TPH 101 / TCY 101 | Engg,Physics / Engg.Chemistry | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 | 4 |
| 3 | THM 101 | Basic Technical Communication – I | 3 | 0 | 2 | 40 | 10 | 50 | 100 | 150 | 3 |
| 4 | TEE 101 / TME 101 | Basic Electrical Engineering / Mechanical Engineering | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 | 4 |
| 5 | TCS 101 / TEC 101 | Fundamentals of Computer & Programming / Fundamentals of Electronic Engineering | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 | 4 |
| * | TES 101 | Environmental Studies | 2 | 0 | 0 | - | - | - | - | - | - |
| | | **Practicals** | | | | | | | | | |
| 1 | PPH 101 / PCY 101 | Physics / Chemistry | 0 | 0 | 2 | - | - | 25 | 25 | 50 | 2 |
| 2 | PEE 101 / PME 101 | Basic Electrical Engineering / Mechanical Engineering | 0 | 0 | 2 | - | - | 25 | 25 | 50 | 2 |
| 3 | PCS 101 / PEC 101 | Fundamentals of Computer & Programming / Fundamentals of Electronic Engineering | 0 | 0 | 2 | - | - | 25 | 25 | 50 | 2 |
| 4 | PWS 101/PED 101 | Workshop Practice / Engineering Drawing | 0 | 0 | 2 | - | - | 25 | 25 | 50 | 2 |
| | | **TOTAL** | - | - | - | | | | | **950** | **27** |

# UTTRAKHANDTECHNICAL UNIVERSITY, DEHRADUN
## STUDY AND EVALUATION SCHEME
## B.Tech I$^{st}$Year (Common to All B.Tech Courses)
## (Effective from the session : 2009-2010)
### Year: I, Semester-1I
UTTRAKHANDTECHNICAL UNIVERSITY, DEHRADUN

| S.No | Course Code | Subject | Periods | | | EVALUATION SCHEME | | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SESSIONAL EXAM | | | External Exam. | Subject Total | |
| | | | L | T | P | CT | TA | Total | | | |
| 1 | TMA 201 | Mathematics - II | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 | 4 |
| 2 | TCY 201 / TPH 201 | Chemistry / Physics | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 | 4 |
| 3 | THM 201 | Advanced Technical Communication | 3 | 0 | 2 | 30 | 20 | 50 | 100 | 150 | 3 |
| 4 | TME 201 / TEE 201 | Basic Mechanical Engineering / Electrical Engineering | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 | 4 |
| 5 | TEC 201 / TCS 201 | Fundamentals of Electronic Engineering / Fundamentals Computer & Programming | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 | 4 |
| * | TES 201 | Environmental Studies | 2 | 0 | 0 | 30 | 20 | 50 | - | 50 | - |
| | | **Practicals** | | | | | | | | | |
| 1 | PCY 201 / PPH 201 | Chemistry / Physics | 0 | 0 | 2 | - | - | 25 | 25 | 50 | 2 |
| 2 | PME 201 / PEE 201 | Basic Mechanical Engineering / Electrical Engineering | 0 | 0 | 2 | - | - | 25 | 25 | 50 | 2 |
| 3 | PEC 201 / PCS 201 | Fundamentals of Electronic Engineering / Fundamentals Computer & Programming | 0 | 0 | 2 | - | - | 25 | 25 | 50 | 2 |
| 4 | PED201/PWS 201 | Engineering Drawing / Workshop Practice | 0 | 0 | 2 | - | - | 25 | 25 | 50 | 2 |
| | | **TOTAL** | - | - | - | - | - | | | **1000** | **27** |

## MATHEMATICS –I (TMA101)

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|---|---|---|
| 3 | 1 | 0 |

**UNIT-1**

**Matrices** **10L**

Elementary row and column transformations Rank of matrix, linear dependence, Consistency of linear system of equations, Characteristic equation, Cayley-Hamilton theorem, Eigen values and Eigen vectors, Diagonalization, Complex and unitary matrices.

**UNIT-2**

**Differential Calculus-I** **9L**

Leibnitz theorem, Partial Differentiation, Euler‘s theorem, Change of variables, Expansion of functions of several variables.

**UNIT-3**

**Differential Calculus-II** **9L**

Jacobian, Approximations and errors, Extrema of functions of several variables, Lagrange method of multipliers

**UNIT-4**

**Multiple Integrals** **6L**

Double and triple integrals, Change of order, Change of variables, beta and gamma functions, Application to area, volume, Drichlet integral and applications.

**Vector Calculus** **6L**

Point functions, Gradient, divergence and curl of a vector and their physical interpretation, Line, surface and volume integrals, Green, Stokes and Gauss divergence theorem.

**References:**


- Advanced Engineering Mathematics, Kreyszig, Wiley India
- A Text book of Engineering Mathematics (Vol.1) by Peter V. O‘ Neil, Cengage Learning
- B. S. Grewal: higher Engineering Mathematics, *Khanna Publications.*
- N. Piskunov: Differential & Integral Calculus, *Moscow Peace Publications*.
  G Shankar Rao, Text book of engineering mathematics,BS Publication, Hyderabad


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# ENGINEERING PHYSICS (TPH-101/201)

**L T P**
**3 1 0**

**UNIT-I** **(8L)**

**Relativistic Mechanics:**

Inertial and Non-inertial Frames, Postulates of Special Theory of Relativit y, Galilean and Lorentz Transformation, Length Contraction and Time Dilation, Addition of Velocities, Mass Energy Equivalence and Variation of Mass with Velocity. **Radiation:** Kirchoff's Law, Stefan's law (only statement), Energy spectrum of Blackbody Radiation, Compton Effect.

**UNIT-II** **(8L)**

**Interference:** Coherent Sources, Conditions of Interference, Fresnel's Biprism Experiment, Displacement of Fringes, Interference in Thin Films – Wedge Shaped Film, Newton's Rings. **Diffraction:** Single and n-Slit Diffraction, Diffraction Grating, Raleigh's Criterion of Resolution, Resolving Power of Grating.

**UNIT-III** **(7L)**

**Polarization:** Phenomenon of Double Refraction, Ordinary and Extra-ordinary Rays, Nicol Prism, Production and Analysis of Plane, Circularly and Elliptically Polarized Light, Fresnel Theory, Optical Activity, Specific Rotation, Polarimeter. **Laser:** Principle of Laser Action, Einstein's Coefficients, Construction and Working of He-Ne and Ruby Laser.

**UNIT-IV** **(8L)**

**Electromagnetic:** Ampere's Law and Displacement Current, Maxwell's Equations in Integral and Differential Forms, Electromagnetic Wave Propagation in Free Space and Conducting Media, Pointing Theorem. **Magnetic Properties of Materials:** Basic Concept of Para- , Dia and Ferro-Magnetism, Langevin's Theory of Diamagnetism, Phenomenon of Hysteresis and Its Applications

**UNIT-V** **(9L)**

**Superconductivity:-**

Essential properties of superconductors (zero resistivity), London equations, penetration depth and coherence length, Meissner effect, critical field , critical current Isotope effect, heat capacity, Type I and Type II superconductors, Characteristics of superconductors in superconducting state, applications of superconductors. **Wave Mechanics :** Wave Particle Duality, de Broglie Concept of Matter Waves, Heisenberg Uncertainty Principle, Schrödinger Wave Equation and Its Applications: Particle in a Box.

## Reference Books:


- Introduction to Special theory of Relativity Robert Resnick – Wiley India
- Physics of Atoms ,Wehr Richards & Adia
- Fundamentals of Physics, Halliday, Wiley India
- Engineering Electromagnetics,William Hayt, 7th Ed.(TMH)
- Ashutosh Asthana, Engg. Physics, BS Publication, Hyderabad

## ENGINEERING CHEMISTRY (TCY -101/201)

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3 1 0

**UNIT – I GENERAL & ORGANIC CHEMISTRY 8L**

Molecular orbital diagram of diatomic molecules, valence bond theory & molecular orbital Theory linear combination of atomic orbitals, hybridization, hydrogen bonding, band theory of solids, liquid crystals with their classification applications, Bragg‘s Law, Fullerenes & their application , Nature of organic molecules, attacking reagents, inductive effect, electromeric, mesomeric (resonance) effect, hyper conjugation, reaction intermediates types of organic reaction (substitution, addition, elimination reaction & organic rearrangements), Saytzeff‘s rule, organic name reactions (cannizzaro‘s reaction, aldol condensation, Pinnacol-pinnacolon rearrangement, Beckmann‘s rearrangement, Hoffmann‘s rearrangement), Optical isomerism & confirmations, E-Z nomenclature, R-S configuration.

**UNIT – II PHYSICAL & WATER CHEMISTRY 10 L**

Rate of reaction, order & molecularity of reaction, Zero order, First Order, Second order reaction, steady state approximation, concept of activation energy, energy barrier, cell potential, liquid junction potential, conductance & its variation with dilution, Transport no. Kohlraush‘s Law and its application, pH, buffer solution, calculation of pH of buffer mixture solubility & solubility Product, Nernst distribution law & its application, corrosion, its type, Mechanism & control , Theory of Electrochemical corrosion. Hardness of water, boiler feed water, Softening of water (Calgon Process, Zeolite process, Lime Soda process & Ion exchange process), Reverse osmosis, treatment of boiler feed water.

**UNIT – III CHEMISTRY OF ENGINEERING MATERIALS 7 L** Introduction & classification of polymers, Types of Polymerization, bulk solution, suspension & emulsion, copolymers, vulcanization, PVC, Polyamides, Polyurethane, Polyethylene, Poly propylene, PET, Resins (Phenol Formaldehyde), PMMA, PAN, Rubber, Conducting and Biodegradable polymers, Pyroceramics, Toughened glass, Strengthening of glass, Refractories, Nano Composites, Protective Coatings, Fe, Al, Cu, Pb & Zn alloys, Organometallics & their applications.

**UNIT – IV FUELS & COMBUSTION 8 L**

Classification of Fuels, calorific value of fuel, gross & net calorific value, determination of calorific value using Bomb calorimeter, Coal, Biomass and Biogas, Bio Fuel, Esterification & Transesterification,Introduction of Lubricants, Mechanism of Lubrication, Classification of Lubricant, Bio Lubricant, Flash and Fire Point, Pour Point, Cloud Point, Aniline point, Viscosity index.

**UNIT – V ANALYTICAL METHODS AND APPLICATIONS 7 L**

Titrimetric analysis with reference to acid-base, redox, precipitation and complexometric titrations. Elementary ideas and simple applications of UV, visible, mass and NMR spectral techniques $^{1}$NMR spectral techniques.

**REFERENCE BOOKS**


- Engineering Chemistry – Wiley India
- Engineering chemistry by Sivasankar, TMH, New Delhi.
- Organic Chemistry by Morrisson & Boyd, Pearson Publication.
- Organic Chemistry by Loudon, Oxford University Press.
- C Parameswara Murthy, C V Agrawal and etal., Engineering Chemistry, BS Publication, Hyderabad

**BASIC ELECTRICAL ENGINEERING**
**(TEE101/201) EE 101**
**(*A*UTUMN/ SPRING) L T P**

**L T P**
**3 1 0**

**UNIT-1**
**D.C. Network Theory : 4**
Circuit theory concepts-Mesh and node analysis. Network Theorems- Super-position theorem. Thevenin‘s theorem, Norton‘s theorem, Maximum, Power Transfer theorem, Star Delta transformation.
**Steady State Analysis of A.C. Circuits : 5**
Sinusoidal and phasor representation of voltage and current: single phase A.C. circuit behavior of resistance, inductance and capacitance and their combination in series & parallel and power factor, series parallel resonance-band width and quality factor : magnetic circuit.
**UNIT-2**
**Three Phase A.C. Circuits : 4**
Star-Delta connections, line and phase voltage/current relations, three phase power and its measurement.
**3. Measuring Instruments: 4**
Construction and principle of operation of voltage and current measuring instruments; introduction to power and energy meters.
**UNIT-3**
**Transformer : 6**
Principle of operation, types of construction, phasor diagram, equivalent circuit, efficiency and voltage regulation of single phase transformer, O.C. and S.C. tests.
**Rotating Machine**
**Unit-4**
**D.C. Machines 6**
Principle of electromechanical energy conversion, types of d.c. machines, E.M.F. equation, Magnetization and load characteristics, losses and efficiency, Starter and speed control of d.c. motors, their applications.
**Synchronous Machines:** Principle of Operation of Alternator and synchronous motor. **2**
**UNIT-5**
**Three phase induction Motor 4**
Principle of operation, types and methods of starting, slip-torque characteristics, applications. **Single phase Motors :** Principle of operation and methods of starting of induction motor, Stepper motor and Universal motor **3**
**References :**


1. Dr. R. K. Singh and Dr. P.S. Subramanyam, Basic Electrical Engineering, BS Publication, Hyderabad.
2. Gaikwad, Basic Electrical Engineering, Wiley India
3. A.e. Fitgerald, D.E., Higginbotham and A Grabel, –Basic Electrical Engineering – Mc Graw Hill.
4. H. Cotton, –Advanced Electrical Technology‖ Wheeler Publishing.

**MECHANICAL ENGINEERING**

## ME 101 (Autumn / Spring)

LTP
3 1 0

**UNIT-1**

**Fundamental Concepts and Definitions** **8L**

Definition of thermodynamics, System, Surrounding and universe, Phase, Concept of continuum, Macroscopic & microscopic point of view. Density, Specific volume, Pressure, temperature. Thermodynamic equilibrium, Property, State, Path, Process, Cyclic and non cyclic processes, Reversible and irreversible processes, Quasi static process, Energy and its forms, Enthalpy.

**UNIT-2** **8L**

**Zeroth law:**

Zeroth law, Different temperature scales and temperature measurement **First law:**First law of thermodynamics. Processes - flow and non-flow, Control volume, Flow work and non-flow work, Steady flow energy equation, Unsteady flow systems and their analysis. **Second law:** Limitations of first law of thermodynamics, Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator. Statements of second law and their equivalence, Carnot cycle, Carnot theorem, Thermodynamic temperature scale, Clausius inequality. Concept of entropy.

**UNIT-3** **8L**

**Properties of steam:**

Properties of steam, Phase transformation process and its graphical representation on P-V, T-V & T-s diagram, Mollier diagram and Steam Tables, Processes involving steam in closed and open systems.

**Introduction to I.C. Engines:** Two & four stoke S.I. and C.I. engines. Otto cycle, Diesel cycle, Dual cycle.

**UNIT-4** **9L**

**Force system and Analysis**

**Basic concept:** Review of laws of motion, transfer of force to parallel position, resultant of planer force system, Free Body Diagrams, Equilibrium. **Friction:**Introduction, Laws of Coulomb friction, Equilibrium of bodies involving dry fiction.

**Structure Analysis**

**Beams:** Introduction, Shear force and bending moment, Shear force and bending moment diagram for statically determinate and indeterminate beams.

**Trusses:** Introductio n, Simple Trusses, Determination of forces in simple truss members, Method of joints and Method of section.

**UNIT-5** **9L**

**Stress and Strain Analysis**

**Simple stress and strain:** Introduction, Normal shear stresses, Stress-strain diagrams for ductile and brittle materials, Elastic constants, One dimensional loading of members of varying cross section, Strain energy, Thermal stresses.

**Compound stress and strains:** Introduction, State of plane stress, Principal stress and strain, Mohr‘s circle for stress and strain.

**Pure Bending of Beams:** Introduction, Simple bending theory, Stress in beams of different cross sections.**Torsion:** Introduction, Torsion of Shafts of circular section, Torque and Twist, Shear stress due to Torque.

**Reference:**


1. Agarwal, Basic Mechanical Engineering, Wiley India

3. Holman, J.P. : Thermodynamics, Mc Graw Hill book Co. NY.
4. Singh Onkar, Bhavikatti S.S., Chandra Suresh : Introduction to Mechanical Engineering: Thermodynamics, Mechanics and Strength of Materials, New Age International Publishers
5. Yadav R. : Thermodynamics and Heat Engines, Vol I & II (SI Edition) Central Publishing House Allahabad.

**FUNDAMENTALS OF COMPUTER & PROGRAMMING (TCS 101/201)**

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**UNIT-I** **8L**

Introduction to Computer Systems; Data representation: Number systems, character representation codes, Binary, hex, octal codes and their inter conversions. Binary arithmetic, Floating point arithmetic, signed and unsigned numbers IEEE standards,CPU organization, ALU, registers, memory, the idea of program execution at micro level. Concept of computing, contemporary Operating Systems such as DOS, Windows, UNIX etc. (only brief user level description). Introduction to organization and architecture of mainframe, mini and micro systems.

**UNIT-II** **8L**

Concept of flow chart and algorithm; Algorithms to programs: specification, top-down development and stepwise refinement ,Introduction to the design and implementation of correct, efficient and maintainable programs, structured Programming,,Use of high level programming language for the systematic development of programs, programmability and programming languages, Object codes, compilers. Introduction to the Editing tools such as vi or MS-VC editors.

**UNIT-III** **10L**

C: Data types, Identifiers, Storage class, Constant, Operators, expression, Statements, console I/O statements, Selection statements: if-else, switch, Iteration Statements: for, while, do-while, Jump statements: return, go to, break, continue, comments. Function, Call by value, Call by reference, arguments to main(), return statements, recursion, function prototypes, , preprocessor directives.

**UNIT-IV** **6L**

Arrays:

Single dimensional arrays, two dimensional arrays, multidimensional arrays, variable length arrays. Strings, array of strings. Structures: array of structures, passing structure to function, structure pointers, structure within structures. Unions, bit fields, enumerations.

**UNIT-V** **8L**

Pointers: pointer variables, pointer operator, pointer expression, array of pointers, multiple indirection, pointers to functions, dynamic allocation functions.

File I/O : Streams and files, file system basics, fread, fwrite, fseek, random access I/O, fprintf(), fscanf(), standard streams.

**Reference Book**


- Gupta: Computer Concepts & C Programming, Comdex
- Jones, C Programming with problem solving, Wiley India
- Let Us C : Yashwant Kanetkar [BPB]
- Mastering C ,K.R.Venugopal,S.R.Prasad[TMH]
- Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, [India Edition]

**FUNDAMENTALS OF ELECTRONIC ENGINEERING (TEC 101/201)**

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**UNIT-1**

**Semiconductor materials and properties** **4L**

Group-IV materials, Covalent bond, electron-hole concepts
Basic concepts of energy bands in materials, concepts of forbidden gap
Intrinsic and extrinsic semiconductors, donors and acceptors impurities

**UNIT-2**

**Junction diode and diode applications** **5L**

p-n junction, depletion layer, v- i characteristics, diode resistance, capacitance diode ratings ( average current, repetitive peak current, non-repetitive current, peak-inverse voltage).

**Diode Applications** **4L**

rectifiers (half wave and full wave), calculation of transformer utilisation factor and diode ratings, filter (C – filter), calculation of ripple factor and load regulation

clipping circuits, clamping circuits, voltage multipliers

**UNIT-3**

**Breakdown diodes**

**4L**

breakdown mechanisms (zener and avalanche), breakdown characteristics, zener resistance, zener diode ratings, zener diode application as shunt regulator

**UNIT-4**

**Bipolar Junction Transistor** **5L**

Basic construction, transistor action, CB, CE and CC configurations, input/outputCharacteristics, concept of Biasing of transistors-fixed bias, emitter bias, potential divider bias**Transistor Amplifier**

Graphical analysis of CE amplifier, concept of voltage gain, current gain, h-parameter model (low frequency), computation of Ai, Av, Ri, $R_o$of single transistor CE and CC amplifier configurations.

**Field Effect Transistor** **6L**

JFET: Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristics equation CG, CS and CD configurations, Introduction to self and fixed biasing

MOSFFT: depletion and enhancement type MOSFET-construction, operation and characteristics. Computation of Av, Ri, Ro, of single FET amplifiers using all the three configurations

**Switching theory and logic design** **4L**

Number systems, conversions of bases, Boolean algebra, logic gates,
concept of universal gate,concept of K- Map

**Operational Amplifiers** **4L**

Concept of ideal operational amplifiers, ideal op-amp parameters, inverting, non-inverting and unity gain amplifiers , adders,

**Reference Books:**


1. R. K. Singh & Lal Kishor, Basic Electronics Engineering, B S Publication, Hyderabad.
2. Gaikwad, Basic Electronics, Wiley India
3. A Mottershead, ‗Electronic devices and circuits‘. PHI, 2000.
4. Morris Mano, ‗Digital Computer Design‘, PHI, 2003.

# BASIC TECHNICAL COMMUNICATION (THM 101)

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## RELEVANCE OF TECHNICAL COMMUNICATION FOR TECHNOCRATS

English Communication is an integral part of today's life. The advent of new technologies has lead to the rapid development of a global village. A budding technocrat must be equipped with English language proficiency so that he / she can make a mark in this global village. Engineering students come from different backgrounds with different mother tongues. It is imperative for them to overcome their native accentual patterns and gain proficiency in speaking standard English. They also need to acquire optimum writing skills. Hence proper training in English speaking and writing is necessary. This goes hand in hand with the development of reading and listening skills. The course of Basic Technical Communication will help in the development and improvement of the communication skills and linguistic competence of engineering students.

**OBJECTIVES:-**

1. To help students perform better in all academic subjects through greater command over the English language.
2. To promote efficiency in English language with the development of the four skills of communication i.e., LSRW (Listening, Speaking, Reading and Writing).
3. To prepare students face the challenges of their professional lives in an increasingly globalised world.

**UNIT – I: COMMUNICATION**

1) Communication – Definition. Process of communication,
2) Types of communication—Verbal and Non-Verbal communication; Formal and Informal communication (grapevine) and their significance.
3) Barriers to Communication—Semantic barriers, Physical barriers, Psychological barriers, Interpersonal barriers and Organizational barriers. Language as a tool of communication.
4) Importance of communication with reference to students, professionals business etc.
5) Technical communication: Definition, Oral and Written technical communication. Difference between general writing and technical writing.
6) Computer-aided Technical Communication.
7) Style in Technical Communication. Features of technical writing.
8) Importance of Technical Communication

**UNIT-2: READING SKILLS**

1) Importance of Reading Skills, Types of Reading Skills, Methods of Improving Reading Skills, Objectives of Improving Reading Skills
2) Vocabulary Building: Antonyms, Synonyms, Homophones, Word formation (Prefixes and Suffixes). One Word substitution,
3) Jargon/Technical Terminology – Use of Jargon and examples of Jargon.
4) Paragraph: Definition. Requirements of a paragraph -- Understanding, Unity, Coherence and Emphasis in a paragraph. Identifying the Topic Sentence. Development of a Paragraph using Deductive order, Inductive order, Chronological Order (Time Order), Spatial Order (Space Order), Expository Order, Question and Answer Order, Comparison and Contrast Order. Devices used to impart Coherence and Emphasis in a Paragraph. Analysis of a given Paragraph in terms of Unity, Coherence and Emphasis.
5) Developing Reading Skills and Reading Comprehension through the study of thematic and value based critical reading of the following essays –

1. Of Discourse by Francis Bacon
2. Unity of Minds by Dr. A.P.J. Abdul Kalam

**UNIT-3:- WRITING SKILLS.**

1) Importance of Writing Skills, Types of Writing Skills, Methods for Improving Writing Skills, Objectives of Improving Writing Skills
2) Functional Grammar- Parts of Speech.
3) Common Grammatical Errors: Errors of Syntax, Concord etc.
4) Sentence and Paragraph construction. Writing Expository, Argumentative, Deductive etc. Paragraphs.
5) Précis Writing
6) Letter writing: Formal and Informal Letters.
7) Developing Writing Skills through the study of thematic and value based critical reading of the following short stories–
    1. After Twenty Years by O. Henry
    2. The Open Window by Saki (H.H. Munro)

**UNIT 4:- LISTENING SKILLS**

1) Importance of Listening Skills, Process of listening, listening and hearing, Active and Passive Listening. Types of Listening: Academic listening, Appreciative listening, Attentive Listening, Critical Listening, and Discriminative listening etc.
2) Methods for Improving Listening Skills, Objectives of Improving Listening Skills.
3) Barriers to listening: Semantic barriers, Physical barriers, and Psychological barriers.
4) Listening Comprehension: Identifying general content, Identifying specific information.
5) Listening for Note taking and drawing inferences.
6) Developing listening skills and listening comprehension through the study of thematic and value based critical reading of the following one-act play.
    1. The Refund by Fritz Karinthy

**7) Practice of Listening Skills through Language Laboratory**

1. Listening to a recording of a telephone conversation for identifying specific information as well as details.
2. Listening to a recording of a railway / airport announcement for selective listening and identifying specific information.
3. Listening to a recording of a radio / television news bulletin for identifying specific as well as over-all information
4. Listening to a recording of the description of a place, event or inc ident for note-taking, identifying details, descriptions and overall idea.
5. Listening to a recording of a lecture / talk on for note taking and identifying facts and drawing conclusions.
6. Listening to a recording of a television panel discussion on any topic for identifying facts, analyzing those drawing inferences and explaining the conclusion of the discussion in a logical manner.
7. Listening to passages that are read out for practicing note taking and identifying general and detailed content.
8. Listening to dialogues that are read out for identifying specific, general and detailed content.

**UNIT-5:- SPEAKING SKILLS.**

1) Importance of Speaking Skills, Types of Speaking, Methods for Improving Speaking Skills, Objectives of Improving Speaking Skills
2) Organs of Speech, Mechanism of Speech.
3) Phonetics: Classification of English Sounds, Vowel (short vowels and long vowels), Consonants, Diphthongs, Phonemes, Allophones, Phonetic transcription.
4) Syllable: Definition, Types of Syllable. Monosyllabic, Polysyllabic words etc.
5) Stress, Rhythm, Intonation: Rising Tone, Falling Tone and Rising-Falling Tone.
6) Everyday Conversation: Tips and characteristics of a good conversation. Common manners and etiquette.
7) Debate, Making a speech, Role play,
8) Extempore, JAM Session (just a minute session).
9) **Practice of Speaking Skills through Language Laboratory**

1. Practicing the following modules through self-learning software:
   a. Grammar with special emphasis on Tenses
   b. Pronunciation: of consonants, vowels, syllables and individual words c. Word Stress: based on accentual patterns
   d. Rhythm in speech based on content words and strong words e. Intonation: rising, falling and rising-falling tone
   f. Pause groups
   g. Speech making / public speaking
2. Introducing self and others keeping in mind kinesics.
3. Common conversation practice (making small talk etc.).
4. Asking for permission.
5. Making requests.
6. Describing events / people / places
7. Extempore.
8. JAM Session (Just a Minute Session).
9. Role play
10. Holding informal discussions.
11. Logical presentation of one‘s views on a given topic.
12. Delivering a speech using Stress, Rhythm and Intonation.

**Note:** The two class tests for theory will be of 10 marks each and two class tests of Basic Technical Communication will be of 10 marks each so that the total marks for class test will be of 40 marks and 10 marks will be for tutorial/attendance/home assignments. The subject faculty is requested to send the class test marks indicating both for theory and lab saparetly.

(b) Kindly make following changes in the structure of B.Tech. Ist year syllabus. Inthe subject of THM 101 Basic Technical Communication indicate

**SUGGESTED REFERENCES BOOKS:**


- Kavita Tyagi & Padma Misra Basic Technical Communication, PHI, New Delhi
- Norman Lewis: Word Power Made Easy, W.R Goyal Pub. & Distributors.
- Ruther Ford A: Basic Communication Skills; Person Education, N. Delhi
- Joans Daniel: English Pronouncing Dictionary, Cambridge
- John Seely: The Oxford Guide to Writing and Speaking. OUP, Delhi
- Mohammad Aslam: Introduction of English Phonetics and Phonology Cambridge
- Y Kameswari, Successful Career Soft Skills and Business English, BS Publications, Hyderabad

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## ENVIRENVIRONMENTAL STUDIES (TES 101/201)

**UNIT-1 NATURAL RESOURCES: 8 L**

**Renewable and Non-renewable Resources :**

Natural resources and associated problems.

a) **Forest resources :** Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) 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.

**UNIT- 2 ECOSYSTEMS 6 L**

- 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 following ecosystems :-
  - a. Forest ecosystem
  - b. Grassland ecosystem
  - c. Desert ecosystem
  - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**UNIT- 3 BIODIVERSITY AND ITS CONSERVATION 4 L**

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biogeographical classification of India
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
- Biodiversity at global, National and local levels.
- Inida as a mega-diversity nation
- Hot-sports 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-situconservation of biodiversity.

**UNIT- 4 ENVIRONMENTAL POLLUTION & SOCIAL ISSUES 7 L**

- Definition
- Cause, 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
- Disaster management : floods, earthquake, cyclone and landslides.
- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- Wasteland reclamation.
- Consumerism and waste products.

**REFERENCE BOOK**


- M Ajni Reddy, Text book of environmental Science, BS Publication, Hyderabad
- Environmental Studies by Daniel, Wiley India
- Environmental Studies by Erach Bharucha, University Press.
- Fundamental of Ecology, E.P.Odum, Cengage Learning.
- Environmental Science and Engineering by Wright, Pearson Publication.
- First Ecology by Beeby and Brennan, Oxford University Press.
- Environment Science by Miller, Cengage Learning, New Delhi.
- Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards Vol. 1 & Vol. 2, Bharat Publication, New Delhi.

## ENGINEERING DRAWING (PED 101/201)

**L T P**
**0 0 2**

**1. Introduction**
Graphics as a tool to communicate ideas, Lettering and‘ dimensioning, Construction of geometrical figures like pentagon and hexagon.

**2. Orthographic Projection**
Principles of orthographic projections, Principal and auxiliary planes, First and Third angle projections.Projection of points. Pictorial view.Projection of lines parallel to both the planes. Parallel to one and inclined to other, Inclined to both the planes. Application to practical problems.Projection of solid in simple position, Axis or slant edge inclined to one and parallel to other plane,Solids lying on a face or generator on a plane.Sectioning of solids lying in various positions, True shape of the section.Development of lateral surfaces, sheet metal drawing.

**3. Isometric Projection**
Principles of isometric projection, Isometric projection using box and offset methods.


1. Bhatt. N.D.: Elementary Engineering Drawing, Charothar Publishing.

2. D A Hindoliya, Text book of Egg. Graphics, BS Publication, Hyderabad


## WORKSHOP PRACTICE (PWS 101/201)

**L T P**
**0 0 2**

**1. Carpentry Shop:** 1. Study of tools and operation and carpentry joints. 2. Simple exercise using jack plain. 3. To prepare half- lap corner joint, mortise and tennon joints. 4. Simple exercise on woodworking lathe.

**2. fitting Bench Working Shop :** 1. Study of tools and operations 2. Simple exercises involving filling work. 3. Making perfect male-female joint 4. Simple exercise involving drilling/tapping/dieing.

**3. Black Smithy Shop :** 1. Study of tools and operations 2. Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.

**4. Welding Shop :** 1. Study of tools and operations . 2. Simple butt joint. 3. Lap joint. 4. oxy acetylene welding.

**5. Sheet metal shop :** 1.Study of tools and operations. 2. Making funnel complete with soldering. 3. Fabrication of tool box, tray, electrical panel box etc

**6. Machine Shop :** 1. Study of tools and operations. 2. Plane turning. 3. Step turning. 4. Taper turning 5. Threading. 6. Single point cutting tool grinding.

**Reference:**

**1.** Hajra, Bose, Roy: Workshop Technology Vol 1 & 2, Media Promotors
**2.** Raghuvanshi B.S.: Workshop Technology, Vol 1 & 2, Dhanpatrai

## C Programming Lab (PCS-101\PCS201)

### List of Experiments

1. Practice of all internal and External DOS Commands
2. Practice of all UNIX commands and write simple shell script.
3. WAP to perform simple arithmetic operations using different data types.
4. WAP to swap two numbers without using third variable.
5. WAP to find out whether the given number is prime or not.
6. WAP using conditional operator to determine whether a year is leap year or not.
7. WAP to print the ASCII code and their equivalent characters.
8. WAP to print corresponding days of a week using switch case.
9. WAP to print factorial of a number using recursion.
10. WAP to print Fibonacci series using function.
11. WAP to print an array and find greatest element of the array.
12. WAP to arrange elements of a given array in ascending order.
13. WAP for Matrix multiplication and find the inverse of resultant matrix.
14. WAP to print name, price & no. of pages of 3 books using structures.
15. WAP to remove the trailing blanks in a string input by the user, and print the resulting string using pointer.

## CHEMISTRY PRACTICALS (CPY 101/201)

L T P
0 0 2

**LIST OF EXPERIMENTS**

1. Determination of alkalinity in the given water sample.
2. Determination of temporary & permanent hardness in water sample using EDTA as standard solution.
3. Determination of available chlorine in bleaching powder.
4. Determination of chloride content in the given water sample by Mohr‘s method.
5. Determination of iron content in the given ore by using external indicator.
6. Determination of Acid & Base no. in lubricating oil by potentiometric method.
7. Determination of Equivalent weight of Iron by the chemical displacement method.The equivalent weight of copper is 63.5
   (Note : The procedure to be followed in carrying the above experiment is given as annexure)
8. Determination of viscosity index of lubricating oil.
9. Determination of iron concentration in sample of water by colorimetric method. The method involves the use of KCNS as colour developing agent & the measurements are carried out at ?max 480nm.

   Note : The general procedure of estimation is given on pp653-8 of the textbook Of Quantitative Chemical Analysis by A.I.Vogel 6 th Edition, Publisher : Pearson Education Ltd.2000
10. Determination of heat of neutralization of Hydrochloric acid & Sodium hydroxide

11. Determination of flash & fire point of lubricating oil
12. Determination of Carbon residue of lubricating oil.
13. Determination of Sulphated ash of motor oil.
14. Determination of saponification value of lubricating oil & vegetable oil.
15. Separation of metal ions by paper chromatography.

## MATHEMATICS-II ( TMA-201 )

| L | T | P |
|---|---|---|
| 3 | 1 | 0 |

**Unit-1**

**Differential Equations** **8**

Ordinary differential equations of first order, Exact differential equations, Linear differential equations of first order, Linear differential equations of nth order with constant coefficients, Complementry functions and particular integrals, Simultaneous linear differential equations, Solutions of second order differential equations by changing the dependent and independent variables, Method of variation of parameters.

**Unit-2**

**Laplace Transform** **10**

Laplace transform, Existence theorem, Laplace transform of derivatives and integrals, Inverse Laplace transform, Laplace transform of periodic function, Unit step function, Convolution theorem, Applications to solve simple linear and simultaneous liner differential equations.

**Unit-3**

**Infinite Series** **8**

Introduction, Sequences, Series: Convergence, Series of positive terms, Comparison tests, Integral tests, Comparison of ratio‘s, D‘Alembert ratio test, Raabe‘s test, Cauchy root test, Alternating series: Lebnitz rule, Power series, Uniform convergence, Weierstress‘s M-test, Properties of uniformly convergent series.

**Unit-4**

**Fourier Series and Partial Differential Equations** **8**

Periodic functions, Trigonometric series, Fourier series of periodic function, Euler‘s formula, Functions having arbitrary period, Change of intervals, Even and odd functions, Half range sine and cosine series.

Introduction to partial differential equations, Linear partial differential equations with constant coefficients of second order and their classifications: parabolic, hyperbolic and elliptic with illustrative examples.

**Unit-5**

**Applications of Partial Differential equations** **8**

Method of separation of variables for solving partial differential equations, One dimensional wave equation, Laplace equation in two dimensions, Heat conduction equations of one dimension and two dimension.

**References:**


1. A Text book of Engineering Mathematics (Vol.2) by Peter V. O‘ Neil, Cengage Learning.
2. B. S. Grewal: Higher Engineering Mathematics, *Khanna Publications.*
3. C. Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya.

4. E. Kreyszij: Advanced Engineering Mathematics, Wiley Eastern.
5. M.D. Raisinghania: Ordinary & Partial Differential Equations, S. Chand Publication.

# ADVANCED TECHNICAL COMMUNICATION

**L T P**
**3 0 2** **MAXIMUM MARKS -100**

## UNIT 1 : TECHNICAL COMMUNICATION

1. Introduction to technical communication, types of technical communication, history of the development of technical communication.
2. Difference between general and technical communication, importance of technical communication.
3. Characteristic features of technical communication. Elements of style in technical communication.
4. Process of preparing a technical document.
5. Elements, features and objectives of scientific articles, research papers, dissertation and thesis.

## UNIT 2:-BUSINESS COMMUNICATION

1. Importance and Features of Business Communication
2. Business Correspondence – Principles, Features, Types, Format and layout of Business letter.
3. Types of Business Correspondence – letters of Enquiry, Quotation, Order, Instructions, Sales, Credit, Complaint, Collection etc.
4. Some more types of Business Correspondence -- Notice, Agenda, Minutes, Memorandum.
5. Job Application letters -- Covering letter, Resume, Bio-data and C.V.

## UNIT 3:- TECHNICAL PROPOSAL and TECHNICAL REPORT

1. Technical Proposal – Introduction, purpose, features, types, format, importance, process of preparation. Writing technical proposals.
2. Technical Report -- Features, Types, Style, Format, Relevance. Writing Technical Reports.

## UNIT 4:-LITERATURE

1. Critical reading and thematic, value-based study of the Novella, **'Animal Farm'** by George Orwell.
2. Critical review, study of theme, plot, symbolism, characterization, style of writing etc.

## UNIT 5:- SOFT SKILLS

**This unit should be covered in classroom teaching as well as judicious use of language lab, (There should be optimum use of software's related to accent, presentation skills etc.)**

1. Kinesics, Para language, Proxemics.
2. Presentation skills - Features, Types, Structure, Aids and Importance.
3. Interpersonal communication skills – Role of Personality and its various attributes like EQ, attitude, motivation, stress management and accepting criticism in determining efficacy of interpersonal communication.

4. Corporate communication skills – Role of business etiquette, conducting meetings, managing conflict, negotiation, team spirit, decision-making, time management and problem solving skills.
5. Group Discussion skills - Features and Importance
6. Facing Interviews - Interview Tips.

❖ **Practice of Soft Skills using Language Laboratory**

1. Practicing the following modules through self-learning software:
   a. Pronunciation: of consonants, vowels, syllables and individual words
   b. Word Stress: based on accentual patterns
   c. Rhythm in speech based on content words and strong words
   d. Intonation: rising, falling and rising-falling tone
   e. Pause groups
   f. Presentation skills
2. Participating in Mock Interviews
3. Participating in Group Discussions
4. Giving Presentations keeping in mind Kinesics, Para language, and Proxemics
5. Participating in Role Play for enhancing interpersonal and corporate communication skills

**SUGGESTED REFERENCE BOOKS**


- Kavita Tyagi & Padma Misra, Advance Tech. Communication, PHI, New Delhi
- Gupta Advanced Technical Communication, Cambridge University Press, N. Delhi
- George Orwell Animal Farm, Penguin Publishing Company, N. Delhi
- Sharma & Mohan Business Correspondence and Report Writing, TMH, N Delhi.
- Rubens Science & Technical Writing, Foundation books, Cambridge, N. Delhi
- Daniel Riordan Technical Communication, Cengage Learning, N. Delhi
- Raman & Sharma Technical Communication, OUP, N. Delhi
- Wallace, Masters Personality Development, Cengage Learning, N. Delhi
- Robert Barrass Students Must Write, Foundationbooks, Cambridge, N. Delhi
- Bhaskar Rao, Successful Career Soft Skills and Business English, BS Publications, Hyderabad
- Chakrawarthi: Soft Skills for Professionals, Wiley India

# PHYSICS PRACTICALS
**(Autumn / Spring )**

**ASP 11** **L T P**
**0 0 2**

**List of Experiments (At least Ten)**

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using half shade polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To determine the specific resistance of the material of given wire using Carey Foster's bridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To calibrate the given ammeter and voltmeter.
10. To study the Hall effect and determine Hall coefficient, carnier density and mobility of a given semiconductor material using Hall-effect set up.
11. To determine energy bank gap of a given semiconductor material.
12. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the given specimen.
14. To determine the balistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.

***Note : Additional experiments may be added based on contents of syllabus.***

## CHEMISTRY PRACTICALS
## (Autumn / spring)

**ASP 13** **L T P**
**0 0 2**

**LIST OF EXPERIMENTS ( AT LEAST TEN)**

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA asstandard solution.
3. Determination of available chlorine in bleaching powder.
4. Determination of chloride content in the given water sample by Mohr's method.
5. Determination of iron content in the given ore by using external indictor
6. pH-metric titration.
7. Determination of Equivalent weight of Iron by the chemical displacement method. The equivalent weight of copper is 63.5
(Note : the procedure to be followed in carrying the above experiment is given as annexure)
8. Viscosity of an addition polymer like polyster by Viscometer.
9. Determination of iron concentration in sample of water by colorimetric method. The method involves the use of KCNS as colour developing agent and the measurements arecarried out at $l_{max}$ 480 nm.
Note : The general procedure of estimation is given on pp653-8 of the textbook of Quantitative Chemical Analysis by A.I. Vogel 6th Edition, Publisher : Pearson education Ltd. 2000)
10. Determination of heat of neutralization of Hydrochloric acid and Sodium hydroxide
11. Determination of amount of dissolved oxygen in water
12. Separation of metal ions by paper chromatography
13. Preparation of iodoform from acetone
14. Preparation of Sodium Cobaltinitrile salt.
15. Element detection & functional group identification in organic compounds

**BASIC ELECTRICAL + ELECTRONICS LAB**
**EE P 11 (Autumn / Spring )**

**List of Practical** **L T P**
**0 0 2**

**FEP 11**

**Fundamentals of Electronics Lab (Any Ten)**

1. Study of diode characteristics.
2. To study a half wave and full wave rectifier circuit.
3. Determination of ripple factor of capacitive and non capacitive filter for HW and FW diode rectifier circuit.
4. Study of characteristics of Zener Diode as constant voltage.
5. Verification of Application of Zener Diode as shunt regulator.
6. Study of Clipper and Clamper Circuit with different waveforms.
7. Determination of characteristics of BJT in CB and CE configuration.
8. Determination of characteristics of FET in CS and CD configuration.
9. Study of BJT as single stage amplifier and determination of $A_i$, $V_i$, $R_i$ and $R_o$.
10. Study of AND, NAND, OR, NOR and EXOR gates.
11. Verification of Universal gates.

**List of Practical** **L T P**
**0 0 2**

**FEP 11**

**Fundamentals of Electrical Engineering Lab (Any Ten)**

1. Verification of Network Theorems.
2. Study of diode characteristics. Study of phenomenon of resonance in RLC series circuit.
3. Measurement of power in a three phase circuit by two wattmeter method.
4. Measurement of efficiency of a single phase transformer by load test.
5. Determination of parameters and losses in a single phase transformer by OC and SC test.
6. Study of characteristic of DC Motor.
7. Study of characteristic of AC Motor.
8. DC generator characteristics.
9. 10. Speed control of dc shunt motor.
10. Study running and reversing of a three phase induction motor.
11. Study of a single phase energy meter.

# MECHANICAL ENGINEERING LAB
## MEP 11 (Autumn / Spring)

**List of Practical** **L T P**
**0 0 2**

**A minimum of 10 experiments from the following :**

1. Study of Steam engine and steam turbine models.
2. Study of 2-stroke and 4-stroke I.C.E. models.
3. Study of Fiat engine and/ or Diesel engine prototype.
4. Study of a vapour compression Refrigeration unit tutor/refrigerator.
5. Study of a window type air conditioner.
6. To conduct the tensile test on a UTM and determine ultimate Tensile strength, percentage elongation for a steel specimen.
7. To conduct the compression test and determine the ultimate compressive strength for a specimen.
8. To conduct the Impact test (Izod / charpy) on the Impact testing machine and to find the impact strength.
9. To determine the value of acceleration due to gravity by Atwood's Machine appratus.
10. To verify the principle of moment by Bell Crank Lever Appratus
11. To determine the moment of inertia of a flywheel apparatus about its axis of rotation
12. To verify Newton's second law of motion by Fletcher's Trolley apparatus
13. To find out coefficient of friction by combined inclined plane & friction slide apparatus
14. To determine the velocity ratio, mechanical advantage & efficiency of a single purchase crab apparatus & draw graph between load vs effort, mechanical advantage and efficiency.
15. To determine the velocity ratio, mechanical advantage & efficiency of a double purchase crab apparatus.

# COMPUTERS LABORATORY
**(Autumn / Spring)**

**CSP 11** **L T P**
**0 0 2**

**List of Practicals**

1. Practice of some internal and External DOS Commands
2. Write simple batch program.
3. File and program management in windows
4. Familiarization with the ftp ,http etc. supported by various protocols
5. Practice of some UNIX commands
6. Write simple shell script
7. Introduction to text editing and word processing
8. Exposure to advance feature supported by some editors
9. Net Surfing
10. Creation and usage of E- mail account
11. Write small program using C language
12. Handling of data structure in C
13. Familiarizing mail account using PINE, deleting, creating folder/ mail-messages, adding signature, creating directory of addresses.
14. Compressing data file using WINZIP & WINRAR
15. Introduction to various extension of files as TXT, EXE, BAK, BAT, BMP, DOC, XLS, PPT, PDF, HTML, JPEG, MPEG, MP3, DAT & AVI

***Note :*** *List may be modified according to new software available.*

# UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

**REVISED STUDY AND EVALUATION SCHEME**
**YEAR II, SEMESTER-III**
**B. Tech. Mechanical Engineering**

| S. No. | Course Code | SUBJECT | PERIODS | | | Evaluation Scheme | | | | Subject Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SESSIONAL EXAM. | | | ESE | |
| | | | L | T | P | CT | TA | Total | | |
| | | **THEORY** | | | | | | | | |
| 1. | TAS 301 | Mathematics –III | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 2. | TME-301 | Materials Science | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 3. | TME-302 | Applied Thermodynamics | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 4. | TCE-301 | Fluid Mechanics | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 5. | TME-303 | Strength of Material | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| | | **PRACTICAL/TRAINING/PROJECT** | | | | | | | | |
| 6. | PME-351 | Material Science & Testing Lab | 0 | 0 | 3 | 10 | 10 | 20 | 30 | 50 |
| 7. | PME-354 | Machine Drawing-I | 0 | 0 | 2 | 10 | 10 | 20 | 30 | 50 |
| 8. | PCE-351 | Fluid Mechanics Lab | 0 | 0 | 3 | 10 | 10 | 20 | 30 | 50 |
| 9. | PME-352 | Applied Thermodynamics Lab | 0 | 0 | 2 | 10 | 10 | 20 | 30 | 50 |
| 10. | GP-301 | General Proficiency | - | - | - | - | - | 50 | - | 50 |
| | | **Total** | **15** | **5** | **10** | **-** | **-** | **-** | **-** | **1000** |

**YEAR II, SEMESTER-IV**

| S. No. | Course Code | SUBJECT | PERIODS | | | Evaluation Scheme | | | | Subject Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SESSIONAL EXAM. | | | ESE | |
| | | | L | T | P | CT | TA | Total | | |
| | | **THEORY** | | | | | | | | |
| 1. | TME-401 | Industrial Engineering | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 2. | TME-402 | Kinematics of Machine | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 3. | TME-403 | Manufacturing Science-I | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 4. | TEE-405 | Electrical Machines | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 5. | TME-404 | Measurement, Metrology and Control | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| | | **PRACTICAL/TRAINING/PROJECT** | | | | | | | | |
| 6. | PME-453 | Manufacturing Science-I Lab | 0 | 0 | 3 | 10 | 10 | 20 | 30 | 50 |
| 7. | PME-454 | Measurement, Metrology and Control Lab | 0 | 0 | 2 | 10 | 10 | 20 | 30 | 50 |
| 8. | PME-456 | Machine Drawing-II | 0 | 0 | 2 | 10 | 10 | 20 | 30 | 50 |
| 9. | PEE-455 | Electrical Machines Lab | 0 | 0 | 3 | 10 | 10 | 20 | 30 | 50 |
| 10. | GP-401 | General Proficiency | - | - | - | - | - | 50 | - | 50 |
| | | **Total** | **15** | **5** | **10** | **-** | **-** | **-** | **-** | **1000** |

**NOTE:** Practical summer training-I of 4-weeks after IV –semester will be evaluated in VII semester

**TAS 301**

# MATHEMATICS-III

| L | T | P |
|---|---|---|
| 3 | 1 | 0 |

**Unit - I : Integral Transforms** **8**

Fourier integral, Fourier complex transform, Fourier sine and cosine transforms and applications to simple heat transfer equations.

Z – transform and its application to solve difference equations.

**Unit - II : Functions of a Complex Variable - I** **9**

Analytic functions, C-R equations and harmonic functions, Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions, Liouvilles theorem, Fundamental theorem of algebra.

**Unit - III : Functions of a Complex Variable - II** **8**

Representation of a function by power series, Taylor's and Laurent's series, Singularities, zeroes and poles, Residue theorem, evaluation of real integrals of type $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$ and $\int_{-\infty}^{+\infty} f(x)\, dx$, Conformal mapping and bilinear transformations.

**Unit - IV : Statistics and Probability** **8**

Moments, Moment generating functions, Skewness, Kurtosis,Correlation and Regression, Binomial distribution, Poisson distribution, Normal distribution.

**Unit - V : Curve Fitting and Solution of Equations** **5**

Method of least squares and curve fitting of straight line and parabola, Solution of cubic and bi-quadratic equations.

*TME-301*

# MATERIAL SCIENCE

| L | T | P |
|---|---|---|
| 3 | 1 | 0 |

**Unit-I**

**Introduction :** Historical perspective, importance of materials. Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bondings. 4

**Crystallography and Imperfections :** Concept of unit cell space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices. X-ray crystallography techniques. Imperfections, Defects & Dislocations in solids. 3

**Unit-II**

**Mechanical properties and Testing :** Stress strain diagram, Ductile & brittle material, Stress VS strength. Toughness, Hardness, Fracture, Fatigue and Creep. Testings such as Strength testings, Hardness testing, Impact testings, Fatitue testing Creep testing, Non-destructive testing (NDT) 4

**Microstructural Exam :** Microscope principle and methods. Preperation of samples and Microstructure exam and grain size determination. Comparative study of microstructure of varuious metals & alloys such as Mild steel, CI, Brass. 2

**Phase Diagram and Equilibrium Diagram :** Uniary and Binary diagrams, Phase rules. Types of equilibrium diagrams: Solid solution type, eutectic type and combination type. Iron-carbon equilibrium diagram. 4

**Unit-III**

**Ferrous materials :** Iron and steel manufacture, furnaces. Various types of carbon steels, alloy steels and cast irons, its properties and uses. 3

**Heat Treatment :** Various types of heat treatment such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams. 2

**Non-Ferrous metals and alloys :** Non-ferrrous metals such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various type Brass, Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin. Other advanced materials/alloys. 3

**Unit-IV**

**Magnetic properties :** Concept of magnetism - Dia, para, ferro Hysteresis. Soft and hard magnetic materials, Magnetic storages. 2

**Electric properties :** Energy band concept of conductor, insulator and semi-conductor. Intrinsic & extrinsic semi-conductors. P-n junction and transistors. Basic devices and its application. Diffusion of Solid. 3

Super conductivity and its applications. Messier effect. Type I & II superconductors. High Te superconductors. 2

**Unit-V**

**Ceramics :** Structure types and properties and applications of ceramics. Mechanickal/Electrical behaviour and processing of Ceramics. 2

**Plastics :** Various types of polymers/plastics and its applications. Mechanical behavious and processing of plastics. Future of plastics. 2

**Other materials :** Brief description of other material such as optical and thermal materials concrete, Composite Materials and its uses. 2

**Performance of materials in service:** Brief theoretical consi-deration of Fracture, Fatigue, and Corrosion and its control. 3

**References :**


1. W.D. Callister, Jr, - Material Science & Engineering Addition-Wesly Publishing Co.
2. Van Vlash - Elements of Material Science & Engineering John Wiley & Sons.
3. V. Raghvan - Material Science, Pretice Hall of India
4. Narula - Material Science, TMH
5. Srivastava, Srinivasan - Science of Materials Engineering Newage.
6. K.M. Gupta – Material Science.

*TME 302*

# APPLIED THERMODYNAMICS

| L | T | P |
|---|---|---|
| 3 | 1 | 0 |

**Unit-I**

**Review of Thermodynamics :** Brief review of basic laws of thermodynamics, Helmholtz & Gibb's function, Mathematical conditions for exact differentials. Maxwell Relations, Clapeyron Equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic & Isothermal compressibility. Availability & Irreversibility. 7

**Unit-II**

**Properties of Steam and Boilers :** Properties of steam. Use of stream table & Mollier Chart. Steam generators-classifications. Working of fire-tube and water-tube boilers, boiler mountings & accessories, Draught & its calculations, air pre heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance. 6

**Unit-III**

**Steam Engines :** Rankine and modified Rankine cycles, working of stream engine Indicator diagram. 4

**Steam & Gas Nozzles :** Flow through nozzle, variation of velocity, area and sp. Volume, nozzle efficiency, Throat area. Super saturated flow. 4

**Unit-IV**

**Vapour Power cycles:** Effect of Pressure & temp. on Rankine cycle Reheat cycle, Regenerative cycle, feed water heaters.

**Steam Turbines :** Classification, impulse and reaction turbines, Staging, Stage and overall efficiency, re-heat factor, bleeding, comparison with steam engines. Governing of turbines. Velocity diagram of simple & compound multistage impulse & reaction turbines & related calculations work done efficiencies of reaction, impulse Reaction Turbines, state point locus, Reheat factor. 6

**Unit-V**

**Gas Turbine & Jet Propulsion:** Gas turbine classification Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat & regeneration stage efficiency, polytropic efficiency. Deviation of actual cycles from ideal cycles. 5

Introduction to the principles of jet propulsion, Turbojet & turboprop engines & their processes, Introduction to Rocket Engine. 4

**References :**


1. Applied thermodynamics by Onkar Singh, New Age International (P) Publishers Ltd.
2. Thermal Engg. By P.L. Blallaney, Khanna Publisher
3. Theory of Stream Turbine by W.J. Kearton
4. Steam & Gas Turbine by R.Yadav, CPH Allahabad
5. Thermal Engg. By R.K. Rajput, Laxmi Publication
6. Turbine Compressons & Fans by S.M. Yahya, TMH
7. Gas Turbine, by Ganeshan, Tata McGraHill Publishers.
8. Heat Engines byb R. Yadav, CPH Allahabad.
9. Engg. Thermodynamics by Nag
10. Engg. Thermodynamics by C.P. Arora..
11. Gas turbine Theory & Practice, by Cohen & Rogers, Addison Weslay Long man Ltd.

**TCE -301**

# FLUID MECHANICS

| L | T | P |
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**UNIT I**:

**Introduction:** Fluids and continuum; Physical properties of fluids: Viscosity, Compressibility, Surface Tension, Capillarity, Vapour Pressure; Cavitation; Classification of fluids including rheological classification. [03]

**Fluid Statics:** Pascal's law; Pressure-density-height relationship; Measurement of pressure by Manometers and mechanical gauges; Pressure on plane and curved surfaces; The Hydrostatic law; Total Pressure and Centre of pressure; Buoyancy; Stability of immersed and floating bodies; Fluid masses subjected to uniform horizontal and vertical accelerations. [03]

**Dimensional Analysis:** Units and Dimensions, Dimensional analysis, Rayleigh's method, Buckingham's ? theorem, Important dimensionless numbers used in fluid mechanics and their significance. [02]

**UNIT II:**

**Hydraulic Similitude and Model Studies:** Model and prototype; Similitude; Geometric, Kinematic and Dynamic similarity; Model Laws; Un-distorted model studies. [01]

**Fluid Kinematics:** Description of Fluid flow: Lagrangian and Eulerian approach; Types of fluid Flows: Steady and unsteady, Uniform and non-uniform, Laminar and turbulent flows, 1, 2 and 3-D flows; Stream lines, Path lines and Streak lines; Stream tube; Acceleration of a fluid particle along a straight and curved path; Differential and Integral form of Continuity equation; Rotation, Vorticity and Circulation; Elementary explanation of Stream function and Velocity potential; Flow net characteristics, uses and experimental and graphical methods of drawing. [03]

**Fluid Dynamics-I:** Concept of control volume and control surface, Reynolds Transport Theorem, Introduction to Navier-Stokes Equations, Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications – Pitot tube, Flow through orifices, Mouthpieces, Nozzles, Notches, Weirs, Sluice gates under free and submerged flow conditions; Free and Forced vortex motion. [04]

**UNIT III:**

**Fluid Dynamics-II:** Impulse-Momentum Principle; Moment of momentum equation; Momentum equation application to stationary and moving vanes, pipe bends, ***Problems related to,*** combined application of energy and momentum equations, flow measurements, determination of coefficients of discharge, velocity and contraction and energy loss. [02]

**Laminar Flow:** Reynolds Experiment**;** Equation of motion for laminar flow through pipes; Flow between parallel plates; Kinetic energy and Momentum correction factors; Stokes law; Flow through porous media; Darcy's Law; Fluidization; Measurement of viscosity; Transition from laminar to turbulent flow. [03]

**Turbulent Flow:** Turbulence; Equation for turbulent flow; Reynolds stresses; Eddy viscosity; Mixing length concept and velocity distribution in turbulent flow; Working principle of Hot-wire anemometer and Laser Doppler anemometer (LDA). [03]

**UNIT IV:**

**Boundary Layer Analysis:** Boundary layer thicknesses; Boundary layer over a flat plate; Laminar boundary layer; Application of Von-Karman Integral Momentum Equation; Turbulent boundary layer; Laminar sub-layer; Hydro-dynamically Smooth and rough boundaries; Local and average friction coefficient; Total drag; Boundary layer separation and its control. [03]

**Flow Through Pipes:** Nature of turbulent flow in pipes; Equation for velocity distribution over smooth and rough surfaces; Major and Minor energy losses; Resistance coefficient and its variation; Hydraulic gradient and total energy lines; Flow in sudden expansion, contraction, diffusers, bends, valves and siphons; Concept of equivalent length; Branched pipes; Pipes in series and parallel; Simple pipe networks. [05]

**Unit V:**

**Compressibility Effects in Pipe Flow:** Transmission of pressure waves in rigid and elastic pipes; Water hammer; Analysis of simple surge tank excluding friction. [03]

**Ideal (Potential) Fluid Flow:** Importance; Elementary concept of the uniform flow, the source flow, the sink flow and the free vortex flow. [02]

**Flow Past Submerged Bodies:** Drag and lift, Types of drag force, Drag on sphere, Cylinder and airfoil; Circulation and Lift on a cylinder and airfoil; Magnus effect. [03]

**REFERENCES:**


1. R J Fox: Introduction to Fluid Mechanics
2. Hunter Rouse: Elementary Mechanics of Fluids, John Wiley and sons, Omc/ 1946.
3. L H Shames: Mechanics of Fluids, McGraw Hill, International student edition.
4. Garde, R J and A G Mirajgaonkar: Engineering Fluid Mechanics (including Hydraulic machines), second ed., Nemchand and Bros, Roorkee, 1983.
5. K L Kumar: Engineering Fluid Mechanics
6. Munson, Bruce R, Donald F Young and T H Okishi, Fundamentals of Fluid Mechanics, 2nd ed, wiley Eastern.
7. V Gupta and S K Gupta, Fluid Mechanics and its Applications, Wiley eastern ltd.
8. Som and Biswas: Introduction to Fluid Mechanics and Machines, TMH.
9. R K Bansal: Fluid Mechanics and Hydraulic Machines
10. Modi and Seth: Fluid Mechanics and Fluid Machines

**TME-303**

# STRENGTH OF MATERIALS

| L | T | P |
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**UNIT-I**

**Review:** Review of simple and compound stresses, Mohr's Circle. 1

**3-D Stress, Theory of failure, Castingliona's Theorem, Impact load:** Three-dimensional state of stress & strain, equilibrium equations. Generalized Hook's Law. Theories of Failure. Castigliano's Theorem. Impact load & stresses. 4

**Airy's Stress Fuction:** Airy's stress function and its applications 3

**UNIT –II**

- **S**

**tresses in Beams:** Review of pure Bending**.** Direct and shear stresses in beams due to transverse and axial loads, composite beams. 2

- **D**

**eflection of Beams:** Equation of elastic curve, cantilever and simply supported beams, Macaulys method, area moment method, fixed and continuous beams. 4

- **T**

**orsion:** Review of Torsion, combined bending & torsion of solid & hollow shafts. 2

- 
- **U**

**NIT-III**

- **H**

**elical and Leaf Springs:** deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs. 4

**Columns and Struts:** Combined bending and direct stress, middle third and middle quarter rules. Struts with different end conditions. Euler's theory and experimental results, Ranking Gardon Formulae, Examples of columns in mechanical equipments and machines. 4

**UNIT-IV**

- **T**

**hin cylinders & spheres:** Hoop and axial stresses and strain. Volumetric strain. 2

**Thick cylinders:** Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, Compound cylinders. Stress due to interference fits. 5

**UNIT-V**

- **C**

**urved Beams:** Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression. 4

- **U**

**nsymmetrical Bending :** Properties of beam cross-section, slope of beutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel-section. 5

- 
- **B**

**ooks :**


1. Strength of Materials by Ryder
2. Strength of Materials by Singer
3. Strength of Materials by Timoshenko and Timoshenko & Ys ung
4. Engineering Mechanics of Solids by Popov
5. Mechanics of Materials by Bear Jhonson
6. Strength of Materials by R.K. Rajput
7. Strength of Materials by Ramamrutham & Narain
8. Advanced Mechanics of Solids by Kazami, TMH

***PME- 351***

## MATERIAL SCIENCE AND TESTING LAB

| L | T | P |
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**A. Material Science Lab Experiments : (**at least 5 of the following)

1. Making a plastic mould for small metallic specimen.
2. Specimen preparation for micro structural examination-cutting, grinding, polishing, etching.
3. Grain Size determination of a given specimen.
4. Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, cooper etc.)
5. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
6. Material identification of say 50 common items kekpt in a box.
7. Faradays law of electrolysis experiment.
8. Study of corrosion and its effects.
9. Study of microstructure of welded component and HAZ. Macro & Micro examination.

**B. Material Testing Lab Experiments :** (at least 5 of the following)

1. Strength testing of a given mild steel specimen on UTM with full details and s-e plot on the machine.
2. Other tests such as shear, bend tests on UTM.
3. Impact testing on impact testing machine like Charpy, Izod or both.
4. Hardness testing of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index testing on spring testing machine.
6. Fatigue testing on fatigue testing machine.
7. Creep testing on creep testing machine.
8. Deflection of beam experiment, comparison of actual measurement of deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9. Torsion testing of a rod on torsion testing machine.
10. Study of non-destructive testing methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.

**PME-354**

# MACHINE DRAWING-I

| L | T | P |
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1. Introduction : Graphic language, Classification of drawings, Principles of drawing: IS codes for Machine drawing, Lines, Scales, Sections, Dimensioning, Standard abbreviations.
2. Orthographic Projections : Principles of first and third angle projections, drawing and sketching of machine elements in orthographic projections, spacing of views.
3. Screwed (Threaded) fastners: Introduction, Screw thread nomenclature, Forms of threads, Thread series, Thread designation. Representation of threads, Bolted joints, Locking arrangements for nuts, Foundation bolts.
4. Keys and Cotters : Keys, Cotter joints.
5. Shaft couplings : Introduction, Rigid and flexible coupling.
6. Riveted Joints : Introduction, Rivets and riveting, Rivet heads, Classification of riveted joints.
7. Assembly drawing : Introduction, Engine parts, Stuffing box etc.
8. Fee hand sketching : Introduction, Need for free hand sketching, Free hand of sketching of some threaded fasteners and simple machine components.

**References:**


1. N. Siddeshwar, P.Kannaiah, V.V.S. Shastry : Machine drawing, TMH, New Delhi.
2. K.L. Narayana, P. Kannaiah, K. Venkat Reddy : Machine drawing, New Age Intemational Publications, 2nd edition.
3. Engineering drawing practice for schools and colleges, SP46-1998 (BIS)

**PCE-351**

# FLUID MECHANICS LAB

| L | T | P |
|---|---|---|
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1. To measure the surface tension of a liquid.
2. To determine the metacentric height of a ship model experimentally.
3. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
4. To determine the coefficients of velocity, contraction and discharge of an orifice (or a mouth piece) of a given shape. To plot the flow net for a given model using the concept of electrical analogy.
5. To find the velocity distribution in a pipe and hence to compute the discharge by integrating the velocity profile obtained.
6. To verify the Bernoulli's theorem.
7. To calibrate an orifice meter and venturimeter and to study the variation of the coefficient of discharge with the Reynolds number.
8. To calibrate and to determine the coefficient of discharge for rectangular and triangular notches.
9. To verify Darcy's law and to find out the coefficient of permeability of the given medium.
10. To verify the momentum equation.
11. To study the boundary layer velocity profile and to determine boundary layer thickness and displacement thickness. Also to determine the exponent in the power law of velocity distribution.
12. To study the variation of friction factor, 'f' for turbulent flow in smooth and rough commercial pipes.
13. To determine the loss coefficients for the various pipe fittings.
14. To study the flow behaviour in a pipe bend and to calibrate the pipe bend for discharge measurement.

**PME-352**

## APPLIED THERMODYNAMICS LAB

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Experiments : Say minimum 10 experiments out of following in depth and details according to theory covered in applied thermodynamics theory subject (ME-302)

1. Study of Fire Tube boiler
2. Study of water Tube boiler
3. Study & working of Refrigerator
4. Study of velocity compounded steam turbine
5. Study of pressure compounded steam turbine
6. Study of impulse & Reaction turbine
7. Study of steam Engine model.
8. Study and working of two stroke petrol Engine
9. Study and working of Four stroke petrol Engine
10. Determination of Indicated H.P. of I.C. Engine by Morse Test
11. Study of Gas Turbine Model
12. Study & working of Air conditioner
13. Prepare the energy balance for Diesel/Petrol Engine
14. Study & working of two stroke Diesel Engine
15. Study & working of four shope Diesel Engine.
16. Study of Ignition system of I.C. Engine.
17. Study of Breaking system of any vehicle.

**TME –401**

# INDUSTRIAL ENGINEERING

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**Unit-I**

**1.Productivity:** Introduction, definition, measurement, productivity index, ways to improve productivity, Types of Production System. 2

**2. Work study :** Meaning and benefits of work study, time & motion study. Micromotion study P.M.T.S. man machine Diagram flow chart. Motion economy, Method study, work measurement, work sampling, standard time. 6

**Unit-II**

**3. Plant layout and materials Handling :** Plant location, type of layout, principles of facility layout principles of material handling, Material Handling eqpts. 3

**4. Production planning and control :** Objectives, Forecasting, product design and development functions, steps in PPC. Planning routine, scheduling, Dispatching & follow-up, Effectiveness of PPC, Introduction of JIT. 5

**Unit-III**

**5. Managerial Economics :** Introduction, Assumptions, Time Value of money, apprised, criteria step-in BEA, purpose, costs & overheads fixed & variable costs, margin of safety, Angle of incidence profit volume graph. 2

**6. Replacement Analysis :** Depreciation causes, obsolescence, service life of assets, Replacement of items. 3

**7. Maintenance Management :** Maintenance Planning & Control, Maintenance Strategy 2

**Unit-IV**

**8. Inventory Control :** Inventory, function, cost, deterministic models, Introduction to MRP, supply chain Management 4

**9. Quality Control :** Introduction, process control, SQC control Charts, Single double & sequential sampling, Introduction to TQM & bench marking. 4

**Unit-V**

**10. Industrial Ownership :** Proprietorship, partnership, Joint stock & co-operative stores. 2

**11. Manpower Planning :** Resources, Human relationship. 2

**12. Organization :** Principles of organization, Development of Organizational charts like line, staff, line and staff & Functional types. 2

**13. Job Evaluation & Merit rating :** Job analysis, Job description job simplification and job evaluation methods & description, merit rating, wage incentive plans. 3

**References :**


1. Principles of management. An analysis of management functions-H.Koontz & C.O. Donnel. Tata McGrow-Hall Co.
2. Manufacturing Management-J Moore Prentice Hall Englewoon cliffs :New jersey.
3. Modern production operations Management-Buffam E.S. Wiley eastern.
4. Industrial Engg. & Management O.P. Khanna.
5. Industrial Engineering by Ravi Shanker.
6. Industrial Engineering by Mahajan.

TME 402

# KINEMATICS OF MACHINES

| L | T | P |
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| 3 | 1 | 0 |

## UNIT I

**Introduction**

Links-types, Kinematics pairs-classification, Constraints-types, Degree of Freedom, Grubler's equation, linkage mechanisms, inversions of four bar linkage, slider crank chain and double slider crank chain **6**

## Velocity in Mechanisms

Velocity of point in mechanism, relative velocity method, instantaneous point in mechanism, Kennedy's theorem, instantaneous center method. **3**

## UNIT II

## Acceleration in Mechanisms

Acceleration diagram, Coriolis component of acceleration, Klein's construction for Slider Crank and Four Bar mechanism, Analytic method for slider crank mechanism. **4**

**Mechanisms with Lower Pairs**

Pantograph, Exact straight line motion mechanisms - Peaucellier's, Hart and Scott Russell mechanisms, Approximate straight line motion mechanisms – Grass-Hopper, Watt and Tchebicheff mechanisms, Analysis of Hook's joint, Davis and Ackermann Steering gears. **5**

**UNIT III**

**Kinematics Synthesis of Planar Linkages**

Movability of four bar linkages, Grashoff's law, Graphical methods of synthesis – Two and Three position synthesis of four bar and slider crank mechanisms, Analytical method-Freudenstein's equation for function generation (three position) **7**

**UNIT IV**

**CAMS**

Cams and Followers - Classification & terminology, Cam profile by graphical methods for uniform velocity, simple harmonic motion and parabolic motion of followers, Analytical cam design – tangent and circular cams. **7**

**UNIT V**

**Gears**

Classification & terminology, law of gearing, tooth forms, interference, under cutting, minimum number of teeth on gear and pinion to avoid interference, simple, compound and planetary gear trains. **8**

**Books and References:**


1. Theory of machines - Thomas Bevan
2. Theory of machines and mechanisms - Shigley
3. Theory of machines and mechanisms - Ghosh & Mallik
4. Theory of machines and mechanisms - Rao & Dukkipati
5. Theory of Machines – R. K. Bansal
6. Theory of Machines – V. P. Singh
7. Theory of Machines – Malhotra & Gupta
8. Theory of Machines – Khurmi & Gupta
9. Mechanics of Machines – V. Ramamurti

*TME - 403*

## MANUFACTURING SCIENCE-I

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**Unit-I**

**Introduction :**

Importance of manufacturing. Economic & technological considerations in manufacturing. Survey of manufacturing processes. Materials & manufacturing processes for common items. 2

**Metal Forming Processes :**

Elastic & plastic deformation, yield criteria. Hot working vs cold working. Load required to accomplish metal forming operation. 2

Analysis (equilibrium equation method) of forging process with sliding friction sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging 5

**Unit-II**

**Metal Forming Processes (continued):**

Analysis of Wire/strip drawing and max. reduction, Tube drawing, Extrusion and its application. 2

Condition for Rolling force and power in rolling. Rolling mills. 2

Design, lubrication and defects in metal forming processes. 2

**Unit-III**

**Sheet Metal working :**

Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs Piercing. Compound vs Progressive die. Flat-face vs Inclined-face punch and Load(capacity) needed. 4

Analysis of forming process like cup/deep drawing and bending. 3

**Unit-IV**

**Unconventional Metal forming processes :**

Unconventional metal forming processes such as explosive forming, electro-magnetic, electro-hydraulic forming. 3

**Powder Metallurgy :**

Powder metallurgy manufacturing process. The process, advantage and applications. 2

**Jigs & Fixtures :**

Locating & clamping devices/principle. Jigs and Fixtures and its applications. 2

**Manufacturing of Plastic components :**

Review of plastics, and its past, present & future uses. Injection moulding. Extrusion of plastic section. Welding of plastics. Future of plastic & its applications. Resins & Adhesives. 2

**Unit-V**

**Casting (Foundry)**

Basic principle & survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand. Elements of mould and design considerations, gating, riser, runnes, core. Solidification of casting, theory and analysis. Sand casting, defects & remedies and inspection. Cupola furnace. 8

Die Casting centrifugal casting. Investment casting etc. 2

**Books :**

1. Manufacturing Science by Ghosh and Mallik
2. Production Engg. Science by P.C. Pandey
3. Production Technology by R.K. Jain
4. Manufacturing Technology by P.N. Rao.
5. Materials and Manufacturing by Paul Degarmo.

TEE – 405

# ELECTRICAL MACHINES

| L | T | P |
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## Unit – I :

**Transformers**: Construction, polarity test, Sumpner's test, all day efficiency

**Autotransformer**: Volt-amp relation, efficiency, advantages & disadvantages and applications; Three-phase transformers: Connections, three-phase bank of single phase transformers, Scott connections; Instrument Transformers. (8)

## Unit – II :

**D.C. Machines:**

D.C.machine: Construction, emf and torque equations. Armature reaction, commutation, performance characteristics of motors and generators, starting of motors, speed control losses and efficiency. (8)

## Unit – III :

**Three-Phase Induction Motor:**

Construction, rotating magnetic field and principle of operation, of equivalent circuit, torque production, Torque-slip characteristics, speed control, starting of squirrel cage and slip ring induction motors. (7)

## Unit – IV:

**Three-phase Synchronous Machines :**

**Alternator**: Construction, emf equation & effects of pitch and distribution factors phasor diagram, armature reaction, Voltage regulation and its determination by synchronous impedance method, methods of synchronization

**Synchronous motor**: Principle of operation and starting torque and mechanical power developed, effect of excitation on line current, (v – curves) (8)

## Unit – V :

1. **Fractional H.P. Motors:**

Single phase induction motor: Construction, revolving field theory and principle of operation, equivalent circuit and starting methods. Two-phase servo-motor, stepper motor, and their applications.

2. **Industrial Applications** :

Concept of braking in dc and ac motors, two quadrant and four quadrant operation of dc and three phase induction motors, industrial applications of dc and ac motors.(9)

## REFERENCES :


1 Electric Machines by I J Nagrath & D P Kothari , Tata McGraw Hill , 1997

2 Electric Machines by Ashfaq Husain , Dhanpat Rai & Com. , 2005

3 Generalised Theory of Electrical Machines by Dr. P S Bimbhra , 1996

4 Irvin L.Kosow,"Electric Machinery and Transformers" Prentice Hall of India.

5 P.S. Bimbhra,"Electric Machinery" Khanna Publishers.

TME -404

## MEASUREMENT, METROLOGY AND CONTROL

| | L | T | P |
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**Unit-I**

**I. Mechanical Measurements**

**Introduction :** Introduction to measurement and measuring instruments, Generalised measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration, concept of error, sources of error, statistical analysis of errors. 4

**Sensors and Transducers :**

Types of sensors, types of transducers and their characteristics. 2

**Signal transmission and processing :**

Devices and systems. 2

Signal Display & Recording Devices 1

**Unit-II**

**Time related measurements :**

Counters, stroboscope, frequency measurement by direct comparison. 1

Measurement of displacement 1

**Measurement of pressure :**

Gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures. 1

**Strain measurement :**

Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration. 2

**Measurements of force and torque :**

Different types of load cells, elastic transducers, pneumalic & hydraulic systems. 1

**Temperature measurement :**

By thermometers, bimetallic, thermocouples, thermistors and pyrometers. 2

**Vibration:**

Seismic instruments, vibration pick ups and decibel meters, vibrometers accelerometers. 2

**Unit-III :**

**METROLOGY**

**II. Metrology and Inspection :**

Standards of linear measurement, line and end standards. Limit, fits and tolerances. Interchangeability and standarisation. 2

Linear and angular measurements devices and systems Comparators: Sigma, Johansson's Microkrator. 2

Limit gauges classification, Taylor's Principle of Gauge Design. 2

## Unit-IV

Measurement of geometric forms like straightness, flatness, roundness. 2

Tool makers microscope, profile project autocollimator. 1

Interferometry : principle and use of interferometry, optical flat. 2

Measurement of screw threads and gears. 2

Surface texture : quantitative evaluation of surface roughness and its measurement. 1

## Unit-V

**Controls**

**Introduction:** Concept of Automatic Controls – open loop & closed loop systems. Servomechanisms. Block diagrams, transfer functions. Applications of Laplace-Transform in control systems with simple examples / numericals. 5

**Representation of control components & Systems:** Translation & rotational mechanical components, series & parallel combinations, cascade system, analogous system. 2

**Controllers:** Brief introduction to Pneumatic, hydraulic and electric controllers 1

**References**


1. Beckwith Thomas G., Mechanical Measurements, Narosa Publishing House, N. Delhi.
2. Doeblein E.O., “Measurement Systems, Application Design”, McGraw Hill, 1990.
3. Kumar D.S., “Mechanical Measurements and Control”, Metropolitan, N. Delhi.
4. Hume K.J., “Engineering Metrology”, MacDonald and Co. 1963
5. Gupta, I.C., “Engineering Metrology”, Dhanpat Rai & Sons, New Delhi, 1994
6. Sirohi, “Mechanical Measurement” New Age Publishers
7. Jain, R.K., “Engineering Metrology” Khanna Publishers
8. Jain, R.K., “Mechanical Measurement” Khanna Publishers
9. Raven, “Automatic Control Theory”, McGraw Hill Publishers.

10 Nagrath and Gopal, “Control System Engineering”, New Age Publishers.

***PME-453***

# MANUFACTURING SCIENCE-1 LAB

**Experiments :**

Say minimum 8 experiments out of following (or such experiment).

1. Design of pattern for a desired casting (containing hole)
2. Pattern making
3. Making a mould (with core) and casting.
4. Sand testings (at least one such as grain fineness number determination)
5. Injection moulding with plastics
6. Forging hand forging processes
7. Forging - power hammer study & operation
8. Tube bending with the use of sand and on tube bending m/c.
9. Press work experiment such as blanking/pievcing, washer, making etc.
10. Wire drawing/extrusion on soft material.
11. Rolling-experiment.
12. Bending & spring back.
13. Powder metallergy experiment.
14. Jigs & Fixture experiment.

***PME 454***

## MEASUREMENT, METROLOGY AND CONTROL LAB

**Experiments:**

Say minimum 8 out of following (or such experiments)

1. Study & working of simple measuring instruments. Like vernier calipers, micrometer, tachometer etc.
2. Measurement of effective diameter of a screw thread using 3 wire method.
3. Measurement of angle using sinebar & slip gauges.
4. Study of limit gauges.
5. Study & angular measurement using level protector
6. Adjustment of spark plug gap using feeler gauges.
7. Study of dial indicator & its constructional details.
8. Use of dial indicator to check a shape run use.
9. Study and understanding of limits, fits & tolerances
10. Pressure measuring experiment
11. Temperature measurement experiment
12. Strain gauge measurement
13. Speed measurement using stroboscope
14. Flow measurement experiment
15. Vibration/work measuring experiment.

16. & 17. Experiments on 'Controls'

**P*ME- 456***

# MACHINE DRAWING –II LAB

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**Review** (1 class)

Orthographic projection, missing lines, interpretation of views and sectioning.

**Part and Assembly drawing** (2 classes)

Introduction, assemblies drawing of stuffing box, steam engine cross head, air valve, late tailstock, gate valve, screw jack, connecting rods, spark plug, tool post, safety valves etc. Drawing exercises.

**Specification of Materials :** (1 class)

Engineering materials, code designation of steels, copper and aluminum and its alloys.

**Limits, Tolerance and fits :** (1 class)

Introduction, Limit systems, tolerance, fits, Drawings and exercises

**Surface Roughness :** (1 class)

Introduction, surface roughness, machining symbols, indication of surface roughness, drawing exercises

**Production Drawing :** (2 classes)

Indtoduction to developing and reading of production drawing of simple machine elements like helical gear, bevel gear, flange, pinion shaft, connecting rod, crankshaft, belt pulley, piston details etc. Idea about tool drawing.

**Computer Aided Drafting :** (3 classes)

Introduction, input, output devices, introduction to drafting software like Auto CAD, basic commands and development of simple 2D and 3D drawings.

**References :**


1. Machine Drawing by Narayana, et. all, New Age
2. Production drawing by Narayana, et. all, New Age
3. Auto CAD 14 for Engineering Drawing by P. Nageswara Rao, TMH.

**PEE 455**

# ELECTRICAL MACHINES LABORATORY

| L | T | P |
|---|---|---|
| 0 | 0 | 3 |

**Note : Minimum nine experiments are to be performed from the following list.**

1 To obtain magnetization characteristics of a dc shunt generator
2 To obtain load characteristics of a dc shunt generator
3 To obtain load characteristics of a dc series generator
4 To obtain load characteristics of a dc compound generator (a) cumulatively compounded (b) differentially compounded
5 To obtain speed – torque characteristics of a dc shunt motor
6 To obtain efficiency & voltage regulation of a single phase transformer by Sumpner's (back to back) test
7 To perform no load test & block rotor test on a three phase induction motor and determine parameters of equivalent circuit and efficiency
8 To perform no load test and blocked rotor test on a single phase induction motor and determine efficiency
9 To obtain variation of stator current with excitation current (V/curve) of a three phase synchronous motor at no load ½ load and full load.
10 To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation by synchronous impedance method at a power factor of unity 0.8 lagging & 0.8 leading
11 To study operation of a 2-phase ac servomotor and a stepper motor
12 To study parallel operation of three phase alternators

**Uttarakhand Technical University**

**Program: B.Tech**

**Year: 3 Mechanical Engg.** **Session: 2011-2012**

**<u>Scheme and Evaluation Pattern</u>**

**Semester: V**

| S. No | Course NO. | Subject | Periods | | | Evaluation | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Sessional | | | External Exam | |
| | | | | | | CT | TA | Total | | |
| **Theory** | | | | | | | | | | |
| 1 | TME-501 | Mechanical Vibrations | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 2 | TME-502 | Machine Design I | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 3 | TME-503 | Dynamics Of Machine | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 4 | TME-504 | Manufacturing Science II | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 5 | TME-505 | Heat and Mass Transfer | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 6 | TCS-507 | Concepts of programming and OOPS | 2 | 1 | 0 | 15 | 10 | 25 | 50 | 75 |
| **Practical** | | | | | | | | | | |
| 1 | PME-552 | Theory of Machine and design Lab | 0 | 0 | 2 | 0 | 0 | 25 | 25 | 50 |
| 2 | PME-555 | Heat and Mass Transfer | 0 | 0 | 2 | 0 | 0 | 25 | 25 | 50 |
| 3 | PCS-557 | Application of programming and OOPS Lab | 0 | 0 | 2 | 0 | 0 | 0 | 25 | 25 |
| 4 | PME 558 | Discipline | | | | | | | | 50 |
| Total | | | | | | | | | | 1000 |

**L**- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

**Uttarakhand Technical University**

**Program: B.Tech**

**Year: 3 Mechanical Engg. Session: 2011-2012**

**Scheme and Evaluation Pattern**

**Semester: VI**

| S.No | Course NO. | Subject | Periods | | | Evaluation | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Sessional | | | External Exam | |
| | | | | | | CT | TA | Total | | |
| **Theory** | | | | | | | | | | |
| 1 | TME-601 | Operation Research | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 2 | TME-602 | IC Engine | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 3 | TME-603 | Machine Design II | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 4 | TME-604 | Fluid Machinery | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 5 | TME-605 | Refrigeration and Air Conditioning | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 6 | THU-608 | Principle Of Management | 2 | 1 | 0 | 15 | 10 | 25 | 50 | 75 |
| **Practical** | | | | | | | | | | |
| 1 | PME 653 | Machine Design II Lab | 0 | 0 | 2 | 0 | 0 | 25 | 25 | 50 |
| 2 | PME 654 | Fluid Machinary Lab | 0 | 0 | 2 | 0 | 0 | 25 | 25 | 50 |
| 3 | PME 655 | Refrigeration and Air Conditioning Lab | 0 | 0 | 2 | 0 | 0 | 0 | 25 | 25 |
| 4 | PME 657 | Seminar | | | | | | | | 50 |
| **Total** | | | | | | | | | | 1000 |

**L**- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

**Uttarakhand Technical University**

**Program: B.Tech**

**Year: 4 Mechanical Engg. Session: 2012-2013**

**<u>Scheme and Evaluation Pattern</u>**

**Semester: VII**

| S.No | Course NO. | Subject | Periods | | | Evaluation | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Sessional | | | External Exam | |
| | | | | | | CT | TA | Total | | |
| **Theory** | | | | | | | | | | |
| 1 | TME-701 | CAD/CAM | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 2 | TME-702 | Maintenance & Safety | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 3 | TME-703 | Energy Conservation | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 4 | TME-XXX | Elective I | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 5 | | Open Elective I | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| **Practical** | | | | | | | | | | |
| 1 | PME-751 | CAD/CAM Lab | 0 | 0 | 2 | 0 | 0 | 25 | 25 | 50 |
| 2 | PME-752 | Industrial Training | 0 | 0 | 2 | 0 | 0 | 25 | 25 | 50 |
| 3 | PME-753 | Project | | | | | | 100 | | 100 |
| 4 | PME-754 | Seminar | | | | | | 50 | | 50 |
| Total | | | | | | | | | | 1000 |

**L**- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

**Uttarakhand Technical University**

**Program: B.Tech**

**Year: 4 Mechanical Engg. Session: 2012-2013**

**<u>Scheme and Evaluation Pattern</u>**

**Semester: VIII**

| S.No | Course NO. | Subject | Periods | | | Evaluation | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Sessional | | | External Exam | |
| | | | | | | CT | TA | Total | | |
| **Theory** | | | | | | | | | | |
| 1 | TME-801 | Power Plant Engineering | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 2 | TME-802 | Automobile Engineering | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 3 | TME-XXX | Elective II | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| 4 | TME-XXX | Elective III | 3 | 1 | 0 | 30 | 20 | 50 | 100 | 150 |
| **Practical** | | | | | | | | | | |
| 1 | PME-852 | Automobile Engg. Lab | 0 | 0 | 2 | 0 | 25 | 25 | 25 | 50 |
| 2 | PME-853 | Project | 0 | 0 | 2 | 0 | 100 | 100 | 200 | 300 |
| 3 | PME-854 | Discipline | | | | | | | | 50 |
| Total | | | | | | | | | | 1000 |

**L**- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

**TME-501 MECHANICAL VIBRATIONS** **L T P**

**3 1 0**

**UNIT- I**

**INTRODUCTION:**

Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, fourier analysis. Single **4**

Degree Freedom System: Free vibration, Natural frequency, Equivalent Systems, Energy method for determining natural frequency, Response to an initial disturbance, **3**

Torsional vibrations, Damped vibrations. Damping models – Structural, Coulomb and Viscous damping, Vibrations of system with viscous damping, Logarithmic decrement, Viscous dampers. **3**

**UNIT- II**

Single Degree Freedom: Forced vibration, Harmonic Excitation with viscous damping, Steady state vibrations, **4**

Forced vibrations with rotating and reciprocating unbalance, Support excitation, **2**

Vibration isolation, Transmissibility, Vibration measuring instruments- Displacement, Velocity, Acceleration and Frequency measuring instrument. **4**

**UNIT- III**

Two Degree Freedom System: Introduction, Principal modes, Double pendulum, Torsional system with damping, **3**

Coupled System, Undamped dynamic, vibration absorbers, Centrifugal pendulum absorber, Dry friction damper, Untuned viscous damper. **4**

**UNIT- IV**

Multidegree Freedom System: Exact Analysis Undamped free and forced vibrations of multidegree system, **2**

Influence numbers, Reciprocal Theorem, Torsional vibration of multi rotor system, Vibration of geared system, **3**

Principal coordinates, Continuous systems- Longitudinal vibration of bars, Torsional vibrations of Circular shafts, Lateral vibration of beams. **3**

**UNIT- V**

Multidegree Freedom System: Numerical Analysis Rayleigh's, Dunkerley's, Holzer's and Stodola's methods, Rayleigh – Ritz method. **4**

Critical Speed of Shafts: Shafts with one disc with and without damping, Multi-disc shafts, Secondary critical speed. **3**

**Reference Books :**


**1. Mechanical Vibration –Magreb, Cengage India, New Delhi**

**2. Mechanical Vibration Practice with Basic Theory – V. Rama Murthy – Narosa Publishers**

**3. Machanical Vibrations – S.S. Rao, Pearson**

**4. Mechanical Vibration- Palm, Wiley India, New Delhi**

**TME-502 MACHINE DESIGN –I** **L T P**
**3 1 0**

**UNIT-I**

**Introduction,** Definition, Methods, standards in design & selection of preferred size. **3**

**Selection of materials** for static & fatigue loads, Materials for components subjected to creep, BIS system of designation of steels, steels, plastics & rubbers. AISI (American Iron & Steel Institution), ASTM rubber testing methods. **4**

**UNIT-II**
**Design against static load.**
Modes of failure, Factor of safety, stress-strain relationship, principal stresses, theories of failure **4**
**Design against fluctuating load** stress concentration, stress concentration factors, Fluctuating/alternting stresses, fatigue failure, endurance limit, design for finite & infinite life, Soderberg & Goodman criteria. **4**

**UNIT-III**
**Design Of Joints**
Welded joint, screwed joints, ecentric loading of above joints, Joint design for fatigue loading. **3**

**Shaft, keys & coupling**.
Design against static and fatigue loads, strength & rigidity design, Selection of square & flat keys & splines, rigid & flexible couplings. **4**

**UNIT-IV**
**Mechanical springs**
Design of Helical and leaf springs, against static & fatigue loading. **4**

**Design analysis of Power Screws**
Form of threads, square threads, trapezoidal threads, stresses in screw, design of screw jack. **4**

**UNIT-V**
**Introduction to Product Development & Design Process**
Definition of Design, Design Process, Need Analysis, Need based developments, Design by Evolution, Technology based developments, Examples. Case Studies. Brain-storming. **8**

**References**
1. Design of Machine Elements : Bhandari, TMH
2. Machine design : Sharma & Aggarwal, Katsons publications
3. Mechanical Design, Theory and Metholodogy, Waldraon, BSP, Hyderabad
4. M/C Design : Maleev & Hartman
5. Machine Design, Robert L Norton, Pearson
6. Machine Design –U C Jindal, Pearson

**TME-503 DYNAMICS OF MACHINES** **L T P**
**UNIT-I** **3 1 0**

**Force Analysis, Turning Moment & Fly wheel:**
Static force analysis of linkages, Equivalent offset inertia force, Dynamic analysis of slider crank & Bar mechanism. Piston and Crank effort, Inertia, Torque, Turning moment diagrams, Fluctuation of energy, Flywheel. **4**

**UNIT-II Balancing of machines:**
Static and dynamic balancing, Balancing of rotating and reciprocating masses, Primary and secondary forces and couples. **5**

**UNIT-III Friction:**
Pivot and collar friction, Friction circle, Single plate, Multiplate and Cone clutches, Michelle & Kingsbury thrust bearing and rolling contact bearing, Belts and pulleys, Flat and V-belts, Design and selection. **7**

**Brakes and Dynamometers (Mechanical Type):**
External and internal shoe brakes, Band and Block brakes, Hydraulic brakes, Absorption and Transmission dynamometers. **7**

**UNIT-IV**
**Governors:**
Dead weight and spring loaded governors, Sensitivity, Stability, Hunting, Isochronisms, Effort and Power, Friction and Insensitivity, Introduction to inertia governors. **6**

**UNIT - V**
**Gyroscopic Motion:**
Principles, Gyroscopic acceleration, gyroscopic couple and Reaction. Effect of Gyroscopic couple upon the stability of aero planes, ship, two & four wheelers. **4**

**References**
1.Theory of Machine: Thomas Bevan (Pearson)
2.Theory of Machine: S.S.Ratan (TMH)
3. Kinematics, Dynamics & Design of Machinery-Waldron (Pearson)

**TCS-507 CONCEPTS OF PROGRAMMING AND OOPS** **L T P**
**2 1 0**

**UNIT 1**

**UTILIZATION:** Developer fundamentals such as editor, integrated programming environment, UNIX shell, modules, libraries. 2

**PROGRAMMING FEATURES:** Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic I/O.

**APPLICATIONS:** Sample problems in engineering, science, text processing, and numerical methods. 5

**UNIT 2**

**PROBLEM SOLVING WITH ALGORITHMS**- Programming styles – Coding Standards and Best practices - Introduction to C Programming, Testing and Debugging. Code reviews, System Development Methodologies – Software development Models, User interface Design – introduction – The process – Elements of UI design & reports. 5

**UNIT 3**

**OBJECTED ORIENTED CONCEPTS** – object oriented programming, UML Class Diagrams– relationship – Inheritance – Abstract classes – polymorphism, Object Oriented Design methodology - Common Base class, Alice Tool – Application of OOC using Alice tool. 4

**UNIT 4**

**RDBMS- DATA PROCESSING** – the database technology – data models, ER modeling concept –notations – Extended ER features, Logical database design – normalization, SQL – DDL statements – DML statements – DCL statements, Writing Simple queries – SQL Tuning techniques – Embedded SQL – OLTP 8

**REFERENCES:**


1.Computer Concepts and C Programming by Vikas Gupta, Wiley India

2.Introduction to Computers by Peter Norton, TMH

3. G. Dromey, How to Solve It by Computer, Pearson

4.Programming in ANSI C by Balaguruswamy, TMH

**TME-504 MANUFACTURING SCIENCE-II** ` **L T P**
**3 1 0**

**Unit-I**

**A Metal Cutting and Machine Tools**

**Metal Cutting-**
Mechanics of metal cutting. Geometry of tool and nomenclature .ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required. Cutting fluids/lubricants. Tool materials. Tool wear and tool life. Machinability. Brief introduction to machine tool vibration and surface finish. Economics of metal cutting. **8**

**Unit-II**

**Machine Tools**
(i) Lathe : Principle, types, operations, Turret/capstan, semi/Automatic, Tool layout. **2**
(ii) Shaper, slotter, planer : operations & drives. **1**
(iii) Milling : Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required. **2**
(iv) Drilling and boring : Drilling, boring, reaming tools. Geometry of twist drills. **2**

**Unit-III**

**Grinding & Super finishing**
(v) Grinding : Grinding wheels, abrasive, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and Cylindrical grinding. Centerless grinding. **4**
(vi) Super finishing : Honing, lapping, polishing. **1**

**Limits, Fits & Tolerance and Surface-roughness:**
Introduction to Limits, Fits, Tolerances and IS standards, and surface-roughness. **3**

**Unit-IV**

**B. Metal Joining (Welding)**
Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding : Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot, seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electroslag, friction welding. Soldering & Brazing . **8**

Thermodynamic and Metallurgical aspects in welding and weld,. Shrinkage/residual stress in welds. Distortions & Defects in welds and remedies. Weld decay in HAZ. **3**

**Unit-V**

**C. Introduction to non conventional Manufacturing Process**
Benefits, application and working principle of EDM, ECM, LBM, EBM, USM. AJM, WJM. Similarly, non-conventional welding application such as LBW, USW, EBW, Plasma arc welding, Explosive welding. HERE- Explosive Forming **6**

**Books**

1. Modern Machining Processes by P.C. Pandey & H.S. Shan
2. Manufacturing science by Degarmo, Wiley India
3. Manufacturing Technology Metal Cutting & Machine Tools by PN Rao, TMH
4. Manufacturing Process by Sontosh Bhatnagar, BSP Hyderabad

**TME-505 HEAT & MASS TRANSFER** **L T P**
**3 1 0**

**UNIT-1**

**Introduction to Heat Transfer:**
Concepts of heat flows: conduction, convection and radiation; effect
Of temperature on thermal conductivity of materials; introduction to combined heat transfer mechanism. **2**

**Conduction :**
One-dimensional general differential heat conduction equation in the rectangular,initial and boundary conditions. **3**

**Steady State one-dimensional Heat conduction :**
Composite Systems in rectangular, cylindrical and spherical coordinates with and without
Energy generation; thermal resistance concept; Analogy between heat and electricity flow; thermal contact resistance;Overall Heat Transfer Coefficient,critical thickness of insulation.
**3**

**UNIT-2**
Types of fins, Fins of uniform cross-sectional area; errors of measurement of temperature in thermometer wells.
**2**

**Transient Conduction:**
Transient heat conduction Lumped capacitance method, unsteady state heat conduction in one dimension only, Heisler charts. **4**

**UNIT-3**

**Forced Convection:**
Basic concepts; hydrodynamic boundary layer; thermal boundary layer, flow over a flat
plate; flow across a single cylinder and a sphere; flow inside ducts; empirical heat transfer relations; relation between fluid friction and heat transfer; liquid metal heat transfer. **4**

**Natural Convection :**
Physical mechanism of natural convection; buoyant force; empirical heat transfer
relations for natural convection over vertical planes and cylinders, horizontal plates and Cylinders, and sphere. **5**

**UNIT-4**

**Thermal Radiation :**
Basic radiation concepts; radiation properties of surfaces; black body radiation laws;
shape factor; black-body radiation exchange; Radiation exchange between non-blackbodies in an enclosure; Infinite parallel Planes, radiation shields; **7**

**UNIT-5**

**Heat Exchanger :**
Types of heat exchangers; fouling factors; overall heat transfer coefficient; logarithmic Mean temperature difference (LMTD) method; effectiveness-NTU method; compact heat Exchangers, Steam distribution systems.
**Condensation And Boiling :**
Introduction to condensation phenomena; heat transfer relations for laminar film condensation on vertical surfaces and on a horizontal tube; Boiling modes pool boiling, curve, forced convective boiling. **3**

**Introduction To Mass Transfer :**
Introduction; Flick's law of diffusion; steady state equimolar counter diffusion; steady state diffusion though a stagnant gas film. **2**

**Books**
1. Elements of Heat transfer by Cengel, TMH
2. Heat and mass transfer, M.Thirumaleswar, Pearson
3. Fundamentals of Heat & Mass Transfer by Incropera Wiley India
4.Heat & Mass Transfer by Khurmi, Schand,New Delhi

**PME 551 THEORY OF MACHINE & DESIGN LAB**

| L | T | P |
|---|---|---|
| 0 | 0 | 2 |

**( Min 3 out of these)**

1. Design & drawing of a cotter joint.
2. Design & drawing of a knuckle joints.
3. Design & drawing of a simple screw jack.
4. Design of shaft for different loading conditions.
5. Design & drawing of rigid coupling( flanged type).
6. Design & drawing of a leaf spring for an automobile.
7. Design & drawing of a helical spring for a given application

**Note -**

1. Students may be advised to use design data book for design.
2. Drawing shall be made wherever necessary on small drawing sheets.

**Min. 5 out of following (or such) experiments to be done:**

1. Study of simple linkers/models/mechanisms.
2. Exp. on Velocity acceleration.
3. Exp. on cam.
4. Exp. on Governor.
5. Exp. on critical speed of shaft (whirling of shaft )
6. Exp. on Gyroscope
7. Exp. on Balancing (static & dynamic)
8. Exp. on 4-bar mechanism
9. Exp. on Gears (tooth profile, interference etc.)
10. Exp. on Gear trains.
11. Exp. on Mechanism
15. Exp. on Vibration (spring)

**TME-555 HEAT & MASS TRANSFER – LAB** **L T P**
**(min 8 experiment of the following or such experiment)** **0 0 2**

1. Conduction - Composite wall experiment
2. Conduction - Composite cylinder experiment
3. Convection - Pool Boiling experiment
4. Convection - Experiment on heat transfer from tube-natural convection.
5. Convection - Heat Pipe experiment.
6. Convection - Heat transfer through fin-natural convection .
7. Convection - Heat transfer through tube/fin-forced convection.
8. Any experiment - Such as on Stefen's Law,
on radiation detrmination of emissivity, etc.
9. Any experiment - Such as on solar collector, etc.
on radiation
10. Heat exchanger - Parallel flow experiment
11. Heat exchanger - Counter flow experiment
12. Any other suitable exp such as on critical insultation thickness.
13. Conduction - Determination of thermal conductivity of fluids.
14. Conduction - Thermal Contact Resistance Effect.

**TME 601 OPERATIONS RESEARCH** **L T P**
**3 1 0**

**Unit 1: Introduction:**
Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR Mathematical formulation of L.P. Problems. Graphical solution methods. **6**

**Linear Programming Problems**:
The simplex method - slack, surplus and artificial variables. Concept of duality, two phase method, dual simplex method, degeneracy, and procedure for resolving degenerate cases.
**7**

**Unit 2: Transportation Problem**:
Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods,
Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation
problems. **7**
Assignment Problem: Formulation, unbalanced assignment problem, traveling problem. **6**

**Unit 3: Game Theory**:
Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property. **6**

**Unit 4: Queuing Theory:**
Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzingof M/M/ 1 and M/M/C queuing model. **6**

**Unit 5: PERT-CPM Techniques:**
Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks. **8**

**Reference** :
1. Taha H. A. - Operations Research , Pearson
2. Operations Research: Principles and practice: Ravindran, Phillips & Solberg, Wiley India ltd
3. AM Natarajan, P.Balasubramani , ATamilaravari “Operation research” Pearson 2005
4. Introduction to operation research: Theory and Applications, Springer BSP, Hyderabad
5.S D Sharma-Operations Research, Kedarnath Ramnath

**TME 602 I C ENGINES** **L T P**
**3 1 0**

**Unit-1**

**Introduction to I.C Engines:**
Engine classification, Air standard cycles, Otto, Diesel, Stirling, Ericsson cycles, Actual Cycle analysis, Two and four stroke engines, SI and CI engines, Valve timing diagram, Rotary engines, stratified charge engine. **5**

**Fuels:**
Fuels for SI and CI engine , important qualities of SI engine fuels, Rating of SI engine fuels, Important qualities of CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines. **3**

**Unit–2**

**SI Engines:**
Carburetion, Mixture requirements, Carburetor types Theory of carburetor, MPFI. **3**
Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, combustion chamber design for SI engines. **2**

Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition, battery and its types, Charging and discharging of batteries **2**

**Unit–3 CI Engine:**
Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings. **4**
Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines. **2**
Scavenging in 2 Stroke engines, pollution and it's control. **2**

**Unit-4**

**Engine Cooling:** Different cooling systems, Cooling Towers, Radiators and cooling fans. **2**

**Lubrication:** Engine friction, Lubrication principal, Type of lubrication ,Lubrication oils, Crankcase ventilation. **2**

**Supercharging:** Effect of altitude on power output, Types of supercharging. **2**

**Testing and Performance:** Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines. **4**

**Unit-5**

**Compressors:**
Classification, Reciprocating compressors, Single and multi stage, Intercooling, Volumetric efficiency. **3**

Rotary compressors, Classification, Centrifugal compressor, Elementary theory ,Vector Diagram efficiencies, Elementary analysis of axial compressors. **4**

**BOOKS:**
I.C. Engines by Ganeshan ,TMH
I C Engines by Ferguson, Wiley India
A Course in International Combustion Engines, by Mathur & Sharma, Dhanpat Rai & Sons.
Reciprocating and Rotary Compressors, by Chlumsky, SNTI Publications Czechoslovakia .
I.C Engine Analysis & Practice by E.F Obert.
I.C Engine, by Ganeshan, TMH
I.C Engine, by R. Yadav, Central Publishing House, Allahabad

**TME-603 : MACHINE DESIGN-II** **L T P**
**3 1 0**

**UNIT I**

**Spur Gears** Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards. **5**

**Helical Gears** Terminology, Proportions for helical gears, Beam strength and wear strength of helical gears, herringbone gears, crossed helical gears, Design of helical gears. **3**

**Worm Gears** Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing **3**

**UNIT II**

**Sliding Contact Bearing** Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing**, 5**

**Rolling Contact Bearing** Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing.

**6**

**Recommended Books**

Mechanical Design Theory and methodology by Waldron, Springer India

Machine Design by Juvinall, Wiley India , New Delhi

Handbook of Gear Design by Maitra ,TMH

Shigleys Mechanical Engineering Design ,TMH

**UNIT III**

**IC ENGINE PARTS**

Selection of type of IC engine, General design considerations, Design of Cylinder and cylinder head; Design of piston, piston ring and gudgeon pin; Design of connecting rod; Design of centre crankshaft **6**

**References:**


**1. Mechanical Engineering Design – Joseph E. Shigely, McGraw Hill Publications**

**2. Design of Machine Memebers-Alex Valance and VI Doughtie, McGraw Hill Co.**

**3. Machine design-M.F. Spott, Prentice Hall India**

**4. Machine Design-Maleev and Hartman, CBS**

**5. Machine design -Black & Adams, Mc Graw Hill**

**6. Machine Design-Sharma and Agrawal, S.K. Katara & Sons**

**7. Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.**

**TME 604 FLUID MACHINERY** **L T P**
**3 1 0**

**Introduction:**
Classification of Fluid Mechanics, Application of momentum and momentum equation to flow through hydraulic machinery, Euler's fundamental equation. **5**

**Impact of jet:**
Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), effect of inclination of jet with the surface. **3**

**Hydraulic Turbines:**
Classification of turbines, Impulse turbines, constructional details, velocity triangles, power and efficiency calculations, governing of Pelton wheel. **9**

**UNIT-II**

**Reaction Turbines:**
Fransis and Kaplan turbines, constructional details, velocity triangles, power and efficiency calculations, degree of reaction, draft tube, cavitation in turbines, principles of similarity, unit and specific speed, performance characteristics, selection of water turbines. **9**

**UNIT-III**

**Centrifugal Pumps:**
Classifications of centrifugal pumps, vector diagram, work done by impellor, efficiencies of centrifugal pumps, specific speed, model testing, cavitation and separation, performance characteristics. **7**

**UNIT-IV**

**Positive Displacement Pumps:**
Reciprocating pump theory, slip and coefficient of discharges, indicator diagram, effect and acceleration, work saved by fitting air vessels, comparison of centrifugal and reciprocating pumps, positive rotary pumps, Gear and Vane pumps, performance characteristics. **7**

**UNIT-V**

**Other Machines:**
Hydraulic accumulator, Intensifier, Hydraulic press, Lift and Cranes, theory of hydraulic coupling and torque converters, performance characteristics. **5**

**Water Lifting Devices:** Hydraulic ram, Jet pumps, Airlift pumps**,** water distribution systems. **3**

**References:**

Fluid Mechanics and Hydraulic Machines by S C Gupta, Pearson
Fundmanetals of Fluid Mechanics by Munson, Pearson
Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
Hydraulic Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.
Hydraulic Machines by R K Rajput, S.Chand & co Ltd.
Hydraulic Machines by D S Kumar

**TME 605 REFRIGERATION & AIR CONDITIONING** **L T P**
**3 1 0**

**Unit-1**

**Refrigeration:**
Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P. Air Refrigeration cycle:
Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART). **8**

**Unit-2**

**Vapour Compression System:**
Single stage system, Analysis of vapour compression cycle, use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Different configuration of multistage system, Cascade system. **8**

**Unit-3**

**Vapour Absorption system;**
Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Ammonia – Water vapour absorption system, Lithium-Bromide water vapour absorption system, Comparison. **5**

**Refrigerants:**
Classification, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. **3**

**Unit-4**

**Air Conditioning:**
Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body Effective temperature and comfort chart, Cooling and heating load calculations, Infiltration & ventilation, Internal hear gain, Sensible heat factor ( SHF ), By pass factor, Grand Sensible heat factor ( GSHF), Apparatus dew point (ADP). **9**

**Unit-5**

**Refrigeration Equipment & Application:**
Elementary knowledge of refrigeration & air conditioning equipments e.g compressors, condensers, evaporators & expansion devices, Air washers, Cooling, towers & humidifying efficiency, Food preservation, cold storage, Refrigerates Freezers, Icc plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning. **7**

**Books:**
Refrigeration and Air conditioning by C.P Arora.TMH
Refrigeration and Air conditioning by Arora & Domkundwar.Dhanpat Rai
Refrigeration and Air conditioning by stoecker & Jones.
Refrigeration and Air conditioning by Roy J. Dossat.Pearson
Heating Ventilating and Air conditioning by Mcquiston
Thermal Environment Engg. by Kuhen, Ramsey & Thelked. Central Book Agency.
ASHRAE Handbooks

**THU-608**

**PRINCIPLES OF MANAGEMENT** **L T P**
**2 1 0**

**UNIT 1**

**INTRODUCTION TO MANAGEMENT:** Theories of management: Traditional behavioral, contingency and systems approach. Organization as a system. 4

**UNIT 2**

**MANAGEMENT INFORMATION:** Interaction with external environment. Managerial decision making and MIS. 4

**UNIT 3**

**PLANNING APPROACH TO ORGANIZATIONAL ANALYSIS:** design of organization structure; job design and enrichment; job evaluation and merit rating. 3

**UNIT 4**

**MOTIVATION AND PRODUCTIVITY**: Theories of motivation, leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control. Japanese management techniques. Case studies. 7

**TEXT BOOK:**

1.Schermerhorn,; Management and Organisational Behaviour essentials, Wiley India
2. Koontz: Essentials of Management, PHI Learning.
3. Hirschey: Managerial Economics, Cengage Learning.
4.A V Rau: Management Science, BSP, Hyderabad
5.Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.
6.Stephan R Robbins Fundamental of Management, Pearson

**TME-654 FLUID MACHINERY LAB**

| L | T | P |
|---|---|---|
| 0 | 0 | 2 |

**(Say min 8 experiments from following or such experiment)**

1. Impact of Jet experiment.
2. Turbine exp. on Pelton wheel.
3. Turbine exp. on Francis turbine.
4. Tubrine exp. on Kaplan turbine.
5. Exp. on Reciprocating pump.
6. Exp. on centrifugal pump.
7. Exp. on Hydraulic Jack/Press
8. Exp. on Hydraulic Brake
9. Exp. on Hydraulic Ram
10. Study through first visit of any pumping station/plant
11. Study through second visit of any pumping station/plant.
12. Any other suitable experiment/test rig such as comparision & performance of different types of
pumps and turbines.

**TME-655**

**REFRIGERATION & AIR CONDITIONING LAB** **L T P**

**Say min 8 out of following** **0 0 2**

1. Experiment on refrigeration test ring and calculation of various proformance parameters.
2. To study different types of expansion devices used in refrigreation system.
3. To study different types of evaporators used in refrigeration systems.
4. To study basic components of air-conditioning system.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. To study air washers
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
9. Visit of a central air conditioning plant.
10. Visit of cold storage.

**TME 701 CAD/CAM** **L T P**
**3 1 0**

**UNIT I :**
**CAD TOOLS**: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, Review of C, C++, statements such as if else for while & switch, functions, pointernotations, structure & class, concept of OOP. **4**

**GEOMETRICMODELLING:** Output primitives- Bresenham's line drawing and Mid-point circle algorithms. Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves her mite cubic splines Bezier curves B-splines rational curves **3**

**UNIT II:**

**SURFACE MODELING :**Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder. **3**

**PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES** – Hermite Bicubic surface, Bezier surface, B- Spline surface, COONs surface, Blending surface , Sculptured surface, Surface manipulation – Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D). **4**

**GEOMETRICMODELLING-3D :** Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG). **3**

**UNIT III :**
CAD/CAM Exchange : Evaluation of data – exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF. **4**

**Collaborative Engineering:** Collaborative Design, Principles, Approaches, Tools, Design Systems. Introduction to CAD/CAE, Element of CAD, Concepts of integrated CAD/CAM, CAD Engineering applications, its importance & necessity. Finite Element Methods: Introduction and Application of FEM, Stiffness Matrix/ Displacement Matrix, One/Two Dimensional bar & beam element (as spring system) analysis. **7**

**UNIT – IV**

**NC Part Programming-**
Manual (word address format) programming. Examples Drilling and Milling. **5**

**UNIT – V**
System Devices- Introduction to DC motors, stepping motors, feed back devices such as encoder, counting devices, digital to analog converter and vice versa. **4**
**Interpolators-** Principle, Digital Differential Analysers. Linear interpolator, circulator

Interpolator and its software interpolator. Control of NC Systems- Open and closed loops. Automatic control of closed loops with encoder & tachometers. Speed variation of DC motor. Adaptive control **8**

**References**

1. CAD/CAM Theory and Practice – Ibrahim Zeid ,TMH
2. CAD/CAM – Groover & Zimmers Pearson
3. Computer Oriented Numerical Methods – Rajaraman PHI Learning
4. CAD/CAM by

**TME-702 MAINTENANCE& SAFETY ENGINEERING** **L T P**
**3 1 0**

**Unit-I**

Introduction, operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models. maintainability, availability, reliability **4**

**Unit-II**

Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency. **6**

**Unit-III**

Replacement planning &maintain or replace decision, replacement of items that deteriorate with time identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning **8**

**Unit-IV**

**SAFETY IN ENGINEERING INDUSTRY:**

Introduction - definitions - classification of engineering industry - different process in engineering industry. Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage,. disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection.**7**

Care and maintenance of common elements used in material handling equipments like rope chains slings, hooks , clamps .general safety consideration in material handling - manual and mechanical handling . Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents. **8**

**Unit-V**
Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management. **8**

**References**
1) Industrial Safety Handbook : William Handley
2) Introduction to Safety Engineering : David S Gloss & Miriam GayleWardle
3) Industrial Safety : Roland P Blake
4) Health and Safety in Welding and allied process :N C Balchin,Jaico publishers
5.Management of systems – R.N. Nauhria & R. Prakash.

## TME- 703: Energy Conservation

| L | T | P |
|---|---|---|
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### Unit -I

**Energy Audit:** Definition, Need and Objectives. **1**

**Types of Energy Audit:** Internal Audit, External Audit, Walk through Energy Audit, Preliminary Energy Audit, Detailed Energy Audit, Industrial Energy Audit, Utility (Services) Energy Audit, Commercial Energy Audit, Residential Energy Audit. **3**

**Basic Components of Energy Audit:** Preparing for Audit Visit, Instrumentation, Data Collection Techno-economic Analysis, Safety Considerations **2**

### Unit -I I

**Fuel Analysis**

Proximate Analysis, Ultimate Analysis, Calorific Value. Combustion: Theoretical Air Requirement. **3**

**Insulation and Refractories**

Insulation Type and Application, Economic Thickness of Insulation, Heat Savings and Application Criteria, Refractory-Types, Selection and Application of Refractories,. **4**

**Boilers:**

Types, FBC Boilers ,Mechanism of Fluidized Bed Combustion, Saving Potential. Analysis of Losses, Performance Evaluation, Blow Down, Energy Conservation Opportunities. **5**

### Unit -III

**Steam System:**

Properties of Steam, Assessment of Steam Distribution Losses, Steam Leakages, Steam Trapping, Condensate and Flash Steam Recovery System, Identifying Opportunities for Energy Saving. **5**

**Cogeneration and Trigeneration**

Need, Applications, Advantages, Combined Cycles, Saving Potential, **2**

**Unit -IV**

**Waste Heat Recovery:**

Availability and Reversibility, First and Second Law Efficiencies, Classification, Advantages and Applications, Commercially Viable Heat Recovery Devices, HVAC and Refrigeration System, Factors Affecting Refrigeration and Air Conditioning System Performance and Savings Opportunities., Distribution systems for conditioned air **6**

**Compressed Air Systems**

Types of air compressors, compressor efficiency, efficient compressor operation, compressed air systems components, capacity assessment, leakage test, factors affecting the performance and energy savings opportunities. Unit IV **4**

**Pumps and Pumping System**

Performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. 2

**Unit V**

**Electrical Systems:** Active power, reactive power and apparent power, star, delta connection, electrical load management and electrical billing **3**

**Power Factor:** Power factor, Power factor improvement and its benefit, selection and location of capacitors, and energy conservation opportunities. **2**

**Electric Motors:** Types, losses in induction motors, motor efficiency, factor affecting motor performance, rewinding and motor replacement issues, energy saving opportunities in motors, energy efficient motors, soft starter with energy savers. **5**

**References**


1. G. L. Witte, Phillips S.Scbmidt and Daid R. Brown, Industrial Energy Management and Utilization, Hemisphere Publishing Corporation, Washington

2. Carig,B. Saith, Energy Management Principles, Applications, Bnefit and Saving, Per n Press, New York.

3. F. W. Pyne, P *gm* Energy Conservation Manual, Fairmont Proem, INC.P.O. Box 14227 Atlanta,GA 30224

4. D. Patrick and S.W. Fardo, Energy U-sent and Conservation, Prentice Hall, INC Engleweek Cliffs (NJ) 7632.

5. W R Murphy & G McKay, Energy Management, Elsiver/BSP hyderabad

# LIST OF ELECTIVES

## Elective-I

**TME-011 Non conventional energy resources**

**TME-012 Advanced Engineering Material**

**TME-013 Optimization Techniques in Engineering**

**TME-014 Advanced Welding Processes**

**TME-015 Non Destructive Testing**

**TME 011 : NON-CONVENTIONAL ENERGY RESOURCES AND UTILISATION** **L T P**

**3 1 0**

**UNIT-1**

**Energy resources and their utilization :** Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation. 3

**Solar radiations:** Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Surface azimuth angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India. 5

**UNIT-2**

**Solar energy:** Solar thermal power and it's conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing. Solar thermal energy storage, Different systems, Solar pond, Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants Solar photovoltaic system: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system.

7

**UNIT-3**

**Biogas:** Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India.

5

**Wind energy:** Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills,

Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent development. 5

**UNIT-4**

**Electrochemical effects and fuel cells:** Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells . 3

**Tidal power:** Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems. Hydrogen Energy: Properties of hydrogen in respect of it's use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.. 4

**UNIT-5**

**Thermoelectric systems:** Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators. 2

**Geothermal energy:** Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion. 4

**Ocean energy;** Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC, Economics. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.

4

**Reference Books:**


1. Duffle and Beckman, Solar Thermal Engineering Process, John Wiley & Sons, New York
2. H.P. Garg, Advanced in Solar Energy Technology, D. Reidel Publishing Co., Drdricht.
3. S.P. Sukhatme, Solar Energy, Tata McGrew Hill Company Ltd., New Delhi
4. Twidell & AW. Wier, Renewable energy resources, English Language book, Society / E& FN Spon (1986).
5. N.K. Bansal., M. Kleeman & M. Mielee, Renewable conversion technology, Tata McGraw Hill, New Delhi.

**TME-012 ADVANCE ENGINEERING MATERIALS** **L T P**
**3 1 0**

**UNIT-I**

Ferrous Materials, their Properties and Applications: Plain carbon steels, their properties and application: plain carbon steels, effects of alloying elements in plain carbon steels. Alloy steels, tools steels, stainless steels, low and high temperature resisting steels, high strength steels, selections, specifications, form and availability of steel. Cast irons-white, grey, modular malleable and alloy cast irons. Recognized patterns of distribution of graphite flakes in grey cast iron. 5

**UNIT-II**

**Heat Treatment of Steels** TTT diagrams, annealing, normalizing, hardening and tempering of steel. Austempering and martempering of steel. Hardenibility, Journing end quench test. Grauisis and its determination. Effect of graion the properties of steel. 4

**Surface hardening of steel :**

Carbonising nitriding carbonitriding cyniding, flues and inducation hardenirng microscopic determination of case depth and depth of hardening. 4

**Unit-III** Nonferrous materials, their properties and application, brasses, bronzes, cupro-nickel alloys, aluminum, magnesium and titanium alloys, bearing materials, selection, specific form and availability. Heat treatment of nonferrous materials – soputionising and precipitations hardening 4

**Unit-IV**

**Composites**

**Polymer** – polymer, metal-metal, ceramic –ceramic, ceramic-polymer, metal-ceramic, metalpolymer composites. Dispersion reinforced, particle reinforced, laminated and fibre reinforced composites. 5

**UNIT-V**

**ELASIOMERS AND MASULLANEOUS** Types, properties and identifications of different types of rubbers vulcanisation, fabrication andforming techniques of rubber. Introduction of plastics and ceramics – types, application and process. Smart materials-introduction and types. Selection of materials and factors effecting deflection, Selection process and systematic evaluation. 6

**TME-013 OPTIMISATION TECHNIQUES IN ENGINEERING** **L T P**
**3 1 0**

**Unit-I**

Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions. 4

**Unit-II**

**Constrained Optimization:** Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn –Tucker Sufficient Conditions. 6

**Unit-III**

**Optimization:** Quasi-Newton Methods and line search, least squares optimization, GaussNewton, Levenberg- Marquartd, Extensions of LP to Mixed Integer Linear Programming (MILP), Non-Linear Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming, Singular Based Optimization, On-Line Real-Time Optimization, Optimization in Econometrics Approaches – Blue. 8

**Unit-IV**

Optimization and Functions of a Complex Variable and Numerical Analysis: The Finite Difference Method for Poisson's Equation in two Dimensions and for the Transient Heat Equation, Eulers Method, The Modified Euler Mehtod and the Runge-Kutta Method for Ordinary Differential Equations, Gaussian Quardative Tranzoidal Rule and Simpson's 1/3 and 3/8 Rules, the Newton Raphson in one and two Dimensions, Jacobi's Iteration Method. 8

**Unit-V**

Optimization in Operation Research: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation, Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Transshipment Problems, Heuristic Methods. 8

**Books.**

1. Winston W L: Operations Research: Applications and Algorithms

2. Rao S.S., Optimization: Theory and Applications.

3. Walsh G R: M methods of Optimization.

**TME014 ADVANCED WELDING TECHNOLOGY** **L T P**
**3 1 0**

**Unit-I**

**Introduction :** Importance and application of welding, classification of welding process.

Selection of welding process. Review of conventional welding process : Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of MS.CI, Al, Stainless steel & Maurer/Schacfflar Diagram. Soldering & Brazing. 6

**Unit-II** Advanced welding Techniques- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc. 4

**Unit-III** Advanced welding Techniques (continued) : Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spraywelding / Metallising, Hard facing. 5

**Unit-IV Weld Design :** Welding machines/equipments and its characteristics. Weld defects and distortion and its remedies, Inspection/testing of welds, Macrostructure & microstructure of welds, HAZ, Weld Design, Welding of pipe-lines and pressure vessels. Life predication. 4

**Unit-V** Thermal and Metallurgical consideration.: Thermal considerations for welding, temperature distribution, Analytical analysis, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties. 6

**Books**

Welding Hand Book

**TME-015 Non Destructive testing** **L T P**
**3 1 0**

**Unit-1**

**INTRODUCTION:**

Scope and advantages of N.D.T. some common NDT methods used since ages – visual inspection, Ringing test, and chalk – test (oil-whiting test) their effectiveness in detecting surface cracks, bond strength and surface defects. 5

**Unit-2**

Common NDT methods Dye – penetrant tests – principle, scope, equipment and techniques. Zyglo testing. Magnetic Particle Tests- Scope of test, Principle equipment and technique. DC And AC magnetization, use of day and wet powders magnaglow testing. Interpretations of results. 6

**Unit-3**

**RADIOGRAPHIC METHODS** X-ray radiography – principle, equipment and methodology. Interpretation of radiographs, Limitations Gamma ray radiography. Principle, equipment, source of radioactive material and technique. Precautions against radiation hazards, Advantage over x-ray radiography methods. 6

**Unit-4**

**ULTRASONIC TESTING METHODS** Introduction Principle of Operation – piezoelectricity. Ultrasonic probes, cathode ray oscilloscope techniques and advantages limitation and typical applications. 4

**Unit-5**

Testing of castings, forgings & weldments Application of NDT methods in inspection of castings, forgings and welded structures with illustrative examples. Case studies. Sample-testing in the lab. 6

**TME-751**
**CAD/CAM Lab**
**10 experiments (6 from CAD experiments, 4 from CAM experiment)**

A. CAD Experiments-
1. Line drawing or Circle drawing algorithm experiment : writing the program and running it on computer.
2. Transformations algorithm experiment for translation/rotation/scaling : writing program and running it on computer.
3. Design problem experiment : writing the program for design of machine element or other system and running it on computer.
4. Optimisation problem experiment : writing a program for optimising a function and runing it on computer.
5. Auto CAD experiment : understanding and use of Auto CAD commands.
6. Writing a small program for FEM for 2 spring system and running it. Or using a FEM package.
7. Use of Graphic software standards packages e.g. GKs/PHICS/GL etc.
8. Use of pro Engineer/Ideas etc.

B. CAM experiments-
1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NC machine.
2. Writing a part programming (in word address format or in APT) for a job for milling operation (contouring) and running on NC machine
3. Experiment on Robots and it programs
4. Experiment on Transfer line/Material handling.
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motors and feed back devices.
7. Experiment on Mechatronics & controls

**TME-801 POWER PLANT ENGINEERING** **L T P**
**3 1 0**

**Unit-I**

**Introduction:**
Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, calculations. Variable Load problem Industrial production and power generation compared, ideal and realised load curves, terms and factors. Effect of variable load on power plan operation, methods of meeting the variable load problem. Power plant economics and selection Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection. 8

**Unit-II**

**Steam power plant**
Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories. General layout of steam power plant. Different systems such as fuel handling system, pulverizes and coal burners, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing, feed heating, reheating , flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency**.** **8**

**Unit-III**
**Diesel power plant**

General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance. Gas turbine power plant Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants. 6

**Unit-IV**

**Hydro electric station**
Principles of working, applications, site selection, classification and arrangements, hydroelectric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems, micro and mini hydro power plant. 6

**Unit-V Nuclear power plant**

Principles of nuclear energy, basic components of nuclear reactions, nuclear power station. Nuclear fuels in fission and fusion reactors, Types of nuclear reactors, Fissile and fertile materials, Neutron chain reaction in fission reactors, Neutron flux, Concept of criticality for bare homogeneous reactors, Coolants, moderators, Control and structural materials. Heat generations and steady state temperature distribution in fuel elements, Heat removal.

8

**Books:**

1. Nuclear Reactor Engineering By S. Glastone and A . Sesonske.
2. Basic Nuclear Engineering, by K.S. Ram.
3. Introduction to Nuclear Engineering, by J.R lamarsh.
4. “Power Plant Engineering” F.T. Morse, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras.
5. “Power Plant Engineering” Mahesh Verma, Metropolitan Book Company Pvt. Ltd. New Delhi.
6. “Power Plant Technology” El-Vakil, McGraw Hill.
7. Power Plant Engineering by P.K. Nag, Tata McGraw Hill.
8. Steam & Gas Turbines & Power Plant Engineering by R.Yadav, Central Pub.House.

**TME-802**

**AUTOMOBILE ENGINEERING** **L T P**
**3 1 0**

**Unit-I**

**INTRODUCTION:** Classification of automobile, Parts of an automobile, Description of an automobile, performance of automobile, engine cycle-energy balance, terms connected with I.C. Engines, Detonation, performance number, tractive efforts. 5

**FUEL-SUPPLY SYSTEM:**

**S.I. ENGINE:** Carburetion & carburetors, Induction system, factor influencing carburetion, Mixture requirement, Distribution, Complete carburetor, theory of simple carburetor. 4

**C.I. ENGINE:** Functional requirements of an injection system, Fuel pump and fuel injector (Atomizer), Types of nozzles and fuel spray patterns, troubleshooting of a fuel system & carburetor, Turbo Charger (Function and benefits). 4

**Unit II**

**ENGINE FRICTION, LUBRICATION & COOLING SYSTEM:**

Determination of engine friction, Lubrication, lubrication system, Crankcase ventilation, Necessity of engine cooling, Areas of heat flow in engines, gas temperature variation, heat transfer, temperature distribution & temp. profiles, cooling air and water requirements, cooling systems, troubleshooting of cooling system, gear box (Problems). 8

**Unit III**

**CHASSIS:** Introduction. Classification of chassis, Frame.

**SUSPENSION:** Introduction, requirements of suspension system, springs, damper.

**WHEELS:** Introduction, Requirement, types of wheels.

**TYRES:** Introduction, requirements, types of tyre, tyre construction-cross ply, radial ply, belted bias, tyre materials tyre shape, tread patterns, tyre markings, tyre inflation pressure, causes of wear, factors affecting tyre life, wheel balancing, wheel alignments. 6

**Unit IV**

**STEERING AND GEARS:** Purpose, function, requirements, general arrangements of steering systems, steering gears, steering ratio, reversibility, steering geometry, under steering, over steering, steering arms, Drag link, power steering, adjusting of steering geometry, steering troubleshooting. Requirements. Clutches. Toque converters. Over drive and free wheel,Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, 5

**FRONT AXLE:** Introduction, construction, types of front axles, stub axles. 2

**BRAKING SYSTEM:** Necessity, functions, requirements, classification of brakes, Mechanical brakes, hydraulics brakes, power brakes, brake effectiveness, brake shoe holding down arrangements, brake tester, brake service, troubleshooting chart of hydraulic brakes system, air brakes & Brake shoes & drums. 3

**UNIT V**

**AUTOMOTIVE ELECTRICAL SYSTEM:** Introduction, main parts of vehicles.

**STARTING SYSTEM:** Introduction, battery, starting motor.

**IGNITION SYSTEM:** Introduction, purpose, requirements, coil ignition system, firing order, ignition timing, spark plugs, troubleshooting.

**CHARCHING SYSTEM:** Introduction. Dynamo, alternators.

**LIGHTING:** introduction, main circuits, lighting system.

**Maintenance system:** Preventive maintenance, break down maintenance, and over hauling system. 7

**References-**

1. Automotive Engineering- Hietner

2. Automobile Engineering - Kripal Singh.

3. Automobile Engineering - Narang.

4. Automotive Mechanics- Crouse

5. Automobile Engg. – K.N.Gupta

**LIST OF ELECTIVES**

## Elective-II

**TME-020 Total Quality Management (TQM)**

**TME-021 Advanced Fluid Mechanics**

**TME-022 Mechatronics**

**TME-023 Finite Element Method**

**TME O24 Six Sigma and Applications**

## Elective-III

**TME-030 Experimental stress analysis**

**TME-031 Thermal Turbo Machines**

**TME-032 Robotics and automation**

**TME-033 Machine Tool Design**

**TME-034 Unconventional Manufacturing Processes**

**TME-020 TOTAL QUALITY MANAGEMENT (TQM)**

| L | T | P |
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**Unit-I**

**Quality Concepts** Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims. 5

**Unit-II**

**Quality Management** Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme. Human Factor in Quality Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods. 6

**Unit-III**

**Control Charts** Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Charts Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart. 7

**Unit-IV**

Defects Diagnosis and Prevention Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. 6

**Unit-V**

IS0-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details 5

**References:**

1. Lt. Gen. H.LaI, "Total Quality management", Wiley Eastern Limited, 1990. .

2. Greg Bounds. “Beyond Total Quality Management”. McGraw Hill, 1994.

3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

**TME-021 ADVANCED FLUID MECHANICS** **L T P**
**3 1 0**

**UNIT-I**

Review of kinematics of fluid motion, method of describing fluid motion, translation, rate of deformation, the material derivatives, acceleration, vorticity in Cartesian & polar coordinates, Reynolds transport theorem, Stress at a point, velocity profile, wall shear stress. 4

**UNIT-II**

Non-viscous incompressible flow- Equation of continuity, Euler's equation of motion, Bernoulli's equation, circulation and its theorem, stress function, velocity potential, irrotational flow, two dimensional source, sink, source-sink pair, doublet vortex, superposition of sourcesink with rectilinear flow, Rankine body, Superposition of rectilinear flow and doublet, flow around a spinning circular cylinder, Magnus effect, lift & Drag, Skin friction. Lift of aerofoil. 7

**UNIT-III**

Boundary layer Concept-Introduction to boundary layer formation, Novier-stokes equation, Boundary layer thickness, momentum thickness, energy thickness, Boundary layer equations, Momentum-Integral equation - Von Korman, Blasius solution of boundary layer on a flat plate without pressure gradient, Flow with very small Reynolds number, Hogen poisseuille flow, Plane Couette flow, Hydrodynamic theory of lubrication. 8

**UNIT-IV**

Compressible flow- Propagation of pressure change, sound velocity, elastic waves, Mach number, Mach cone, isentropic flow relations in terms of sonic velocity and mach number, Stagnation properties, Regions of flow, Energy equation, Effect of Mach number on compressibility. Propagation of infinitesimal waves, Non-steep finite pressure wave and steep finite pressure waves, Expansion waves Isentropic flow with variable area, Mach number variation and its effect on Flow through nozzles and diffusers. Area ratio, impulse function, Use of Gas/Air tables. 6

**UNIT-V**

Flow with normal shock waves- Development of shock wave, rarefaction wave, governing equations, Prandtle-Meyer relation. Thermodynamic properties across shock. Wind tunnels. Flow in constant area duct with friction-Fanno curves, Fanno flow equations, Solution of fanno flow equations. Variation of flow properties. Tables & charts for Fanno flow. Flow in constant area duct with heat transfer- Rayleigh line, Fundamental equations, Rayleigh flow relation, Variation of flow properties. Tables & Charts for Rayleigh flow. 8

**References:**

1. Fluid Mechanics by White.

2. Fluid Mechanics by Streeter

3. Fluid Mechanics by Som & Biswas

4. Fluid Mechanics by K.L. Kumar

5. Gas Dynamics by E. Radhakrishnan

**TME-022 MECHATRONICS**

**Section – I**

| L | T | P |
|---|---|---|
| 3 | 1 | 0 |

**1** Review of Microprocessors and Micro Controllers: Concepts, Binary numbers to hexadecimal details, information on flipflops, gates, registers, counters, memory, polling and interrupts etc. Architecture, instruction set for 8085, 8051 and assembly level language. Difference between microprocessors and micro controllers. Introduction to programming. Signal and Data Processing: Concepts and principles, analogue signal conditioning, signal level changes, linearization, conversion, filtering. Impedance matching passive circuits. Specifications and circuits in instrumentation. Digital signal conditioning. 7

**2** Ladder Diagram Fundamentals:Basic Components and their symbols, Fundamentals of ladder diagrams, Machine Control Terminology. The Programmable Logic Controller : A Brief History, PLC configurations, System Block Diagrams, Update Solve the ladder – Update, Update, Solve the Ladder 6

**3** Fundamentals of PLC Programming: Physical Components Vs Program, components, Lighting Control Example, Internal Relays, Disagreement Circuit, Majority Circuit, Oscillator, Holding contacts, Always ON and Always OFF Contacts, Ladder Diagram Having more than one rung. Programming On/Off Inputs, to produce on – off outputs : Introduction, PLC input instructions, outputs : Coils, Indicators and others, Operational procedures, Contact and Coil Input output programming Examples, Fail Safe Circuits, Industrial Process Examples. 8

**4** Creating Ladder Diagrams from Process Control Descriptions:Introductions, Ladder Diagrams, Sequence Listings. Large Process Ladder diagram Constructions, Flowcharting as programming Method. Introduction to Robotics: Elementary treatment on anatomy, drives, transmission and end effectors of Robotics 6

**5** Material Handling: Generations Considerations, Applications in material transfer and loading unloading Assembly and Inspections : Assembly and robot assembly automations, Parts presentations methods., Assembly ope4rations, Assembly syst4m configurations inspe4ction automation. Introduction to Nano-technology. 5

**Reference Books:**

1 "Programmable Logic Controller – Principles and Applications" 5/e, J. W. Webb, R. A. Reis; Prentice Hall of India Ltd. ISBN 81-203-2308-4

2 "Industrial Robotics – Technology, Programming and Applications"; M. P. Groover, M. Weiss, R. N. Nagel, N. G. Ordey; McGraw Hill International Editions, Industrial Engineering Series, ISBN 0-0-100442-4

3 "Programmable Logic Controller – Programming methods and Applications" Hackworth JohnR. and Hackworth Frederick D. Jr.; Pearson Education LCE, ISBN 81-297-0340-8.

4 Introduction to 8085 – Gaonkar

**TME-023 FINITE ELEMENT METHOD** **L T P**
**3 1 0**

**UNIT I** Introduction to Finite Difference Method and Finite Element Method, Advantages and disadvantages 310 4

**UNIT II**

Mathematical formulation of FEM, Variation and Weighted residual approaches, Shape functions, Natural co-ordinate system, Element and global stiffness matrix, Boundary conditions, Errors, Convergence and patch test, Higher order elements. 5

**UNIT III**

Application to plane stress and plane strain problems, Axi-symmetric and 3D bodies, Plate bending problems with isotropic and anisotropic materials, Structural stability, Other applications e.g., Heat conduction and fluid flow problems. 5

**UNIT IV**

Idealisation of stiffness of beam elements in beam-slab problems, Applications of the method to materially non-linear problems, Organisation of the Finite Element programmes, Data preparation and mesh generation through computer graphics, Numerical techniques, 3D problems. 6

**UNIT V**

FEM, an essential component of CAD, Use of commercial FEM packages, Finite element solution of existing complete designs, Comparison with conventional analysis. 4

**Books:**

1. The Finite Element Method O.C. Zienkiewicz and R.L. Taylor McGraw Hill

2. An Introduction to Finite Element Method J. N. Reddy McGraw Hill

3. Finite Element Procedure in Engineering Analysis K.J. Bathe McGraw Hill

4. Finite Element Analysis C.S. Krishnamoorthy Tata McGraw Hill

**TME 023 SIX SIGMA METHODS & APPLICATION** **L T P**

**Unit 1** **3 1 0**

**Quality Perception** : Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement.

**Descriptive statistics:** Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis.

**Probability Distribution :** Normal, Binomial, Poisson DistributionUnit 2

**Basics of Six Sigma:** Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X'S, Customer focus, Six Sigma for manufacturing, Six Sigma for service. Z score, Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

**Unit 3**

Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

**Unit 4**

Six Sigma Tools: Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis, Design of Experiments.

**Unit 5**

Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to softwares for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

**References:**

1. Six Sigma: SPC and TQM in manufacturing and service, Geoff Tennant, Gower Publishing

Co.

2. Six Sigma for managers, Greg Brue, TMH

3. What is Six Sigma, Pete Pande, TMH

4. The Six Sigma Way, Peter S. Pande, TMH Team Field book

5. The Six Sigma way, Peter S. Pande, TMH

**TME 030 EXPERIMENTAL STRESS ANALYSIS** **L T P**
**3 1 0**

**UNIT I**

**Elementary Elasticity:**

Stress: Introduction, Stress Equations of Equilibrium, Laws of Stress Transformations, principal Stresses, Two-Dimensional State of Stress, Stresses Relative to Principal Co-ordinate System, Special States of Stress. Strain: Introduction, Displacement and Strain, Strain Transformation Equation, Principal Strains, Compatibility, Volume Dilation, Stress Strain Relations, Strain Transformation Equations and Stress Strain Relations for Two-Dimensional State of Stress. 7

**UNIT II**

Strain Measurements: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid-Method of Strain Analysis. Brittle Coating Method: Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data. 7

**UNIT III**

Electrical Resistance Strain Gages: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor. Strain Gage Circuit: Potentiometer and its Application, Wheat-Stone Bridge, Bridge Sensitivity, Null Balance Bridges. Analysis of Strain Gage Data: Three Element Rectangular Rosette, Delta Rosette, Stress Gage, Plane Shear-Gage. 8

**UNIT IV**

Theory of Photoelasticity: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polariscope, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polariscope, Light and Dark Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirrors. 7

**UNIT V**

Two Dimensional Photoelasticity : Introduction, Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method, Materials for TwoDimensional Photoelasticity. 6

**References:**

1. Experiment Stress Analysis by James W. Dally and William F. Riley, International Student

Edition, McGraw-Hill Book Company.

2. Experiment Stress Analysis by Dr. Sadhu Singh, Khanna Publishers.TME-043

**TME 031 THERMAL TURBO MACHINES** **L T P**
**3 1 0**

**UNIT-I**

Brief history of turbo machinery, introduction to blowers, pumps, compressors, steam & gas turbines, turbojet, Review of laws of thermodynamics & SFEE in reference to turbo machinery, Energy transfer in turbo machines, Euler's equation, Velocity diagrams for axial & radial turbo machinery and pumps. Definition of various efficiencies, Introduction to blowers, pumps, compressors, steam & gas turbines turbojet. 6

**UNIT-II**

Centrifugal compressors- Principle of operation, work done and pressure rise, Diffuser, state losses, ship factors, Performance, characteristics. Axial flow compressor- basic operation, Elementary theory, Factors affecting stage pressure ratio, Blockage in compressor annulus, Degree of reaction, 3-D flow, Design process, blade design, calculation of stage performance. Supersonic & transonic stages, Performance. 7

**UNIT-III**

Axial flow turbines-Elementary theory of axial flow turbine, Vortex theory, Choice of blade profile, pitch and chord, Estimation of stage performance. 5

**UNIT-IV**

**Steam turbines-** Constructional details, working of steam turbine.

**Pumps :** Pumps, main components, indicator diagram and modification due to piston acceleration, performance and characteristics, axial flow pumps.

**Radial flow turbines:** Single velocity triangle Enthalpy- Entropy diagram, State losses, performance, Characteristics. 7

**UNIT-V**

**Gas Turbine Starting & Control Systems:** Starting ignition system, combustion system types, safety limits & control. 3

**Turbine Blade coding:** Cooling techniques, types Mechanical Design consideration: Overall design choices, Material selection, Design with traditional materials. 3

**References:**


1. Gas turbine theory : Gohen & Rogers, Addison Weslay Longman Ltd.

2. Design of high efficiency turbomachinery and gas turbines, David Gordon Wilson,

Theodosios Korakianitis, Prentice Hall International.

3. Turbomachinery : S.M. Yahya.

4. Turbine, Compressors and Fans, S.M. Yahya, Tata Mc Graw Hill.

5. Gas Turbine- Ganeshan, Tata Mc Graw HillTME 044

**TME 032 ROBOTICS AND AUTOMATION** **L T P**
**3 1 0**

**Unit I**

**Introduction** : Brief history, robot terminology, classification, characteristic, physical configuration, structure of industrial robot. Robot and Effectors: Types, mechanical grippers, other types of gripper, tools as end effectors, Robot/end effector interface, design consideration. 4

**Robot Motion Analysis & Control :** Introduction to manipulator kinematics, robot dynamics,

manipulator dynamics, robot control, task planning. 5

**Unit II**

**Sensors :** Transducers and sensors, sensors in robotics, tedile sensors, proximity and range sensors, miscellaneous sensors and sensor-based systems, use of sensors in robotics, touch sensors, force-torque sensors. 6

**Machine Vision:** Introduction, sensing and digitizing function in machine vision, image processing and analysis, vision system robotic applications. 3

**Unit III**

**Programming :** Basics of robot programming, languages, commands, communications and data processing.

**Applications :** Welding, electro-plating, painting, spraying, assembling, material handling, inspection, Future applications. Introduction to design of robot in specific applications. 6

**Unit IV**

Fundamentals of Manufacturing Automation: Basic Principles of automation, types of automated systems, degrees of automation,Automated flow lines. Automation for machining operations Design and fabrication considerations.Analysis of multi station assembly. 4

**Automated Material Handling:** components, operation, types, design of automated guided vehicles and applications. 2

**Automated storage / retrieval systems** - types, basic components and applications. 2

**Unit V**

**Group Technology:** Part families, part classification and coding, machine Cell design, Benefits. Computer Aided Process Planning, benefits and limitations.

**Automated Inspection And Testing:** Automated inspection principles and methods sensors techniques for automated inspection-techniques for automated inspection-contact and noncontact inspection methods-in process gauging, CMM's, construction, types, inspection probes, types, and applications. Machine vision, LASER Micrometer and optical inspection methods. 6

**Reference Books:**

1. Industrial Robotics (Technology, Programming and applications) – Mc Graw Hill Editions

2. Robotics – An introduction - Douglas R. Malcolm. Jr -- Delmar Publisher Inc

3. Robot technology fundamentals - Saures G. Keramas - Delmar publishers

4. Fundamentals of robotics – analysis & control - Robert J. Schilling – (PHI) edition

**TME-033 MACHINE TOOL DESIGN** **L T P**
**3 1 0**

**Unit-I**

**Introduction:** Developments is machine tools, types of machine tools surface, profits and paths produced by machine tools. Features of construction and operations of basic machine tools e.g. lathe, drill, milling shapes and planers, grinding machine etc. General requirement of machine tool design. Machine tool design process. Tool wear, force Analysis. 5

**UNIT-II**

Machine Tools Drives: Classification of machine tool drives, group Vs individual drives, Selection of electric motor, A brief review of the elements of mechanical transmission e.g. gear, belt and chain drives, slider-crank mechanism, cam mechanism, nut & Screw transmission, Devices for intermittent motion, reversing & differential mechanisms. Couplings and clutches Elements of hydraulic transmission system. e.g. pumps, cylinder, directional control valves, pressure valves etc. Fundamentals of Kinematics structure of machine tools. 7

**Unit-III**

Regulation of Speed and Feed rates : Laws of stepped regulation, selection of range ratio, standard progression ratio, selection of best possible structural diagram, speed chart, Design of feed box, Developing gearing diagrams. Stepless regulation of speed and feed in machine tool, speed and feed control. 7

**Unit-IV**

Design of Machine Tool Structure: Requirements and design criteria for machine tool structures, selection of material Basic design procedure for machine tool structures, design of bed, column and housing, Model technique in design. Design of guide ways and power screws: Basic guide way profiles, Designing guide way for stiffness a wear resistance, hydrostatic and antifriction grand ways. Design of sliding friction power Screws. Design of spindlier & spindle supports. Layout of bearings, selection of bearings for machine tools 8

**Unit-V**

Dynamics of machine tools: General procedure for assessing the dynamic stability of cutting process, closed loop system, chatter in machine tools.Control Systems : Functions, requirements & types of machine tool controls, controls for speed & feed change. Automatic and manual Controls. Basics of numerical controls. Machine tool testing. 6

**References:**

1. Machine Tools Design & Numerical Controls –N.K. Mehta, T.M.H. New Delhi.

2. Design of Machine Tools – S.K. Basu Allied Publishers.

3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.

**TME034 UNCONVENTIONAL MANUFACTURING PROCESSES**

| L | T | P |
|---|---|---|
| 3 | 1 | 0 |

**Unit-I**

**Introduction:** Limitations of conventional manufacturing processes, need of unconventional manufacturing processes and its classification.

**Unit-II**

Unconventional Machining Process: Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electro-chemical machining, ultrasonic machining, Abrasive jet machining etc.

**Unit-III**

Principle and working and application of unconventional machining processes such as laser beam machining, Electron beam machining, Ultrasonic machining etc.

**Unit-IV**

Unconventional welding processes: Explosive welding, Cladding etc. Under water welding,Metallising, Plasma are welding/cutting etc.

**Unit-V**

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc.

**Books:**

1. Modern Machining Processes – P.C. Pandey

2. Unconventional Machining – V.K. Jain

3. Modern Machining – G.F. Benedict

## OME 005 Energy Efficient Buildings

| L | T | P |
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**Energy Efficient Building Design Strategies**

Energy use in Buildings, Factors effecting Energy use, Energy Conservation options. External Factors – Climate, Building Orientation, Shading, types of shading devices.

**Thermal Comfort**

Criteria and various Parameters, Psychometric Chart, Thermal Indices. Indoor air quality; Requirements in residential, Commercial, Hospital Buildings.

**Passive concepts and components**

(a) passive heating concepts direct gain, indirect gain, isolated gains and suspenses;(b) passive cooling concepts - evaporative cooling, evaporative air and water coolers, radiative cooling, application of wind, water and earth for cooling ,use of isolation, shading, paints and cavity walls for cooling; (c) passive heating and cooling concepts - roof pond/sky therm, roof radiation trap, vary-therm wall, earth sheltered or earth based structures and earth airtunnels; selective ventilation, components- windows and thermal storage

Heat Transmission in Buildings: Surface Coefficient, Air cavity, Internal and External Surface, Overall Thermal Transmittance Walls and Windows, and Packed Roofthached Heat Transfer due to ventilation/ infiltration, Building loss coefficient Internal Heat gains, Solar Temperature, Steady State Method (for Trombe Wall, Water wall and Solarium), Degree Day method.
Correlation methods - solar load ratio, load collector ratio, thermal time constant method, Analytical methods - thermal circuit analysis, admittance procedure of metrics. The periodic solutions - thermal modeling of AC / Non AC buildings.

Typical Designs of Selected Buildings in various Climatic Zones, Thumb Rules for Design of Building systems and Building Codes.

## Reference Books


1. M.S.Sodha, N.K. Banaal, P.K.Bansal, A.Rumaar and M.A.S. Malik, Solar Passive: Building Science and Design, Pergamon Preen (1986).
2. Jamee; L. Threlked, Thermal Environment Engineering, Prentice Hall, INC-, Raglevood Cliffs, New Jersey ( 1970)
3. T.A. Markus and R.N. Morris, Building, Climate and Energy Spottwoode Ballantype Ltd-, London U.K. ( 1980)
4. Solar Thermal Energy Storage, H. P. Garg et.al, D. Reidel Publishing Company (1985)
5. Mathematical Modeling of Melting and Freezing Process, V Alexiades & A.D. Solomon, Hemisphere Publishing Corporation, Washington ( 1993)
6. Energy storage technologies, a reading material prepared by Dr. D. Buddhi, School Of Energy And Environmental Studies, DAVV, Indore.

**List of Open Electives to be Offered by the Mechanical Engineering**

OME-001 Optimization Techniques in Engineering

OME-002 Robotics and automation

OME-003 Advanced Engineering Materials

OME-004 Computer Integrated Manufacturing

OME-005 Energy Efficient Buildings