B. E. SYLLABUS

MECHANICAL ENGINEERING

III & IV SEMESTER

With
Scheme of Teaching
& Examination
## DEPARTMENT: MECHANICAL ENGINEERING

<table>
<thead>
<tr>
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<th>Name</th>
<th>Position</th>
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<tr>
<td>1</td>
<td>Dr. Shrinivasa Rao B.R.</td>
<td>Prof./Vice Principal / COE</td>
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<td>2</td>
<td>Vinaya B R</td>
<td>Asso. Prof/1st year co-ordinator</td>
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<tr>
<td>3</td>
<td>Dr. Subrahmanya Bhat</td>
<td>Prof./HOD</td>
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<td>4</td>
<td>Dr. Sudesh Bekal</td>
<td>Professor, Dean(R&amp;D)</td>
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<tr>
<td>5</td>
<td>Dr. Shashikant Karinka</td>
<td>Professor, P G Coordinator</td>
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<td>6</td>
<td>Dr. Srinivas Pai P</td>
<td>Prof./DCOE</td>
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<td>7</td>
<td>Dr. Narasimha Marakala</td>
<td>Professor</td>
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<td>8</td>
<td>Dr. Muralidhar</td>
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<td>9</td>
<td>Dr. Mallikappa</td>
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<td>10</td>
<td>Manjunath Shenoy</td>
<td>Asso. Prof</td>
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<td>11</td>
<td>Narasimha Bailkeri</td>
<td>Asst. Prof, Gd III</td>
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<td>12</td>
<td>T.R. Venugopal</td>
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<td>Ravishankar Bhat</td>
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<td>P. Venkatesh Murthy</td>
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<td>15</td>
<td>Gururaj Upadhyaya</td>
<td>Asst. Prof, Gd III</td>
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<td>16</td>
<td>Ravindra</td>
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<td>Ananthakrishna Swamayaji</td>
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<td>Suresh Shetty</td>
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<td>19</td>
<td>Udaya</td>
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<td>Austin Dinesh D’Souza</td>
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<td>Kumar H S</td>
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<td>Rashmi P Shetty</td>
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<td>Dilip Kumar K</td>
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<td>Ravikiran Kamath B</td>
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<td>Veeresh R.K</td>
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<td>Grynal D’Mello</td>
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<td>Vishwanath J S</td>
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<td>31</td>
<td>Ajith M Hebbale</td>
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<td>Krishna Prasad</td>
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<td>Manjunath Maiya</td>
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<td>Sharathchandra</td>
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<td>Santhosh G</td>
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<td>Rajath N Rao</td>
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<td>Kshatriya Akshatha Manjunath</td>
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<td>Srinivas Prabhu</td>
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<td>39</td>
<td>Goutham Hebbar</td>
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Department of Mechanical Engineering, NMAMIT, Nitte

Vision:
To produce Mechanical engineers of the highest quality who are professionally competent and highly qualified to suit the needs of industries and organizations by promoting excellence in teaching, learning and research.

Mission:
The Dept. of Mechanical Engineering is committed to –

- Provide high quality education to the students, to fulfill the requirements of a ‘Global Engineer’.
- Constantly strive to improve the teaching-learning methods, in order to deliver good academic programs.
- To respond to the fast evolving scientific and technological challenges in a highly competitive world.
- To inculcate, ethics, integrity, honesty, credibility, social and environmental consciousness.

Programme Educational Objectives (PEO’s):

To satisfy the mission of the mechanical engineering program, the graduates will:

1. Be able to research, design, develop, test, evaluate, and implement engineering solutions to problems that are of a complexity encountered in professional practice.

2. Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments.

3. Consider the ethical implications and societal impacts of engineering solutions.

Programme Outcomes (PO’s):

- An ability to apply knowledge of mathematics, science, and applied sciences.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to formulate or design a system, process or program to meet desired needs.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve imaging/printing problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of solutions in a global, and social context.
- A recognition of the need for, and an ability to engage in life-long learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.
### DEPARTMENT OF MECHANICAL ENGINEERING
#### SCHEME OF TEACHING

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sub. Code</th>
<th>Subject</th>
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**33 Hours/week**
# DEPARTMENT OF MECHANICAL ENGINEERING

## SCHEME OF TEACHING

**IV Semester**

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<th>Sl. No.</th>
<th>Sub. Code</th>
<th>Subject</th>
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<th>Cr</th>
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ENGINEERING MATHEMATICS –III

Subject Code : 13ME 301  
Credits : 04  
Hrs/Week : 4  
Total Hours : 52

Prerequisites:  
Vector algebra, infinite series, differentiation and integration, knowledge of complex numbers.

Course learning Objectives: At the end of the course the student is expected to:  
1. know the application of vector calculus in engineering field.  
2. apply the results of topics like complex variables, Fourier Analysis, Z-transforms etc to solve engineering problems.

UNIT – I  
10 Hrs

UNIT – II  
8 Hrs

UNIT – III  
Line integrals in complex plane, Cauchy’s theorem, Power series, Residues, Cauchy’s residue theorem.  
12 Hrs

UNIT – IV  
Fourier Analysis: Periodic functions, Euler’s formulae, Fourier series of odd and even functions, functions with arbitrary period, half range series. Harmonic Analysis. Fourier integral theorem, Fourier Transforms, Inverse Fourier transform, Convolution theorem. Fourier sine and Fourier cosine transforms, Inverse Fourier sine and Inverse Fourier cosine transforms.  
11 Hrs

UNIT – V  
11 Hrs
TEXT BOOKS:

REFERENCE BOOKS:
2) Murray R. Spiegal: Vector Analysis, Schuam publishing Co.

MATERIAL SCIENCE AND METALLURGY
Subject Code : 13ME 302  Credits : 03
Hrs / Week : 3  Total Hours : 39

UNIT - I
Structure of crystalline solids: Fundamental concepts of unit cell, space lattice, Bravaias space lattices, unit cells for cubic structure & hcp, study of stacking of layers of atoms in cubic structure & hcp, calculations of Atomic radius, Coordination Number and Atomic Packing Factor for different cubic structures. Crystal imperfections- point, line, surface & volume defects. Diffusion, Diffusion Mechanism, Fick’s laws of diffusion. 8 Hrs

UNIT - II
Fundamentals of solidification, nucleation and its types, crystal growth, cast structure. Solid solutions: Types, Rules governing the formation of solids solutions. Phase diagrams: Basic terms, phase rule, cooling curves, construction of phase diagrams, interpretation of equilibrium diagrams, Types of phase diagrams. Lever rule, Problems on Phase diagrams  8 Hrs

UNIT - III
martempering, austempering, surface hardening like case hardening, carburizing, cyaniding, nitriding, Induction hardening. Hardenability, Jominy end-quench test, Age hardening of Al & Cu alloys. 10 Hrs

UNIT - IV

**Hardness:** Rockwell, Vicker’s & Brinell’s Hardness testing. Plastic deformation, slip and twinning, strain hardening, strain aging, Bauschinger effect, Recovery, Recrystallisation and grain growth. 

**Fracture:** types, stages in cup & cone fracture, Griffith’s criterion. Notch effect, ductile-brittle transition. 

**Fatigue:** fatigue tests, mechanism, S-N curves, Factors affecting fatigue life, and protection methods. 

**Creep:** Various stages of creep, Mechanisms of creep, effect of temperature, creep fracture, stress relaxation, Creep resistant materials. 8 Hrs

UNIT - V

**Engineering Alloys:** Properties, composition and uses of low, medium, and high carbon steels. 

**Steel:** Method of designation as per AISI–SAE. 

**Cast irons:** Gray CI, White CI, Malleable CI, SG iron. 

**Microstructures of cast iron.** 

**Light alloys:** Aluminum, Magnesium & Titanium alloys. 

**Copper & its alloys:** Brasses & Bronzes. 

**Advanced Materials:** Types of Fibres & Matrix, and applications of Composites, Ceramics, Optical, Smart Materials, Powder metallurgy and Introduction to shape memory alloys, nuclear, space and high temperature materials. 8 Hrs

TEXT BOOKS:

REFERENCE BOOKS:

Scheme Examination:
TWO questions to be set from each UNIT and Students shall answer FIVE full questions choosing at least ONE question from each UNIT.
BASIC THERMODYNAMICS (3-0-0)

Subject Code : 13ME 303  Credits : 03
Hrs / week : 3  Examination Hrs : 03
CIE Marks : 50  Total Marks : 100
SEE Marks : 50

UNIT - I

Fundamental Concepts & Definitions:
Characteristics of system boundary and control surface; surroundings; fixed, moving and imaginary boundaries, examples. Thermodynamic state, state point, identification of a state through properties; definition and units, intensive and extensive various property diagrams, Path and process, quasi-static process, cyclic and non-cyclic processes. Thermodynamic equilibrium. Zeroth law of thermodynamics. Temperature as an important property-Temperature measurement. Numerical problems  4 Hrs

Work and Heat
Mechanics: definition of work and its limitations. Thermodynamic definition of work and heat. Examples & sign convention. Displacement work as part of a system boundary and as whole of a system boundary. Expressions for displacement work in various processes through p-v diagrams. Numerical problems.  4 Hrs

UNIT - II

First Law of Thermodynamics
Statement of the First law of thermodynamics for a cycle, derivation of the First law of processes. Internal energy as a property, thermodynamic distinction between energy and work; concept of enthalpy, definitions of specific heats at constant volume and at constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation Important applications such as flow in a nozzle, diffuser, throttling, compressor, turbine etc. Numerical problems.  8 Hrs

UNIT - III

Second Law of Thermodynamics
Devices converting heat to work and vice versa in a thermodynamic cycle, thermal reservoirs. heat engine and a heat pump. Schematic representation and efficiency and coefficient of performance. Carnot
cycle-explanation and arrangements. Identifications of directions of occurrences of natural processes, Offshoot of II law from the I\textsuperscript{st}. Kelvin-Planck and Clasius's statements of Second law of Thermodynamic; Equivalence of the two statements. Reversible heat engines, refrigerators and heat pumps. Irreversible process. Numerical problems. \hspace{1cm} 8 Hrs

\textbf{UNIT - IV}

\textbf{Entropy}
Entropy; definition, a property, principle of increase of entropy, entropy as a quantitative test for irreversibility; Calculation of entropy, role of T-s, h-s diagrams. Use of steam table and mollier chart for determining entropy. Representation of heat quantities; Entropy generation in closed system. Numerical problems. \hspace{1cm} 5 Hrs

\textbf{Pure Substances}
Definition of a pure substance, phase of a substance, triple point and critical points. Sub-cooled liquid, saturated liquid, vapour pressure, two phase mixture of liquid and vapour, saturated vapour and superheated vapour states of a pure substance. Representation of properties of pure substance on p-T and p-V diagrams. Simple numerical problems. \hspace{1cm} 3 Hrs

\textbf{UNIT - V}

\textbf{Ideal & Real Gas Mixtures}
Differences between perfect, ideal and real gases. Equation of state. Evaluation of properties of perfect and ideal gases. Introduction. Van der Waal’s Equation of state, Van der Waal's constants in terms of critical properties, law of corresponding states, compressibility factor; compressibility chart. Ideal gas mixtures: Dalton’s law, Properties of ideal gas mixtures. Numerical problems. \hspace{1cm} 5 Hrs

\textbf{Basics of Psychrometry}
Basic definitions, properties of atmospheric air, psychrometer, adiabatic saturation process. Simple numerical problems without using psychrometric chart. \hspace{1cm} 3 Hrs

\textbf{Text Books:}
Reference Books:

Scheme Examination:
TWO questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

**MANUFACTURING PROCESSES-I**

**Subject Code**: 13ME 304  
**Credits**: 03  
**Hrs / Week**: 3  
**Total Hours**: 39

**UNIT - 1**

Casting Process:
Concept of manufacturing process, its importance, Classification.  
- Introduction to Casting Process- steps involved – Advantages and Limitations.  
- Patterns-types-materials-pattern allowances  
- Sand casting; Moulding sand – Properties, types, binder and additives – conditioning and testing  
- Cores- Types-Core sand & core making.  
- Hand and machine moulding processes and equipment 8 Hrs

**UNIT - II**

Special Casting Processes:
CO₂ Moulding, Shell moulding, Investment Casting, slush casting.  
- Die casting – Gravity die casting – Pressure die casting Centrifugal casting, Continuous casting.  
- Advanced casting processes – Squeeze casting, Thixo casting.  
- Casting defects 8 Hrs
UNIT - III

Hot and Cold working metals
- Rolling, Forging, Principle of Extrusion, Drawing.
- Press working – Press working operations & tools, simple compound & progressive dies.
- HERF, Explosive forming, Electro hydraulic forming, Magnetic pulse forming 10 Hrs

UNIT - IV

Welding (Joining Process)
Classifications & Advantages and applications.
- Gas welding – Principle & Equipment, types of flames
- Resistance welding and principle – Seam – butt, Spot and Projection welding 8 Hrs

UNIT - V

Advanced welding processes
- Soldering, brazing and Adhesive bonding process
- Welding defects, Inspection- visual, magnetic, Radiography, Eddy current. 8 Hrs

TEXT BOOKS:

REFERENCE BOOKS:

Scheme Examination:
TWO questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.
MECHANICS OF MATERIALS

Subject Code : 13ME 305  
Credits : 04  
Hrs /Week : 4  
Total Hours : 52

UNIT - I

Stress in composite section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

UNIT - II
Compound stresses: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr’s circle for plane stress.

Thick and thin cylinders: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame’s equation), (compound cylinders not included).

UNIT - III
Bending moment and Shear force in beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniform distributed load (udl) and couple for different types of beams.

UNIT - IV
Bending and shear stresses in beams: Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses and radius of curvature, relationship between bending moment and radius of curvature, moment carrying capacity of a section, shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections (composite / fletched beams not included).
UNIT - V

Deflection of beams: Introduction, differential equation for deflection, equations for deflections, slope and moments, double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay’s method.  

6 Hrs

Torsion of circular shafts and Elastic stability of columns:
Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts. Introduction to columns, Euler’s theory for axially loaded elastic long columns, derivation of Euler’s load for various end conditions, limitations of Euler’s theory, Rankine’s formula.  

6 Hrs

TEXT BOOKS:

REFERENCE BOOKS:

Scheme Examination:
TWO questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.
COMPUTER AIDED MACHINE DRAWING

Subject Code : 13ME 306  
Credits : 03  
Hrs /Week  : 6  
Total Hours : 39

UNIT – I

INTRODUCTION:  
Introduction to machine drawing: Importance of sectional view in machine drawing.  
Section of solids: sectional views and true shape of cut surface of simple solids like prism, pyramid, cone, cylinder, cube and tetrahedron. (Resting on base only-3 problems)  
Free hand sketching of: Orthographic views of simple machine parts with section from Isometric views.  

UNIT – II

FITS AND TOLERANCES:  

UNIT – III

ASSEMBLY CONCEPTS:  
Methods and concepts of assemblies-assembly requirements, Bill of materials. Methods of assembly of bolts, nuts, studs, screws and pins. Methods of arresting motion of members in an assembly, Assembly and dismantling exercise of a typical assemblies with emphasis on assembly sequence and appropriate fits.  

UNIT - IV

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

UNIT – V

ASSEMBLY USING SOLID MODELING:  

TEXT BOOKS:  
1. A Primer on CAMD, VTU  
REFERENCE BOOKS:
1. A Text book of CAMD by Tryambaka murthy
3. Auto CAD 2006 for Engineers and Designers by Sham Tickoo

Scheme Examination:
ONE question from unit-I – for 20 marks.
ONE question from unit – IV for 20 marks.
ONE question from unit – V for 60 marks.

MATERIAL TESTING LABORATORY

Subject Code : 13ME 307
Credits : 02
Hrs /Week : 3

PART – A
1. Tensile, shear and compression tests of metallic and non metallic specimens using a Universal Testing Machine.
2. Torsion tests.
3. Bending Test on metallic and nonmetallic specimens.
4. Izod and Charpy tests on M.S. Specimen.
6. Fatigue Test.

PART – B
3. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
4. Non-destructive test experiments like,
   (a) Ultrasonic flaw detection
   (b) Magnetic crack detection
   (c) Dye penetration testing, to study the defects of Cast and Welded specimens

Scheme of Examination:
Two experiments to be conducted from part - A
One experiment from Part – B
Viva - Voce: 10 Marks
Total: 50 Marks
FOUNDRY, FORGING & WELDING LABORATORY

Subject Code: 13ME 309
Credits: 02
Hrs / Week: 3

PART – A

1. WELDING
Preparation of specimens for welding and conduction of the welding exercises of following joints:
   1) Lap Joint
   2) Butt Joint
   3) L-Joint.
   4) T-Joint

PART – B

2. Forging Operations
Preparation of minimum forged models involving: Upsetting, Drawing and bending operations.

PART – C

3. Foundry Practice

4. Testing of Molding sand and Core sand
Preparation of sand specimens and conduction of the following tests:
   1) Compression, Shear and Tensile tests on Universal Sand Testing
   2) Permeability test
   3) Clay content test.
   4) Moisture content test.

Scheme of Examination:
One question is to be set from Part-A: 10 marks
One question is to be set from either Part-B or Part-C: 30 marks
Viva-Voce: 10 marks.
Total: 50 marks.
ENGINEERING MATHEMATICS-IV

Subject code : 13ME401           Credits : 04
Hrs/Week     : 4                     Total Hours : 52

Prerequisites:
Set Theory, Calculus, differential equations and finite differences.

Course learning Objectives: At the end of the course the student will be able to
1. understand and appreciate probabilistic models for situations involving chance effect.
2. learn some probability distributions both discrete and continuous and its applications in real life problems.
3. Apply numerical methods to solve engineering problems where the analytical solutions for some functions are not possible.

UNIT – I
Introduction to probability, finite sample space, conditional probability and independence. Baye’s theorem. One dimensional random variable: discrete and continuous random variable, probability distribution function, cumulative distribution function. Mean and variance. 10 Hrs

UNIT - II
Probability distributions and Curve fitting: Binomial, Poisson, Normal, Exponential distributions. Curve fitting: curve fitting by the method of least squares: y=a+bx, y=a+bx+cx^2, y=ab^x .Correlation and regression. 10 Hrs

UNIT - III
Numerical integration: General quadrature formula, Trapezoidal rule, Simpson’s one third rule, Simpsons, three eight rule. 12 Hrs

UNIT - IV

**UNIT – V**

**Series solution of Ordinary Differential equations and Special functions**: Series solution-Frobenius method, Series solution of Bessel’s D.E leading to Bessel function of first kind. The generating function for $J_n(x)$. Orthogonality of Bessel functions. Series solution of Legendre’s D.E. leading to Legendre polynomials. Rodrigue’s formula. The generating function for $P_n(x)$. Orthogonality of Legendre polynomials.

**TEXT BOOKS:**

**REFERENCE BOOKS:**

**KINEMATICS OF MACHINES**

**Subject Code**: 13ME 402

**Credits**: 04

**Hrs /Week**: 5

**Total Hours**: 52

**UNIT - I**

**INTRODUCTION**: Definitions : Link or element, kinematic pair, Kinematic chain, structure, mechanism, degrees of freedom, Grubler’s Criteria (without derivation) Mobility of Mechanism, Inversion, Machine. Kinematic chain with three lower pairs, Practical applications of four bar chain.

**4 Hrs**

**KINEMATIC CHAINS AND INVERSIONS**: Inversions of Single slider crank chain and Double slider crank chain.
MECHANISMS: Quick return mechanisms – Crank and slotted lever mechanism, Whitworth mechanism, Drag link mechanism. Straight line motion mechanism – Peaucellier’s mechanism, Intermittent motion mechanism – Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph  

UNIT - II  
**Velocity and Acceleration** analysis of mechanisms (GRAPHICAL METHOD): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism and Simple mechanisms by vector polygons, Relative velocity and acceleration of particles in a common link.  

**Velocity** analysis by instantaneous centre method: Definition, Kennedy’s Theorem and its applications to locate number of instantaneous centers, Determination of linear and angular velocity using instantaneous centre method.  

UNIT - III  
Relative velocity and accelerations of coincident particles on separate links – Coriolis component of acceleration, Angular velocity and angular acceleration of links KLEIN’S CONSTRUCTION: Analysis of velocity and acceleration of single slider crank mechanism.  

CAMS: Types of cams, Types of followers, Displacement, velocity and acceleration time curves for cam profiles, disc cam with reciprocating follower having knife edge, roller and flat faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, Uniform acceleration and retardation and Cycloidal motion  

UNIT - IV  
SPUR GEAR: Gear terminology, Law of gearing, velocity of sliding, Involumetry, Involute function, Characteristics of Involute action, Comparison of involute and cycloidal teeth, Path of contact, arc of contact ,contact ratio, Interference in Involute gears, Methods of avoiding interference, Determination of backlash.  

UNIT - V  
GEAR TRAINS: Simple gear trains, Compound gear trains, reverted gear trains, Epicyclic gear trains ,Tabular method of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear train
**Belt and Rope drives:** Ratio of tensions, Centrifugal stress in a belt or rope, Power transmitted, effect of centrifugal tension on power transmitted, Numerical problems.  

5 Hrs

**TEXT BOOKS:**
2. Theory of Machines by Thomas Bevan
3. Mechanisms and Dynamics of machinery by Mabie and Ocvirk
4. Mechanics of Machines by Ham, Cranes and Rogers.

**REFERENCE BOOKS:**
1. Theory of Machines by V.P.Singh
2. Theory of Machines & Mechanisms by Shigley J.V. & Uickers J.J.
3. Theory of Machines by Ballaney.

**APPLIED THERMODYNAMICS (3-0-0)**

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**UNIT - I**

**Vapour Power Cycles**
Carnot vapour power cycle & its associated difficulties; Simple Rankine cycle – description, T-s diagram & analysis of performance; Application to thermal power plants. Comparison of Carnot and Rankine cycles; Effect of pressure and temperature on Rankine cycle performance; Numerical problems without using mollier chart. Reheat Rankine cycle; HPT and LPT steam expansion; Efficiency of reheat cycles. Ideal and practical regenerative Rankine cycles; open and closed feed water heaters; Efficiency of regenerative cycles; Numerical problems by using mollier chart.  

10 Hrs
UNIT - II

Gas Power Cycles
Air standard cycle approximations; Carnot, Otto, Diesel, Dual Cycles – p-v and T-s diagrams; Numerical Problems. Stirling cycle; Basic Gas turbine (Brayton) cycle (for open and closed systems). Efficiency of gas turbine cycle; Regenerative gas turbine cycle; Inter-cooling and reheating in gas turbine cycles; Numerical problems. 10 Hrs

UNIT - III

Reciprocating Compressors
Single stage reciprocating compressor cycle without clearance; Work input and power through p-v diagrams; Effect of clearance on volumetric efficiency and, Work input through p-v diagrams; Adiabatic, isothermal and mechanical efficiencies; Multi-stage compressors: Advantages. Effect of intercooling on work input in multi-stage compression; Optimum intermediate pressure (general case); Numerical problems. 8 Hrs

Flow through nozzles:
1 D isentropic flow in a variable area duct; critical pressure; Choking in a isentropic flow; shapes of supersonic and subsonic nozzles and diffusers; steam nozzles.(descriptive only) 2 Hrs

UNIT - IV

Refrigeration Cycles
Reversed Carnot cycle and its limitations; Basic vapour compression refrigeration system; Refrigeration effect; COP; Unit of refrigeration; p-h & T-s diagrams. Practical vapour compression refrigeration system; Numerical problems. Vapour absorption refrigeration system & COP; Comparison between VCRS and VARS and their applications (descriptive only). Air cycle refrigeration; Reversed Brayton cycle; Numerical problems 8 Hrs

Use of psychrometry for air conditioning application:
Brief review on construction and use of psychometric chart; Representation of various processes – heating, cooling, dehumidifying and humidifying. Adiabatic mixing of stream; sensible cooling load and latent cooling load, Numerical problems by using psychrometric chart. Summer and winter air conditioning; (descriptive only) 4 Hrs
UNIT - V

I C engine & combustion
Stoichiometric air for combustion of fuels; Excess air; Insufficient air, Mass balance; A/F ratio; exhaust gas analysis (Orsat apparatus); Numerical problems. I C engine performance measurement; calculation of IP, BP, bmep, bsfc, brake thermal efficiency; volumetric efficiency; and heat balance sheet. Numerical problems. 10 Hrs

TEXT BOOKS:
2. Engineering Thermodynamics, C.P.Gupta, Rajendra Prakash, Nemi Chand & Bros

REFERENCE BOOKS:
1. Applied Thermodynamics, Roy and Chaudary,
2. Energy Conversion, Kadambi & Prakash,
3. Applied thermodynamics, D Eastop and A McConkey, V Ed, Pearson
4. Thermal Engineering, R K. Rajput,
5. Thermodynamics, by Yunus A Cengel, Michael A Boles
6. Thermodynamic Data Hand Book by Dr. Nijaguna & Dr. B. S. Samaga

MANUFACTURING PROCESSES - II

Subject Code : 13ME 404  Credits : 04
Hrs /Week : 4  Total Hours : 52

UNIT - I

Theory of metal cutting
• Single point tool – terminology
• Chip formation types
• Merchant’s analysis
• Tool wear
• Tool life
• Machinability
• Cutting tool materials
• Cutting Fluids 12 Hrs
UNIT - II

Lathe
- Centre Lathe – Constructional tendencies - Driving and feeding mechanisms, operations
- Production lathe – Capstan and Turret lathe – Constructional Features- mechanisms – tool layout

UNIT - III

Milling Machines
Classification, construction of column, knee type and planer type milling machines
- Milling cutters, classification, Terminology.
- Milling operations.
- Indexing: universal dividing head , indexing operations
- Principle of shaping, Planning and slotting mechanisms

UNIT - IV

Grinding:
Abrasives: Matural and Artificial.
- Grinding wheel: Construction, designation, selection, mounting, balancing, glazing and loading, truing and dressing.

UNIT - V

Non conventional machining
- Mechanical – USM – AJM – WJM.
- Thermal & electro thermal – EDM, LBM, PAM.
- Chemical – Electro Chemical – ECM, ECH.

TEXT BOOKS:
2. Fundamentals of metal cutting and machine tools by Junneja and G S Shekhar
REFERENCE BOOKS:
1. Processes and Materials manufacture. By Roy and Lindberg
3. Production technology – H M T.

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

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FLUID MECHANICS

Subject Code : 13ME 405  
Credits : 04
Hrs/Week : 4  
Total Hours : 52

UNIT - I

11 Hrs

UNIT - II
Buoyancy and stability criteria:
Fluid kinematics: Fluid flow concepts, lines flow, Types of functions for 2-D flow, relationship between them and flow nets. Fluid Dynamics: general energy and momentum equation. Euler’s equation, Bernoulli’s equation for real fluids.  

10 Hrs

UNIT - III
Dimensional analysis: Introduction-derived quantities, dimensions of physical quantities, dimensional homogeneity, Buckingham’s theorem, Raleigh’s method, dimensionless numbers, similitude, types of similitude, Model testing
Laminar and viscous flow effects: Reynolds number, critical Reynolds number, laminar flow through circular pipe, Hagen Poiseulle’s equation, laminar flow between parallel and stationary plates.  

10 Hrs
UNIT - IV
Fluid flow measurements: Venturimeter, orificemeter, pitot tube, V and rectangular notch, Flow through pipes: frictional losses in pipe flow, Darcy-Weisbach equation, Chezy’s equation for loss of head due to friction in pipes, hydraulic gradient and total energy line

11 Hrs

UNIT - V
Flow past immersed bodies: Drag, Lift, expressions for lift and drag, pressure drag and friction drag, boundary layer concept, displacement thickness, momentum thickness and energy thickness. Introduction to compressible flow: Velocity of sound in a fluid, Mach number, propagation pressure wave in compressible fluid.

10 Hrs

TEXT BOOKS:
2. Fluid Mechanics by Dr. R K Bansal, Laxmi publications, 2004

REFERENCE BOOKS:

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.
ENGINEERING ECONOMICS

Subject Code : 13ME 406          Credits : 03
Hrs / Week : 3                      Total Hours : 39

UNIT - I

Some fundamental economic concepts
Consumer goods, Producer goods, Factors of production, Economy of organization, Demand theory, Law of demand, Exceptions to law of demand, Law of supply, Determinants of supply, Law of increasing returns and law of diminishing returns (No exercises)
Classification of cost; First cost, operating and maintenance cost, Fixed cost, Variable cost, Incremental and marginal cost, Sunk cost and Life cycle cost

Cost Accounting
Terminologies used in accounting, Profit and loss statement, Balance sheet, Understanding basic financial ratios, Simple exercises.

UNIT - II

Interest
Rate of interest, Determining rate of interest, Time value of money, Simple interest, Compound interest, Nominal and effective interest rate, Equivalence involving interest, Interest formulae [single payment, uniform series and arithmetic gradient only], problems using interest formulae [discrete compounding only].

UNIT – III

Economic Analysis of Alternatives
Analysis based on: Present Worth [equal life and unequal life situations], Future Worth, Payback Period, Capitalized Worth, Equivalent Annual Worth, Exercises.

UNIT – IV

Economic Analysis of Alternatives
Rate of Return, Analysis based on Rate of Return, Exercises.

Depreciation
Causes of depreciation, Methods of depreciation [Straight line, Declining balance, Double declining balance], Depletion, Exercises

UNIT – V

Estimating and Costing
Components of cost [Material cost, Labour cost, Overhead expenses, Prime cost, Factory cost, Total cost], Determination of selling price of a product, Exercises
Estimation of cost for simple components, Exercises

6 Hrs
TEXT BOOKS:
2. Mechanical Estimating and Costing, Banga and Sharma

REFERENCE BOOKS:

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

ENERGY CONVERSION ENGINEERING LAB
Subject Code : 13ME 407 Credits : 02
Hrs /Week : 3

PART A
1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Pensky Martins Apparatus.
2. Determination of Caloric value of solid, liquid and gaseous fuels.
5. Use of planimeter.

PART B
Performance Tests on I. C. Engines, Calculations of IP, BP, Thermal efficiencies, SFC, FP, heat balance sheet for:
(a) Four stroke Diesel Engine.
(b) Four stroke petrol Engine.
(c) Multi cylinder Diesel/Petrol Engine, (Morse test)
(d) Two stroke Petrol Engine
(e) Variable Compression Ratio I. C. Engine.

21 Hrs

21 Hrs
Scheme of Examination:
One Question Part-A: 15 marks
One Question Part-B: 25 marks
Viva Voce: 10 marks
Total: 50 marks

MACHINE SHOP

Subject Code : 13ME 408  Credits  : 02
Hrs/Week     : 3

1. Study of constructional features of following machines through drawings/ Sketches:
   a) Lathe
   b) Radial drilling machine
   d) Universal milling machine
   e) Shaper and planer
   g) Grinding machines (Surface, cylindrical)

2. Advanced exercises on Lathe where the students will work within specified tolerances, cutting of V- threads and square threads (internal as well as external).

3. Production of machined surfaces on shaper and planner.

4. Exercises on milling machines; generation of plane surfaces, production of spur gears and helical involute gears, use of end mill cutters.

5. Grinding of single point cutting tool, cutter and drills.

6. Study of recommended cutting speeds for different tool- work material combinations.

7. Identification of different cutting tool and work materials.

A student shall make models of 5 to 6 components (Composite Job), (excluding standard and commercial components). Job shall involve operations like Turning, Boring, Drilling, Taping, Threading, Milling, Shaping, Taper turning etc. and also a welding exercise.