B. E. SYLLABUS

MECHANICAL ENGINEERING

III & IV SEMESTER

With

Scheme of Teaching

& Examination
## Syllabus of III & IV Semester B.E. / Mechanical Engg.

### DEPARTMENT: MECHANICAL ENGINEERING

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name</th>
<th>Designation</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr. Shrinivasa Rao B.R.</td>
<td>Ph.D. Professor/Vice Principal / COE</td>
</tr>
<tr>
<td>2</td>
<td>Prof. Vinaya B. R.</td>
<td>M.Tech Asso. Professor/1st year coordinator</td>
</tr>
<tr>
<td>3</td>
<td>Dr. Subrahmanya Bhat</td>
<td>Ph.D. Professor and HOD</td>
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<tr>
<td>4</td>
<td>Dr. Sudesh Bekal</td>
<td>Ph.D. Professor/ Dean(R&amp;D)</td>
</tr>
<tr>
<td>5</td>
<td>Dr. Shashikanth Karinka</td>
<td>Ph.D. Professor/ P G Coordinator</td>
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<tr>
<td>6</td>
<td>Dr. Srinivasa Pai P.</td>
<td>Ph.D. Professor/DCOE</td>
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<tr>
<td>7</td>
<td>Dr. Narasimha Marakala</td>
<td>Ph.D. Professor</td>
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<tr>
<td>8</td>
<td>Dr. Muralidhara</td>
<td>Ph.D. Professor</td>
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<tr>
<td>9</td>
<td>Dr. Mallikappa</td>
<td>Ph.D. Professor</td>
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<tr>
<td>10</td>
<td>Dr. Narasimha Bailkeri</td>
<td>Ph.D. Professor</td>
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<tr>
<td>11</td>
<td>Mr. Manjunath Shenoy</td>
<td>M.Tech Associate Professor</td>
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<tr>
<td>12</td>
<td>Mr. T.R. Venugopal</td>
<td>M.Tech Associate Professor</td>
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<tr>
<td>13</td>
<td>Mr. Gururaj Upadhyaya</td>
<td>M.Tech Associate Professor</td>
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<tr>
<td>14</td>
<td>Mr. Suresh Shetty</td>
<td>M.Tech Associate Professor</td>
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<tr>
<td>15</td>
<td>Mr. Ananthakrishna Somayaji</td>
<td>M.Tech Associate Professor</td>
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<tr>
<td>16</td>
<td>Mr. Udaya</td>
<td>M.Tech Associate Professor</td>
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<tr>
<td>17</td>
<td>Mr. Ravishankar Bhat</td>
<td>M.Tech Asst. Prof, Gd III</td>
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<tr>
<td>18</td>
<td>Mr. P. Venkatesh Murthy</td>
<td>M.Tech Asst. Prof, Gd III</td>
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<tr>
<td>19</td>
<td>Mr. Ravindra</td>
<td>M.Tech Asst. Prof, Gd III</td>
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<tr>
<td>20</td>
<td>Mr. Austin Dinesh D’Souza</td>
<td>M.Tech Asst. Prof, Gd III</td>
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<tr>
<td>21</td>
<td>Mr. Kumar H. S.</td>
<td>M.Tech Asst. Prof, Gd II</td>
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<tr>
<td>22</td>
<td>Mr. Adarsh Rai</td>
<td>M.Tech Asst. Prof, Gd II</td>
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<tr>
<td>23</td>
<td>Mrs. Rashmi P. Shetty</td>
<td>M.Tech Asst. Prof, Gd II</td>
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<tr>
<td>24</td>
<td>Mr. Dilip Kumar K.</td>
<td>M.Tech Asst. Prof, Gd II</td>
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<td>25</td>
<td>Mr. Ravikiran Kamath B.</td>
<td>M.Tech Asst. Prof, Gd II</td>
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<td>26</td>
<td>Mr. Nithin Kumar</td>
<td>M.Tech Asst. Prof, Gd II</td>
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<tr>
<td>27</td>
<td>Mr. Srinivas Prabhu</td>
<td>M.Tech Asst. Prof, Gd II</td>
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<tr>
<td>28</td>
<td>Mr. Veeresh R.K</td>
<td>M.Tech Asst. Prof, Gd I</td>
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<tr>
<td>29</td>
<td>Mr. Grynal D’Mello</td>
<td>M.Tech Asst. Prof, Gd I</td>
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</table>
DEPARTMENT OF MECHANICAL ENGINEERING

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 (PEOs):

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 (POs):

1. An ability to apply knowledge of mathematics, science, and applied sciences

2. An ability to design and conduct experiments, as well as to analyze and interpret data

3. An ability to formulate or design a system, process or program to meet desired needs

4. An ability to function on multi-disciplinary teams

5. An ability to identify, formulate and solve engineering problems

6. An understanding of professional and ethical responsibility.

7. An ability to communicate effectively.

8. The broad education necessary to understand the impact of solutions in a global, and social context.

9. A recognition of the need for, and an ability to engage in life-long learning

10. A knowledge of contemporary issues

11. An ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.

12. An ability to apply the concepts of mechanical engineering to solve real world problems, as required by industries and organizations and provide reasonable solutions which are socially and ethically acceptable.
# DEPARTMENT OF MECHANICAL ENGINEERING
## SCHEME OF TEACHING AND EXAMINATION

### III SEMESTER

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Theory/Tuto./Prac./ Self Study</th>
<th>Total Hrs./Week</th>
<th>C.I.E.</th>
<th>S.E.E.</th>
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<td>14ME301</td>
<td>Engineering Mathematics -III</td>
<td>4+0+0+0</td>
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<td>2</td>
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<td>Material Science &amp; Metallurgy</td>
<td>3+0+0+S</td>
<td>3</td>
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<td>3</td>
<td>14ME303</td>
<td>Basic Thermodynamics</td>
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<td>4</td>
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<td>Manufacturing Processes-I</td>
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<td>5</td>
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<td>Mechanics of Materials</td>
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<td>6</td>
<td>14ME306</td>
<td>Computer Aided Machine Drawing</td>
<td>0+0+6+0</td>
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<td>Material Testing Lab.</td>
<td>0+0+3+0</td>
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<td>Individual Effectiveness laboratory -I</td>
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<td>9</td>
<td>14ME309</td>
<td>Foundry, Forging &amp; Welding shop</td>
<td>0+0+3+0</td>
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<td>Kinematics of Machines</td>
<td>3+2+0+0</td>
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<td>Applied Thermodynamics</td>
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<td>Energy Conversion</td>
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ENGINEERING MATHEMATICS –III

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<td>Hrs/Week</td>
<td>4+0+0+0</td>
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**Course Outcomes:**

At the end of the course the successful student is expected to:

1. Understand the concepts of gradient of a scalar function, divergence and curl of a vector function and apply these concept to the field of engineering.
2. Identify and apply the techniques of surface integrals and volume integrals
3. Use the concepts of analytical functions, poles, residues and line integrals in related situations
4. Understand Fourier series and Fourier transform techniques and able to apply these Techniques in their technical subjects.
5. Apply Z-transforms to solve difference equations with boundary conditions.

**UNIT – I**

**Vector Calculus:** Vector algebra, Vector differentiation- gradient, divergence, curl, laplacian, solenoidal and irrotational vectors, Curvilinear, Spherical & Cylindrical Co-ordinates.

10 Hours

**UNIT – II**

**Vector integration**- Line, Surface & Volume integrals. Green’s, Gauss divergence & Stoke’s theorems. Applications.

8 Hours

**UNIT – III**

**Theory of complex variables:** Functions of complex variables, Cauchy Riemann equations. Properties of analytic functions, conformal mapping. Bilinear transformations.

Line integrals in complex plane, Cauchy’s theorem, Power series, Residues, Cauchy’s residue theorem.

12 Hours
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 and Parseval’s identity. Fourier sine and Fourier cosine transforms, Inverse Fourier sine and Inverse Fourier cosine transforms.

11 Hours

UNIT – V

**Z transforms:** Z-transform, standard forms, linearity property, damping rule, shifting rule. Inverse Z-transform, Finite differences and difference equations, Solving Difference equations using Z-transforms.

11 Hours

**TEXT BOOKS:**

**REFERENCE BOOKS:**

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MATERIAL SCIENCE AND METALLURGY

<table>
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<th>14ME302</th>
<th>Credits</th>
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<tr>
<td>Hrs/Week</td>
<td>3+0+0+S*</td>
<td>Total Hours</td>
<td>39</td>
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</table>

*Self Study to be exercised under the supervision of course instructor and to be restricted to not more than 10% of the total teaching hours.*
Course Outcomes:

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

1. Identify and analyze the various crystal structure and defects responsible for change in the material properties.
2. Become competent to identify possible cause of failure due to fatigue, Creep and types of failures
3. The students demonstrate the knowledge of homogenous and heterogeneous nucleation, Crystal growth and its structure. solid solution types and Unary and types of binary phase diagram
4. To know different phases in Iron carbon diagram for steels and cast-iron and selection of best heat treatment process (annealing, normalizing, tempering, hardening, and other heat treatment process) according to the requirement.
5. Shall demonstrate to identify the composition, properties and application of various ferrous, nonferrous and composite materials.

UNIT - I
Structure of crystalline solids: Fundamental concepts of unit cell, space lattice, Bravais 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 Hours

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 Hours
UNIT - III

10 Hours

UNIT - IV

8 Hours

UNIT - V

8 Hours

TEXT BOOKS:
REFERENCE BOOKS:

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BASIC THERMODYNAMICS

Sub code : 14ME303
Credits : 03
Hrs/Week : 3+0+0+0
Total Hours : 35

Course Outcomes:

At the end of the course the student should be able to
1. Understand the basic concepts of thermodynamic systems, state of systems, thermodynamic properties, thermodynamic equilibrium, and understand the concept of temperature measurement; this has evolved from zeroth law of thermodynamics. Also, understand the difference between thermodynamic definition of work and mechanics definition of work and distinction between heat and work.

2. Use the First Law of Thermodynamics for energy conservation analysis to a control mass or control volume at an instant of time, and understand the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another.
3. To apply Second Law of Thermodynamics and entropy concepts in analyzing the thermal efficiencies of heat engines and the coefficients of performance for refrigerators.

4. Use the ideal gas laws to individual gases and gas mixtures with the application of thermodynamic laws, and understand different properties of moist air.

5. Understand the concept of entropy and entropy principle, and the meaning, properties & phase diagrams of pure substance. Also, calculate the change of entropy of pure substance and ideal gas under different thermodynamics processes.

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 Hours

Work and Heat


4 Hours
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 Hours

UNIT III
Second Law of Thermodynamics


8 Hours

UNIT IV
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.

5 Hours

Pure Substances

Definition of a pure substance, phase of a substance, triple point and critical points. Sub-cooled liquid, saturated liquid, vapour pressure, two

3 Hours

UNIT V

Ideal & Real Gas Mixtures


5 Hours

Basics of Psychrometry

Basic definitions, properties of atmospheric air, psychrometer, adiabatic saturation process. Simple numerical problems without using psychrometric chart.

3 Hours

TEXT BOOKS:

REFERENCE BOOKS:
2 Engineering Thermodynamics, Gordon Rogers/Yon Mayhew, AWL, 4th edition 2001

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MANUFACTURING PROCESSES-I

Sub code     : 14ME304  
Credits      : 03
Hrs/Week     : 3+0+0+0  
Total Hours  : 42

Course Outcomes:

At the end of the course the student should be able to
1. To know what is manufacturing and to understand the casting process.
2. To know about various special casting techniques used in industries along with their advantages and disadvantages.
3. To understand how the properties and the shape of a raw material can be altered by rolling, forging, extrusion, press working etc.
4. To know how two materials can be joined together by welding and also about various types of welding processes.
5. To know about the various advanced welding techniques which are used in the industries where the normal welding techniques cannot be used.

UNIT I

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 Hours

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.
• Melting furnaces : Cupola – Construction & Operations &
  zones.
• Advanced casting processes – Squeeze casting, Thixo casting.
• Casting defects

  8 Hours

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

Powder metallurgy

  10 Hours

UNIT IV
Welding (Joining Process)
Classifications & Advantages and applications.
• Arc welding- Principle & Equipment, power source – TIG, MIG,
  SAW & Atomic hydrogen arc welding.
• Gas welding – Principle & Equipment, types of flames
• Resistance welding and principle – Seam – butt, Spot and
  Projection welding

  8 Hours

UNIT V
Advanced welding processes
• Principle equipment – operation and process parameters of
  Ultrasonic, Laser, Explosive, Electron beam, Plasma arc welding
  processes.
• Soldering, brazing and Adhesive bonding process
• Welding defects, Inspection- visual, magnetic, Radiography,
  Eddy current.

  8 Hours
TEXT BOOKS:

REFERENCE BOOKS:

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MECHANICS OF MATERIALS

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<tr>
<th>Sub code</th>
<th>Credits</th>
<th>Hrs/Week</th>
<th>Total Hours</th>
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<tr>
<td>14ME305</td>
<td>04</td>
<td>4+0+0+0</td>
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</table>

Course Outcomes:

1. Students should be able to understand the concept of stress, strain and volumetric strain of various physical systems.
2. Students should be able to analyse the stresses induced in combined systems for loads and analyze cylindrical members
3. Students should be able to represent the shear force and bending moment for different types of beam subjected to different loads.
4. Students should be able to determine the shear stress and bending stress in beams for different cross sections
5. Students should be able to understand the concept of deflection of beams, twisting moment in shafts and buckling of columns

UNIT - I

**Simple stress and strain:** Introduction, stress, strain, mechanical properties of materials, Linear elasticity, Hooke’s Law and Poisson’s ratio, Stress-Strain relation – behaviour in Tension for Mild steel and non-ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of superposition.

7 Hours

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

6 Hours

UNIT- II

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

7 Hours

**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 (Lamé’s equation), (compound cylinders not included).

6 Hours

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.

7 Hours

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)  7 Hours

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 Hours

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 Hours

TEXT BOOKS:


REFERENCE BOOKS:

3. Engineering Mechanics by Timoshenko & Young, Tata McGraw
COMPUTER AIDED MACHINE DRAWING

Sub code : 14ME306
Hrs/Week : 0+0+6+0
Credits : 03
Total Hours : 45

Course Outcomes:
At the end of this elective, student shall be able to:

1. Apply the concepts of Orthographic projections in drawing different views of solids with section, machine parts (with and without sections)

2. Understand and apply the concepts, conventional representations of different views of threaded fasteners, keys, and assemblies of joints, couplings and Assembled machine parts.

3. Apply the tools of 3-D modeling software Solid Edge-V19 to create, assemble, section and draft the different views along with Bill of Material.

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.

9 Hours
UNIT –II


3 Hours

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.

3 Hours

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. 6 Hours

UNIT –V


24 Hours

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

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MATERIAL TESTING LABORATORY

Sub code     : 14ME307  Credits     : 02
Hrs/Week     : 0+0+3+0

Course Outcomes:
At the end of this course, the students will be
1. Able to check the mechanical properties of materials
2. Estimate the tribological properties of materials
3. Identify various specimens by metallography

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

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**INDIVIDUAL EFFECTIVENESS LABS (IEL)**

**Introduction**
Entry Edge (E²) is an industry readiness program designed for technology undergraduates to help them enhance important individual behavior & skills, and become productive from the very beginning of their corporate carrier. The program places a high emphasis on the pedagogy of learning by doing.

As part of the program, students first go through individual behavior & skill labs (Individual Effectiveness Labs) in their II year of engineering curriculum and then participate in “hands on” and “minds on” team activities in a simulated work environment, to accomplish tasks and to solve real-world organizational issues during a week long Immersive Group Workshop (IGW) held in the III year of their engineering course.

This document provides the syllabus and evaluation framework for Individual Effectiveness Labs (IEL).
INDIVIDUAL EFFECTIVENESS LABS (IEL)

Sub Code: 14ME308  
Credits: 02  
Hrs / Week: 0+0+4+0

Course Outcome:
1. To help the students understand themselves. Identify and analyze personality/behavioral attributes of personal effectiveness – exploratory orientation, self-disclosure, receptivity to feedback and sensitivity to others.
2. To help the students identify their primary and secondary motivators – what drives them for achievement?
   a. Understanding the student’s need for achievement
   b. Understanding how positive expectations lead to positive results.
3. To help the students to develop a goal driven mindset and to take the first steps into individual personal planning, controlling and measuring results.
4. To make the students aware of importance of communication and typical barriers to communication.
5. To help the students develop effective oral communication skills.
6. To help the students develop effective written communication skills.
7. To help the students develop listening skills.
8. To help the students participate in group discussions.
9. To help the students develop effective business presentation skills.
10. To help the students receive feedback with an open mind, respond to feedback and take the action on them.
11. To help the students develop time management and organization skills.

Contents

Module 1: Know Yourself
Self assessment profilers to identify and assess the following – Identify and analyze personality/behavioral attributes of personal effectiveness – exploratory orientation, self disclosure, receptivity to feedback, sensitivity to others.  

8 Hours
Module 2: Achievement Motivation & Goal Setting
- Identifying primary and secondary motivators using a motivational profiler.
- Understanding need for achievement.
- Developing goal driven mindset.
- First steps into career planning.  
  8 Hours

Module 3: Communication Skills
- Effective oral communication
- Effective written communication
- Constructing effective messages (memo, letters, e-mails)
- Writing persuasively
- Correspondence etiquettes – letters & email
- Importance of listening responsively
- Handling conversations
- Effective group discussions  
  15 Hours

Module 4: Presentation Skills
- Understanding audience, presentation objectives, best practices & tools in preparation of presentation.
- Improving quality of presentation through better use of voice, eyes, gestures, visual aids.
- Presenting to groups
- Presenting one-on-one.  
  13 Hours

Module 5: Handling Feedback
- Seeking feedback
- Accepting feedback with an open mind
- Responding to feedback
- Actionizing feedback  
  6 Hours

Module 6: Time Management
- Introduction to Time Management and importance of managing self
- Beating procrastination
- Action plans-starting to achieve in a small way
- Scheduling skills  
  6 Hours
REFERENCE BOOKS:
2. Online reference materials provided as part of the Entry Edge program.

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FOUNDRY, FORGING & WELDING Laboratory

Sub code : 14ME309
Credits : 02
Hrs/Week : 0+0+3+0

Course Outcomes:
At the end of the course the student should be
1. Able to prepare different types of moulds with the help of patterns.
2. Able to estimate the raw materials requirement and to produce simple smithy models like L-nail, EYE-nail, Bolts etc.
3. Able to acquire skills of electric arc welding.

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
   Study and practice of: Use of foundry tools and other equipments.
   Preparation of moulds using two molding boxes using: Patterns (Split pattern, Match plate pattern and Core boxes).
   Preparation of moulds using: Two molding boxes without patterns.

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.
Syllabus of III & IV Semester B.E. / Mechanical Engg.

ENGINEERING MATHEMATICS-IV

Sub code : 14ME401
Credits : 04
Hrs/Week : 4+0+0+0
Total Hours : 52

Course Outcomes:

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

1. Understand and appreciate probabilistic models for situations involving chance effect. Apply the concept of conditional probability and its consequences.
2. Understand some important probability distributions and able to apply them to real life problems. Fit linear, quadratic and exponential curves for the given data.
3. Apply numerical methods to solve algebraic or transcendental equations where the analytical solutions are not possible. Study the important concepts like interpolation, numerical differentiation and integration which are highly required by technical fields.
4. Identify and formulate parabolic, hyperbolic and elliptic partial differential equations and solve by grid analysis.
5. Understand and appreciate the series solution technique of solving Bessel and Legendre equations and study the properties and results of Bessel and Legendre functions.

UNIT – I

Introduction to probability: finite sample space, conditional probability and independence. Baye’s theorem(Overview). One dimensional random variable: discrete and continuous random variable, probability functions, cumulative distribution function. Mean and variance. 10 Hours

UNIT – II

Probability distribution and Data analysis: Binomial, Poisson, Normal, Exponential distributions. Curve fitting: curve fitting by the method of least squares: \(y= a+ bx, \quad y= a+ bx+ cx^2, \quad y= ab^x\). Correlation and regression. 10 Hours
UNIT – III


12 Hours

UNIT – IV

**Numerical solution of first order ordinary differential equations:** Taylor’s series Method, Modified Euler’s method, Runge – Kutta 4th order Method.

**Numerical solution partial differential equations:** Laplace and Poisson equations by standard five point formulae, heat and wave equations by explicit method.

10 Hours

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. Equations reducible to Bessel D.E 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.

10 Hours

TEXT BOOKS:

REFERENCE BOOKS:

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KINEMATICS OF MACHINES

Sub code : 14ME402 Credits : 04
Hrs/Week : 3+2+0+0 Total Hours : 52

Course Outcomes:

At the end of the course the student should be able to
1. Understand the terminologies connected with the subject kinematics of machines and working principle of some machines.
2. Apply relative velocity and instantaneous centre methods to determine the velocity and acceleration in different mechanisms.
3. Design the cam profile for various follower motions.
4. Understand the terminologies and concepts connected with gear design and speed ratio and torque calculation in gear trains.
5. Analyse the effect of centrifugal tension on power transmission and to calculate the major dimensions for belt and rope drives.

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 Hours
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

6 Hours

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.

6 Hours

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.

5 Hours

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.

5 Hours

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

6 Hours
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.  

10 Hours

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  

5 Hours

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 Hours

TEXT BOOKS:  
4. Mechanics of Machines by Ham, Cranes and Rogers.

REFERENCE BOOKS:  

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APPLIED THERMODYNAMICS

Sub code : 14ME403
Credits : 03
Hrs/Week : 4+0+0+0
Total Hours : 52

Course Outcome:
At the end of the course the student should be able to

1. Quantify the behaviour of power plants based on the
   Rankine cycle, including the effect of enhancements such as
   superheat, reheat and regeneration and sketch P-V, T-S and
   H-S diagram for the same.

2. Analyze the performance of I.C.Engines based on the otto
   cycle, diesel cycle and dual cycle, and gas turbines based on
   the Brayton cycle. Solve problems for all the cycles
   involving calculation of properties at nodal points, mean
   effective pressure, cycle efficiency.

3. Compute work of compression, power required to drive the
   air compressor, for both single stage as well as multi stage
   compressor, and understand the concept of nozzles with
   applications and derivations for critical parameters.

4. Develop a systematic approach to thermodynamic cycle’s
   analysis of various refrigeration cycles, and understand
   various Psychometric processes; apply the principles of
   psychrometry to the thermodynamic analyses of air-
   conditioning systems.

5. Compute the theoretical air or minimum air required for the
   combustion of a fuel of known or unknown composition and
   also compute the percent theoretical air, air fuel ratio, given
   the analysis of products of combustion. Also, calculate
   performance characteristics for a given 2-stroke or 4 - stroke
   petrol or diesel engines and prepare the heat balance sheet.

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, regenerative Rankine cycles (description only)  

10 Hours

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 Actual gas turbine cycle. Numerical problems.

10 Hours

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.

10 Hours

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 Hours

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 on psychometric processes only. Summer and winter air conditioning; (descriptive only)

4 Hours
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); Simple 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 Hours

TEXT BOOKS:
2. Engineering Thermodynamics, C.P.Gupta, Rajendra Prakash, , Nemi Chand & Bros,2009

REFERENCE BOOKS:
2. Energy Conversion, Kadambi & Prakash, John Wiley & Sons (March 1978)
6. Thermodynamic Data Hand Book by Dr. Nijaguna & Dr. B. S. Samaga, 2010

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MANUFACTURING PROCESSES – II

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*Self Study to be exercised under the supervision of course instructor and to be restricted to not more than 10% of the total teaching hours.

Course Outcomes:
At the end of the course the student should be able to

1. Suggest suitable cutting tools and process parameters for conventional machining and also estimate various force components and tool life in metal cutting operations.

2. Appreciate the construction and working of centre lathe, capstan and turret lathe, drilling machines and the various machining operations performed on them.

3. Appreciate the construction and working of milling machines and various milling operations including gear milling.

4. Appreciate working principle of different grinding machines, manufacture, marking and selection of grinding wheels

5. Appreciate the working principles of Non-conventional machining processes like EDM, ECM, PAM, LBM, USM, AJM etc. with their specific characteristics

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 Hours
UNIT- II

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

10 Hours

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

10 Hours

UNIT- IV

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

10 Hours

UNIT- V

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

REFERENCE BOOKS:
2. Production Technology – R K Jain. 2004
4. Workshop technology – vol. II – Hajra Choudury. 2010
5. Manufacturing technology – Serope Kalpakajin. 2005

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FLUID MECHANICS

Sub code    : 14ME405         Credits   : 04
Hrs/Week    : 4+0+0+0        Total Hours : 52

Course Outcomes:
Upon completion of this course, graduates will have,
1. An understanding of fluid mechanics fundamentals, including concepts of mass and momentum conservation.
2. An ability to apply the Bernoulli equation
3. An ability to perform dimensional analysis for problems in fluid mechanics.
4. An understanding of the basic concepts involving fluid flow measuring equipment’s.
5. Understandings of the basic concepts viz. buoyancy, floatation, friction in pipe flow, lift and drag
UNIT - I


11 Hours

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 Hours

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 Hours

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 Hours
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 Hours

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

REFERENCE BOOKS:

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ENGINEERING ECONOMICS

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Course Outcomes:
Upon completion of this course, graduates will be,
1. Able to understand the different terminology of Economics and prepare a balance sheet
2. Able to know and analyse the time value of money.
3. Able to evaluate the worth of creations, by comparing the alternatives visa, vis the cost (cost-benefit analysis)
4. Able to make decisions with the limited resources, the relevant course of action, with the help of suitable tools.
5. Able to determine the cost involved in each operations, a product should undergo with an aim to fix suitable selling price for the product

UNIT - I

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].

8 Hours

UNIT – II

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.

8 Hours

UNIT – III

Rate of Returns
Analysis based on Rate of Return, Exercises, IRR misconceptions, cost of capital concepts, introduction to CHEER programming.

4 Hours

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

4 Hours

UNIT – IV

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.
Mensuration, Machine shop calculations, Forging shop calculations, Exercises

6 Hours

UNIT V

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) 5 Hours

Financial management
Terminologies used in accounting, Journal and ledger, Profit and loss statement, Balance sheet, Understanding basic financial ratios, Simple exercises. 4 Hours

TEXT BOOKS:

REFERENCE BOOKS:

ENERGY CONVERSION ENGINEERING LAB
Sub code    : 14ME407   Credits    : 02
Hrs/Week    : 0+0+3+0   Total Hours : 42

Course Outcomes:
1. The student will be able to find flash and fire point of lubricating oil using Abel Pensky and Pensky Martins Apparatus.
2. The student will be able to find caloric value of solid, liquid and gaseous fuels and able to select the fuel for combustion.
3. The student will be able to find viscosity of lubricating oils using Redwood, Saybolt viscometers and study the variation of viscosity with temperature. Hence able to select proper lubricating oil for various applications.
4. The student will be able to draw valve timing/port opening diagram of four stroke and two stroke I.C engines.
5. The student will be able to find area of an regular/irregular surfaces using Planimeter.
6. Student should be able to conduct performance tests and calculate IP, BP, Thermal efficiencies, SFC, FP and prepare heat balance sheet for four stroke Diesel engines, four stroke petrol engine, multicylinder Diesel/Petrol engine (Morse test) and variable compression ratio I.C engine

**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.

**21 Hours**

**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.
I Multi cylinder Diesel/Petrol Engine, (Morse test)
(d) Two stroke Petrol Engine
(e) Variable Compression Ratio I. C. Engine.

**21 Hours**
Syllabus of III & IV Semester B.E. / Mechanical Engg.

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

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MACHINE SHOP

Sub code     : 14ME408
Credits         : 02
Hrs/Week   : 0+0+3+0

Course Outcomes:

Upon completion of this course, graduates will,

1. Demonstrate preparation of models involving various types of turning operations on lathe.
2. Demonstrate preparation of models involving various milling & shaping operations

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.

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