## Scheme of Studies
### B.Tech Degree Programme (Regular)
#### (Common to all Disciplines)

### 2nd Year

#### SEMESTER – III

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<th>Course No.</th>
<th>Course Name</th>
<th>L-T-P</th>
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**28+1* (TWO)Credits will be assigned to TWO WEEKS Hands on training.
Objective: To enhance the language proficiency, communication process and the importance of English language in the present scenario; to develop good body language; to learn the correct sentence structure and to develop the career skills.

UNIT 1: Communication process:- Language for communication; Language skills; Status of English language; Types of communication; Means of communication; process of communication; Barriers in communication; Principles of effective communication; Pronunciation with proper accent, stress, tone & intonation

UNIT 2: Comprehension: Listening & Reading Comprehension; Framing questions from passages; Framing sentences using words, phrases etc. Types of sentences

UNIT 3: Grammar:- Question tag; Conditional sentences; Use of Gerund & infinitive; Degrees of comparison; Articles; Punctuation & capitalization; Subject-verb agreement; Sentence correction

UNIT 4: Presentation Skills:- Types of presentation; Strategies of effective presentation; Merits & demerits of interactive presentation & power point presentation; Presentation on the given topic

UNIT 5: Group communication:- Non verbal Communication; Body language in GD; Leading & directing discussion; Effective interventions; Expressing opinions &
disagreements; GD in the selection process; GD on corporate issues; Conference, seminar & symposium

UNIT 6: Interview:- An introduction; Types of interview with purpose; Preparation for job interview; Types of job interview; Strategies for successful interview; Press conference

UNIT 7: Career Skills:- Job interview; Resume writing & Job Application; Group dynamics; Decision making; Leadership qualities

Prescribed Text book

1. Technical Communication Principles & Practice (2nd Ed.) by Meenakshi Raman & Sangeeta Sharma published by Oxford University

2. The Functional Aspects of Communication Skills by Dr. Prajapati Prasad published by S.K. Kataria & Sons


SUGGESTED READING:

1. Language in Use (Upper intermediate Level, Adrian Doff Christopher Jones, Cambridge University Press


5. The sounds of English, Veena Kumar, Makaav Educational Software, New Delhi.


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<th>ME-101</th>
<th>ENGINEERING MECHANICS</th>
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OBJECTIVE

Engineering Mechanics is one of the core subjects that introduces the students to analysis of forces and motion and prepares the student for studying strength of materials and theory of machines.

1. **FORCE SYSTEMS**: Basic concepts of space, time, mass, force, particle and rigid body; scalars and vectors; conventions for equations and diagrams; external and internal effects if a force; principle of transmissibility; force classification; rectangular components of two and three dimensional force systems; resultant of two and three dimensional and concurrent force systems; moment about a point and about an axis; Varignon’s theorem; resultant of non-concurrent force systems; couple; equivalent couples; force couple systems.

2. **EQUILIBRIUM**: Equilibrium in two and three dimensions; system isolation and the free-body-diagram; modeling the action of forces; equilibrium conditions; applications including plane trusses; frames and machines.

3. **PROPERTIES OF SURFACES/CROSS SECTIONS**: Centre of mass; determining the centre of gravity; centre of mass versus centre of gravity; centroids of lines, areas and volumes including composite sections; moments of inertia; MI of plane figures; MI with respect to axis in its plane and with respect to an axis perpendicular to the plane of figure; parallel axis theorem; moment of inertia of a rigid body of a lamina and of three dimensional body; MI of composite figures.

4. **SIMPLE STRESSES AND STRAINS**: Resistance to deformation; Hook’s law and stress-strain diagram; typing of stresses; stresses and strains in bars of varying sections; stresses in composite bars; lateral strain and Poisson’s ratio; volumetric strain, modulus of rigidity and bulk modulus; relation between elastic constants.

5. **TORSION OF CIRCULAR SHAFTS, TORSION FORMULA POWER TRANSMISSION**

6. **SHEAR FORCE AND BENDING MOMENTS**: Definitions; SF and BM diagrams for cantilevers, simply supported beams with or without overhang and calculation of max. BM and SF and point of contra-flexture under i) concentrated loads, ii)
uniformly distributed loads over whole span or part of it iii) combination of concentrated and uniformly distributed loads, iv) uniformly varying loads and application of moments; relationship between rate of loading, shear force and bending moments.

7. **Compound Stresses & Strains**: Concept of surface and volumetric strains, two dimensional stress system, conjugate shear stress at a point on a plane, principle stresses and strains and principle-planes, Mohr’s circle of stresses, Numericals.

**TEXT BOOK**


**REFERENCE BOOKS**


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<th>MA-202</th>
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**OBJECTIVE**

To provide a foundation for numerical computing for scientific and engineering applications

**PRE-REQUISITE**

Knowledge of Basic Mathematics involving differentiation, integration, differential equations, linear equations, etc.

1. **ERRORS IN NUMERICAL CALCULATIONS**: Introduction; numbers and their accuracy; absolute; relative and percentage errors and their analysis; truncation errors; general formula; error calculation for inverse problem.

2. **SOLUTION OF NON-LINEAR EQUATIONS**: Bisection method; Regula-Falsi method; Secant method; Newton-Raphson method; fixed point method; initial approximation and convergence criteria.

3. **SOLUTION OF LINEAR SYSTEMS**: Gauss elimination method; Gauss-Jorden method; UV factorization, Jacobi’s method; Gauss-Seidal method.

4. **INTERPOLATION & CURVE FITTING**: Introduction to interpolation; Newton’s forward and backward formula; Sterling formula; Lagrangian polynomials; divided differences; least squares method.
5. NUMERICAL DIFFERENTIATION AND INTEGRATION: Derivatives from differences tables; numerical differentiation formulas, Newton- Cotes integration formulae; trapezoidal rule; Simpson’s rule; Bool’s rule; Weddle’s rule; Romberg’s rule.
6. SOLUTION OF DIFFERENTIAL EQUATIONS: Taylor’s series method; Euler and modified Euler’s method; Runge-Kutta method; Milne’s prediction corrector method, Adams–Bashforth method.
7. SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: Finite difference approximation; solution of Laplace equation (standard 5 point formula) one-dimensional heat equation (Schmidt method, Cranck-Nicolson method; Dufort & Frankel method and wave equation.

TEXT BOOK
Grewal B. S., —Numerical Methods in Engineering and Sciencesl, Khanna Publisher

REFERENCE BOOKS
3. Sastry S. S., -Introductory Methods of Numerical Analysisls, Prentice Hall of India

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<th>MA-252</th>
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LIST OF EXPERIMENTS
1. To find the roots of non-linear equation using Bisection method.
2. To find the roots of non-linear equation using Secant method.
3. To find the roots of non-linear equation using Newton’s method.
4. To solve the system of linear equations using Gauss-Elimination method.
5. To solve the system of linear equation using Gauss-Seidal iteration method.
6. To find the values of function at a particular point using Newton's forward formula.
7. To find the values of function at a particular point using Newton's backward formula.
8. To find the values of function at a particular point using Lagrange's interpolation formula.
9. To integrate numerically using Trapezoidal rule.
10. To integrate numerically using Simpson’s rule.
11. To find the solution of o.d.e (ordinary differential equation) by Euler’s method.
12. To find the solution of o.d.e by Runge-Kutta method.
13. To find the numerical solution of Laplace equation.
14. To find the numerical solution of heat equation.
15. To find the numerical solution of wave equation.

REFERENCE BOOKS
    Wesley
3. Sastry S. S., -Introductory Methods of Numerical Analysisl, Prentice Hall of India
    Scientific and Engg. Computationsl, Wiley Eastern

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<tr>
<th>ME-206</th>
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OBJECTIVE
This course makes the student to learn the representation of components and assemblies
into various views and vice versa. This will enable the student to learn to
conceive an object and go for its production. Autocad is introduced to facilitate
this process

PRE REQUISITES
Engg Graphics ME-152

1 INTRODUCTION TO CAD: Advantages of CAD; Starting Autocad program;
    Autocadscreen; Autocad commands; Function key assignments; short cut key
    characters; VCS and VCS con; Coordinate system; units; Drawing Aids Object
    snap; Drawing basic entities; Correcting mistakes; object section; modify commands;
    modify properties; match properties

2 SECTIONAL VIEWS: Types of sections; conventions in sectioning;
    hatching; using Autocad; Isometric projections; Isometric Scale; Drawing
    isometric drawing of Circles; conversion of isometric to orthographic and vice versa;
    Isometric grid with CAD Examples;

3 JOINTS AND COUPLINGS: Riveted joints; Bolts and Nuts threads; welded
    joints; shafts; keys; cotter and pin joints; couplings

4 TOLERANCES: LIMITS & FITS & MATERIAL SPECIFICATION: Limits
    and fits; Geometrical Tolerances and surface finish; Material Specifications

5 SPRINGS, BELTS & PULLEYS, BEARINGS, GEARS:

6 MACHINE PARTS AND ASSEMBLY DRAWINGS: Assembly of a connecting
    rod; crank shaft of a four cylinder; Assembly of a screw Jack; assembly drawing of a stop
    valve; assembly of a spring loaded safety Valve; assembly of Tail stock; assembly of shaper
    tool slide; Block diagrams

TEXT BOOK

REFERENCE BOOKS
OBJECTIVE
The course provides the knowledge on the composition; testing and applications of materials; It also provides knowledge about the structure of materials and the effect of temperature; composition and time on various metallurgical processes. The study of this course will help the students to identify and select suitable materials for various engineering applications

PRE REQUISITES
Knowledge of Applied Physics; Applied Chemistry; Manufacturing Practice

1 STRUCTURE OF MATERIALS: Crystal structure; Crystal imperfections and their classifications; point defects; line defects; edge and screw dislocations; surface defects; volume defects and effects of imperfections on metal properties

2 SOLID SOLUTIONS AND PHASE DIAGRAM:
Solid solution and its types; importance and objectives of phase diagram; systems; phase and structural constituents; cooling curves; Gibbs’s phase rule; Lever rule; Iron Carbon equilibrium diagram and TTT diagram

3 HEAT TREATMENT: Principles; purpose; classification of heat treatment processes; annealing; normalizing; hardening; tempering; carburizing; nitriding; cyaniding; flame and induction hardening; Allotropy of iron; artempering and Austempering

4 DEFORMATION OF METALS : Elastic and plastic deformation; mechanism of plastic deformation; yield point phenomena; strain ageing; work hardening; Bauschinger effect; season cracking; Recovery; re-crystallization and grain growth

5 CORROSION CREEP & FATIGUE : Phenomenon of Corrosion ; Creep concept and creep curve; mechanism of creep; creep testing and prevention against creep ; fatigue; fatigue limit; mechanism of fatigue; factors affecting fatigue; fatigue testing and SN curve

6 METALS AND ALLOYS: Ferrous Metals: Plain carbon steel; high speed steel and cast iron; Effect of alloying elements on steel and stainless steel; Properties and
applications of non ferrous metals – Aluminium; Copper and their common alloys

7 NON DESTRUCTIVE TESTING OF MATERIALS: Purpose and challenges; techniques: visual aids – bioscopes; fibre optics scanner; magnetic particles inspection; liquid penetrants; eddy currents; ultrasonic; radiography; Selection of NDT techniques; Merits ; demerits

TEXT BOOKS

REFERENCE BOOKS
1 Budinski, K. G, & Budinski MK., ‖Engineering Materials Properties and Selection‖, PMI; 2010
2 VanVlack., —Elements of Material Science and Engineering‖, Wesley Pub Comp 1998
3 Raghuwanshi, B. S., —Workshop Technology‖, Vol I Dhanpat Rai & Co.

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<th>ME-201</th>
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OBJECTIVE
To become familiar with programming in Mat Lab and its applications. At the end of the course, student will be able to write programs in Mat Lab for problems arising in his course work and in further studies.

REFERENCE BOOKS

WEB REFERENCES
OBJECTIVE
This course introduces the student to the fundamental laws of thermodynamics, the interaction between energy and matter, the quantitative and qualitative aspects of energy and its transformations, the properties of the working substance and their relationship.

1. **BASIC CONCEPT:** Thermodynamic systems; Surrounding and Boundary; Thermodynamic Property – Intensive and Extensive; Thermodynamic Equilibrium; State; Path; Process and Cycle; Quasi-static; Reversible and Irreversible Processes; Working Substance; Concept of Thermodynamic Work and Heat; Equality of Temperature; Zeroth Law of Thermodynamics and its utility; Numericals

2. **FIRST LAW OF THERMODYNAMICS:** Internal Energy and 1st Law Applied to Non-flow process; PMMFK; Enthalpy Steady flow energy equation; Steady and unsteady Flow Process; Throttling Process and Free Expansion Process; Numericals

3. **SECOND LAW OF THERMODYNAMICS:** Limitations of First Law; Heat Source and Heat Sink; Heat Engine; Refrigerator and Heat Pump; Kelvin-Planck and Clausius Statements and their Equivalence; PMMSK; Carnot Cycle; Carnot Theorem; and its Corollaries; Thermodynamic Temperature Scale; Entropy; Clausius Inequality; Principle of Entropy Increase; Entropy Change in Different Processes; Introduction to Third Law of Thermodynamics; Numericals

4. **AVAILABILITY AND IRREVERSIBILITY:** High and Low Grade Energy; Availability and Unavailable Energy; Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference; Dead state of a system; Availability of a Non-Flow or Closed System; Availability of a Steady Flow System; Helmholtz and Gibb’s Functions; Effectiveness and Irreversibility; Numericals

5. **IDEAL AND REAL GASES:** Concept of an Ideal Gas; Basic Gas Laws; Characteristic Gas Equation; and Universal Gas Constant; Vander Waal’s Equation of state; Reduced Co-ordinates; Compressibility factor and law of corresponding states; Mixture of Gases; Mass; Mole and Volume Fraction; Gibbs Dalton’s law; Gas Constant and Specific Heats; Entropy for a mixture of non-reactive gases; Numericals

6. **PURE SUBSTANCE:** Pure Substance and its Properties; Phase and Phase Transformation; Vaporization; Evaporation and Boiling; Saturated and Superheat Steam; Solid – Liquid – Vapour Equilibrium; T-V; P-V and P-T Plots; Properties of Dry; Wet and Superheated Steam; Property Changes During Steam Processes; Use of steam tables and Mollier Diagram for Process calculation; Throttling And Measurement of
Dryness Fraction of Steam; Numericals

7. **THERMODYNAMIC RELATIONS**: Maxwell Relations; Clapeyron Equation; Relations for changes in Enthalpy and Internal Energy & Entropy; Specific heat capacity Relations; Joule Thomson coefficient & inversion curve;

**TEXT BOOK**

**REFERENCE BOOKS**
4. Estope, TD and MeconkeyA.,“Applied Thermodynamics for Engineers Technologists”, AWL, 1999

**WEB REFERENCES**
1. www.mdpo.org/entropy
2. www.nptel.iitm.ac.in

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<th>ME-251</th>
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**LIST OF EXPERIMENTS**
1. To perform the operations of Interactive computing; Array and Matrix manipulation; saving loading data from excel sheets; saving m-files
2. To write simple programs for manipulation of arrays; matrices; solving polynomial expressions; differentiating and integrating simple equations
3. To perform plotting of different variables in 2D and 3D workspace
4. To perform exercises related to for-loop; if statements and while loop and understanding the variables and debugging in MatLab
5. To write programs for manipulation strings; symbols and numbers;
6. To perform the experiment no. 2 using symbolic tool box
7. To perform the experiment no. 3 using symbolic tool box
8. To write a program for solving a set of linear system of equations using different algorithms and compare with built in functions of MatLab
9. To perform experiment no. 7 using symbolic tool box
10. To write programs for solving differential equations numerically using different algorithms
11. To write programs to solve the set of differential equations using different algorithms
12. To perform experiment no. 11 using symbolic tool box

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LIST OF EXERCISES

1. Introduction of AUTOCAD and drawing simple figures by using Draw and Modify tools in AUTOCAD
2. To make complex / Engg; Objects by using Layers with proper dimensioning tools
3. Conversion of Isometric views to orthographic views
4. Conversion of Orthographic views to Isometric views
5. Objects are given in Isometric views and that are to be converted in sectional views
6. Excises on Threads; Bolts and nuts
7. Excises on Riveted Joints and welded joints
8. Excises on Shafts; keys cotter and pin joints
9. Excises on Couplings
10. Geometrical tolerance; Limits and fits
11. Excises on springs; belts and Pulleys
12. Excises on Gears and bearings
13. Assembly drawing of Cylinder; Piston; rings and connected rod And part drawing of crank shaft
14. Assembly drawing of screw Jack
15. Block Diagrams; (Power plant; Civil; Electronics etc)
16. Assembly drawing of stop valve
17. Assembly drawing of spring loaded safety Valve
18. Assembly drawing of Tail stock of Lathe
19. Assembly drawing of Shaper tool slide
20. Conversion of Assembly drawing to part drawings and vice versa
LIST OF EXPERIMENTS

1. To study the creep deformation of the solder wire
2. To study the Bravais Lattices
3. To study the arrangement of atoms in simple crystal with the aid of models
4. To study the chemical methods of corrosion
5. To normalize a given specimen and check its toughness
6. To temper the given hardened steel specimen at 300°C and measure hardness
7. To temper the given hardened steel specimen at 500°C and measure hardness
8. To study the microstructure of heat treated steel
9. To harden a given specimen and check its hardness
10. To anneal a given specimen and check its Hardness

2nd Year (SEMESTER – III)
**Objective:** To strengthen the four language skills and to refine the presentation skills; to learn report writing and to practice the etiquettes for better personality.

**UNIT 1:** Semantics:- Phrasal verbs & idioms, their usage in sentences; foreign words & phrases, their meaning and sentence formation; abbreviations & acronyms

**UNIT 2:** Remedial grammar:- Types of verb; Active voice & passive voice; Types of sentences based on mood and structure; Reported speech; Sentence correction based on tense, voice & reported speech

**UNIT 3:**- Listening & Reading Skills: Listening & hearing; Barriers in listening; Effective listening; Listening exercises; Types of reading; Reading with correct tone & intonation; Reading comprehension; Paraphrasing; Summarizing the passage

**UNIT 4:** Oral communication:- Presentation; Self introduction in front of the Interview board; Public speaking tips; Effective PPt. Presentation on topics of current importance

**UNIT 5:** Writing skills & Internal communication:- Meeting; Agenda; Minutes; Notice; Memo; Memorandum; Circular:- Paragraph writing; Job application & Resume; Introduction to Report writing; Structure & objective of different types of reports; Report writing; Press report

**UNIT 6:** Business Correspondence: Note-Making, Precis writing; Types of Business letters; Letter of Appointment; Resignation Letter; Formal Invitation

**UNIT 7:** Professional skills:- Interpersonal skill; Job interview; Team work; Leadership qualities; Case studies on the above professional skills

**Prescribed Text book**

1. Technical Communication Principles & Practice (2nd Ed.) by Meenakshi Raman & Sangeeta Sharma published by Oxford University

2. The Functional Aspects of Communication Skills by Dr.Prajapati Prasad published by S.K.Kataria & Sons

SUGGESTED READING:
1. Language in Use (Upper Intermediate Level, Adrian Doff Christopher Jones, Cambridge University Press)
5. The sounds of English, Veena Kumar, Makaav Educational Software, New Delhi.

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OBJECTIVE
The strength of materials is one of the core subjects and aim is to provide a sound foundation to design various elements of mechanical equipment.

PRE REQUISITES
Knowledge of Engineering Mechanics

1. BENDING: Bending stress in beams (straight members) with loading in the plane of symmetry (rectangular; circular; I. T. sections); Flexural formula; Unsymmetrical bending: Pure bending of a beam having an arbitrary cross section; Components of moment along principal axes; Generalized flexural formula; Curved beams: stresses in bars of initial small radius of curvature; (cross sections – circular; rectangular; trapezoidal)
2. **TRANSVERSE SHEAR**: The shear formula; shear stress in beams (rectangular cross section; I section); shear flow in thin-walled members (I. C. L sections); shear centre

3. **BI-AXIAL STRESS**: Thin walled pressure vessels; plane stress transformation; general equations; principal stresses; plane strain transformation; principal strains; Mohr’s circle – plane stresses; plane strains; Stresses in shaft due to combined bending and axial loads; bending and torsion

4. **SLOPE AND DEFLECTION OF BEAMS & SHAFTS**: Relationship between bending moment; slope and deflection Calculations of slope and deflection by method of integration; Macauley’s method; moment area method; method of superposition

5. **STRAIN ENERGY**: expression for strain energy and various types of loadings; axial force; bending moment; transverse shear; torsional moment Castigliano’s theorem to find slope; deflection of beams; rings; Theories of elastic failure with derivations and graphical representation

6. **COLUMNS AND STRUTS**: Column under axial load; concept of instability and buckling; slenderness ratio; Euler’s formula for elastic buckling load; Rankine-Gordon Formula

7. **THICK CYLINDERS**: Derivations of Lame’s equations; radial and hoop stresses and strains in thick and compound cylinders; hub shrunk on solid shaft

**TEXT BOOK**


**REFERENCE BOOKS**


**WEB REFERENCES**

1. [www.mdsolids.com](http://www.mdsolids.com)
2. [www.ecourses.ou.edu](http://www.ecourses.ou.edu)
OBJECTIVE
The primary purpose of this course is to make student understand and develop skill to predict the effect of force and motion while carrying out design function. It is foundation for design of various mobile devices.

PRE REQUISITES
Knowledge of Engg Mechanics

1. KINEMATICS OF PARTICLES: Particle motion; velocity and acceleration in path and cylindrical coordinates; relative motion; motion of constrained particles

2 KINETICS OF PARTICLES: Force; mass and acceleration; Newton’s Law for rectangular coordinates and cylindrical coordinates; Equations of motion and solution of problems; work energy equations; work energy equations for system of particles; linear and angular momentum equations for system of particles

3 PLANE KINEMATICS OF RIGID BODIES: Plane motion; translation and rotation of rigid bodies; Chasles theorem relative velocity; Instantaneous center of zero velocity; relative acceleration; Coriolis acceleration

4 PLANE KINETICS OF RIGID BODIES: Force; mass and acceleration; general equations of motion; Translation; fixed axis rotation; general plane motion

5 INTRODUCTION TO 3-DIMENSIONAL DYNAMICS OF RIGID BODIES: Kinematics-translation; fixed axis rotation; parallel plane motion; general motion; Kinetics-angular momentum; gyroscopic motion

6 STATIC & DYNAMIC FORCE ANALYSIS: Static force analysis of planer mechanisms;
dynamic force analysis including inertia and frictional forces of planar mechanisms

7 DYNAMIC FORCE ANALYSIS Dynamic force analysis of reciprocating engines

TEXT BOOK
Meriam, J. L., -Dynamicsl, Wiley India, 5th edition, 2006

REFERENCES BOOKS
4th ed;
2003
2. —Vector Mechanics for Engineers Dynamicsl 8th ed; Ferdinand P Beer; E Russel Johnston

WEB REFERENCES
www.nptel.iitm.ac.in

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<th>ME-207</th>
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OBJECTIVE
It imparts the basic concept; knowledge and laws of fluid flow; its dynamics and kinematics and idea of estimation of various losses encountered in fluid flow

1. **FLUID PROPERTIES AND FLUID STATICS**: Concept of fluid and flow; ideal and real fluids; Continuum concept; properties of fluids; Newtonian and non-Newtonian fluids; Pascal’s Law; hydrostatic equation; hydrostatic forces on plane and curved surfaces; stability of Floating and submerged bodies; relative equilibrium; Problems

2. **FLUID KINEMATICS**: Eulerian and Lagrangian description of fluid flow; stream; streak and path lines; types of flows; flow rate and continuity equation; differential equation of Continuity; rotation; vorticity and circulation; stream and potential functions; Problems

3. **FLUID DYNAMICS**: Concept of system and control volume; Euler's equation; Bernoulli’s equation; venturimeter; pitot tubes; orifice meter; kinetic and momentum correction factors; Impulse momentum relationship and its applications; Problems

4. **VISCOUS FLOW**: Flow regimes and Reynolds’s number; Relationship between shear stress and pressure gradient; uni-directional flow between stationary and moving parallel plates;
   - Couette flow; laminar flow through pipes – Hagen Poiseuille law; movement of piston in a dashpot; power absorbed in bearings; Problems

5. **FLOW THROUGH PIPES**: Friction loss in pipe flow; Darcy-Weisbach formula coefficient of friction and friction factor; Major and minor losses in pipes; hydraulic Gradient and total energy lines; series and parallel connection of pipes; branched pipes; Equivalent pipe; power transmission through pipes; Problems

6. **BOUNDARY LAYER FLOW**: Boundary layer concept; displacement;
momentum and energy thickness; von-karman momentum integral equation; laminar and turbulent boundary layer flows; drag on a flat plate; boundary layer separation; Streamlined and bluff bodies; lift and drag on a cylinder and an airfoil; Problems

7 COMPRESSIBLE FLOW Introduction; Sonic Velocity; Mach Number; Isentropic flow stagnation properties; normal shock; flow through a converging – diverging nozzle; Problems

TEXT BOOK
Kumar, K. L., —Engineering Fluid Mechanicsl, Eurasia Publication House, 2002

REFERENCE BOOKS

WEB REFERENCES
1 www.nptel.iitm.ac.in
2 www.ecourses.ou.edu

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OBJECTIVE
To enable students to understand the construction and operation of instruments for measurement of pressure; level; flow and temperature; describe a suitable calibration procedure for a particular measurement instrument; identify and quantify errors from calibration graphs and describe correction procedures for selected instruments; select a suitable measurement instrument for a given process measurement; solve numerical problems involving equations pertaining to pressure; level; temperature and flow measurements

1 INTRODUCTION TO INSTRUMENTATION: Role of instruments in industrial processes; block representation of measurement systems; Need for calibration and Standards; Instrument parameters: Sensitivity; accuracy; resolution; span; range; Static errors: zero error; proportionality error; hysteretic; maximum non linearity error
2 **TRANSDUCERS:** Introduction; Analog and digital transducers: electromechanical: potentiometric; Inductive; Self generating and Non-self generating types; Electromagnetic; Electrodynamic; Eddy current; Magnetostrictive; variable inductance; LVDT; variable capacitance; piezoelectric transducer and associated circuits; unbonded and bonded strain gauges; strain gauge bridge circuits; single; double and four active arm bridge arrangements; Temperature; compensation; Balancing and calibration; Ionisation Transducers; Mechano-electronic transducers; Opto-electrical transducers; photo conductive transducers; photo voltaic transducers; digital transducers; frequency domain transducer; vibrating string transducer

3 **MOTION FORCE AND TORQUE MEASUREMENT:** Relative motion measuring devices; electromechanical; optical photo electric; Moire-Fringe; Absolute motion devices; calibration; hydraulic load cell; pneumatic load cell; elastic force devices; separation of force components; electro mechanical methods; strain gauge; torque transducers

4 **PRESSURE MEASUREMENT:** Definition and units; Relationship between absolute atmospheric and gauge pressures; use of manometers for pressure measurement; principle of operation of following pressure gauges; diaphragm gauges; bellow gauges; Bourdan gauges; strain gauges; Gauge calibration using manometers dead weight gauge; gauges for high pressure and low pressure measurement

5 **LEVEL MEASUREMENT:** Direct level measuring systems: dipsticks; float systems pressure measuring devices; capacitive devices; ultrasonic level gauges; radiation methods; vibrating level sensor; hot-wire elements; radar methods; laser methods; fiber optic level sensors Flow measurement: Volume and mass flow rate; Bernouilis equation and applications to differential pressure devices; differential pressure primary elements; Orifice plate; venturi tube; dall tube; flow nozzle and pitot tube; positive displacement flow meters: reciprocating piston; rotating impeller; calibration of flow meters

6 **TEMPERATURE MEASUREMENT:** Introduction; Non electrical methods: Bimetallic thermometer; liquid in glass thermometer; pressure thermometer; electrical resistance sensors; resistance thermometers and thermistors; thermocouple; radiation methods; pyrometry and pyrometers

7 **BASIC STATISTICAL CONCEPTS:** types of measure and quantities (discrete and continuous) central tendency of data; mode; median; arithmetic mean; best estimate of true value of data; measures of dispersion; range; mean deviation; variance; standard deviation; normal distribution; central limit theorem; significance test; method of least squares; graphical representations and curve fitting of data

**TEXT BOOK**

REFERENCE BOOKS

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OBJECTIVE
The purpose of this course is to □ Acquaint the students in the basic economic concepts and their operational significance and □ stimulate him to think systematically and objectively about contemporary economic problems.

1. INTRODUCTION: Definition of economics; difference between micro and macro economics; central problems of economy including PP curve; factors of production

2. UTILITY: Concept and measurement of utility; Law of Diminishing Marginal Utility (DMU); derivation of Law of Demand from Law of DMU; Law of Equimarginal Utility (EMU) – its practical applications

3. DEMAND: What is demand and supply; shift in demand and extension of demand; law of demand and law of supply; demand function; demand schedule; elasticity of demand; measurement of elasticity of demand; factors affecting elasticity of demand; role of demand and supply in price determination and effect of changes in demand and supply on prices

4. PRODUCTION FUNCTIONS: Meaning of production and production functions; Law of Variable Proportion; returns to scale, internal and external economies and diseconomies of scale.

5. COSTS: Various concepts of costs: fixed cost, variable cost, average cost, marginal cost, opportunity cost; shape of average cost, marginal cost, total cost etc. in short run
and long run.

6. **MARKET STRUCTURES:** What is market; main features of perfect competition; monopoly; oligopoly; monopolistic competition.

7. **MACRO ECONOMICS:** Macro economics: brief concepts of GDP, GNP, NI, per capita income; inflation; privatization; globalization (merits & demerits); elementary concepts of VAT, WTO, GATT and TRIPS

**TEXT BOOK**
Hirshey M., —Managerial Economicsl, Thomson Learning, 2007

**REFERENCE BOOKS**

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<th>ME-202</th>
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**OBJECTIVE**
The course provides knowledge on the different casting processes; metal forming processes and welding processes so as to select a proper process for a given job

**PRE REQUISITES**
ME 151A Manufacturing Practice

1. **SAND CASTING PROCESSES:** Advantages and limitations; sand mold making procedure; Patterns and cores; Pattern materials; pattern allowances; types of pattern; color coding; Molding materials; Molding sand composition; sand preparation; sand properties and testing; sand molding processes

2. **MOULD MAKING AND INSPECTION:** Types of cores; core prints; chaplets and chills; Gating system; Gates and risers; Melting practice; Cupola and Induction furnace; charge calculations; Casting cleaning and casting defects: Fettling; defects in castings and their remedies; methods of testing of castings for their soundness

3. **SPECIAL CASTING PROCESSES:** Shell molding; precision investment casting; permanent mold casting; die casting; centrifugal casting; and continuous casting

4. **METAL FORMING PROCESSES:** Nature of plastic deformation; hot working and
cold working Principles of rolling; roll passes; roll pass sequences; Forging: Forging operations; smith forging; drop forging; press forging; forging defects

5. EXTRUSION AND OTHER PROCESSES: Extrusion principle; hot extrusion; cold extrusion; wire drawing; swaging; tube making; Sheet metal operations; Press tools operations; shearing action; drawing dies; spinning; bending; stretch forming; embossing and coining

4. GAS AND ARC WELDING: Classification; oxy- acetylene welding equipments and techniques; Electric arc welding: Electrodes; manual metal arc welding; inert gas shielded arc welding; tungsten inert gas welding (TIG); metal inert gas welding (MIG) submerged arc welding (SAW)

7. RESISTANCE WELDING: Principles; resistance spot welding; resistance seam welding; upset welding; flash welding Other Welding Processes: Introduction of thermit welding; electro slag welding; electron beam welding; forge welding; friction welding; diffusion welding; brazing and soldering

TEXT BOOK


REFERENCE BOOKS


WEB REFERENCES

1. www.ider.herts.ac.uk/school/courseware
2. www.efunda.com
3. www.technologylinks.org

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<th>ME-252</th>
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LIST OF EXPERIMENTS

1. To make a pattern for a given casting with all the necessary allowances
2. To make a component involving gas welding joints and to study the welding defects and suggesting their remedies
3. To make a component involving MIG welding and study the welding defects and suggest their remedies
4. Development and manufacture of a Complex sheet metal component such as, five piece elbow
5. To make a casting of aluminium material
6. To study defects in a casting and suggest the remedial measures
7. To make a sand mould with a core for making a hollow job
8. To prepare a simple Engg. component by forging
9. To make a sheet metal job involving punching and blanking on a press
10. To prepare a job involving soldering / brazing

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LIST OF EXPERIMENTS

1. To perform the Brinell Hardness Test
2. To perform the Rockwell Hardness Test
3. To study the Impact Testing Machine and perform the Impact Tests (IZOD & CHARY)
4. To study UTM and Torsion Testing Machine
5. To perform the Tensile Test on UTM
6. To perform the Shear Test on UTM
7. To perform the torsion test on Torsion Testing Machine
8. To determine the Moment of Inertia of a Flywheel about its own axis of rotation
9. To study the Erichsen Sheet Metal Testing Machine and Perform the Erichsen Sheet Metal Test;
10. To verify support reactions for different types of loads at different locations on the beam
LIST OF EXPERIMENTS

1. To study a linear variable differential transformer (LVDT) and use it in a simple experimental set up to measure small displacement
2. To measure strain using strain gauges mounted on a cantilever beam
3. To measure torque using strain gauge torque transducer
4. To measure temperature using a thermocouple
5. Temperature measurement by a resistance – temperature device and to draw its characteristic curve;
6. To draw the characteristic curve for the given thermister;
7. To measure the speed of a motor shaft with the help of (non contact type magnetic pick up)
8. To measure the speed of a motor shaft with the help of a proximity sensors;
9. To measure load using load cell
10. Measurement of pressure using pressure cell

LIST OF EXPERIMENTS

1. To determine the meta-centric height of a floating Body
2. To verify Bernoulli’s theorem
3. To find critical Reynolds number for pipe flow
4. To determine the coefficient of discharge; contraction and velocity; of an orifice
5. To determine the coefficient of discharge of a venturimeter
6. To determine the coefficient of discharge of “V” notches
7. To determine the friction factor for pipes
8. To determine the minor losses due to sudden enlargement; sudden contraction and bends; in pipe flow
9. To determine the coefficient of impact of jet
10. To determine the velocity and pressure variation with radius in a forced vortex flow