B.Tech (Mechanical Engineering) detail Syllabus for Admission Batch 2015-16

### First Semester

<table>
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<tr>
<th>Code</th>
<th>Course Name</th>
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<th>Internal Evaluation</th>
<th>Hours/Week L/T</th>
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**Total Marks:** 1100
**Total Credits:** 23

For Honours and Minor Specialization

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**Total Marks:** 1200
**Total Credits:** 25

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**Total**

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**Total Marks:** 1200
**Total Credits:** 25

For Honours and Minor Specialization

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**Total Marks:** 1200
**Total Credits:** 25

*College should conduct at least one NSDC program under this category.*
### B.Tech (Mechanical Engineering) detail Syllabus for Admission Batch 2015-16

#### Third Year Engineering

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For Honours and Minor Specialization

# To be conducted by the Training & Placement department by inviting experts from the industry. No academician to be called. Record may be asked by the University for verification. Evaluation to be done by the TPO.

# # To be conducted by the Training & Placement department of the College.
# Final Year Engineering

## Seventh Semester

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Total Marks: 1000

Total Credits: 24

For Honours and Minor Specialization

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<tr>
<td>GS Nano Science &amp; Bio Technology</td>
<td>3-1</td>
<td>4</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE Mechanical Vibration/Tribology/Fatigue Creep &amp; Fracture</td>
<td>3-1</td>
<td>4</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE Robotics/Simulation,Modelling &amp; Control/Mechatronics &amp; MEMs</td>
<td>3-1</td>
<td>4</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
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<tr>
<td>OE Soft Computing */ Other subjects</td>
<td>3-1</td>
<td>4</td>
<td>100</td>
<td>50</td>
<td></td>
<td></td>
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<tr>
<td>PC Advance Lab-II/ Project/3D Printing</td>
<td>8</td>
<td>4</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Projects on Internet of Things</td>
<td>8</td>
<td>4</td>
<td>200</td>
<td></td>
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<td>16</td>
<td>16</td>
<td>400</td>
<td>200</td>
<td>16</td>
<td>8</td>
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</table>

Total Marks: 1000

Total Credits: 24

*Student can choose from any department but subject must be running in that semester.

## Eighth Semester

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Hours/week</th>
<th>Credit Theory</th>
<th>Total Marks</th>
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</thead>
<tbody>
<tr>
<td>Industrial Training cum Project/ Entrepreneurship Training cum Project / Startup Training cum Project</td>
<td>30</td>
<td>20</td>
<td>1000</td>
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</table>

Evaluation by the Industry / Training Organisation Evaluation by the Institute (Report & Institute Viva)

<table>
<thead>
<tr>
<th>Marks</th>
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<tbody>
<tr>
<td>500</td>
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<td>500</td>
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Total 30 20 1000 1000

Total Marks:1000

Total Credits:20

Note- Minimum Pass Mark from Industry Evaluation is 300 (i.e. 60%).
Distribution of Credit Semester wise:

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credit</th>
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<tbody>
<tr>
<td>First</td>
<td>25</td>
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<tr>
<td>Second</td>
<td>25</td>
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<td>Third</td>
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<td>Fourth</td>
<td>25</td>
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<tr>
<td>Fifth</td>
<td>24</td>
</tr>
<tr>
<td>Sixth</td>
<td>24</td>
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<tr>
<td>Seventh</td>
<td>24</td>
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<tr>
<td>Eighth</td>
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<td><strong>Total</strong></td>
<td><strong>190</strong></td>
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**Internal Evaluation Scheme**

<table>
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<tr>
<th>Component</th>
<th>Mark</th>
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<tbody>
<tr>
<td>Attendance &amp; Class Interaction</td>
<td>05</td>
</tr>
<tr>
<td>Assignment</td>
<td>05</td>
</tr>
<tr>
<td>Surprise Test</td>
<td>05</td>
</tr>
<tr>
<td>Quiz</td>
<td>05</td>
</tr>
<tr>
<td>Class Test I &amp; II</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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</table>

Class Test Time(Hrs.): 1

Pass Mark in Internal is 50% of total marks i.e. 25

**External Evaluation Scheme**

University Semester Examination of 3 Hours duration.

Pass mark will be 35% which means students have to score 35 out of 100.

**Practical/Sessional Evaluation Scheme**

Pass mark will be 50% which means students have to score 25 out of 50.

**Evaluation Scheme**

<table>
<thead>
<tr>
<th>Component</th>
<th>Mark</th>
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<tbody>
<tr>
<td>Attendance &amp; Daily Performance</td>
<td>-10</td>
</tr>
<tr>
<td>Lab Record</td>
<td>- 10</td>
</tr>
<tr>
<td>Lab Quiz</td>
<td>- 05</td>
</tr>
<tr>
<td>Final Experiments &amp; Viva</td>
<td>- 25</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
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</table>

All Lab examinations are to be completed one week before the end semester examination and marks are to be displayed on the college notice board.
DETAIL SYLLABUS

FROM

III - VIII SEMESTER OF B.TECH. DEGREE PROGRAMME

for

ADMISSION BATCH 2015-16

BRANCH-MECHANICAL ENGINEERING
## Second Year Engineering
### Third Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Name</th>
<th>Hours/week</th>
<th>Credit</th>
<th>University Marks</th>
<th>Internal Evaluation</th>
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<th>Credit</th>
<th>Marks</th>
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<tbody>
<tr>
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<td>L/T</td>
<td>Theory</td>
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<td>PC</td>
<td>Mechanics of Solids</td>
<td>3-0</td>
<td>3</td>
<td>100</td>
<td>50</td>
<td>2</td>
<td>1</td>
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<tr>
<td>PC</td>
<td>Introduction to Physical Metallurgy &amp; Engg Materials</td>
<td>3-0</td>
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<td>100</td>
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<td>PC</td>
<td>Fluid Mechanics &amp; Hydraulics Machines</td>
<td>3-0</td>
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<td>100</td>
<td>50</td>
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<td>PC</td>
<td>Engg. Thermodynamics</td>
<td>3-0</td>
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<td>2</td>
<td>1</td>
<td>50</td>
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<td>PC</td>
<td>Kinematics &amp; Dynamics Machines</td>
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<td>50</td>
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<tr>
<td>HS</td>
<td>Engineering Economics/ Organizational Behavior</td>
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<td>3</td>
<td>100</td>
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<td><strong>Total</strong></td>
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<td><strong>19</strong></td>
<td><strong>600</strong></td>
<td><strong>300</strong></td>
<td><strong>8</strong></td>
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<td><strong>Total Marks: 1100</strong></td>
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<td><strong>Total Credits: 23</strong></td>
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<table>
<thead>
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<th>Credit</th>
<th>University Marks</th>
<th>Internal Evaluation</th>
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<tr>
<td></td>
<td>Applied Mathematics</td>
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<table>
<thead>
<tr>
<th>Minor</th>
<th>Course Name</th>
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<th>Credit</th>
<th>University Marks</th>
<th>Internal Evaluation</th>
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<tbody>
<tr>
<td></td>
<td>Applied Thermal Engineering</td>
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Semester : 3rd

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<tr>
<td>PME3D001</td>
<td>Honours (CP) Applied Mathematics</td>
<td>4-0-0</td>
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<tr>
<td>PEK3E001</td>
<td>Engineering Economics</td>
<td>3-0-0</td>
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<td>POB3E002</td>
<td>Organizational Behavior</td>
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<tr>
<td>PME3G001</td>
<td>Minor (CP) Applied Thermal Engineering</td>
<td>4-0-0</td>
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<tr>
<td>PME3I001</td>
<td>PC (CP) Introduction to Physical Metallurgy &amp;</td>
<td>3-0-0</td>
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<tr>
<td></td>
<td>Engineering Materials</td>
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<tr>
<td>PME3I101</td>
<td>PC (CP) Mechanics of Solid</td>
<td>3-0-1</td>
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<tr>
<td>PME3I102</td>
<td>PC (CP) Fluid Mechanics &amp; Hydraulics Machines</td>
<td>3-0-1</td>
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<tr>
<td>PME3I103</td>
<td>PC (CP) Engineering Thermodynamics</td>
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<tr>
<td>PME3I104</td>
<td>PC (CP) Kinematics &amp; Dynamics of Machines</td>
<td>4-0-1</td>
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TENTATIVE

Likely to be Modified
PME31101 MECHANICS OF SOLID

Theory L/T (Hours per week): 3/0, Credit: 3

MODULE - I (10 Lectures)

1. Concept of Stress:
   Load, Stress, Principle of St.Venant, Principle of Superposition, Strain, Hooke's law, Modulus of Elasticity, Stress-Strain Diagrams, Working Stress, Factor of safety, Strain energy in tension and compression, Resilience, Impact loads, Analysis of Axially Loaded Members: Composite bars in tension and compression - temperature stresses in composite rods, Concept of Statically indeterminate problems. Shear stress, Complimentary shear stress, Shear strain, Modulus of rigidity, Poisson's ratio, Bulk Modulus, Relationship between elastic constants.

2. Biaxial State of Stress:
   Analysis of Biaxial Stress. Plane stress, Principal plane, Principal stress, Mohr's Circle for Biaxial Stress. Stresses in thin cylinders and thin spherical shells under internal pressure, wire winding of thin cylinders.

MODULE - II (10 Lectures)

3. Biaxial State of Strain:
   Two dimensional state of strain, Principal strains, Mohr's circle for strain, Calculation of principal stresses from principal strains, Strain Rossette.

4. Shear Force and Bending Moment Diagrams:
   Shear force and bending moment. Types of load and Types of support. Support reactions, Relationship between bending moment and shear force, Point of inflection. Shear Force and Bending Moment diagrams.

5. Bending of Beams:
   Theory of simple bending of initially straight beams, Bending stresses, Shear stresses in bending, Distribution of normal and shear stress, Composite beams.

MODULE - III (8 Lectures)

6. Deflection of Beams:
   Differential equation of the elastic line, Slope and deflection of beams by integration method and area - moment method.

7. Theory of Columns:
   Long columns, Euler's column formula, Lateral buckling, Critical Load, Slenderness ratio, Eccentric loading of short column

MODULE - IV (8 Lectures)

8. Torsion:
   Torsion in solid and hollow circular shafts, Twisting moment, Strain energy in shear and torsion, strength of solid and hollow circular shafts. Strength of shafts in combined bending and twisting, Close - Coiled helical springs.

TEXT BOOKS


REFERENCE BOOKS

   a. Student Edition
5. Strength of Materials by James M. Gere and Barry J. Goodno, Cengage Learning

MECHANICS OF SOLID LABORATORY

Practical L/T/P (Hours per week): 0/0/2, Credit: 3

Laboratory Experiments (Minimum 8 experiments)

1. Determination of tensile strength of materials by Universal Testing Machine
2. Determination of compressive strength of materials by Universal Testing Machine
3. Determination of bending strength of materials by Universal Testing Machine
4. Double shear test in Universal Testing Machine
5. Determination of Impact strength of material (Charpy and Izod)
6. Determination of Hardness strength of materials (Brinnel, Rockwell and Vickers)
7. Determination of Rigidity modulus of material
8. Determination of Fatigue strength of material
9. Estimation of Spring Constant under Tension and Compression.
10. Load measurement using Load indicator, Load Cells.
11. Strain measurement using Strain Gauge.
12. Stress measurement using strain rosette.
PME31001 INTRODUCTION TO PHYSICAL METALLURGY AND
ENGINEERING MATERIALS

Theory L/T (Hours per week): 3/0, Credit: 3

MODULE-I (08 Lectures)
Classification of Engineering Materials, Engineering properties of materials. Characteristic property of metals, bonding in solids, primary bonds like ionic, covalent and metallic bond, crystal systems, common crystal structure of metals, representations of planes and directions in crystals, atomic packing in crystals, calculation of packing density, voids in common crystal structures and imperfections crystals.

MODULE-II (08 Lectures)
Concept of plastic deformation of metals, critical resolve shear stress, dislocation theory, deformation by slip and twin, plastic deformation in polycrystalline metals, yield point phenomenon and related effects, concept of cold working preferred orientation. Annealing; recovery; recrystallization and grain growth; hot working.

Concept of alloy formation, types of alloys, solid solutions, factors governing solids solubility viz. size factor, valency factor, crystal structure factor and chemical affinity factor; order-disorder transformation.

MODULE-III (10 Lectures)
Binary phase diagrams (a) Isomorphism system, (b) Eutectic system, (c) Peritectic system, (d)Eutectoid system and (e) Peritectoid system. Allotropic transformation. Lever rule and its application, Interpretation of solidification behaviors and microstructure of different alloys belonging to those systems, Effect of non-equilibrium cooling, coring and homogenization.

Iron-cementite and iron-graphite phase diagrams, microstructure and properties of different alloys (alloy steels; stainless steel, tool steel, HSS, high strength low alloy steel) types of cast iron, their microstructures and typical uses. Specification of steel.

T.T.T. diagram: concept of heat treatment of steels i.e. annealing, normalizing, hardening and tempering; microstructural effects brought about by these processes and their influences on mechanical properties; factor affecting hardenability.

MODULE-IV (10 Lectures)

Plastic:- Thermosetting and thermoplastics.
Ceramics: Types, structure, Mechanical properties, application

Text Books:
1. Introduction to Physical Metallurgy by Avner, Tata McGraw Hill
3. Physical Metallurgy: Principles and Practice by Ragahvan, PHI
Reference Books
1. Engineering Physical Metallurgy and Heat Treatment by Y.Lakhtin, Mir Publisher, Moscow.
2. Elements of Material Science and Engineering, L.H.Van Vlack, Addison Wesley
4. Elements of Materials Science & Engineering by Van Vlack, Pearson
5. Mechanical Metallurgy by Dieter, Tata MacGraw Hill
7. Material Science and Metallurgy, by U. C. Jindal, Pearson

PME31102 FLUID MECHANICS AND HYDRAULIC MACHINES

Theory L/T (Hours per week): 3/0, Credit: 3

Module I (12 Lectures)
Introduction: Scope of fluid mechanics and its development as a science
Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.
Fluid statics: Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer. Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface. Buoyancy and floatation, Archimedes' principle, stability of immersed and floating bodies, determination of metacentric height.

Module II (14 Lectures)

Module III (8 Lectures)
Hydraulic turbines: Classification, Impulse and Reaction turbine; Tangential, Radial and axial turbine. Impulse turbine, Pelton wheel, bucket dimensions, number of buckets in pelton wheel, efficiency and performance curves.
Reaction Turbines: Francis turbine and Kaplan turbine, velocity triangle and efficiencies, performance curve. Function of draft tube and casing cavitation.
Module IV (06 Lectures)

**Centrifugal Pump:** constructional features, vane shape, velocity triangles, Efficiencies, Multi stage centrifugal pumps, Pump Characteristic, NPSH and Cavitation.

**Positive displacement pumps:** Reciprocating Pump, Working principle, Discharge, work done and power requirement, Slip, Indicator diagram

**Text Books**

1. Fluid Mechanics, Y A Cengel, TMH
2. Fluid Mechanics and Hydraulic Machines, Modi & Seth
3. Fluid Mechanics, A.K. Mohanty, PHI

**Reference Books:**

1. Fluid Mechanics and Machinery, CSP Ojha and P.N. Chandramouli, Oxford University Press
2. Fluid Mechanics and Fluid Machines by A.K.Jain, Khanna Publishers
4. Introduction to Fluid Mechanics, Fox, McDonald, Willey Publications
5. Fluid Mechanics by Kundu, Elsevier
6. An Introduction to Fluid Dynamics, G.K.Batchelor, Cambridge University Press
7. Engineering Fluid Mechanics by Garde et. al., Scitech
8. First course in Fluid Mechanics by Narasimhan, University press
10. Fluid Mechanics and Machines, Sukumar Pati, TMH

**Practical (Hours per week): 2, Credit: 1**

**Laboratory Experiments (Minimum 8 experiments)**

1. Determination of Metacentric Height and application to stability of floating bodies.
3. Experiments on impact of Jets
4. Experiments on performance of Pelton Turbine
5. Experiments on performance of Francis Turbine
6. Experiments on performance of Kaplan Turbine
7. Experiments on performance of centrifugal pump
8. Experiments on performance of reciprocating pump
9. Experiments on Reynold’s Apparatus
10. 12 Experiments on Flow through pipes
11. Experiments on performance of Gear pump
12. Verifications of momentum equation
**Module-I (10 Lectures)**
1. Review of First and Second laws:
   First law analysis of unsteady flow control volumes, Entropy generation, Entropy balance for closed systems and steady flow systems, Available energy, Quality of energy, Availability for non-flow and flow processes, Irreversibility, Exergy balance, Second law efficiency.

**Module-II (12 Lectures)**
2. Vapour Power Cycles:
   The Carnot vapor cycle and its limitations, The Rankine cycle, Means of increasing the Rankine cycle efficiency, The reheat cycle, The regenerative feed heating cycle, Cogeneration (Back pressure and Pass-out turbines), Combined-cycle power generation systems, Binary vapour cycles.

3. Gas Power Cycles:

**Module-III (12 Lectures)**
4. Refrigeration cycles:
   Reversed Carnot cycle, Reversed Brayton cycle (Gas refrigeration system), The vapor compression cycle, The vapor absorption cycle.

5. General Thermodynamic property relations:

**Module-IV (06 Lectures)**
6. Reciprocating Air Compressors:
   Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors.

**Text Books**
1. Engineering Thermodynamics by P. K. Nag, Publisher: TMH
2. Engineering Thermodynamics by P. Chattopadhyay, OXFORD
3. Fundamentals of Thermodynamics by Sonntag, Borgnakke, Van Wylen, John Wiley & Sons
4. Fundamentals of Engineering Thermodynamics by E. Rathakrishnan, PHI
Reference
1. Engineering Thermodynamics by M. Achyuthan, PHI
2. Engineering Thermodynamics by Y.V.C. Rao, University Press
3. Thermodynamics and Thermal Engineering by Kothandaraman & Domkundwar, Dhanpat Rai
5. Steam Tables in SI Units by Ramalingam, Scitech
6. Steam Tables by C.P. Kothandaraman, New Age International

Practical (Hours per week): 2, Credit: 1

Laboratory Experiments: (Minimum 8 experiments)
1. Study of Cut-Sections of 2 stroke and 4 stroke Diesel Engine.
2. Study of Cut-Sections of 2 stroke and 4 stroke Petrol Engine.
3. Study of steam power plant.
4. Study of refrigeration system.
5. Study of gas turbine power plant.
8. Determination of performance characteristics of gear pump.
9. Measurement of steam quality using calorimeter
10. Verification of Joule-Thomson coefficient.

PME31104 KINEMATICS AND DYNAMICS OF MACHINES

Theory L/T (Hours per week): 3/1, Credit: 4

Module – I: (10 Lectures)
1. Kinematic fundamental: Basic Kinematic concepts and definitions, Degrees of freedom, Elementary Mechanism: Link, joint, Kinematic Pair, Classification of kinematic pairs, Kinematic chain and mechanism, Gruebler’s criterion, Inversion of mechanism, Grashof criteria, Four bar linkage and their inversions, Single slider crank mechanism, Double slider crank mechanism and their inversion. Transmission angle and toggle position, Mechanical advantage.

Module – II : (10 Lectures)

3. Mechanism Synthesis : Graphical methods of synthesis, Chebychev spacing for precision positions, Freudenstein’s equation applicable to four bar linkages.


Module – III : (8 Lectures)

5. Combined Static and Inertia Force Analysis: Inertia forces analysis, velocity and acceleration of slider crank mechanism by analytical method, engine force analysis - piston effort, force acting along the connecting rod, crank effort. dynamically equivalent system, compound pendulum, correction couple.

6. Friction Effects: Screw jack, friction between pivot and collars, single, multi-plate and cone clutches, anti friction bearing, film friction, friction circle, friction axis,

Module – IV : (8 Lectures)

7. Flexible Mechanical Elements: Belt, rope and chain drives, initial tension, effect of centrifugal tension on power transmission, maximum power transmission capacity, belt creep and slip.

8. Brakes &Dynamometers : Classification of brakes, Analysis of simple block, Band and internal expanding shoe brake, Braking of a vehicle. Absorption and transmission dynamometers, Prony brake, Rope brake dynamometer, belt transmission, epicyclic train, torsion dynamometer.

Text Books

1. Kinematics and Dynamics of Machinery by R L Norton, Tata MacGraw Hill
3. Theory of Machines by S.S.Rattan, Tata MacGraw Hill

Reference

1. Theory of Machines by Thomas Bevan, CBS Publications
2. Kinematics and Dynamics of Machinery by Charles E. Wilson and J.Peter Saddler, Pearson Education
5. Kinematics and Dynamics of Machines by G.H. Martin, McGraw-Hill.
7. Theory of Mechanisms and Machines by C.S.Sharma and K.Purohit, PHI.
**Practical (Hours per week): 2, Credit: 1**

**Laboratory Experiments: (Minimum 8 experiments)**

1. Design of any one working model related to Kinematics of Mechanisms i.e., Module I and II.
2. Design of any one working model related to Dynamics of Machinery i.e., Module III and IV.
3. Radius of gyration of compound pendulum
4. Radius of gyration of connecting rod
5. TRI – FILAR / BI-FILAR System
6. Experiment on Screw Jack
7. Experiment on Journal Bearing Apparatus
8. Experiment/Study on clutches
9. Experiment on Epicyclic Gear Train
10. Experiments on Simple/Compound/Reverted Gear trains
11. Experiment on Dynamometer
12. Experiment on Brake
13. Experiment on Coriolis component of acceleration

**PEK3E001 ENGINEERING ECONOMICS**

*Theory L/T (Hours per week): 2/1, Credit: 3*

**Module I (12 hours)**


Demand- Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement (Simple numerical problems to be solved), Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).

Production-Production function, Laws of returns: Law of variable proportion, Law of returns to scale

**Module II (12 hours)**

Cost and revenue concepts, Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).

Banking -Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.

Inflation-Meaning of inflation, types, causes, measures to control inflation.

National Income-Definition, Concepts of national income, Method of measuring national income.
Module III (12 hours)

Time value of money - Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.
Depreciation- Depreciation of capital asset, Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method), After tax comparison of project.

Text Books
5. Ahuja, H.L., “Principles of Micro Economics”, S.Chand & Company Ltd
7. Macro Economics by S.P.Gupta, TMH

POB3E002 ORGANIZATIONAL BEHAVIOUR

Credit- 3 Class Hours - 40

Objectives:
1. To develop an understanding of the behavior of individuals and groups inside organizations
2. To enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations.
3. To develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
<th>Class Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Fundamentals of OB: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behavioristic and social cognitive), Limitations of OB.</td>
<td>6</td>
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<tr>
<td>02</td>
<td>Attitude: Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes. Personality and values: Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality</td>
<td>10</td>
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</table>
model, Significant personality traits suitable to the workplace (personality and job – fit theory), Personality Tests and their practical applications.

**Perception:** Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect).

**Motivation:** Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom’s expectancy Theory & Porter Lawler model), Contemporary Theories – Equity Theory of Work Motivation.

**03 Foundations of Group Behavior:** The Meaning of Group & Group behavior & Group Dynamics, Types of Groups, The Five – Stage Model of Group Development.

**Managing Teams:** Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building.

**Leadership:** Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership, Meaning and significance of contemporary leadership, Concept of transformations leadership, Contemporary theories of leadership, Success stories of today’s Global and Indian leaders.

**04 Organizational Culture:** Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.

**05 Organizational Change:** Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change. Implementing Organizational Change : How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin’s-Three step model, Seven Stage model of Change & Kotter’s Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.

**Reference Books**

1. Understanding Organizational Behaviour, Parek, Oxford
2. Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.
3. Organizational Behaviour, K. Awathappa,HPH.
4. Organizational Behaviour, VSP Rao, Excel
5. Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.
6. Organizational Behaviour, Hitt, Miller, Colella, Wiley
HONOURS ELECTIVE

PME3D001 APPLIED MATHEMATICS (L/T: 4/0, Credit: 4)

Module-I (15 Hours)
Probability:
Probability, Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson, and Hyper-geometric distributions, Normal and exponential distribution, Distribution of several random variables.

Statistics:
Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis, Acceptance sampling, Regression Analysis, Fitting Straight Lines, Correlation analysis

Module-II (15 Hours)
Partial Differential Equation:
Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge's method, Second order partial differential equation
The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates.

Module-III (08 Hours)
Complex Analysis:
Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping,
Complex integration: Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions

Module-IV (06 hours)
Power Series, Taylor’s series, Laurent's series, Singularities and zeros, Residue integration method, evaluation of real integrals.

Text books:

Reference books:
4. Mathematical Methods by Potter Goldberg Publisher: PHI
MINOR SPECIALIZATION

PME3G001 APPLIED THERMAL ENGINEERING

Theory L/T (Hours per week): 4/0, Credit: 4

Module-I (8 Lectures)
Review of First and Second laws:
First law analysis of unsteady flow control volumes, Entropy change for different process, Entropy generation ,Entropy balance for closed systems and steady flow systems, Available energy, Quality of energy, Availability for non flow and flow process, Irreversibility, Second law efficiency.

Module – II (8 Lectures)


Reciprocating Air Compressors: Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling. Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors

Module – III (12 Lectures)


Steam Nozzles:- Types of nozzles, isentropic flow through nozzles, effect of friction on nozzle efficiency. Critical pressure ratio and maximum discharge, throat and exit area.

Module – IV (14 Lectures)


Heat Transfer: Basic modes of heat transfer, one dimensional steady state, conduction through slab, cylinder and sphere ; basic theory of radiant heat transfer, black body & mono chromatic radiation, total emissive power, heat exchangers.

Refrigeration system: Reversed Carnot cycle, Reversed Brayton cycle (Gas refrigeration system), The vapor compression cycle, The vapor absorption cycle, air conditioning.

Text Books
1. Engineering Thermodynamics by P. Chattopadhyay, OXFORD
2. Power plant Engineering by P. K. Nag, Publisher:TMH
Reference

1. Fundamentals of Thermodynamics by Sonntag, Borgnakke, Van Wylen, John Wiley & Sons
2. Fundamentals of Engineering Thermodynamics by E. Rathakrishnan, PHI
3. Engineering Thermodynamics by M. Achyuthan, PHI
4. Engineering Thermodynamics by Y.V.C. Rao, University Press
5. Thermodynamics and Thermal Engineering by Kothandaraman & Domkundwar, Dhanpat Rai
6. Steam Tables in SI Units by Ramalingam, Scitech
7. Steam Tables by C.P. Kothandaraman, New Age International
### Fourth Semester

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<th>Code</th>
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<tr>
<td>HS</td>
<td>Engineering Economics/ Organizational Behavior</td>
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<td>3</td>
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**Total Marks: 1200**

**Total Credits: 25**

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#### Minor

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### SEMESTER : 4TH

1. **PME4D001** HONOURS (O2) STATISTICAL QUALITY CONTROL  
   4-0-0  4

2. **PME4D002** HONOURS (O2) SURFACE ENGINEERING  
   4-0-0  4

3. **PME4D003** HONOURS (O2) RAPID MANUFACTURING PROCESS  
   4-0-0  4

4. **PME4E001** HS (CP) PURELY APPLIED MATHEMATICS FOR SPECIFIC BRANCH OF ENGINEERING  
   3-0-0  3

5. **PEK4E002** HS (O1) ENGINEERING ECONOMICS  
   3-0-0  3

6. **POB4E003** HS (O1) ORGANIZATIONAL BEHAVIOR  
   3-0-0  3

7. **PME4G001** MINOR (CP) FLUID MECHANICS & HYDRAULICS MACHINES  
   4-0-0  4

8. **PME4I101** PC (CP) MECHANISM & MACHINES  
   3-0-1  4

9. **PME4I102** PC (CP) BASIC MANUFACTURING PROCESS  
   3-0-1  4

10. **PME4I103** PC (CP) IC ENGINE & GAS TURBINE  
    3-0-1  4

11. **PME4I104** PC (CP) MECHANICAL MEASUREMENT, METALLURGY & RELIABILITY  
    3-0-1  4

12. **PME4I201** PC (CP) SKILL PROJECT AND HANDS ON  
    0-0-3  3
PME4I101 MECHANISMS AND MACHINES

MODULE – I (8 HOURS)


MODULE – II (8 HOURS)

4. Gears: Theory of shape and action of tooth properties and methods of generation of standard tooth profiles, Standard proportions, Force analysis, Path of contact, Arc of contact, Contact ratio, Interference and Undercutting, Methods for eliminating Interference, Minimum number of teeth to avoid interference.

MODULE III (8 HOURS)


MODULE IV (8 HOURS)


TEXT BOOKS
1. Theory of Machines by S.S.Rattan, Tata MacGraw Hill
REFERENCE

1. Theory of Machines by Thomas Bevan, CBS Publications.
2. Kinematics and Dynamics of Machinery by R.L.Norton, Tata MacGraw Hill
4. Theory of Mechanisms and Machines by C.S.Sharma and K.Purohit, PHI
5. Theory of Machines by Shah Jadwani, Dhanpat Rai
6. Theory of Machines by Abdulla Shariff, Dhanpat Rai
8. Theory of Machines by Sadhu Singh, Pearson Education.

PRACTICAL

Practical (0-0-2) Credit: 1

1 and 2 are compulsory. In addition, minimum six experiments from sl. No. 3-10 to be performed.

1. Design of any one working model related to Mechanisms and Machines i.e., Module I and II.
2. Design of any one working model related to Mechanisms and Machines i.e., Module III and IV.
3. Determination of gyroscopic couple using gyroscopic test rig.
4. Performance characteristics of a spring loaded governor
5. Determination of critical speed of rotating shaft
6. Experiment on static and dynamic balancing apparatus
7. Determination of natural frequencies of un-damped as well as damped vibrating systems.
8. Study of interference and undercutting for gear drives
9. Experiment on Cam Analysis Apparatus.
10. Experiment on evaluation of damping in a vibrating system
PME41102 BASIC MANUFACTURING PROCESS

MODULE - I (10 LECTURES)
1. Foundry:
   a. Types of patterns, pattern materials and pattern allowances.
   c. Composition of molding sand, Silica sand, Zircon sand, binders, additives, Binders - clay, binders for CO₂ sand, binder for shell molding, binders for core sand.
   d. Properties of molding sand and sand testing.
   e. Melting furnaces - cupola, resistance furnace, induction and arc furnace.
   f. Solidification of castings, design of risers and runners, feeding distance, centre line freezing resistance chills and chaplets.
   g. Degasification and inoculation of metals.
   h. Casting methods like continuous casting, centrifugal casting, disc casting.
   i. Casting defects.

MODULE - II (8 LECTURES)
   Brazing and soldering, welding defects.
   Destructive and non-destructive testing of castings and welding.

MODULE – III (08 LECTURES)
3. Brief introduction to powder metallurgy processes.
5. Rolling: Pressure and Forces in rolling, types of rolling mills, Rolling defects.

MODULE – IV (08 LECTURES)
8. Wire drawing methods and variables in wire-drawing, Optimum dies shape for extrusion and drawing.
10. Brief introduction to explosive forming, coating and deposition methods.

TEXT BOOKS
2. Welding Technology by R.A. Little, TMH
3. Manufacturing Science by A.Ghosh and A K Malick, EWP

REFERENCE BOOKS
1. Fundamentals of metal casting technology by P.C. Mukherjee, Oxford PIBI.
2. Mechanical Metallurgy by Dieter, Mc-Graw Hill
3. Processes and Materials of Manufacture by R.A Lindberg, Prentice hall (India)
4. A Text Book of Production Engineering by P.C.Sharma, S.Chand
PRACTICAL (BASIC MANUFACTURING PROCESS LABORATORY)

LIST OF EXPERIMENTS:
1. Determination of grain size, clay content, permeability and green compressive strength of Molding sand. (2 to 3 experiments)
2. Foundry Practices
3. Preparation of a wood pattern.
4. Determination of strength of brazed and solder joints
5. Practice and preparation of job in TIG/MIG welding
7. Demonstration of different rolling mills
8. Demonstration of Extrusion processes

PME4I103 INTERNAL COMBUSTION ENGINES AND GAS TURBINES

MODULE - I (11 HOURS)

Introduction:
Classification, Engine nomenclature, engine operating and performance parameters, Valve timing diagram of SI & CI Engines, Comparison of SI and CI engine.

Thermodynamic Analysis of cycles:
Fuels:
Fuels of SI and CI engine, Fuel additives, Properties, potential and advantages of alternative liquid and gaseous fuels for SI and CI engines (biofuels, LPG and CNG)
Fuel Induction Techniques in IC engines:
Fuel induction techniques in SI and CI engines, Mixture Requirements at Different Loads and Speeds.

Carburetion:

MODULE II (12 HOURS)

Fuel Injection:

Ignition:
Energy requirement for ignition, requirements of an ignition system, conventional ignition systems, modern ignition systems (TCI and CDI), firing order, Ignition timing, Spark advance mechanism,

Combustion:
Stages of combustion in SI and CI engines, effects of engine variables on flame propagation and ignition delay, Abnormal combustion, Preignition & Detonation, Theory of Detonation. Effect of engine variables on Detonation, control of Detonation. Diesel Knock & methods to control diesel knock, Requirements of combustion chambers. Features of different types of combustion chambers system for S.I. engine. (I-head, F-head combustion chambers), C.I. engine combustion chambers - Open and divided type, Air swirl turbulence-M. type combustion chamber. Comparison of various types of combustion chambers.

Module III (8 hours)

Cooling & Lubricating Systems, Engine Emission & Controls: Air cooling & water cooling systems, effect of cooling on power output & efficiency, properties of lubricants and different types of lubricating system.
Modern developments in IC Engines, EGR, MPFI, CRDI, GDI, HCCI, dual fuel engine, lean burn engine, Stratified engine (basic principles).


Module IV (9 hours)

Air Craft Propulsion: Analysis of Turbo Jet, Turbo Prop, Turbo fan & Ram jet engines.

Axial Flow & Centrifugal Compressor: Basic construction of centrifugal and axial flow compressor, velocity diagram, performance characteristics of centrifugal and axial flow compressor, effects of slip, surging and stalling on compressor.

Text Books:
1. IC Engines, Mathur & Sharma
2. Internal Combustion Engines, V. Ganesan, TMH, 3rd edition

Reference books:
1. Fundamentals IC Engines, J.B. Heywood, McGraw Hill
2. A course in IC Engines, V.M. Domkundwar, Dhanpat rai and sons
3. Gas Turbines, Cohen and Roser
5. Fundamentals of Internal Combustion Engines, H.N. Gupta, PHI

PRACTICAL (I. C. ENGINE LABORATORY)
1. Valve timing diagram of an IC engine
2. Study of a modern carburetor (e.g. Solex Carburetor)
3. Study of fuel injection system of a diesel engine
4. Analysis of exhaust gas of automobile
5. Study of different cooling systems in automobiles (Air cooling and water cooling).
7. Load test on 4-stroke single cylinder C.I. engine.
8. Load test on 4-stroke single cylinder S.I. engine.
9. Morse Test on multi-cylinder S.I. or C.I. engine
10. Load test on variable compression ratio S.I. engine
11. Load test and Heat balance on 2 stroke S.I. Engine
PME4I104  MECHANICAL MEASUREMENT, METROLOGY & RELIABILITY

MODULE – I (16 HOURS)
Strain Measurement
The electrical resistance strain gauge. The metallic resistance strain gauge, Selection and Installation factors for metallic strain gauge, Circuitry, metallic strain gauge. The strain gauge ballast circuit, the staring gauge bridge circuit, Temperature compensation.
Measurement of Pressure
Pressure measurement systems, Pressure measurement transducers, Elastic diaphragms, strain gauge pressure cells, measurement of high pressure, Measurement of low pressures, dynamic characteristics of pressure measuring systems.
Measurement of Fluid Flow
Flow characteristics obstruction meters, Obstruction meter for compressible fluids - Orifice, Venturi meter and Pitot tube, The variable-area meter, Turbine Flow meters.
Temperature Measurement
Use of bimetallic pressure thermometers, Thermocouples, Pyrometry, Calibration of temperature measuring devices.
Force, Power, Speed and Torque Measurement:
Load Cell, Dynamometers, Tachometer and Tacho-generator, Stroboscope, The seismic instrument. - Vibrometers and accelerometers

MODULE – II (10 HOURS)
Principles of Measurements, Line and End & optical Standards, Calibration, accuracy and Precision, Random error and systematic error.
Measurement of Surface Roughness, Screw Thread and Gears.
Limits, Fits and Gauges, Assembly by full, partial and group interchangeability, geometric tolerances.
Measurement of straightness, Flatness and circularity.

MODULE – III (10 HOURS)
Definition, bath-tub-curve, system reliability, reliability improvement, maintainability and availability, Availability of single repairable system using Markov model, Life tests, acceptance sampling plan based on life tests, Sequential acceptance sampling plan based on MTTF & MTBF.
TEXT BOOKS:
3. Engineering Metrology, R.K. Jain, Khanna Publisher, Delhi

Reference Books:

PRACTICAL
(MECHANICAL MEASUREMENT, METROLOGY & RELIABILITY LAB)
(Minimum 08 Experiments/Studies)

List of Experiments:

1. Calibration of LVDT using indicator / CRO
2. Calibration of load cell using electrical resistance strain gauge
3. Calibration of a Rotameter for fluid flow measurement
4. Calibration of thermo couples
5. Calibration of Bourden Tube Pressure Gauge and measurement of pressure using manometer
6. Experiment on Pneumatic trainer
7. Experiment on Hydraulic trainer
9. Strain measurement using resistant strain gauge
10. Measurement of straightness and flatness
11. Measurement of roughness of the surface
12. Experiment on slip gauges and sine bar
PME4D002 SURFACE ENGINEERING (HONORS ELECTIVE)

MODULE – I (14 HOURS)

MODULE – II (16 HOURS)
Thermal Spraying Processes and Electrodeposited Coatings: Thermal spraying materials, characteristics of thermal spray processes, Design for thermally sprayed coatings coating production, spray fused coatings, Principles of electroplating, Technology and control-electroplating systems, Properties and applications of electrodeposits, Non aqueous and electroless deposition, plasma coating.

Hot Dip Coating and Diffusion Coating: Principles, Surface preparation, Batchcoating and continuous coating process, Coating properties and application, Principles of cementation, Cladding-vacuum deposition, Sprayed metal coating, Structure of diffusion coatings, Chemical vapour deposition (CVD), Physical vapour deposition (PVD).

MODULE – III (14 HOURS)
Non-Metallic Coating Oxide and Conversion Coatings: Plating coating, lacquers, rubbers and elastomers, viterous enamels, anodizing Chromating, application to aluminium, magnesium, tin, zinc, cadmium copper and silver, phosphating primers.

Quality Assurance, Testing and Selection of Coatings: The quality plan, design, testing and inspection, thickness and porosity measurement, selection of coatings, industrial applications of engineering coatings.

TEXT BOOKS:

REFERENCE BOOKS:
PME4D003  RAPID MANUFACTURING PROCESS (HONORS ELECTIVE)

MODULE – I (14 HOURS)

Basic principles of RP steps in RP, Process chain in RP in integrated CAD-CAM environment, Advantages of RP

MODULE – II (14 HOURS)
Rapid Manufacturing Process Optimization: factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation. Classification of different RP techniques based on raw materials, layering technique (2D or 3D) and energy sources.

Process technology and comparative study of stereo lithography (SL) with photopolymerisation, SL with liquid thermal polymerization, solid foil polymerization, selective laser sintering, selective powder binding, Ballastic particle manufacturing – both 2D and 3D, Fused deposition modeling, Shape melting

MODULE – III (16 HOURS)
Laminated object manufacturing solid ground curing, Repetitive masking and deposition. Beam interference solidification, Holographic interference solidification special topic on RP using metallic alloys, Programming in RP modeling, Slicing, Internal Hatching, Surface skin films, support structure.

Software for RP: STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools.

TEXT BOOKS:
1. Rapid Prototyping and Engineering Applications, Frank W. Liou, CRC Press

REFERENCE BOOKS:
PME4G001  FLUID MECHANICS AND HYDRAULIC MACHINES

(Minor Specialization)

MODULE I (12 LECTURES)
Introduction: Scope of fluid mechanics and its development as a science
Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.

Fluid statics: Pressure, Pascal’s Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer.

Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface. Buoyancy and floatation, Archimedes’ principle, stability of immersed and floating bodies, determination of metacentric height.

MODULE II (12 LECTURES)
Fluid dynamics : Introduction, Introduction to N-S equation, Euler’s equation along a streamline, energy equation, Bernoulli’s equation and its application to siphon, venturimeter, orificemeter, pitot tube.

MODULE III (10 LECTURES)
Hydraulic turbines: Classification, Impulse and Reaction turbine; Tangential, Radial and axial turbine.
Impulse turbine, Pelton wheel, bucket dimensions, number of buckets in pelton wheel, efficiency and performance curves.
Reaction Turbines: Francis turbine and Kaplan turbine, velocity triangle and efficiencies, performance curve. Function of draft tube and casing cavitation

MODULE IV (06 LECTURES)
Centrifugal Pump: constructional features, vane shape, velocity triangles, Efficiencies, Multi stage centrifugal pumps, Pump Characteristic, NPSH and Cavitation.
Positive displacement pumps: Reciprocating Pump, Working principle, Discharge, work done and power requirement, Slip, Indicator diagram

Text Books
1. Fluid Mechanics, A.K.Jain, Khanna Publishers
2. Fluid Mechanics and Hydraulic Machines, Modi & Seth
Reference Books:

1. Fluid Mechanics, A.K. Mohanty, PHI
2. Introduction to Fluid Mechanics, Fox, McDonald, Willey Publications
3. Fluid Mechanics by Kundu, Elsevier
5. Engineering Fluid Mechanics by Garde et. al., Scitech
6. First course in Fluid Mechanics by Narasimhan, University press
8. Fluid Mechanics and Machines, Sukumar Pati, TMH
### Fifth Semester

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**Total**  
17 17 500 250 14 7 350

**Total Marks: 1100**

**Total Credits: 24**

### Honours

| Hours/week | Credit | University Marks | Internal Evaluation | Theory | L/T | Credit | Practical | Marks |PC | Machining Science & Technology | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 | Honours | Advanced Mechanics of Solids / Design of Machine Components/ Experimental Stress Analysis | 4 | 4 | 100 | 50 | Minor | Manufacturing Process | 3-1 | 4 | 100 | 50 |

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**Honours**

- Advanced Mechanics of Solids / Design of Machine Components / Experimental Stress Analysis: 4-0, 4, 100, 50

**Minor**

- Manufacturing Process: 3-1, 4, 100, 50
## SEMESTER : 5TH

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>PME5D001</td>
<td>HONOURS (O4) ADVANCED MECHANICS OF SOLIDS</td>
<td>4-0-0</td>
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<tr>
<td>PME5D002</td>
<td>HONOURS (O4) DESIGN OF MACHINE COMPONENTS</td>
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<td>PME5D003</td>
<td>HONOURS (O4) EXPERIMENTAL STRESS ANALYSIS</td>
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<td>MINOR (CP) MANUFACTURING PROCESS</td>
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<td>PME5H004</td>
<td>OE (O2) C++ &amp; OBJECT ORIENTED PROGRAMMING</td>
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<td>PME5H005</td>
<td>OE (O2) INTERNET &amp; WEB TECHNOLOGY</td>
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<td>PME5H006</td>
<td>OE (O2) ANALOG &amp; DIGITAL ELECTRONICS</td>
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<td>PME5H007</td>
<td>OE (O2) DIGITAL SIGNAL PROCESSING</td>
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<td>PME5I001</td>
<td>PC (CP) DESIGN OF MACHINE ELEMENTS</td>
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<td>PME5I101</td>
<td>PC (CP) MACHINING SCIENCE &amp; TECHNOLOGY</td>
<td>3-0-1</td>
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<tr>
<td>PME5I102</td>
<td>PC (CP) HEAT TRANSFER</td>
<td>3-0-1</td>
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<td>PME5I201</td>
<td>PC (CP) ADVANCE LAB - I</td>
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<td>PME5J101</td>
<td>PE (O3) OPTIMIZATION IN ENGINEERING</td>
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<td>PME5J102</td>
<td>PE (O3) PROJECT MANAGEMENT</td>
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<tr>
<td>PME5J103</td>
<td>PE (O3) QUALITY MANAGEMENT &amp; RELIABILITY</td>
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**Total Credits:** 28
FIFTH SEMESTER

PME5I001  DESIGN OF MACHINE ELEMENTS
[Only specified data book as mentioned in the syllabus is permitted during examination]

MODULE-I (8 HOURS)

MODULE-II (8 HOURS)

MODULE-III (10 HOURS)

MODULE-IV (6 HOURS)

TEXT BOOKS:

REFERENCE BOOKS:
7. Design of Machine Elements by C. S. Sharma and K. Purohit, PHI

DESIGN DATA HAND BOOKS:
1. P.S.G. Design Data Hand Book, PSG College of Tech Coimbatore
3. Design Hand Book by S.M.Jalaluddin ; Anuradha Agencies Publications
PRACTICAL (DESIGN OF MACHINE ELEMENTS)

1. Design of any one working model related to Design of machine elements i.e., Module I and II.

2. Design of any one working model related to Design of machine elements i.e., Module III and IV.

3. Design & drawing of Riveted joint
4. Design and drawing of Cotter joint
5. Design and drawing of Knuckle joint
6. Design of shafts subjected to combined loading
7. Design and drawing of Flange coupling
8. Design of spring
9. Design of bearing

Compulsory

Total no. of Drawing: 6
3 in drawing sheets
3 in AutoCad/Pro-E/CATIA/ANSYS

Total number of Design: Minimum 8 nos including 2 working model.
PME51101  MACHINING SCIENCE AND TECHNOLOGY

MODULE - I (13 HOURS)

MODULE - II (13 HOURS)
Conventional machining process and machine tools – Turning, Drilling, Shaping, Planning, Milling, Grinding. Machine tools used for these processes, their specifications and various techniques used. Principles of machine tools : Kinematics of machine tools, speed transmission from motor to spindle, speed reversal mechanism, mechanism for feed motion, Tool holding and job holding methods in different Machine tools, Types of surface generated, Indexing mechanism and thread cutting mechanism, Quick return mechanism.
Production Machine tools – Capstan and turret lathes, single spindle and multi spindle semiautomatics, Gear shaper and Gear hobbing machines, Copying lathe and transfer machine

MODULE - III (10 HOURS)
Non-traditional Machining processes :
Ultrasonic Machining, Laser Beam Machining, Plasma Arc Machining, Electro Chemical Machining, Electro Discharge Machining, Wire EDM, Abrasive Jet Machining

TEXT BOOKS :
1. Fundamentals of Machining and Machine Tools, G.Boothroyd and W.A.Knight, CRC Press
2. Metal Cutting Principles, M.C.Shaw, Oxford University Press
3. Metal Cutting Theory and Practice, A.Bhattacharya, Central Book Publishers

REFERENCE BOOKS :
8. Principles of Metal Cutting, G.Kuppuswamy, Universities Press
PRACTICAL (MACHINING SCIENCE AND TECHNOLOGY LAB.)
(Minimum 08 Experiments/Studies)

LIST OF EXPERIMENTS:
1. Job on lathe with tapper turning, thread cutting, knurling and groove cutting (3 experiments).
2. Gear cutting (with index head) on milling machine
3. Working with shaper, Planner and slotting machine.
4. Working with surface and cylindrical grinding.
7. Study of Non-traditional machining processes.(USM, AJM, EDM, ECM)
8. Study of CNC Lathe and demonstration of making job in CNC lathe.
9. Study of CNC Milling machine and demonstration of making job in CNC Milling machine
PME5I102  HEAT TRANSFER

MODULE-I (12 HOURS)

1. Introduction:
   Modes of heat transfer: conduction, convection, and radiation. Mechanism & basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity, Thermal conductance, Thermal resistance, Contact resistance, convective heat transfer coefficient, radiation heat transfer coefficient, Electrical analogy, combined modes of heat transfer. Initial conditions and Boundary conditions of 1st, 2nd and 3rd Kind.

2. Heat Conduction:

MODULE-II (12 HOURS)

3. Convective Heat Transfer:
   Introduction to convective flow - forced and free. Dimensional analysis of forced and free convective heat transfer. Application of dimensional analysis, physical significance of Grashoff, Reynolds, Prandtl, Nusselt and Stanton numbers. Conservation equations for mass, momentum and energy for 2-dimensional convective heat transfer in case of incompressible flow, Hydrodynamic and thermal boundary layers for flow over a flat plate. Critical Reynolds number; general expressions for drag coefficient and drag force Reynolds-Colbourn analogy. Thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer Coefficient; Nusselt number. Flow inside a duct-velocity boundary layer, hydrodynamic entrance length and hydrodynamically developed flow; flow through tubes (internal flow). Use of empirical relations for solving turbulent conditions for external and internal flow. Mechanism of heat transfer during natural convection, Experimental heat transfer correlations for natural convection in the following cases
   (a) Vertical and horizontal plates
   (b) Inside and outside flows in case of tubes

Module-III (8 hours)

4. Radiative heat exchange:
   Introduction, Radiation properties, definitions of various terms used in radiation heat transfer; Absorptivity, reflectivity & transmissivity. Emissive power & emissivity, Kirchoff’s identity, Planck’s relation for monochromatic emissive power of a black body, Derivation of Stefan-Boltzmann law and Wien’s displacement law from Planck’s relation, Radiation shape factor, Relation for shape factor and shape factor algebra. Heat exchange between black bodies through non-absorbing medium. Gray bodies and real bodies, Heat exchange between gray bodies. Radiosity and Irradiation, Electrical analogy and radiation network for 2-body and 3-body radiations exchange in non-absorbing medium, Radiation shields.
Module-IV (8 hours)

5. **Heat transfer for boiling liquids and condensing vapours:**

6. **Heat Exchangers:**
   Introduction, Types of heat exchanger, The overall heat transfer coefficient and fouling factors, LMTD and _ - NTU analysis of heat exchangers.

**Text Books :**
1. Heat Transfer Incropera and Dewitt, Willey publications
2. Heat Transfer : J.P.Holman, TMH Publications

**References :**
1. Heat Transfer by P.K. Nag, TMH
2. Heat Transfer by S.P. Sukhatme, TMH
4. Heat and Mass Transfer: Domkundwar and Arora, Danpatrai and sons

**PRACTICAL (HEAT TRANSFER LABORATORY )**

1. Determination of Thermal conductivity of composite slab
3. Determination of surface emissivity
4. Performance test on parallel flow and counter flow heat exchanger
5. Efficiency and effectiveness of fins (Natural / Forced convection)
7. Verification of Stefan Boltzman’s law.
PME5J101  OPTIMIZATION IN ENGINEERING (PROFESSIONAL ELECTIVE)

MODULE-I (10 HOURS)

MODULE -II (10 HOURS)
Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel’s approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method Assignment problems: Hungarian method for solution of Assignment problems Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

MODULE -III (10 HOURS)

TEXT BOOKS
3. Prabhakar Pai, Operation Research, Oxford University Press

REFERENCE BOOKS:
PME5J102 PROJECT MANAGEMENT (PROFESSIONAL ELECTIVE)

MODULE-I PROJECT MANAGEMENT CONCEPTS AND NEEDS IDENTIFICATION

Attributes of a Project, Project Life Cycle, The Project management Process, Benefits of Project Management, Needs Identification, Project Selection, Project organization, the project as part of the functional organization.

Project feasibility Analysis: Technical feasibility, commercial and financial visibility, Environment Analysis.

MODULE-II PROJECT PLANNING AND SCHEDULING:

Design of project management system; project work system; work breakdown structure,

project execution plan, work packaging plan, project procedure manual; project scheduling; bar charts, line of balance (LOB) and Network Techniques (PERT / CPM)/ GERT, Resource allocation, Crashing and Resource Sharing, capacity planning and expansion capacity decision.

MODULE III PROJECT MONITORING AND CONTROL AND PROJECT PERFORMANCE

Planning, Monitoring and Control; Design of monitoring system; Computerized PMIS (Project Management Information System). Coordination; Procedures, Meetings, Control; Scope/Progress control, Performance control, Schedule control, Cost control, Performance Indicators; Project Audit; Project Audit Life Cycle, Responsibilities of Evaluator/ Auditor, Responsibilities of the Project Manager.

BOOKS:

1. Project Planning, Analysis, Selection, Financing, Prasana Chandra, TMH
2. Project Management, Grey, TMH.
3. Project Management, Richman, PHI
4. Project Management, Vasant Desai, HPH
5. Project Management, Bhavesh M.Patel, Vikash
PME5D002  DESIGN OF MACHINE COMPONENTS  
(HONOURS ELECTIVE)

MODULE I (8 HOURS)
1. **Design of Pressure vessels**: Thin pressure vessels: cylindrical and spherical vessels, Design of end Closures, Thick cylindrical shells.
2. **Design of Lever**: Classification, Design of levers, Cranked lever, Lever of safety - valve.

MODULE II (8 HOURS)
3. **Design of belt drive and power screw**: Design of belt drive and pulley, Power screw design with square thread such as screw jack.
4. **Design of clutch and brake**: Friction clutch, Cone clutch and Centrifugal clutch, Block brake, Band brake, Internal expanding shoe brake.

MODULE III (8 HOURS)
5. **Gears**: Design of Spur, Helical, bevel and worm gears.
6. **Flywheel**: Design of Flywheel.

MODULE IV (8 HOURS)

TEXT BOOKS:
2. Design of Machine Elements by C. S. Sharma and K. Purohit, PHI

REFERENCE BOOKS:

DESIGN DATA HAND BOOKS:
1. P.S.G. Design Data Hand Book, PSG College of Tech Coimabture
3. Design Hand Book by S.M.Jalaluddin ; Anuradha Agencies Publications
PME5D001  ADVANCED MECHANICS OF SOLIDS  
(Honours Elective)

MODULE – I  (12 HOURS)
Elementary concept of elasticity, stresses in three dimensions, Principal Stresses, Stress Invariants, Mohr’s Circle for 3-D state of stress, Octahedral Stresses, State of pure shear, Differential equations of equilibrium and compatibility conditions, plane stress. Analysis of strain, State of strain at a point, Strain Invariant, Principal Strains, Plane state of strain, Strain measurements. Theories of Failure, Various yield criteria

MODULE – II  (14 HOURS)
Energy Methods: Work done by forces and elastic strain energy stored. Reciprocal relations, Theorem of virtual work, Castigliano’s theorems, Bending of beams: Asymmetrical bending, Shear centre, Bending of curved beams, Stress distribution in beam with rectangular, circular and trapezoidal cross section, stresses in crane hooks, ring and chain links, Deflection of thick curved bars. Axisymmetric problems: Thick walled cylinder subjected to internal and external pressures, Compound cylinders, Shrink fit,

MODULE – III  (10 HOURS)

TEXT BOOK:
2. Advanced Mechanics of Materials : Boresi and Schmdt, Willey

REFERENCE BOOK:
1. Advanced Mechanics of Materials : Siley and Smith
3. Mechanical Metallurgy by Dieter
8. Mechanics of Materials by James M. Gere, Thomson Learning
PME5D003  EXPERIMENTAL STRESS ANALYSIS  
(Honours Elective)

MODULE – I  (12 HOURS)
Elementary Elasticity: Stress at a point, Principal Stresses in 2D and 3D stress systems, strain and stress-strain relations, principal strains, plane stress and plane strain problems. Theory of Photo elasticity: Photo elasticity methods- Light and optics as related to photoelasticity, polarization of light, plane and circularly polarized light, plane polarscopes. The stress-optic law, effects of a stressed model in plane and circular polariscopes. Dark field and light field arrangements.

MODULE – II  (12 HOURS)
Photoelastic model materials for two-dimensional applications, calibration methods. Analysis techniques, Isochromatic and Isoclinic fringe Patterns, Compensation techniques, stress separation techniques, scaling model to prototype stresses. Birefringent coatings and scattered light in Photoelasticity, reflection polarscope.

MODULE – III  (14 HOURS)

TEXT BOOKS:
2. Experimental stress Analysis and Motion Measurements by Dove and Adams Prentice Hall of India (P) Ltd.

REFERENCES:
PME5G001 MANUFACTURING PROCESSES (MINOR SPECIALIZATION)

MODULE – I (16 HOURS)
Definition and classification of manufacturing processes. Principle of casting, components of casting process including riser and gating system, pattern and types of pattern, pattern material, mould and moulding materials, properties, melting furnaces (copula), solidification of casting, casting methods and casting defects.
Introduction to gas welding, cutting, Arc welding and equipment’s. TIG (GTAW) and MIG (GMAW) welding, resistance welding and Thermit welding (Basic Principles). Brazing and soldering, welding defects.

MODULE – II (14 HOURS)
Conventional machining process and machine tools – Turning, Drilling, Shaping, Planning, Milling, Grinding. Machine tools used for these processes, their specifications and various techniques used.

MODULE – III (14 HOURS)
Non-traditional Machining processes : Ultrasonic Machining, Laser Beam Machining, Plasma Arc Machining, Electro Chemical Machining, Electro Discharge Machining, Wire EDM, Abrasive Jet Machining
Concept of Flexible manufacturing process, concurrent engineering, production tools like capstan and turret lathes, rapid prototyping processes.

TEXT BOOKS :
2. Welding Technology by R.A. Little, TMH
3. A Text Book of Production Engineering (vol. I & II) by P.C.Sharma, S.Chand

REFERENCE BOOKS:
3. Rapid Prototyping by Amitav Ghosh
ADVANCED LAB-I

PME51201 MACHINE DRAWING

Orthographic and Sectional drawing of Machine components: (Any seven)
Screw threads, Screwed fastenings, Turn Buckle, Keys, Cotter joints and Knuckle joints; Pulley;
Flanged coupling, Pedestal Bearing or Plummer Block.
Fundamentals of AutoCAD (Two classes)

1. Dimension & annotations
2. Use of Layers
3. Working with constraint in dimension
4. Creating assembly
5. Axi-symmetrical parts
6. Creating surface features
7. Working with bill of material

Drawing of the following using AUTOCAD: (Any two)

1. Projection of solids
2. Nut & bolt and Fasteners
3. Cotter joint
4. Expansion joint
5. Shaft coupling

TEXT BOOKS:

REFERENCE BOOKS:
OTHER ELECTIVE

ENERGY CONVERSION TECHNIQUES (PME5H001)

MODULE- I  (10 Hrs)
1. DC GENERATORS: Constructional features and operating principles, EMF equation, No Load Characteristics for Separately Excited DC Generator and DC Shunt Generator, Conditions for Self Excitation, Critical Resistance and Critical Speed, Losses and Efficiency.
2. DC MOTORS: Speed~Armature Current, Torque~Armature Current and Speed~Torque Characteristic for (i) Separately Excited DC Motor, (ii) DC Shunt Motor, (iii) DC Series Motor, Starting, Speed control and application of DC motor.

MODULE- II  (10 Hrs)
3. SINGLE PHASE TRANSFORMERS: Constructional Features, EMF Equation, Turns Ratio, Open Circuit Test and Short Circuit Test, Losses and Efficiency, Introduction to Three Phase Transformers: Three Single Phase Transformers Connected as a Bank of Three Phase Transformer.
4. INDUCTION MOTORS: (a) Three Phase Induction Motors: Constructional Features of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Principle of Operation, Concept of Slip, Slip~Torque Characteristics, Starting of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Speed Control of Induction Motors. (b) Introduction to Single Phase Induction Motors: Construction, Principle of Operation and Application.

MODULE- III  (10 Hrs)
5. THREE PHASE SYNCHRONOUS GENERATORS: Constructional Features, Principle of operation as Alternator, Synchronous reactance, Equivalent circuit of alternator, Power-Angle curve, Synchronization of alternators.

Text Book :

Reference Book(s):
2. The Performance and Design of DC Machines – A E Clayton.
3. Theory and Performance of AC Machines – M G Say
8. Electric Machines – Charles Hubert – Pearson Education.
HUMAN RESOURCE MANAGEMENT (PME5H002)

Module I:
Concept scope and objectives of HRM. Relationship between HRM and HRD. The challenges for HRM – Environmental, organizational and Individual. Role and functions of HR managers in the changing business scenario. Human Resources Planning – overview, Recruitment – concept, objectives, legal framework regulating recruitment in India, Selection – Objectives and methods, Test and interviews, Induction and orientation, validity and reliability of Tests and interviews.

Module II:

Module III:

Books Recommended
2. HRM - Text and cases – Aswathappa, THM
MARKETING MANAGEMENT (PME5H002)

Objective of the Course: The course aims at introducing the basic concepts of marketing to the undergraduate students in engineering. The learning shall help the students in better designing, manufacturing and selling product/service packages keeping competitive market, customers and cost in view.

Module – I (10 hours)

Module II (10 hours)

Module – III (10 hours)
Pricing Decision: Objectives and Factors influencing pricing, Pricing method and strategies. Integrated Marketing Communication(IMC)- Concept of IMC, the marketing communication process, Promotion Mix, elements of promotion mix, Direct marketing. Channels of Distributions: Types of intermediaries, functions of distribution channels, channel levels, Designing Distribution Channels, Physical Distribution, Supply Chain Management (Basic only). Trends in Marketing: Green Marketing, Customer Relationship Management, Emarketing, Rural Marketing and Service Marketing (concepts only)

Text Book:
1. Etzel, Walker, Stanton and Pandit, Marketing, 14/e, Tata McGraw Hill.

Reference
C++ AND OBJECT ORIENTED PROGRAMMING (PME5H004)

Module I (08 hrs)
Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

Module II (16 hrs)
Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references. Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors. Polymorphism: Binding, Static binding, Dynamic binding. Static polymorphism: Function Overloading, Ambiguity in function overloading. Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes. Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators. Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

Module III (08 hrs)
Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor. Template: template classes, template functions. Namespaces: user defined namespaces, namespaces provided by library.

Text Books:
1. Object Oriented Programming with C++ - E. Balagurusamy, McGraw-Hill Education (India)
2. ANSI and Turbo C++ - Ashoke N. Kamthane, Pearson Education

Reference Books:
1. Big C++ - Wiley India
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
INTERNET AND WEB TECHNOLOGY (PME5H005)

Module –I (Lecture Hour 12)
The Internet and WWW
Understanding the WWW and the Internet, Emergence of Web, Web Servers, Web Browsers, Protocols, Building Web Sites

HTML
Planning for designing Web pages, Model and structure for a Website, Developing Websites, Basic HTML using images links, Lists, Tables and Forms, Frames for designing a good interactive website

Module –II (Lecture Hour 12)
JAVA Script
Programming Fundamentals, Statements, Expressions, Operators, Popup Boxes, Control Statements, Try…. Catch Statement, Throw Statement, Objects of Javascript: Date object, array object, Boolean object, math object

CSS
External Style Sheets, Internal Style Sheets, Inline Style, The class selector, div & span tag

DOM
HTML DOM, inner HTML, Dynamic HTML (DHTML), DHTML form, XML DOM

Module –III (Lecture Hour 11)
CGI/PERL
Introduction to CGI, Testing & Debugging Perl CGI Script, Using Scalar variables and operators in Perl

Java Applet
Introduction to Java, Writing Java Applets, Life cycle of applet

Textbooks
1. Web Warrior Guide to Web Design Technologies, Don Gosselin, Joel Sklar& others, Cengage Learning

Reference Books
3. Web Technologies, Uttam K Roy, Oxford
ANALOG AND DIGITAL ELECTRONICS (PME5H006) (OE)

MODULE – I (9 Hours)
1. Diode Circuits: Zener Diode Voltage Regulator, Diode Circuits with Time-Varying Sources, Switching Characteristics of a Diode, Special Purpose Diodes, Rectifiers and Filters. (4 Hours)

MODULE – II (12 Hours)
3. Large Signal Amplifiers: Classification, Class-A and Class-B Power Amplifiers Complimentary and Symmetry Amplifiers, Class-C Amplifiers. (4 Hours)
4. Feed Back Amplifiers and Oscillators: Feedback Concepts, Types of Feedback Circuits, Effects of Negative Feedback Circuits, Unijunction Oscillator and PLL. (4 Hours)
5. Operational Amplifier: Basic Operational Amplifier, Differential Amplifier, Basic Operational Amplifier Circuits, Application of OPAMPs, Linear Application of OPAMPs, OPAMP Filters. (4 Hours)

MODULE – III (13 Hours)
6. Conditional Circuits: Introduction to Digital Electronics Circuits, K-maps and their Simplification, Adder, Substractors, Digital Comparator Circuits, Parity Checkers/Generators, Multiplexers and Decoders, Demultiplexers/Decoders, Programmable Logic Arrays. (5 Hours)
7. Sequential Circuits and Systems: Introduction, Memory Cells and Flip-Flops, Resistors, Counters, Asynchronous Counters, State Diagrams, Memories, ROM and RAM, Digital to Analog and Analog to Digital Converters (DAC and ADC). (5 Hours)
8. Multivibrators and Switching Regulators: Multivibrators, Analog Multivibrators, 555 Timer, Power Supply and Regulators (3 Hours)

Text Books:
1. Electronics: Analog and Digital, I.J. Nagrath (Selected portions of Chapter 1, 3, 4, 5, 6, 7, 9, 10, 11), PHI Learning Pvt. Ltd., New Delhi.

Reference Books:
DIGITAL SIGNAL PROCESSING (PME5H007)

Module – I  (10 hours)
The Z-Transform and Its Application to the Analysis of LTI Systems:
The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; Analysis of Linear Time-Invariant Systems in the z-Domain: Response of Systems with rational System Functions, Transient and Steady-State Responses, Causality and Stability, Pole-Zero Cancellations. Selected portions from Chapter 3 (3.1.1, 3.1.2, 3.2, 3.4.2, 3.4.3, 3.5.1, 3.5.2, 3.5.3, 3.5.4) of Textbook – I

The Discrete Fourier Transform: Its Properties and Applications

Module – II  (10 hours)
Implementation of Discrete-Time Systems:

Design of Digital Filters:
General Considerations: Causality and Its Implications, Characteristics of Practical Frequency-Selective Filters; Design of FIR Filters: Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation. Selected portions from Chapter 10 (10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.2.4, 10.3.2, 10.3.3) of Textbook – I

Module- III  (15 hours)
Efficient Computation of the DFT: Fast Fourier Transform Algorithms
Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of the DFT a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation. Selected portions from Chapter 8 (8.1.1, 8.1.3, 8.2.1, 8.2.2, 8.2.3) of Textbook – I
Adaptive Filters:
Application of Adaptive Filters: System Identification or System Modeling, Adaptive Channel
Equalization, Adaptive Line Enhancer, Adaptive Noise Cancelling; Adaptive Direct-Form FIR
Filters-The LMS Algorithm: Minimum Mean Square Error Criterion, The LMS Algorithm.
Selected portions from chapter 13 (13.1.1, 13.1.2, 13.1.5, 13.1.6, 13.2.1, 13.2.2) of Text book –I

Text Books

Reference Book :
2. Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, TMH.
3. Digital Signal Processing – Manson H. Hayes (Schaum’s Outlines) Adapted by Subrata
Bhattacharya, Tata McGraw Hill.
Proakis, Cengage Learning.
L. Harris, Cengage Learning.
QUALITY MANAGEMENT AND RELIABILITY (PME5J103)

Module- I (8 hours)
Attributes of quality, Evolution of philosophy of Quality Management: Inspection, Quality Control, Quality Assurance, Total Quality Management, Cost of quality
Acceptance sampling: Design of single sampling plan. Double, multiple and sequential sampling plans, O.C. curve, Producer’s risk and consumer’s risk, AOQ, AOQL

Module-II (10 hours)
Statistical process control, Use of control charts and process engineering techniques for implementing quality plan, X-Chart, R-Chart, p-chart, np-chart, c-chart, cusum-chart, Process capability analysis, statistical tolerance analysis
Experimental designs and factorial experiments: \( 2^k \) factorial experiments, Taguchi philosophy; Loss function; Signal to noise ratio, Orthogonal arrays for parameter and tolerance design.

Module-III (6 hours)
Definition – Reliability vs quality; Reliability function – MTBF, MTTR, availability; Bathtub curve – time dependent failure models – distributions – normal, weibull; Reliability of system and models – serial, parallel and combined configuration; Economic analysis and life cycle cost; Proactive, preventive, predictive maintenance; Maintainability and availability

Module-IV (8 hours)
Quality Improvement: Fundamentals of TQM; Some important philosophies and their impact on quality (Deming, Juran, Crossby); Quality circle, QC Tools; Service Quality; Quality Standard: Product and Process Standard, Introduction to ISO 9000 and 14000 standards; Concept of Six Sigma, Lean Management and TPM

Books
1. Quality Planning and Analysis, Juran J M and Gryna F M, TMH
5. Quality control and Application, B.L. Hansen and P.M. Ghare, Prentice Hall of India.
**SEMESTER : 6TH**

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**TENTATIVE**

Likely to be Modified
PME6I101 PRODUCTION AND OPERATION MANAGEMENT

Objective: The course aims at acquainting all engineering graduates irrespective of their specializations the basic issues and tools of managing production and operations functions of an organization.

MODULE I

MODULE II
   Group Technology (4 Hours)
5. Forecasting : Principles and Method, Moving Average, weighted Moving Average, Exponential Smoothing, Winter's Method for Seasonal Demand, Forecasting Error. (4 Hours)

MODULE III
8. Inventory Control : Relevant Costs, Basic EOQ Model, Model with Quantity discount, Economic Batch Quantity, Periodic and Continuous Review Systems, Safety Stock, Reorder Point and Order Quantity Calculations. ABC Analysis. (4 Hours)

REFERENCE BOOK:
3. Aswathappa & Bhatt – Production & Operations Management, HPH.
5. Russell & Taylor - Operations Management, PHI Publication
7. E.E. Adam and R.J. Ebert “Production and Operations Management”, Prentice Hall of India
PME61102 REFRIGERATION AND AIR CONDITIONING

THEORY

MODULE I (12 HOURS)
3. Multi-stage compression and Multi-evaporator systems: Different arrangements of compressors and inter-cooling, Multistage compression with inter-cooling Multi-evaporator system, Dual compression system. Simple problems

MODULE II (12 HOURS)
4. Vapour Absorption System: Simple Ammonia - absorption system, Improved absorption system, Analysis of vapour absorption system (Specifically of analyzing column and rectifier), Electrolux / Three fluid system, Lithium-bromide-water vapour absorption system, comparison of absorption system with vapour compression system. Simple Problems and solution.
5. Thermoelectric Refrigeration: Basics and Principle. Defining the figure of Merit. (No Problem)

MODULE III (10 HOURS)
7. Psychrometrics: Properties of air-vapour mixture, Law of water vapour-air mixture, Enthalpy of moisture, Psychrometric chart, simple heating and cooling, Humidification, Dehumidification, Mixture of air streams. Review question and discussions
Requirements of comfort air conditioning: Oxygen supply, Heat removal, moisture removal, air motion, purity of air, Thermodynamics of human body, comfort and comfort chart, effective temperature, factors governing optimum effective temperature

MODULE IV (06 HOURS)

TEXT BOOKS:
1. Refrigeration and Air Conditioning by R.C. Arora, PHI Publication
2. Refrigeration and Air conditioning by C.P. Arora, Tata McGraw Hill
3. Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpat Rai & Sons. Chapters ; 3,4,5,6,7,11,16,17,19,20
4. Refrigeration and Airconditioning Data book by Manohar Prasad

REFERENCE BOOKS:
2. Refrigeration and Air conditioning by Manohar Prasad,New Age international publishers.
PRACTICAL (REFRIGERATION & AIR CONDITIONING LAB)

1. Determination of C.O. P on vapour compression system
2. Determination of C.O. P on vapour absorption system
3. Performance test on Air conditioning test rig (Window type)
4. Performance test on Air conditioning test rig (Duct type)
5. Determination of C.O.P of ice plant

PROFESSIONAL ELECTIVES

PME6J001 PRODUCT DESIGN AND PRODUCTION TOOLING

MODULE – I (14 HOURS)
Product Design-Product design considerations, product planning, product development, value analysis, product specification. Role of computer in product design.
Process Planning – selection of processes, machines and tools. Design of sequence of operations, Time & cost estimation

MODULE – II (14 HOURS)
Forging design- allowances, die design for drop forging, design of flash and gutter, upset forging die design.
Sheet metal working- Design consideration for shearing, blanking piercing, deep drawing operation, Die design for sheet metal operations, progressive and compound die, strippers , stops, strip layout.

MODULE – III (16 HOURS)
Design of jigs and fixtures, principle of location and clamping, clamping methods, locating methods, Drill Jig bushing, Indexing type drilling Jig.
Design of single point cutting tool, broach and form tool. Tooling design for turret lathe and automats. Design of limit gauges.

TEXT BOOKS:
3. A Textbook of Production Engineering, P.C. Sharma, S. Chand & Co

REFERENCE BOOKS:
PME6J002  COMPUTER INTEGRATED MANUFACTURING & FMS  

(PROFESSIONAL ELECTIVE)

MODULE – I (14 HOURS)
Fundamentals of Manufacturing and Automation: Production systems, automation principles and its strategies; Manufacturing industries; Types of production function in manufacturing; Automation principles and strategies, elements of automated system, automation functions and level of automation; product/production relationship, Production concept and mathematical models for production rate, capacity, utilization and availability; Cost-benefit analysis.

Computer Integrated Manufacturing: Basics of product design, CAD/CAM, Concurrent engineering, CAPP and CIM.

MODULE – II (14 HOURS)
Industrial Robotics: Robot anatomy, control systems, end effectors, sensors and actuators; fundamentals of NC technology, CNC, DNC, NC part programming; Robotic programming, Robotic languages, work cell control, Robot cell design, types of robot application, Processing operations, Programmable Logic controllers: Parts of PLC, Operation and application of PLC, Fundamentals of Net workings; Material Handling and automated storage and retrieval systems, automatic data capture, identification methods, bar code and other technologies.

MODULE – III (16 HOURS)
Introduction to manufacturing systems: Group Technology and cellular manufacturing, Part families, Part classification and coding, Production flow analysis, Machine cell design, Applications and Benefits of Group Technology.

Flexible Manufacturing system: Basics of FMS, components of FMS, FMS planning and implementation, flexibility, quantitative analysis of flexibility, application and benefits of FMS.

Computer Aided Quality Control: objectives of CAQC, QC and CIM, CMM and Flexible Inspection systems.

TEXT BOOKS:
2. Automation, Production systems & Computer Integrated Manufacturing, M.P Groover, PHI.
3. CAD/CAM/CIM, P.Radhakrishnan, S.Subramanyam and V.Raju, New Age International

REFERENCE BOOKS:
1. CAD/CAM Theory and Practice, Zeid and Subramanian, TMH Publication
2. CAD/CAM Theory and Concepts, K. Sareen and C. Grewal, S Chand publication
COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING
PME6J003 (CAD&CAM)

(MODULE – I (14 HOURS))
Fundamentals of CAD: Design process, Applications of computer for design, Creating the Manufacturing Database, The Design workstation, Graphical Terminal, Operator input Devices, Plotters and other devices, Central Processing Unit, Memory types.

(MODULE – II (14 HOURS))
Computer graphics Software and Database: Configuration, Graphics Packages, Constructing the Geometry, Transformations of geometry, Database structure and content, Wire frame versus solid modeling, Constraint– Based modeling, Geometric commands, Display control commands, Editing.

(MODULE III (14 HOUR))
CAM - Numerical Control and NC Part Programming: Numerical Control, Numerical Control elements, NC Coordinate system, NC motion control system, Manual and Computer Aided programming, the APT language, Miscellaneous Functions, M, Advanced part-programming methods.

TEXT BOOKS:
2. CAD & CAM, J Srinivas, Oxford University Press

REFERENCE BOOKS:
1. CAD/CAM Theory and Practice, Zeid and Subramanian, TMH
2. CAD/CAM Principles, Practice and Manufacturing Management, McMahon and Browne, Pearson Education
3. CAD/CAM Concepts and Applications, C.R Alavala, PHI
5. CAD/CAM Theory and Concepts, K.Sareen and C.Grewal, S.Chand Publication
6. CAD/CAM/CAE, N.K.Chougule, Scitech
PME6J005  AUTOMOBILE ENGG

(PROFESSIONAL ELECTIVE)

MODULE I (14 HOURS)

Introduction
Main units of automobile chassis and body, different systems of the automobile, description of the main parts of the engine, motor vehicle act.

Power for Propulsion
Resistance to motion, rolling resistance, air resistance, gradient resistance, power required for propulsion, tractive effort and traction, road performance curves.

Breaking systems
Hydraulic breaking system, breaking of vehicles when applied to rear, front and all four wheel, theory of internal shoe brake, design of brake lining and brake drum, different arrangement of brake shoes, servo and power brakes.

MODULE II (12 HOURS)

Transmission Systems
Layout of the transmission system, main function of the different components of the transmission system, transmission system for two wheel and four wheel drives. Hotchkiss and torque tube drives.

Gear box : Sliding mesh, constant mesh and synchromesh gearbox, design of 3 speed and 4 speed gear box, over drive, torque converter, semi and fully automatic transmission.

Hookes joint, propeller shaft, differential, rear axles, types of rear axles, semi floating, there quarter floating and full floating types.

MODULE III (14 HOURS)

Front wheel Geometry and steering systems : Camber, castor, kingpin inclination, toe-in and toe-out, centre point steering condition for true rolling, components of steering mechanism, power steering.

Electrical system of an automobile : Starting system, charging system, ignition system, other electrical system.

Electrical vehicles:
History, electrical vehicles and the environment pollution, description of electric vehicle, operational advantages, present EV performance and applications, battery for EV, Battery types and fuel cells, Solar powered vehicles, hybrid vehicles.

TEXTBOOKS :
1. Automobile Mechanics, N.K.Giri, Khanna publishers
2. Automobile Engineering, K.M. Gupta, VolI & II, Umesh Publication

REFERENCE BOOKS
1. Automotive mechanics: William h. Crouse and Donald L. Anglin, TMH
2. The motor vehicle, Newton and Steeds
3. Automobile Mechanics, J. Heitner, East West Press
4. Automobile Engineering, Jain and Asthana, Tata McGraw Hill
5. Automobile Engineering, K.K.Ramalingam, Scitech
PME6J006  NON CONVENTIONAL ENERGY SOURCES  
(PROFESSIONAL ELECTIVE)

MODULE I  (6 CLASSES)

MODULE II  (15 CLASSES)

MODULE III  (08 CLASSES)

MODULE IV  (08 CLASSES)

TEXT BOOK:
1. Solar Energy Technology: Sukhatme and Nayak, TMH
2. Renewable Energy Sources and Emerging Technology: D.P.Kothari and etal., PHI
REFERENCE:
3. Non Conventional Energy Sources: H.P. Garg
5. Renewable Energy, Godfrey Boyle, Oxford University Press

PME6D003 POWER PLANT ENGINEERING
(HONOURS ELECTIVE)

MODULE- I (8 HRS)
1. INTRODUCTION
   Different sources (Conventional and non-conventional) of energy and the principle of power generation only, Types of power plant and site selection, overall view of a steam power plant.
2. STEAM GENERATOR
   Fossil fuel steam generators, classification, circulation in water tube boilers, Modern high pressure water tube boilers (both sub critical and super critical), Boiler mounting and accessories, Combustion equipment: air supply systems (Natural and Mechanical Draught Systems), Pulverized coal burning systems and Basics of Fluidized bed combustion, Feed water treatment (Necessity & general consideration only). Boiler performance calculations.

MODULE – II (10HRS)
3. FLOW THROUGH NOZZLES
   Types of nozzles and their area of application & related calculation, critical pressure & choked flow, super saturated flow. Effect of friction and nozzle efficiency
4. STEAM TURBINES
   Turbine types, Variation of Pressure and Velocity in different types of turbines, Simple impulse Turbines, Flow through turbine blades and velocity diagram, Pressure-compounded impulse turbines and Velocity compounded impulse turbines. Turbine power and related calculations.

MODULE – III (10HRS)
5. REACTION TURBINES
   Reaction turbines Flow through blades and velocity diagram, degrees of reaction, Parsons turbine, power and related calculations, Blade height calculations, Losses in steam turbines, Reheat factor & condition line, Governing of turbines.
6. STEAM CONDENSER & CIRCULATING WATER SYSTEMS
   Types, Surface condenser, Performance calculation, Air removal methods, Vacuum & vacuum efficiency. Cooling towers. (Types, principle of operation and performance)

MODULE – IV (8HRS)
7. NUCLEAR POWER PLANT
   Introduction, Nuclear fuels, Nuclear fission, Reactor components, & materials and classification, Boiling Water Reactor (BWR), Pressurized water Reactor (PWR), CANDU Reactor, Gas cooled Reactors, Liquid metal fast breeder Reactor. Heavy water Reactors. Waste disposal and Safety of Nuclear power plant.
8. ECONOMICS OF POWER PLANT
   Basic definitions, cost of electrical energy (Fixed cost and operating cost), Types of tariff, Types of loads (typical load curves), Economic Load sharing
PME6D001 ADVANCED FLUID MECHANICS
(HONOURS ELECTIVE)

MODULE I (08 HRS.)
Concept of continuum and definition of a fluid. Body and surface forces, stress tensor, Scalar and vector fields, Eulerian and Lagrangian description of flow. Motion of fluid element - translation, rotation and vorticity; strain rate tensor, continuity equation, stream function and velocity potential.

MODULE II (10 HRS.)

MODULE III (10 HRS.)

MODULE IV (08 HRS.)
Two dimensional and axisymmetric jets. Description of turbulent flow, velocity correlations, Reynold's stresses, Prandtl's Mixing Length Theory, Karman's velocity defect law, universal velocity distribution.

TEXT BOOK:
1. Advanced Fluid Mechanics, Som and Biswas, Tata McGraw Hill

REFERENCE BOOKS:
1. Fluid Mechanics, A.K. Mohanty, PHI
2. Fundamentals of Fluid Mechanics, Schlitching
3. Introduction to Fluid Mechanics, Shaughnessy, Oxford University Press
4. Fluid Mechanics: Frank M. White, TMH
5. Fluid Mechanics: Cengel and Cimbala, TMH
PME6G001 MECHANICS OF SOLID

(MINOR SPECIALIZATION)

MODULE - I (10 LECTURES)
1. Load, Stress, Principle of St.Venant, Principle of Superposition, Strain, Hooke’s law, Modulus of Elasticity, Stress-Strain Diagrams, Working Stress, Factor of safety, Strain energy in tension and compression, Resilience, Impact loads,
Analysis of Axially Loaded Members : Composite bars in tension and compression - temperature stresses in composite rods, Statically indeterminate problems.
Shear stress, Complimentary shear stress, Shear strain, Modulus of rigidity, Poisson’s ratio, Bulk Modulus, Relationship between elastic constants.
2. Members in Biaxial State of Stress :
Stresses in thin cylinders, thin spherical shells under internal pressure - wire winding of thin cylinders. Analysis of Biaxial Stress. Plane stress, Principal stress, Principal plane, Mohr’s Circle for Biaxial Stress.

MODULE - II (11 Lectures)
3. Strain Deformation :
Two dimensional state of strain, Mohr’s circle for strain, Principal strains and principal axes of strain measurements, Calculation of principal stresses from principal strains.
4. Shear Force and Bending Moment for Simple Beams
Shear force and bending moment. Types of load and Types of support. Support reactions, Relationship between bending moment and shear force, Point of inflection. Shear Force and Bending Moment diagrams.
5. Simple Bending of Beams :
Theory of simple bending of initially straight beams, Bending stresses, Shear stresses in bending, Distribution of normal and shear stress, beams of two materials, Composite beams.

MODULE - III (8 LECTURES)
6. Deflection of Beams :
Differential equation of the elastic line, Slope and deflection of beams by integration method and area - moment method.
7. Theory of Columns:
Eccentric loading of a short strut, Long columns, Euler’s column formula, Lateral buckling, Critical Load, Slenderness ratio

MODULE - IV (7 LECTURES)
8. Torsion in solid and hollow circular shafts, Twisting moment, Strain energy in shear and torsion, strength of solid and hollow circular shafts. Stresses due to combined bending and torsion, Strength of shafts in combined bending and twisting.

TEXT BOOKS
3. Strength of Materials by James M. Gere and Barry J. Goodno, Cengage Learning
REFERENCES BOOKS
7. Strength of Materials by R.Subramaniam, Oxford University Press

FLUID POWER AND TURBOMACHINERY

Module I (12 hours)
Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids and pneumatics. Advantages and Disadvantages of Fluid control, Types of Hydraulic Fluids, physical, chemical and thermal properties of hydraulic fluids, selection of hydraulic fluid, fluid flow fundamentals. Hydraulic Pumps and Motors: Basic Types and constructions, ideal pump and motor analysis, Performance curves and parameters


Module II (10 hours)

Module III (10 hours)
Flow through Centrifugal compressors. Stage velocity triangles, specific work, forward, radial and backward swept vanes. Enthalpy entropy diagram, degree of reaction, slip factor, efficiency. Vane less and vaned diffuser systems, volute as spiral casing. Surge and stall in compressors

Module IV (08 hours)
Axial turbine stages, stage velocity triangles, work, efficiency, blade loading, flow coefficient. Single stage impulse and reaction turbines, degree of reaction, 50% reaction turbine stage, Radial equilibrium and Actuator disc approach for design of turbine blades. Partial admission problems in turbines. Losses in turbo machines.
Text Books
1. S.M. Yahya, Turbines, Compressors and Fans, Tata Mcgraw Hill.
2. V. Kadambi, Manohar Prasad, An introduction to energy conversion, Volume-3, new age International publishers
3. E. Rathakrishnan, Gas Dynamics, PHI Learning Pvt. Ltd

Reference books:
1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria & Sons

COMPRESSIVE FLOW & GAS DYNAMICS (PME6J004)

Module I: (10 hours)
Fundamentals of Fluid dynamics and Thermodynamics: continuity equation, Momentum equation, Energy equation of incompressible flow Introduction to compressible flow: Introduction, Isentropic flow in a stream tube, speed of sound, Mach waves; One dimensional Isentropic Flow: Governing equations, stagnation conditions, critical conditions, maximum discharge velocity, isentropic relations

Module II: (10 hours)
Normal Shock Waves: Shock waves, stationary normal shock waves, normal shock wave relations in terms of Mach number; Oblique Shock Waves: Oblique shock wave relations, reflection of oblique shock waves, interaction of oblique shock waves, conical shock waves; Expansion Waves: Prandtl-Meyer flow, reflection and interaction of expansion waves, flow over bodies involving shock and expansion waves

Module III: (10 hours)
Variable Area Flow: Equations for variable area flow, operating characteristics of nozzles, convergent-divergent supersonic diffusers; Adiabatic Flow in a Duct with Friction: Flow in a constant area duct, friction factor variations, the Fanno line; Flow with Heat addition or removal: One-dimensional flow in a constant area duct neglecting viscosity, variable area flow with heat addition, one-dimensional constant area flow with both heat exchanger and friction

Module IV: (10 hours)
Text Books

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### SEMESTER : 7TH

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TENTATIVE Likely to be Modified
SEVENTH SEMESTER

PROFESSIONAL ELECTIVES

PME7C001  NANO SCIENCE AND BIOTECHNOLOGY

"will be uploaded soon"
PME7J001  MECHANICAL VIBRATION

MODULE - I [12]
1. INTRODUCTION & IMPORTANCE OF MECHANICAL VIBRATION:
   Brief history of Mechanical Vibration, Types of Vibration, Simple Harmonic Motion (S.H.M.),
   Principle of superposition applied to S.H.M., Beats, Fourier Analysis, Concept of degree of freedom
   for different vibrating systems.
2. UNDAMPED FREE VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS: Modeling of Vibrating
   Systems, Evaluation of natural frequency – differential equation, Energy & Rayleigh’s methods,
   Equivalent systems.
3. DAMPED FREE VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS: Different types of damping,
   Equivalent viscous damping, structural damping, Evaluation of damping using free and forced
   Vibration technique, Concept of critical damping and its importance, study of vibration response of
   viscous damped systems for cases of under damping, critical damping and over damping,
   Logarithmic decrement.

MODULE - II [15]
4. FORCED VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS: Steady state solution with viscous
   damping due to harmonic force, reciprocating and rotating unbalance mass, vibration isolation and
   transmissibility due to harmonic force excitation and support motion. Vibration measuring
   instruments – vibrometer and accelerometer. Whirling of shaft with single disc and without
   damping, Concept of critical speed and its effect on the rotating shaft.
5. UNDAMPED VIBRATION OF TWO DEGREE FREEDOM SYSTEMS: Free vibration of spring coupled
   and mass coupled systems, Longitudinal, Torsional and transverse vibration of two degree freedom
   systems, influence coefficient technique, Un-damped vibration Absorber.

MODULE - III [13]
6. INTRODUCTION TO MULTI-DEGREE FREEDOM SYSTEMS: Normal mode vibration, Co-ordinate
   coupling-close coupled and far coupled systems, Orthogonality of mode shapes, Methods of matrix
   iteration, Holzer’s method and Stodola method. Torsional vibration of two, three and multi-rotor
   systems. Dunkerley’s lower bound approximate method.
7. CONTINUOUS SYSTEMS: Vibration of strings, longitudinal vibration of rods, torsional vibration of
   rods, transverse vibration of Euler-beams.

TEXT BOOKS:
1. Theory of vibration with Applications: W.T. Thomson and Marie Dillon Dahleh, Pearson
   Education 5\(^{th}\) ed. 2007.
2. Introductory Course on theory and Practice of Mechanical Vibrations. J.S. Rao & K. Gupta,

REFERENCE BOOKS:
   Indian ed., 2007
3. Mechanical Vibrations: V.P. Singh, Dhanpat Rai & company Pvt. Ltd. 3\(^{rd}\) ed., 2006
   2007
PME7J002 TRIBOLOGY

(PROFESSIONAL ELECTIVE)

MODULE - I (12 HOURS)

Introduction : Lubricant and lubrication, Types of bearings, properties and testing of lubricants,
Basic equations: Generalized Reynolds equation, Flow and Shear Stress, Energy equation, Equation
of state
Hydrodynamic lubrication:
Mechanism of pressure development and load carrying capacity, Plane-slider bearing, Idealized
slider bearing with a pivoted shoe, Step bearing, Idealized journal bearing. – infinitely long journal
bearing, Petroffs equation for a lightly loaded bearing, narrow bearing.

MODULE - II (11 HOURS)

Oil flow and thermal equilibrium - Heat balance of lubricants
Hydrostatic Bearing:
Principles, Component of hydrostatic lubrication, Hydrostatic circular thrust bearing, calculation
of pressure, load carrying capacity, flow rate, power loss in bearing due to friction.

MODULE - III (12 HOURS)

Concept of gas lubricated bearing
Concept of Elastohydrodynamic lubrication, Design and selection of antifiction bearing
Friction and wear of metals:
Theories of friction, surface contaminants, Effect of sliding speed on friction, classification and
mechanism of wear, Wear resistant materials.

TEXT BOOKS
1. Introduction to Tribology of Bearing , B.C .Majumdar , S. Chand & Co

REFERENCE BOOKS
2. Basic Lubrication theory, A. Cameron, John Wiley & sons
3. Lubrication Fundamentals, D.M.Pirro and A.A.Wessol, CRC Press
6. Tribology in Industries, Srivastava S., S Chand and Company limited, Delhi 2002
7. Lubrication of bearings – Theoretical Principles and Design, Redzimovskay E I.,
   Oxford press company 2000
PME7J00  FATIGUE CREEP AND FRACTURE
(PROFESSIONAL ELECTIVE)

MODULE – I : (12 HOURS)
Design philosophy : (i) Infinite life, (ii) Safe life, (iii) Fail safe and (iv) Damage tolerant design concepts.

MODULE – II : (12 HOURS)
Improvement of fatigue strength’ by chemical/metallurgical processes such as nitriding, flame hardening, case carburizing. Fatigue strength enhancement by mechanical work : cold rolling, peening, shot peening. Effect of environment : Corrosion Fatigue, Concept of cumulative fatigue damage
Fracture Mechanics : Ductile and brittle fracture Theoretical cohesive strength of metals, Griffith Theory of brittle Fracture, Oruron’s modification to Griffith Theory.

MODULE – III (14 HOURS)
Creep Analysis :
Definition, Constant stress and constant, strain creep tests. Unaxial creep tests : Baily’s Power Law, Creep relaxation : strain hardening and time hardening creep relaxation. Introduction to Creep bending and deflection of simple problems.

Text Books:
5. Prasant Kumar, Fracture Mechanics

Reference Books:
PME7J004 ROBOTICS

(PROFESSIONAL ELECTIVE)

MODULE – I
   Direct Kinematic model: Mechanical Structure and notations, Description of links and joints, Kinematic modeling of the manipulator, Denavit-Hartenberg Notation, Kinematic relationship between adjacent links, Manipulator Transformation matrix.

MODULE – II
3. Inverse Kinematics: Manipulator workspace, Solvable of inverse kinematic model, Manipulator Jacobian, Jacobian inverse, Jacobian singularity, Static analysis.

MODULE – III
7. Trajectory Planning: Definition and planning tasks, Joint space planning, Cartesian space planning.
8. Applications of Robotics: Capabilities of robots, Material handling, Machine loading and unloading, Robot assembly, Inspection, Welding, Obstacle avoidance.

TEXT BOOKS:
2. Introduction to Robotics: Mechanics and control, John J Craig, PHI

REFERENCE BOOKS:
3. Robotics, Appuu Kuttan K.K., I.K. international
4. Robot Dynamics and Control, M.W.Spong and M. Vidyasagar , Wiley India.
5. Industrial Robotics Technology, programming and application, M.P.Groover, TMH.
PME7J005  SIMULATION, MODELING AND CONTROL

(PROFESSIONAL ELECTIVE)

MODULE I 14 HOURS
Basic simulation modeling, Discrete event simulation, Simulation of queuing and Monte Carlo simulations.

MODULE II 12 HOURS

MODULES III 10 HOURS
Simulation of manufacturing and material handling systems, Goals and performance measures, Modeling downtime and failures, Trace driven models, Case studies.

TEXT BOOKS:
PME7J006 MECHATRONICS
(PROFESSIONAL ELECTIVE)

MODULE 1 (10 HOURS)
Evolution of Mechatronics, components of mechatronic system, types of mechatronic products, Signal theory, signal analysis and processing, Laplace transformation, Z-transformation modulation and de-modulation.
Electrical components and Electronic device – Resister, inductor and capacitor, reactance and impedance. Basic electronics devices junction diodes, Bipolar transistors

MODULE II (10 HOURS)
Basic Digital Technology : Digital number system, Binary number system, Hexadecimal number system, Binary addition, Boolean Algebra, Logic function, Universal GATES, FLIP-FLOP, Registers counters.
System modeling : Frequency response, Mechanical system, electrical system, Thermal system, Fluid system.

MODULE III (16 HOURS)
Actuators- Electric motors; D.C. Motors, Stepper motor, , Hydraulic actuators, Pneumatic actuators
Transducer and Sensors : Principles, difference between transducer and sensors, transducer types – photo emissive, photo conductive, photovoltaic, thermistors, Thermocouple, Inductive, capacitive, Peizoelectric, Hall effect transducers, Ionization transducer, Encoders- Incremental encoder, Optical encoder, Bimetallic strip, Strain gauge, load cell.
Programmable Logic controller : Basic Structure - Programming : Ladder diagram Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls, data handling, Analog input / output, PLC Selection & Application.
Microprocessor ad Microcontroller : Microprocessor based Digital control, registers, Program counter, Intel -8085 microprocessor

TEXT BOOKS
1. A Text Books of Mechatronics, R.K.Rajput, S.Chand & company

REFERENCE BOOKS :
1. Mechatronics, A.Smaili & F Mrad, Oxford University Press
3. Mechatronics An Intigrated approach, Clarence W de Sliva, CRC Press
MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS)
(PROFESSIONAL ELECTIVE)

MODULE-I 14 LECTURES
Overview of MEMS and Microsystems. (Chapter 1 of Text Book 1)
Micromachining Techniques: Silicon as material for micromachining, Photolithography, thin film deposition, doping, wet and dry etching, surface and bulk micromachining, Wafer bonding, packaging. (Chapter 3 and Section 8.2 of Text Book 1, Chapter 2 of Text Book 2)

Module II 10 lectures
Microsystem Modeling and Design: Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage. (Section 4.1 to 4.3 and 6.2.2 of Text Book 1, Section 3.4 of Text Book 2)

MODULE III 15 LECTURES
MEMS Applications: Mechanical sensors and actuators: Piezoresistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, Piezoelectric actuators. (Section 8.3 of Text Book 1 and Section 5.3 and 5.11 of Text Book 2)
Optical: Micro-lens, Micro-mirror, Optical switch (Section 7.5 to 7.7 of Text Book 2)
Radio frequency MEMS: Inductor, Varactor, Filter, Resonator. (Section 9.3 to 9.7 of Text Book 2)
Microfluidics: Capillary action, Micropumping, Electrowetting, Lab-on-a-chip. (Section 10.1 to 10.8 of Text Book 2)

TEXT BOOKS:

REFERENCE BOOK:
PME7D001  COMPUTATIONAL FLUID DYNAMICS

(HONOURS ELECTIVE)

MODULE-I (10 HRS.)
1. Basics of Computational Fluid Dynamics (CFD)- Introduction to One dimensional computation: Finite difference methods (FDM)- Finite element method (FEM)- Finite volume method (FVM). Solution of Discretised Equations:

MODULE-II (12 HRS.)
2. The central differencing scheme - Assessment of the central differencing scheme for convection-diffusion problems - The upwind differencing scheme - Assessment of the upwind differencing scheme - The hybrid differencing scheme - Assessment of the hybrid differencing scheme - The power-law scheme - Higher order differencing schemes for convection-diffusion problems - Quadratic upwind differencing scheme: the QUICK scheme.

MODULE-III (08 HRS.)

MODULE-IV (08 HRS)

TEXT BOOK

REFERENCE BOOKS
PME7D002  FINITE ELEMENT METHOD

(HONOURS ELECTIVE)

MODULE – I (12 HOURS)
Finite Element Modeling of one dimensional problems.
Finite Element Analysis of 2-D and 3-D framed structures.

MODULE – II (12 HOURS)
FEM formulation of 2-D and 3-D stress analysis problems.
Axisymmetric solids subjected to axisymmetric loadings.
Two-dimensional isoparametric elements and numerical integration.

MODULE – III (12 HOURS)
FE modeling of basic vibration problems
Finite element modeling of fluid flow and heat conduction problems
Computer programs: preprocessing and post processing.
Exposure to commercial FE codes such as ANSYS, NASTRAN and IDEAS etc.

TEXT BOOKS
1. Finite Elements in Engineering, T.R.Chandraputla and A.D.Belegundu, PHI

REFERENCE
1. Introduction to Finite Element Method, C.Desai and J.F.Abel, CBS publishers
3. Numerical Methods in Finite Element Analysis, K.J.Bathe and E.L.Wilson, PHI
PME7D003 AUTOMATIC CONTROL SYSTEM

(HONOURS ELECTIVE)

MODULE I (10 HOURS)
Introduction: Basic concept of control system, Open loop and Close loop control systems. Control System and components.

Laplace Transform: Laplace transformation, Laplace transforms theorems, inverse Laplace transform. Mathematical model of physical systems: modeling of fluid systems and thermal systems. Liquid level systems, pneumatic systems, hydraulic systems, thermal systems. Feedback Characteristics of control systems, Types of feedback, effects of different feedbacks on control systems.

MODULE II (16 HOURS)
Time response analysis:

Standard input signals, Step, ramp, parabolic and impulse inputs. Time response of first and second order systems to input signals. Time response specifications, Steady state error and error constants of different types of control systems.

Concept of stability, Necessary condition for stability, Routh's stability criterion, application of Routh's criterion for linear feed back system, relative stability.

Root-locus analysis: Root locus concepts, rules for construction of root loci, root contours, systems with transportation lead and lag.

MODULE III (16 HOURS)
Frequency response analysis: Bode diagrams, polar plots, Nyquist stability criterion, Stability analysis, relative stability in frequency domain.

Controllers: Proportional, derivative and integral control actions, PD, PI and PID controllers and their applications to feedback control systems.

Mathematical modeling of Dynamic systems in state space, state-space representation of mechanical and electrical systems. State equation and transfer functions, Characteristic equation, Eigenvalue and eigenvector of state matrix. Design of control systems in state space.

BOOKS
1. Modern Control Engineering, K. Ogata
2. Automatic Control system, B. C. Kuo
PME71201  NUMERICAL COMPUTATION & SOLIDS MODELING LAB  
(ANY TWO FROM GROUP A, B OR C)

(A) NUMERICAL COMPUTATION  
(Using MATLAB or other software/language)

1. Basics of MATLAB or similar software/language
2. Finding solution by Numerical Methods (including graphics) for the following: (Minimum 06 problems)
   
   a. Bisection Method
   b. Newton-Raphson Method
   c. Secant Method
   d. Gauss Elimination Method
   e. Numerical Differentiation
   f. Numerical Integration (e.g. Newton Cotes Quadrature)
   g. Curve fitting Method
   h. Initial-Value Problems (e.g. Runge-Kutta Method)
   i. Boundary Value Problem (e.g. Shooting Method)
   j. Eigen Value Problem

(B) SOLIDS MODELING  
(Using Solid Modeling software eg. AUTOCAD/ProE/CATIA/SolidWorks etc)

1. Learning the Basics of Solid Modeling Software
2. Describe and Apply the CONE, SPHERE and TORUS command to draw solid primitives

Describe and Apply the EXTRUDE and REVOLVE command to draw solid models that can not be drawn with a composition of primitives

(C) COMPUTER SIMULATION AND ANALYSIS ON FINITE ELEMENT METHODS OR COMPUTATIONAL FLUID DYNAMICS PROBLEMS  
(four or five problems) using any software/language (MATLAB, ANSYS, NASTRAN etc.)

BOOKS

01. Applied Numerical Methods with MATLAB, S.C.Chapra, TMH
02. Numerical Methods for Engineers and Scientists, J.D.Hoffman, CRC Press
03. Numerical Methods, E Balagurusamy, TMH
04. Numerical Methods for Engineers, Chapra and Canale, TMH
05. MATLAB Programming for Engineers, Chapman, Thomson Learning
06. Getting Started with MATLAB, Rudra Pratap, Oxford University Press
07. Mastering MATLAB 7, Hanselman and Littlefield, Pearson Education
MINOR (CP)

MACHINE DYNAMICS AND DESIGN (4-0-0) PME7G001
[Only specified design data book as mentioned in the syllabus is permitted during examination]

Module – I : (10 Lectures)
1. Kinematic fundamental: Basic Kinematic concepts and definitions, Degrees of freedom, Elementary Mechanism : Link, joint, Kinematic Pair, Classification of kinematic pairs, Kinematic chain and mechanism, Inverse criterion, Inversion of mechanism, Inversions of Four bar linkage, Single slider crank mechanism and Double slider crank mechanism.

Module – II : (10 Lectures)
3. Friction Effects: Friction between pivot and collars, single, multi-plate and cone clutches, friction circle, friction axis. Classification of brakes, Analysis of internal expanding shoe brake, Absorption and transmission dynamometers, Rope brake dynamometer, Belt transmission dynamometer, Belt drives, Initial tension, Effect of centrifugal tension on power transmission, Maximum power transmission capacity, Belt creep and slip.

Module – III : (6 Lectures)

Module – IV : (10 Lectures)
7. Machine Element Design: Design of Joints: Rivets and welds based on different types of loading, Boiler joints, Socket and Spigot cotter joint and knuckle joint.
B.Tech (Mechanical Engineering) detail Syllabus for Admission Batch 2015-16  7th Semester

Text Books
1. Kinematics and Dynamics of Machinery by R L Norton, Tata MacGraw Hill
3. Theory of Machines by S.S.Rattan, Tata MacGraw Hill

Reference Books
1. Theory of Machines by Thomas Bevan, CBS Publications
5. Design of Machine Elements by C. S. Sharma and K. Purohit, PHI

DESIGN DATA HAND BOOKS:
1. P.S.G. Design Data Hand Book, PSG College of Tech Coimbatore
3. Design Hand Book by S.M.Jalaluddin ; Anuradha Agencies Publications

SOFT COMPUTING

MODULE-I (12 Lectures)

(BOOK-1:- Chap-1: 1.1 to 1.3, Chap-2: 2.1 to 2.4, Chap-3: 3.2 to 3.4 & Chap-4: 4.2 to 4.5)

MODULE-II (14 Lectures)
Neural Networks: Neuron Abstraction, Neuron Signal Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feed forward and Feedback, Salient Properties and Application Domains of Neural Networks, Multi-layered Network Architectures, Back-propagation Learning Algorithm, Practical Considerations in Implementing the BP Algorithm, Structure Growing Algorithms, Universal Function Approximation and Neural Networks, Applications of Feed Forward Neural Networks, Reinforcement Learning, Radial Basis Function Networks, Regularization Theory Route to RBFNs, Generalized Radial Basis Function Network, Learning in RBFNs, Associative Learning, Hopfield Network, Content Addressable Memory,
Bidirectional Associative Memory, Self Organizing Feature Maps, Applications of the Self Organizing Map.

(BOOK-2: Chap-3: 3.1 to 3.6, Chap-6: 6.1 to 6.2, 6.5 to 6.6 & 6.8 to 6.10, Chap-8: 8.4 to 8.7, Chap-10: 10.2 & 10.5 to 10.6 & 10.16 and Chap-12: 12.8 to 12.9)

MODULE-III (08 Lectures)


(BOOK-1: Chap-5: 5.1, 5.3 to 5.5, Chap-7: 7.2 to 7.5 and Chap-12: 12.2 to 12.3)

TEXT BOOK:
2. “Neural Networks: A Classroom Approach” By Satish Kumar, TMH Education

Reference Book:

PROFESSIONAL ELECTIVE

MECHATRONICS AND MICRO ELECTRO MECHANICAL SYSTEMS

(PME7J006)

MODULE I (10 HOURS)
Evolution of Mechatronics, components of mechatronic system, types of mechatronic products, Signal theory, signal analysis and processing. Basic electronics devices: junction diodes, Bipolar transistors Basic Digital Technology: Digital number system, Binary number system, Hexadecimal number system, Binary addition, Boolean Algebra, Logic function, Universal GATES, FLIP-FLOP, Registers counters.

MODULE II (10 HOURS)
System modeling: Frequency response, Mechanical system, electrical system, Thermal system, Fluid system. Actuators- Electric motors; D.C. Motors, Stepper motor, , Hydraulic actuators, Pneumatic actuators Transducer and Sensors : Principles, difference between transducer and sensors, transducer types – photo emissive, photo conductive, photovoltaic, thermistors, Thermocouple, Inductive, capacitive, Peizoelectric,

MODULE III (10 HOURS)
Overview of MEMS and Microsystems. Micromachining Techniques: Silicon as material for micromachining, Photolithography, thin film deposition, doping, wet and dry etching, surface and bulk micromachining, Wafer bonding, packaging.

MODULE IV (10 HOURS)
Microsystem Modeling and Design: Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage. MEMS Applications: Mechanical sensors and
actuators: Piezoresistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, Piezoelectric actuators.

TEXT BOOKS
1. A Text Books of Mechatronics, R.K. Rajput, S. Chand & company

REFERENCE BOOKS:
2. Mechatronics, A. Smaili & F Mrad, Oxford University Press