COURSE STRUCTURE

BATCH: 2017-2021

(UPDATED AS PER BOS 03 JUNE, 2017)

DEPARTMENT OF MECHANICAL ENGINEERING
INSTITUTE OF ENGINEERING & TECHNOLOGY
Table of Contents

B.Tech. (ME) Course Structure .................................................. (i)
B.Tech. (ME) Syllabus ................................................................. (1)
COURSE STRUCTURE

B.TECH.(ME)
Course Curriculum (w.e.f. Session 2017-18)
B.Tech. (Mechanical Engineering)

ABOUT THE PROGRAM

The Department offers a 4-Year Undergraduate Program in Mechanical Engineering (B. Tech.). Excellent facilities in terms of equipment and staff are available to prepare students as professional mechanical engineers with a focus on innovation, analysis, and development of technologies. Excellent infrastructural facilities exist for academic development of the students. The Department believes in the philosophy that the students can apply theoretical knowledge to practice and exploration that eventually leads to experiential learning. The laboratories and workshops in the Department have the finest equipment and are maintained impeccably. Dedicated faculty members keep pace with new trends and developments in the sphere of mechanical engineering. With technological advancement, the significance of machines and tools can hardly be debated. The Mechanical Engineering Department boasts of strength in the areas of production, thermal science, automobile engineering, CAD/CAM, designing, industrial engineering, total quality management, etc. Constant and careful attention to the departmental infrastructure has immensely helped in keeping it up-to-date, thus equipping the students with the necessary tools to acquire technical know-how.

**Workshop:** It helps the students train themselves in machine shops consisting of lathe machines, milling machines, shaper, planer, slotter, smithy, carpentry, welding, etc. Due attention is paid in imparting fundamental knowledge to the students as well as specialization of the subject.

**Engineering Mechanics Lab:** This lab consists of experimental set-ups to familiarize students with the relationship between external forces and behavior of objects under equilibrium in different configurations.

**Material Science and Testing Lab:** This lab is equipped with various testing machines like universal testing machine of 40T capacity, torsion testing machine, impact testing machine, hardness testing machine, metallurgical microscopes, and polishing machine, etc.

**Fluid Machine Lab:** This lab is vital for mechanical engineering students. This lab contains turbines like Pelton wheels, Francis and Kaplan of 5 H.P. capacities. It also includes the working test rigs of hydraulic ram, reciprocating and centrifugal pumps.

**Heat and Mass Transfer Lab:** The lab is well equipped with appropriate apparatus explaining the principles of heat transfer. It includes the test rig of thermal conductivity, specific heat of air test rigs, pin fin apparatus, Stephen Boltzmann const. Apparatus, heat flux apparatus, etc.

**Kinematics and Dynamics of Machine Lab:** This lab helps the students know about various types of linkage mechanisms like Watt, steering, quick return, etc. It also includes the working kits of governors, balancing equipment, vibration kit, belt drives, cam analysis, gear trains, Coriolis components, etc.

**Refrigeration and Air Conditioning Lab:** This lab enables the students to know about various types of refrigeration and air conditioning systems. This lab consists of test rigs of air conditioning and refrigeration.

**Measurement Lab:** This is an essential lab of the mechanical engineering department. It consists of various measuring instruments like sine bar, slip gauges, dial indicators, pressure measurements and temperature measurements, equipment, filler gauges, vernier calipers, etc.

**CAD/CAM Lab:** This lab includes the CNC lathe machine trainer and CNC machines. It also has simulation software of lathe machine and milling machine along with a robotic kit. This lab contains 65 computers of well-suites configuration and license software like Auto-CAD, Inventor series, & Pro/Engineer.

**Automobile Lab:** This lab contains various working models and experimental setups like 2-stroke and 4-stroke engines, steering system, suspension system, electrical & lighting system, fuel supply and ignition system, etc.
## First Semester

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE</th>
<th>SUBJECT</th>
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# Course Curriculum (w.e.f. Session 2017-18)

## B.Tech. (Mechanical Engineering)

### Fifth Semester

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## Course Curriculum (w.e.f. Session 2017-18)

### B.Tech. (Mechanical Engineering)

#### Seventh Semester

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<td>Elective 1</td>
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<td>5.</td>
<td>MEE XXXX</td>
<td>Open Elective</td>
<td>3 1 0</td>
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</table>

**PRACTICALS**

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE</th>
<th>SUBJECT</th>
<th>TEACHING SCHEME</th>
<th>CREDITS</th>
<th>CONTACTS HR/WK</th>
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<tr>
<td>6.</td>
<td>MEE 7181</td>
<td>Automobile Engineering Lab</td>
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<td>7.</td>
<td>MEE 7082</td>
<td>CAD/CAM Lab</td>
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<td>8.</td>
<td>MEE 7083</td>
<td>Project</td>
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<td>9.</td>
<td>MEE 7084</td>
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<td>10.</td>
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#### Eighth Semester

<table>
<thead>
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<th>CODE</th>
<th>SUBJECT</th>
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<tbody>
<tr>
<td>1.</td>
<td>MEE 8001</td>
<td>Operations Research</td>
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<td>2.</td>
<td>MEE 8002</td>
<td>Industrial Engineering</td>
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<td>3.</td>
<td>MEE 8021-8025</td>
<td>Elective - 2</td>
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<td>4.</td>
<td>MEE 8041-8045</td>
<td>Elective - 3</td>
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<td>5.</td>
<td>MBA XXXX</td>
<td>Industrial Economics</td>
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</table>

**PRACTICALS**

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE</th>
<th>SUBJECT</th>
<th>TEACHING SCHEME</th>
<th>CREDITS</th>
<th>CONTACTS HR/WK</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>MEE 8082</td>
<td>Advanced Software Lab</td>
<td>0 0 2</td>
<td>1</td>
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<tr>
<td>7.</td>
<td>MEE 8083</td>
<td>Project</td>
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<td>MEE 8099</td>
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# List of Open Electives/Electives

<table>
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<tr>
<th>S. NO.</th>
<th>CODE</th>
<th>SUBJECT NAME</th>
<th>S. NO.</th>
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<tr>
<td>1</td>
<td>MEE 7066</td>
<td>Total Quality Management</td>
<td>6</td>
<td>MEE 8025</td>
<td>Robotics &amp; FMS</td>
</tr>
<tr>
<td>2</td>
<td>MEE 7065</td>
<td>Supply Chain Management</td>
<td>7</td>
<td>MEE 8041</td>
<td>Industrial Automation &amp; Control Systems</td>
</tr>
<tr>
<td>5</td>
<td>MEE 7062</td>
<td>Renewable Energy Resources and Its Utilization</td>
<td>8</td>
<td>MEE 8042</td>
<td>Mechanical Vibrations</td>
</tr>
<tr>
<td>4</td>
<td>MEE7061</td>
<td>Entrepreneurship Development Program</td>
<td>9</td>
<td>MEE 8023</td>
<td>Mechatronics</td>
</tr>
<tr>
<td>5</td>
<td>MEE 7063</td>
<td>Project Management</td>
<td>10</td>
<td>MEE 8022</td>
<td>Finite Element Method</td>
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<td>Electives</td>
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<td>MEE 8021</td>
<td>Basics of Nano Technology</td>
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<td>1</td>
<td>MEE 8044</td>
<td>Product Development &amp; Design</td>
<td>12</td>
<td>MEE 8043</td>
<td>Modern Manufacturing Processes</td>
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<tr>
<td>2</td>
<td>MEE 7023</td>
<td>Micro Manufacturing</td>
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<td>MEE 7021</td>
<td>Composite Materials</td>
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<td>3</td>
<td>MEE 8024</td>
<td>Power Plant Engineering</td>
<td>14</td>
<td>MEE 7024</td>
<td>Reliability &amp; Maintenance Engineering</td>
</tr>
</tbody>
</table>

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Course Curriculum (w.e.f. Session 2017-18)

B.Tech. (Mechanical Engineering)

DEPARTMENT OF MECHANICAL ENGINEERING, Institute of Engineering & Technology
SYLLABUS

B.TECH. (ME)
AHM-1201: ENGINEERING MATHEMATICS I

Course Objectives: To make the students understand the concepts of differential calculus, differential equations and matrices by giving more emphasis to their applications in engineering.

Credits: 04

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours (Approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Differential Calculus</strong>: Partial differentiation, Euler's theorem for homogeneous functions, Composite functions, Total derivatives, Expansion of functions of several variables, Asymptotes and Curve Tracing (in Cartesian coordinates), Jacobian and its properties, Extrema of functions of several variables using Lagrange's multipliers.</td>
<td>13</td>
</tr>
<tr>
<td>II</td>
<td><strong>Matrices</strong>: Elementary transformations, Rank by echelon form, Consistency and Solution of system of linear equations, Complex matrices, Eigen values and Eigenvectors, Cayley–Hamilton theorem &amp; its applications. <strong>Ordinary Differential Equations I</strong>: Solution of Exact and Reducible to exact differential equations.</td>
<td>13</td>
</tr>
<tr>
<td>III</td>
<td><strong>Ordinary Differential Equations II</strong>: Solution of $n^{th}$ order linear differential equations with constant coefficients, Euler-Cauchy Equations, Simultaneous differential equations, Solution of II order differential equations by method of reduction of order, Reduction to normal form, Change of independent variable and Method of variation of parameters, Applications of second order differential equations in electrical circuits and mechanical systems.</td>
<td>14</td>
</tr>
</tbody>
</table>

Learning Outcomes:
After studying these topics, the student will be able to
- Understand partial differentiation and its applications
- Trace the curves in Cartesian coordinates
- Find rank of a matrix & its applications in solving systems of linear equations
- Solve the ordinary differential equations and know their applications in engineering

Text Books:

Reference Books:
# AHP 1101: ENGINEERING PHYSICS

**Objective:** The Syllabus is designed and styled especially to give B.Tech. I year students a sound base in fundamental physics as well as to give their exposure to a wide range of its utility in engineering and technology.

**Credits:** 04  
**Semester I**  
**L–T–P:** 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Interference & Diffraction:** Principle of superposition, Coherent Sources, Interference due to division of wave front- Biprism experiment and division of amplitude- Interference in thin films, Newton’s rings Expt; Diffraction of light, Fresnel and Fraunhoffer diffraction, Diffraction due to single slit and N-slits (Grating).  
**Polarization:** Concept of polarization of light, Phenomenon of double refraction, Superposition of ordinary and extra ordinary rays: Plane, Circularly and elliptically polarized light, quarter and half wave plates, Optical activity, Fresnel’s theory for optical rotation, Specific rotation, Biquartz polarimeter. | 20 |
| II         | **Solid State Physics & Superconductivity:** Bands in solids, band formation in solids, Fermi level and Fermi energy, temperature dependence of conductivity in semiconductors, Hall effect, Temperature dependence of resistivity in superconducting materials, Meissner effect; Type I and Type II superconductors, Temperature dependence of critical field, Applications of superconductors. Introduction of nanoscience and nanotechnology with applications.  
**Electromagnetics & Dielectrics:** Gauss law in electrostatics, Ampere’s law, Faraday law, Maxwell’s equations (Integral and Differential forms), Equation of continuity, Inconsistency in Ampere’s law: Displacement current, Propagation of E-M waves in free space and in conducting media, Poynting theorem and Poynting vector, Dielectric behavior of materials. | 20 |
| III        | **Relativistic Mechanics:** Basic Concepts, Inertial & non-inertial frames, Galilean Transformations, Michelson- Morley experiment; Einstein’s postulates, Lorentz transformation equations; Length contraction, Time dilation, Addition of velocities, Variation of mass with velocity, Mass energy equivalence.  
**Wave Mechanics & X-ray Diffraction:** Wave - particle duality, de-Broglie hypothesis, Phase and group velocities: wave packet, Heisenberg’s uncertainty principle and its applications; Wave function and its normalization, Schrödinger’s wave equation: time dependent and time independent wave equations, Particle in one dimensional potential box; Bragg’s law, Compton’s effect. | 20 |

**Text Books:**

**Reference Books:**
- Optics - Ajoy Ghatak (TMH)
- Fundamental of Physics - Resnick, Halliday & Walker (Wiley)
- Concept of Modern Physics - by Beiser (Tata Mc-Graw Hill)
- Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
- Introduction to Electrodynamics by David J. Griffith (Prentice Hall of India)
- Solid State Physics by S.O. Pillai (New Age International Publishers)

**Outcome:**
- After completing the course the B.Tech. I year students would be able to apply the subject knowledge in engineering science and technology.
- A student of ordinary caliber can comprehend the theoretical aspects easily without much strain and difficulty.
- Teaching-learning methodology of the course is such that the elementary knowledge of a student raises gradually to its complex aspects during the completion of the course program.
AHC 1101: ENGINEERING CHEMISTRY

**Objective:** The subject intends to provide understanding of the fundamental concepts of Chemistry applicable in Engineering Sciences with the emphasis on the latest technological advancements thereby preparing the students for a rewarding career in science and technology.

**Credits:** 04

**Semester I/II**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Chemical Bonding: M.O. theory and its applications in homo &amp; hetero diatomic molecules. Hydrogen bond, metallic bond and their applications. Semiconductors. <strong>Reaction intermediates</strong> (carbocation, carbanion &amp; free radical). Types of isomerism (optical and geometrical) chirality, elements of symmetry, diastereomers, optically active compounds, R-S configuration and E-Z geometrical isomers, conformation of ethane and n-butane. <strong>Fuels:</strong> Definition and classification of fuels. Analysis of coal and determination of calorific value by bomb calorimeter. <strong>Synthetic petrol:</strong> Bergius and Fischer Tropsch methods <strong>Lubrication:</strong> Introduction, classification, properties &amp; uses of lubricants. <strong>Ceramics:</strong> Introduction, classification, scope &amp; applications.</td>
<td>15</td>
</tr>
<tr>
<td>II</td>
<td>Polymers: Polymerization and its classification. Preparation, properties and uses of polymers: Thermoplastics (Polystyrene, Teflon and Nylon 66), Thermosetting polymer (Bakelite). Biodegradable polymers (PLA, poly β-hydroxy butyrate), molecular weights of polymers, natural rubber and its vulcanization, synthetic rubber (neoprene, Buna-S, Buna-N). <strong>Water Treatment:</strong> Introduction, hardness and its units, L-S Process, calgon process, zeolite and ion-exchange processes, reverse osmosis, treatment of municipal water, impurities in water, boiler feed water, boiler troubles and remedial measures <strong>Functional materials:</strong> Biomaterials, smart materials (piezoelectric, pyroelectrics &amp; ferroelectrics) and advanced materials. <strong>Glass:</strong> Preparation, varieties &amp; uses.</td>
<td>16</td>
</tr>
<tr>
<td>III</td>
<td>Corrosion: Introduction, consequences, types, theories of corrosion, (galvanic, pitting, stress, water line, intergranular &amp; soil corrosion) and protection of corrosion. <strong>Spectroscopy:</strong> Elementary ideas and simple applications of UV, visible, infrared and NMR spectral techniques <strong>Chemical Kinetics:</strong> Order and molecularity of reactions, zero order, first and second order reactions. Integrated rate equations. Theories of reaction rates, factors affecting rate of reaction. pH, buffer solution (Henderson-Hasselbach equation). <strong>Introduction to Nanoscience &amp; Nanotechnology:</strong> Basic concepts of nanoscience and nanotechnology, fullerenes, graphenes, carbonnanotubes, principle and uses of SEM &amp; TEM techniques. Applications of nanomaterials.</td>
<td>17</td>
</tr>
</tbody>
</table>

**Text Book:**

**Reference Books:**
Course Curriculum (w.e.f. Session 2017-18)

B.Tech. (Mechanical Engineering)

- Malik, Tuli and Madan “Selected topics in Inorganic chemistry”, 7th edition, S. Chand and Co.ltd.

Outcome:
- Knowledge of Chemical Sciences for better appreciation of applications in engineering field.
- The students will develop thorough understanding of the fundamental concepts of Chemistry and its applications in the field of various Engineering Sciences such as Electrical, Mechanical, Environmental, Civil and Material Sciences and Technology.
- The student’s ability to perform experiments, analyze and interpret the data of experiments will be enhanced.
- The students will be acquainted with recent technological advancements and thus will be better equipped for a rewarding career in science and technology.
CSE 1101: FUNDAMENTALS OF COMPUTER & PROGRAMMING

Objective: To impart adequate knowledge on the need of problem solving techniques and develop programming skills using the fundamentals and basics of C Language.

Credits: 03  Semester I  L–T–P: 2–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td><strong>Operators and Expression</strong>: Assignment, Unary, Arithmetic, Relational, Logical, Bitwise, Conditional, Special operators and their precedence &amp; Associativity. IEEE representation of data types like float &amp; double, Lvalue and Rvalue. <strong>Type Conversion</strong>: Type Promotion in expression, Conversion by Assignment, Truncation and Casting Arithmetic expression. <strong>Decision and Case Control Structure</strong>: if, if-else, nested if-else, Decisions using switch, switch versus if-else ladder, goto. <strong>Loop Control Structure</strong>: For loop, while loop, do-while loop, nesting of loops, break, and continue.</td>
<td>7</td>
</tr>
<tr>
<td>III</td>
<td><strong>Arrays</strong>: Introduction, one dimensional and two dimensional Array-Declaration, Initialization, Address Calculation. <strong>Operations on Arrays</strong>: Insertion, Deletion, Linear Search &amp; Bubble Sort. <strong>String</strong>: Introduction, One dimensional and two dimensional Array-Declaration, Initialization. <strong>Operations on String</strong>: Length, Copy, Reverse, Concatenate, Compare with &amp; without built-in functions.</td>
<td>7</td>
</tr>
</tbody>
</table>

Text Book:

Reference Books:

Outcome: At the end of the course, students will be able to understand:
- A new programming language well enough to implement simple algorithms.
- The strengths and weaknesses of programming languages as well as the domains for which they are intended.
- The implementation, testing, debugging, and documentation procedures of programs in C.
MEE 1001: APPLIED MECHANICS

**Objective:** The aim of the applied mechanics is to teach the basic analytical methods that is the fundamental concepts and techniques of engineering mechanics. It describes and predicts the condition of rest or motion of solid under the action of forces. This shows the implementation of these methods in basic engineering design.

**Credits: 04**

<table>
<thead>
<tr>
<th>Semester I/II</th>
<th>L-T-P: 3–1–0</th>
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</table>

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
**Force Systems And Equilibrium:** Concurrent forces in a plane, Parallel forces in a plane, Free Body Diagram, Equation of equilibrium and their applications to various systems of forces.  
**Friction:** Concepts of friction, Dry friction, Laws of friction and their applications to wedge, ladder, screw, belt-pulley system, Rolling friction. | 14 |
| II         | **Distributed Forces and Moment of Inertia:** Centroid of Composite figures, Area Moment of Inertia, Polar Moment of Inertia, Parallel axis theorem, Perpendicular axis theorem, Principle Moment of Inertia, Mass Moment of Inertia of circular ring, disc, cylinder, sphere and cone about their axis of symmetry.  
**Beams:** Different support & load conditions, Shear Force and Bending Moment Diagrams for point load, uniformly distributed load, uniformly varying load. | 12 |
| III        | **Analysis of Plane Trusses:** Engineering structures, Perfect Truss, Determination of axial forces in the members, Method of Joints, Method of Section.  
**Kinematics of Rigid Body:** Plain motion of rigid body, Velocity and acceleration under translation and rotational motion, Absolute motion, Relative motion.  
**Kinetics of Rigid Body:** Force, Mass and Acceleration, Work, Power and Energy, Impulse and Momentum, D’Alembert’s Principle and dynamic equilibrium. | 14 |

**Text Books:**
- “Engineering Mechanics” – Statics & Dynamics by Dr. A.K. Tayal, Umesh Publications, Delhi

**Reference Books:**
- “Mechanics for Engineers” – (Statics and Dynamics) F.P. Beer & E.R. Johnston, TMH New Delhi

**Outcome:** At the end of the course the student will be able to:
- Understand the representation and analysis of forces, moments, and equilibrium of particles and rigid bodies, Concept and principles of work and energy.
- The effect of friction and its role in engineering applications.
- Develop basic know how and awareness to deal with real life applications in various fields of engineering.
MEE1102: BASIC MECHANICAL ENGINEERING

Objective: Precise thermodynamics education is a requirement to discuss issues that one faces in thermodynamics and resulting studies in global warming, energy conversion and other energy related topics that affect sustainability of the environment in the global sense. Also introduce the students to various basic manufacturing processes carried out in various industries very commonly.

Credits: 04

Semester I/II

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Fundamentals of Thermal Engineering:</strong> Thermodynamic systems, State &amp; properties, Thermodynamic equilibrium &amp; processes, Heat &amp; work, Work done for different polytrophic processes, Zeroth law of thermodynamics and its applications, First law of thermodynamics, Steady flow energy equation, Application of first law to various thermodynamic systems and its limitations.</td>
<td>13</td>
</tr>
<tr>
<td>III</td>
<td><strong>Casting Process:</strong> Patterns and types of patterns and their allowances, Moulding sand and its properties, Elements of gating system, Casting defects. <strong>Machining Processes:</strong> Working principle and operations of Lathe and Drill Machine. <strong>Fabrication processes:</strong> Introduction and classification of welding, principle and applications of Shielded Metal Arc Welding and Gas Welding.</td>
<td>14</td>
</tr>
</tbody>
</table>

Reference Books:
- Joel R.: Basic Engineering “Thermodynamic”s, Addison Wesley.

Outcome: At the end of the course the student will be able to:
- Understand the basic laws of thermodynamics and their applications in engineering.
- Understand the processes and operations of metal joining, fabrication casting and machining with applications.
- Develop basic know how and awareness of various manufacturing processes.
**Course Curriculum (w.e.f. Session 2017-18)**

**B.Tech. (Mechanical Engineering)**

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**DEPARTMENT OF MECHANICAL ENGINEERING**

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**EEE 1001: ELECTRICAL ENGINEERING**

**Objective:** The objective of the course is to give a glimpse of Electrical Engineering as a discipline. Each and every household as well as industrial unit uses numerous electrical devices daily. Indeed, modern day living is unthinkable without electricity. It is imperative for the students to know how the electricity is generated, transmitted to the consumer and utilized. After going through this course, the students will be aware of the working principles of the electrical devices around them and safety precautions while handling them.

**Credits:** 04  
**Semester I/II:** L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **DC circuit analysis & Network theorems:** Fundamentals of electric circuits, Kirchhoff’s laws, mesh analysis, node analysis, Thevenin theorem, maximum power transfer theorem, superposition theorem.  
**Steady state AC analysis:** AC fundamentals, average & rms values of different AC waveforms, phasor algebra, analysis of series AC circuits, power triangle, concept of power factor, power factor improvement. | 13             |
| II         | **Three phase AC circuits:** Generation & advantages of three phase system, star & delta connection, line & phase voltage/current relations.  
**Magnetic circuits:** Faraday’s law, Self and mutual inductance, B-H characteristics, hysteresis & eddy current losses, basics of magnetic circuit.  
**Single phase Transformers:** Constructional feature, Working Principle, EMF equation, Ideal transformer, Equivalent Circuit, Phasor diagram, Definition of voltage regulation and efficiency, Introduction to Auto-Transformer. | 13             |
**Electrical Installation and Illumination:** Introduction to distribution of electrical energy, Types of cables & switches, Electrical wiring. Fluorescent sodium vapour and mercury lamp. | 14             |

**Text Books:**

**Reference Books:**

**Outcome:** After completion of course, students will be able to:
- Understand the basic concepts of magnetic, DC & AC circuits.
- Explain the working principle, construction, applications of DC & AC machines.
- Gain basic knowledge about the switches, cables, wirings and lamps.
ECE 1001: ELECTRONICS ENGINEERING

**Objective:** The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering.

<table>
<thead>
<tr>
<th>Credits: 04</th>
<th>Semester I/II</th>
<th>L–T–P: 3–1–0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module No.</td>
<td>Contents</td>
<td>Teaching Hours</td>
</tr>
<tr>
<td>I</td>
<td><strong>Transport phenomenon in semiconductors:</strong> Semiconductor materials; Intrinsic and Extrinsic semiconductors; Mass-action law, Drift and diffusion of charge carriers. <strong>Junction diodes:</strong> P-N Junction diode: construction, operation &amp; characteristics; Zener and Avalanche breakdown mechanisms; Diode resistance and capacitance; Photo-diode and LED. <strong>Diode applications:</strong> Rectifiers: half wave, full wave : Centre-tapped and bridge type.; Filters; Clippers; Clamps; Voltage Multipliers; Zener diode as voltage regulator; Regulated power supply.</td>
<td>14</td>
</tr>
<tr>
<td>II</td>
<td><strong>Bipolar Junction Transistor (BJT):</strong> Bipolar junction transistor: construction &amp; operation; CB, CE, CC configurations &amp; their Characteristics; Operating point; Transistor as a switch; Need of biasing; Biasing methods: fixed bias, emitter bias, potential divider bias, voltage feedback bias; Bias stabilization; Stability factor; h-parameters; Small signal analysis of Single stage BJT amplifier. <strong>Field Effect Transistor (FET):</strong> Construction, operation &amp; characteristics of JFET; Shockley's equation; Depletion &amp; Enhancement type MOSFET; Biasing of JFET: fixed bias, self-bias and voltage divider bias; Biasing of depletion type &amp; enhancement type MOSFET.</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td><strong>Digital Electronics:</strong> Number systems; Binary Addition &amp; Subtraction; 1’s and 2’s complement, Subtraction using 2’s complement; Boolean algebra; Logic gates; Implementation of basic gates using universal gates; Realization of Boolean functions using basic &amp; universal gates; Canonical forms(SOP &amp; POS); Simplification of Boolean functions using Boolean postulates &amp; K-map up to 4 variables with don’t care condition. <strong>Operational Amplifier (Op-Amp):</strong> Operational amplifier: Block diagram, ideal and practical Op-Amp characteristics; Inverting, non-inverting and differential configurations (open loop and closed loop); Applications of Op-Amp as buffer, adder, subtractor, integrator and differentiator.</td>
<td>13</td>
</tr>
</tbody>
</table>

**Text Book:**

**Reference Books:**
- Morris Mano, "Digital design", Pearson Education.

**Outcome:** After completion of course, student will be able to:
- **Explain the theory, construction, and operation of basic electronic devices.**
- **Use the basic electronic devices**
## Course Curriculum (w.e.f. Session 2017-18)

### B.Tech. (Mechanical Engineering)

**AHE 1101: ENGLISH LANGUAGE SKILLS FOR COMMUNICATION-I**

**Objective:** The core objective of this course is to equip the students with the essential knowledge of basic English grammar, common vocabulary, writing strategies and reading skills thereby enable them to read, write and speak English with considerable accuracy and confidence.

**Credits:** 02  
**Semester:** I  
**L–T–P:** 2–0–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | Parts of Speech: Noun, kinds & usage  
             Pronoun, kinds & usage  
             Adjectives & their degrees  
             Articles: Definite and Indefinite articles  
             Paragraph Writing: Small paragraphs on given topics  
             Vocabulary: Words of functional usage  
             Text: 'The Eyes are Not Here' by Ruskin Bond | 10 |
| II         | Verb: Main verbs & auxiliary verbs  
             Forms of verbs  
             Transitive and intransitive verbs  
             Modal auxiliaries  
             Adverb: Usage and positioning of adverb  
             Text: 'After Twenty Years' by O’Henry | 8 |
| III        | Preposition  
             Tenses and Usage: Present, past and future  
             Correction of Errors: Error correction on the topics covered in all the three modules  
             Reading Comprehension (Unseen)  
             Text: 'What We Must Learn from the West' by Narayana Murthy | 8 |

**Recommended Reading:**

*English Teacher* by R.K. Narayan

**References:**

Course Handbook (Collection of Short Stories, One Act Play & Essays)  
English Grammar in Use by Raymond Murphy, IV Edition, Cambridge University Press, UK  
Living English Structure by W.S. Allen, Pearson India

**Outcome:** After the completion of the course students will be able to:

- Write grammatically correct English while expressing themselves in textual answers and paragraph writing.
- Identify common English errors and correct them.
- Read to understand, evaluate, analyze and discuss through text and reading comprehension.
- Communicate well with others in correct English.
AHE 1181: ENGLISH LANGUAGE LAB-I

Objective: The objective of this course is to provide the learners with an opportunity to practice listening and speaking skills – the two most important aspects of language learning - enabling them to speak fluently and correctly using standard pronunciation. The course also aims at giving them a platform to practice language in various social and professional settings.

Credit: 01 Semester: I L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | Audio Visual Material for Listening and Speaking  
The Power of English: How English became a global language  
Entry level recording by students  
Sounds of English RP (Practice with IPA)  
Duncan’s Speech  
**Speaking Activities:**  
Introduction of the Students  
Practicing pronunciation (with the help of dictionary)  
Describing objects  
Picture Analysis | 10 |
| II         | Audio Visual Material for Listening and Speaking:  
‘Slow Poisoning of India’: A documentary on Environmental issues  
Video clips from ‘Water Horse’  
‘Enterprising India’: Interview of Ratan Tata & Narayan Murthy  
**Speaking Activities:**  
Discussion on environmental issues  
Review of ‘Water Horse’  
Role plays on real life situations: Focus on the use of verbs and adverbs | 8 |
| III        | Audio Visual Material for Listening and Speaking:  
Varieties of English (Indian, American and British): video clips of these varieties  
Narration in Present tense: (documentary on ‘Holy Ganges’)  
Narration in Past tense: ‘Robin hood-II’  
Future Tense: Video on use of future tense  
Exit level recording  
**Speaking Activities**  
Describing places/routine  
Story Narration/Describing a past event  
Description of future plans/goals | 9 |

Audio-Visual Material:
Material available in the Language Lab.

References:
Mohan, Krishan & N.P. Singh, Speaking English Effectively, Macmillan India Ltd., New Delhi
Cambridge English Pronouncing Dictionary by Daniel Jones

Outcome: After the completion of the course students will be able to:
- Listen and understand English correctly.
- Acquire correct pronunciation.
- Improve their vocabulary.
- Enhance speaking skills, confidence and overcome hesitation in conversing in English.
MEE1082: ENGINEERING WORKSHOP PRACTICE LAB

Objective: The purpose of this lab is to enable the students to have the practical skills for basic workshop practices e.g. Marking out, drilling, turning, milling and grinding. The student will also have practical exposure to various welding and joining processes along with various moulds preparation for castings in Foundry shop.

Credits: 01
Semester I/II
L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>List of Experiments</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>To study the working of basic machine tools like Lathe m/c, Shaper m/c, Drilling m/c and Grinding m/c.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To perform the following operations on Centre Lathe:</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Turning, Step turning and Taper turning</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Facing, Grooving and Knurling</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To perform the operations of Marking, Filing and Sawing on the given metallic work-piece (M.S.) as per given dimensions.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To perform the operations of drilling of making the holes on the given metallic work-piece (M.S.) by use of Drilling machine.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To perform the operations of making external and internal threads by use of Tapes and Dies.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To develop the blank dimensions for the given product using development process.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To prepare a Funnel of required dimensions using joining processes.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To prepare Lap/Butt joint by an Electric Arc welding.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To prepare Lap/Butt joint by Gas welding.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To perform different operations in Carpentry shop such as cutting, planning and chiseling on the given wooden piece.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To prepare a joint (Lap/T) by using wooden specimen/piece.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To prepare a Sand mould for solid casting with the help of given pattern.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To prepare the mould for hollow casting with the help of pattern and core.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>To prepare square bolt head by upsetting process in Black Smithy shop.</td>
<td>36</td>
</tr>
</tbody>
</table>

Outcome: On successful completion of this lab, the students will be able to:

- Demonstrate an understanding of and comply with workshop safety regulations.
- Select and perform a range of machining operations to produce a given job.
- Identify and use marking out tools, hand-tools, and measuring equipments and to work to prescribed tolerances. Acquire knowledge of welding, joint design and the application of welding.
MEE 1083: ENGINEERING DRAWING

Objective: To know about different types of lines & use of different types of pencils in an Engineering Drawing. To know about different types of projection. To know projection of points, straight lines, solids etc. To know development of different types of surfaces. To know about isometric projection. To know fundamentals of AUTO-CAD. Basics of dimensioning, Lettering & representation of lines.

Credits: 01

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Lab Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Introduction to drawing instruments, sheet layout, types of lines and their uses, lettering, types of dimensioning, application of symbols and conventions in drawing practice, geometrical construction. Concepts of scales in drawing and their types  
**Theory of projections:** Introduction of projections, Orthographic & Pictorial projection,  
**Orthographic projection:** Projection of points, lines, planes and solids. Section of solids,  
**Isometric projection:** Concepts of isometric and perspective views. Conversion of pictorial views to orthographic views and vice versa. Development of surfaces & Computer Aided Drawing using Auto CAD. | 24        |

Text Books:

Reference Books:

Outcome: At the end of the course the student will be able to:
- Use common drafting tools to construct engineering drawings and apply dimensions on engineering drawings.
- Create, construct and Interpret views and sectional views and projections.
- Create isometric and oblique sketches and identify standard features Use SI units, and standards scales to produce engineering drawings.
- Produce engineering drawings using computer aided drafting (CAD) system to improve visualization skills.
AHP1081: ENGINEERING PHYSICS LAB

Objective: 14 no. of experiments based on theoretical aspects are set in laboratory to give B.Tech Students a sound practical knowledge in fundamental and applied physics.

Credits: 01

Any twelve experiments, at least five from each group

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Lab Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Group -A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To determine the wavelength of monochromatic light by Newton’s rings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To determine the wavelength of monochromatic light with the help of Fresnel’s biprism.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To determine the specific rotation of cane sugar solution using polarimeter.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To determine the wavelength of spectral lines using plane transmission /diffraction grating.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To determine the wave length of laser light by diffraction grating method.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To verify Stefan’s law by electrical method.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To determine high resistance by leakage method using digital D.C. microvoltmeter.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group – B</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>To determine the specific resistance of the material of a given wire using Carey Foster’s bridge.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To study the variation of magnetic field along the axis of current carrying circular coil and then to estimate the radius of the coil.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To calibrate the given ammeter by potentiometer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To calibrate the given voltmeter by potentiometer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To study the Hall Effect and determine Hall coefficient, carrier density and mobility of a given semiconductor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To determine the energy band gap of a given semiconductor material.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measurement of resistivity of semiconductor by four probe method at different temperatures and determination of the band gap.</td>
<td></td>
</tr>
</tbody>
</table>

Outcome:
- B.Tech. Students learn about the applications of basic-laws, principles and concepts of Engineering Physics in the various fields of science and technology.
- Practical training of a student reinforces his/her theoretical knowledge adequately and make him confident in subject.
## AHC 1081: ENGINEERING CHEMISTRY LAB

**Objective:** The subject intends to provide understanding of the fundamental concepts of Chemistry with practical exposure applicable in Engineering Sciences thereby preparing the students for a rewarding career in science and technology.

**Credits:** 01

**Semester I/II**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Lab Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>To prepare and standardize the solution of NaOH (N/10) against standard solution of Oxalic acid (N/5). To determine the percentage of available chlorine in the given sample of bleaching powder by iodometric titration using starch as an internal indicator. To determine the constituents and amount of alkalinity in the given water sample by titrating it against standard HCl solution (N/20) using phenolphthalein and methyl orange as an internal indicator. To determine the ferrous content in the supplied sample of iron ore by titrimetric analysis against standard potassium dichromate (N/20) solution using potassium ferricyanide $K_3[Fe(CN)<em>6]$ as an external indicator. To determine chloride ion content in a given water sample by argentometric method (Mohr’s method) using $K_2CrO_4$ as an internal indicator. To determine the temporary, permanent and total hardness of water in a given sample of water by titrating it against standard EDTA solution (N/20) using eriochrome black – T as an internal indicator. To determine the viscosity of an addition polymer solution (like polystyrene) with respect to water by using Ostwald viscometer. Viscosity of water is 0.0101 poise at 20°C. To determine the % of moisture in a given sample of coal by proximate analysis. To determine strength of given HCl solution by titrating it against N/5 NaOH solution by using pH meter. To determine iron concentration in the given water sample by colorimetric method by using KSCN as a color developing agent and the measurement are carried out at $\lambda</em>{max}$ 480nm. To determine the free CO$_2$ in a given sample of water. To determine iodine value of given oil sample. Show that the hydrolysis of an ester in presence of an acid is an example of first order reaction.</td>
<td>26</td>
</tr>
</tbody>
</table>

**Outcome:**
- Knowledge of Chemical Sciences for better appreciation of applications in engineering sciences.
- The student’s ability to perform experiments, analyze and interpret the data of experiments will be enhanced.
CSE1181: COMPUTER PROGRAMMING LAB - 1

Objective: Students will be able to enhance their analyzing and problem solving skills and use the same for writing programs in C.

Credits: 01

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Lab Hours</th>
</tr>
</thead>
</table>
| I          | Basic Linux Command  
Mapping of flow chart, Algorithm, Language  
Simple C-program execution  
Programs based on various operators  
Programs based on Decision and case Control Structure  
Programs based on Loop Control Structure  
Program based on special control statement  
  - break  
  - continue  
Programs based on Array  
  - Insertion, Deletion, Linear Search & Bubble Sort.  
Programs based on String  
  - Length, Copy, Reverse, Concatenate, Compare with & without built-in functions | 24 |

Outcome:
- Acquire knowledge of basic Commands in Linux.
- Acquire knowledge about the basic concept of writing a program.
- Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
- Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.
- Understand the basic concept of C Programming, and its different modules that include conditional and looping expressions, Arrays and Strings.
# EEE1081: ELECTRICAL & ELECTRONICS LAB

**Objective:** To provide exposure to the students with hands on experience on basic Electrical & Electronics circuits.

**Credits:** 01  
**Semester:** I/II  
**L-T-P:** 0-0-2

<table>
<thead>
<tr>
<th>Module</th>
<th>List of Experiments</th>
<th>Lab Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I,II &amp; III</td>
<td>1. To verify the Thevenin’s theorem (DC circuits).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. To verify the maximum power transfer theorem (DC circuits). Also draw graph between power and load resistance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. To study the phenomenon of resonance in series R-L-C circuit and also draw the graph between frequency and current.</td>
<td></td>
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<tr>
<td></td>
<td>4. To determine the V-I characteristics of a semi-conductor diode.</td>
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<tr>
<td></td>
<td>5. To study the working of a Half-Wave &amp; Full Wave (Bridge type) rectifier and determine the ripple factor for both cases.</td>
<td></td>
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<tr>
<td></td>
<td>6. To determine the efficiency of a single phase transformer by direct load testing.</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>7. To study the application of CRO i.e. (current measurement, voltage measurement and frequency measurement).</td>
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</tr>
<tr>
<td></td>
<td>8. To study and calibrate single phase (induction type) energy meter and also compare it with digital meter.</td>
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<tr>
<td></td>
<td>9. To study various logic gates such as OR, AND, NOT, NAND, NOR.</td>
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<tr>
<td></td>
<td>10. To verify the Superposition Theorem (DC circuits).</td>
<td></td>
</tr>
</tbody>
</table>

**Outcome:** At the end of the course students will be able

1. To construct basic circuits.
2. To construct circuits on a breadboard.
3. To measure the various electrical quantities (like voltage, current, frequency and power).
4. To measure resistance using DMM.
5. To measure energy using single-phase energy meter.
6. To understand working of 1-phase transformer.
7. To write satisfactory laboratory reports.
MEE1081: APPLIED MECHANICS LAB

Objective: The Applied Mechanics Laboratory to plan to provide the students the opportunity to perform experiments and understand the application of theory covered in course on mechanics. It investigates the concepts of Newtonian (classical) mechanics through weekly hands-on experiments, emphasizing connections between theoretical principles and practical applications in engineering. In addition to furthering their understanding about the workings of the physical world, students will improve their skills at conducting experiments, obtaining reliable data, presenting numerical results, and extracting meaningful information from such numbers.

Credits: 01

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Lab Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>List of Experiments</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Study of functioning of gear trains.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Deflection of simply supported beam and verification of theoretical values.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To determine the modulus of rigidity of rod with the help of torsion testing machine.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To study functioning of belt pulley systems.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To find the mechanical advantages, velocity ratio and efficiency of worm and worm wheel.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To find the coefficient of friction between the surface of a given wood slide bar and an inclined plane.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To find the coefficient of friction between belt and pulley using belt pulley system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To find reaction at the supports of a simply supported beam with different types of loading.</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>- To find moment of inertia of a fly wheel about the axis of rotation using electronic counter machine.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To find centre of gravity of different geometrical objects.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To find forces in members of a truss for different load conditions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To study conversion of momentum.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To verify the law of conservation of energy.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To verify law of polygon of forces.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To verify law of parallelogram of forces.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Demonstration for centrifugal forces.</td>
<td></td>
</tr>
</tbody>
</table>

Outcome: At the end of the course the student will be able to:

- Know the practical skills to analyze the forces, moments, and their equilibrium.
- Know the practical skills to analyze the effect of friction.
- Develop basic know how and awareness to deal with practical aspects of applied mechanics.
AHM-2201: ENGINEERING MATHEMATICS II

**Course Objectives:** To make the students understand the concepts of integral calculus, convergence of infinite series, vectors and partial differential equations by giving more emphasis to their applications in engineering.

**Credits: 04**

**Semester II**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours (Approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Convergence of Infinite Series</strong>: Introduction, Limit u_n test,</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Leibnitz test, Comparison and p-series test, Cauchy’s root</td>
<td></td>
</tr>
<tr>
<td></td>
<td>test, Ratio test, Raabe’s and Logarithmic tests, De Morgan &amp;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bertrand’s test, Special logarithmic test (without proofs).</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Beta and Gamma Functions</strong>: Transformations, Relation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>between Beta &amp; Gamma functions, Duplication formula (without proof),</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Applications in solving definite integrals.</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td><strong>Multiple Integrals</strong>: Double and Triple integrals, Change of</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>order of integration, Applications to area and volume,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change of variables, Dirichlet integral and its applications.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Vector Calculus I</strong>: Introduction, Scalar and Vector point</td>
<td></td>
</tr>
<tr>
<td></td>
<td>functions, Gradient, Divergence and Curl.</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td><strong>Vector Calculus II</strong>: Vector identities, Line, Surface and</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Volume integrals, Work done by a force, Green's theorem,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gauss’ divergence theorem &amp; Stoke’s theorem (without proof).</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Partial Differential Equations (PDEs)</strong>: Introduction,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I order Lagrange’s linear PDEs, n^th order linear PDEs.</td>
<td></td>
</tr>
</tbody>
</table>

**Learning Outcomes:**

After studying these topics, the student will be able to

- Apply different tests for determining convergence of an infinite series
- Evaluate double and triple integrals and study their applications
- Find the gradient of a scalar field and divergence, curl of a vector field
- Understand various integral theorems related to line, surface and volume integrals
- Solve partial differential equations of first and higher orders

**Text Books:**


**Reference Books:**

CSE 2101: PROBLEM SOLVING USING COMPUTERS

**Objective:** To enable effective usage of arrays, structures, functions, pointers, implement the memory management concepts and to teach the issues in file organization and the usage of file systems. Fundamentals of Computer & Programming

<table>
<thead>
<tr>
<th>Credits: 03</th>
<th>Semester II</th>
<th>L–T–P: 2–1–0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module No.</strong></td>
<td><strong>Content</strong></td>
<td><strong>Teaching Hours</strong></td>
</tr>
<tr>
<td>I</td>
<td>Functions: Declaration and Definition, Category of Functions, Parameter Passing Techniques – Call by Value, Passing Arrays to Functions. <strong>Introduction To Storage Classes:</strong> Auto, Static, Extern and Register. <strong>Recursion:</strong> Mechanics of Recursive Call, Implementation of Recursion, Recursion vs. Iteration. <strong>The C Preprocessor:</strong> Introduction, Macro Expansion and File Inclusion, Conditional Compilation and Miscellaneous Directives.</td>
<td>9</td>
</tr>
<tr>
<td>II</td>
<td>Pointers: Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Arrays and Pointers, Pointer and Strings, Pointer Arithmetic, Pointers to Pointers, Array of Pointers, Pointer to an Array, Two Dimensional Array and Pointers, Pointers to Functions, Dynamic Memory Allocation, void Pointer and Null Pointer. <strong>User Defined Types:</strong> enum, typedef, Union and Structure - Declaration, Initialization, Nested Structures, Arrays of Structures, Structure and Pointer, Passing Structure Through Function. Difference Between Structures and Union.</td>
<td>8</td>
</tr>
</tbody>
</table>

**Text Book:**

**Reference Books:**

**Outcome:** At the end of the course, students will be able to understand:
- To solve the memory access problems by using pointers
- To understand about the dynamic memory allocation using pointers which is essential for utilizing memory
- To understand about the code reusability with the help of user defined functions.
- To develop advanced applications using enumerated data types, function pointers and nested structures.
- To learn the basics of file handling mechanism that is essential for understanding the concepts in database management systems.
- To understand the uses of preprocessors, various header file directives and advanced concept of C.
AHE 2101: ENGLISH LANGUAGE SKILLS FOR COMMUNICATION-II

**Objective:** The objective of this course is to enrich the comprehension skills of the students with a focus on essential nuances of English grammar, functional vocabulary and writing skills, in this manner, enable them to read, write and speak English correctly and effectively.

**Credits:** 02  
**Semester:** II  
**L–T–P:** 2–0–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I         | Functional Categories: Subject, Object, Predicate  
Sentence: Types - simple, compound and complex sentences  
Conjunctions  
Parallelism  
Vocabulary: Words of Functional Usage  
Text: 'Science and Human Life' by JBS Haldane | 10 |
| II        | Word Formation: Inflection, derivation, blending, compounding and clipping  
Concord: Subject-verb Agreement  
Non-Finites: Gerund, infinitives, participle  
Text: 'The Last Leaf' by O' Henry | 8 |
| III       | Punctuation  
Voice: Active & Passive  
Narration: Direct & Indirect  
Correction of Errors: Correction of Errors on the topics covered in all the three modules  
Reading comprehension (Unseen)  
Text: ‘A Brief History of the Future’ by Stephen Hawkins | 8 |

**Recommended Reading:**  
*Time Machine* by H.G. Wells

**References:**  
Course Handbook (Collection of Short Stories, One Act Play & Essays)  
English Grammar in Use by Raymond Murphy, IV Edition, Cambridge University Press, UK  
Living English Structure by W.S. Allen, Pearson India

**Outcome:** After the completion of this course, the students will be able to:  
- Use syntactically correct and effective English while writing textual answers or while expressing themselves elsewhere.  
- Identify common English errors and correct them in speaking and writing.  
- Develop their reading skills as well as understand, evaluate, analyze and discuss through textual reading and other reading materials.  
- Express themselves in various fields in an effective and impressive manner.
# AHE 2181: ENGLISH LANGUAGE LAB II

**Objective:** The objective of this course is to give students exposure of listening and speaking English in various communicative contexts. The course will also provide them with an opportunity to form their opinion, develop their thinking skills, analyze their thoughts and express themselves in an effective way, honing their communicative skills in English.

**Credit:** 01  
**Semester:** II  
**L–T–P:** 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | Audio Visual Material for Listening and Speaking:  
TED Talk by Shashi Tharoor  
‘Freedom is Not Free’ by Shiv Khera  
‘One Crime History’: Animated video  
Group discussion: Videos on group discussion  
**Speaking Activities:**  
Process description  
Advertisement presentations by students  
Newspaper reading and discussion  
Group discussion practice | 10 |
| II         | Audio Visual Material for Listening and Speaking:  
‘The thrilling potential of 6th sense technology’ (TED) by Pranav Mistry  
‘India on four wheels’: A BBC documentary  
Video clips from ‘Movie 9’  
**Speaking Activities:**  
Describing concepts  
Discussion on problems of India  
Extempore | 8 |
| III        | Audio Visual Material for Listening and Speaking:  
Women Empowerment: Speech by Hilary Clinton at UN council meet.  
‘Corporate Culture’ by J. Wilkinson (TED X) on Corporate work culture  
Introduction to Stress Management’ by Dr. LuAnn Helms  
Exit level recording by students  
**Speaking Activities:**  
Discussions on gender discrimination  
Presentations  
Coping with anger, stress and nervousness | 9 |

**Audio-Visual Material:**  
Material available in the Language Lab.

**References:**  
*Cambridge English Pronouncing Dictionary* by Daniel Jones

**Outcome:** After the completion of the course students will be able to:  
- Listen, understand and analyse a variety of speeches, documentaries and interviews.  
- Express themselves with correct pronunciation and fluency.  
- Use appropriate vocabulary and fluency.  
- Enhance communication skills and personality.  
- Participate in discussions on social and professional issues.
CSE 2181: COMPUTER PROGRAMMING LAB – II

Objective: To impart knowledge so that the student will be able to write diversified solutions using C language.

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Lab Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Programs based on Functions.</td>
<td>24</td>
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<td></td>
<td>Programs based on Storage Class.</td>
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<td>Programs based on Recursion.</td>
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<td>Programs based on Preprocessor.</td>
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<td>Programs based on Pointers</td>
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<td>- Problem based on array</td>
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<td>- Problem based on string</td>
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<td>- Problem based on call by value and call by reference</td>
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<td>- Problem based on Dynamic Memory Allocation</td>
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<td>Programs based on User Defined Data types</td>
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<td>- Structure</td>
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<td>- Union</td>
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<td>- Enum</td>
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<td>- Typedef</td>
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<td></td>
<td>Programs based on File handling</td>
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<tr>
<td></td>
<td>- Opening a file</td>
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<tr>
<td></td>
<td>- Reading, writing and appending a file</td>
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<td></td>
<td>- Closing file</td>
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<tr>
<td></td>
<td>- Random Access to Files of Records</td>
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<tr>
<td></td>
<td>Programs based on Command Line Argument.</td>
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</tr>
</tbody>
</table>

Outcome:
- Role of Functions involving the idea of modularity.
- Concept of Array and pointers dealing with memory management.
- Structures and unions through which derived data types can be formed
- File Handling for permanent storage of data or record.
- Applications of Self-referential structure.
MEE 3001: FLUID MECHANICS

**Objective:** To understand basic concept of Hydraulic Turbines, Reciprocating Pumps and Centrifugal Pumps and its application to hydro power generation.

**Credits:** 04  
**Semester:** III  
**L-T-P:** 3-1-0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Fluid and Continuum, Physical Properties of Fluids, Rheology of Fluids.  
**Dimensional Analysis and Hydraulic Similitude:** Dimensional Analysis, Buckingham’s Pi Theorem, Important Dimensionless Numbers and Their Significance, Geometric, Kinematic and Dynamic Similarity, Model Studies.  
**Fluid Statics:** Pressure-Density-Height Relationship, Manometers, Pressure Transducers, Pressure on Plane and Curved Surfaces, Centre of Pressure, Buoyancy, Stability of Immersed and Floating Bodies. |
**Dynamics of Fluid Flow:** Euler’s Equation of Motion Along A Streamline and Its Integration, Bernoulli’s Equation and Its Applications - Pitot Tube, Orifice Meter, Venturi Meter and Bend Meter, Hot-Wire Anemometer and LDA, Notches and Weirs, Momentum Equation and Its Application to Pipe Bends, Fluid Masses Subjected to Linear Acceleration and Uniform Rotation About An Axis. |
**Boundary Layer Analysis:** Boundary Layer Thickness, Boundary Layer Over A Flat Plate, Laminar Boundary Layer, Application of Momentum Equation, Turbulent Boundary Layer, Laminar Sublayer, Separation and Its Control, Drag and Lift, Drag on A Sphere, A Two Dimensional Cylinder, and An Aerofoil, Magnus Effect, Kutta-Jonkowski Theorem. |

**Test Books:**
- Agarwal S.K. *Fluid Mechanics & Machinery*, TMH

**Reference Books:**
- Das M. M., *Fluid Mechanics & Turbomachines*, Oxford University Press

**Outcome:** On learning this subject students will be able to:
- Select a hydro turbine (Pelton wheel, Francis turbine, Kaplan turbine) or a pump on the basis of available head and discharge.
- Also students will be able to calculate various parameters like work done, efficiency, working proportions, specific speed etc.
MEE 3102: MATERIAL SCIENCE

Objective: Materials Science is focused on the fundamentals of biomaterials, nanomaterials, ceramics, metals, polymers, electronic materials and composites, advanced manufacturing, smart materials, energy generation and storage, green and sustainable materials emphasizing the relationships between atomic structure and microstructure as well as the properties, processing and performance of the material in a cohesive and self-contained way within the course.

Credits: 04 Semester III L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Historical Perspective, Importance & Requirement of Materials, Chemical Bondings.  
**Crystallography and Imperfections:** Concept of Unit Cell Space Lattice, Bravais-Lattices, Common Crystal Structures, Atomic Packing Factor and Density. Miller indices. Imperfections, Dislocations in Solids.  
**Testing and characterization:** Non-Destructive Testing (NDT) X-Ray Crystallography Technique  
**Iron & Steel Making:** Study of Iron ores and processing, Energy requirements for Furnaces, Alternate energy sources, Furnaces: Cupola, Blast Furnace, EAF, BOF. Refractory linings (Acidic and Basic lining of furnaces and significance) | 13 |
| II         | **Equilibrium Diagrams:** Types of Equilibrium-Diagrams: Solid-Solution Type, Eutectic Type and Combination Type. Iron-Carbon Equilibrium-Diagram and Its Importance.  
**Heat Treatment:** Various Types of Heat Treatment Such As Annealing, Normalizing, Quenching, Tempering and Case Hardening. Time Temperature Transformation (TTT) Diagrams. | 13 |
| III        | **Die-Electric Materials:** Die-Electric Materials and Its Uses.  
**Properties and Application:** Polymers, composites, carbon fibre, graphene.  
**Super Conductivity & Superconductors:** Superconductivity and Its Applications. Meissner Effect. Type I & II Superconductors. Concept and Applications of Ceramics, Metallic Foams, Nano Materials and Smart Materials Etc. | 15 |

Text Books:
- Narula, “Material Science”, TMH.

Reference Books:
- Avner “Introduction to Physical Metallurgy” TMH Pub

Outcome: On learning this subject students will be able to:
- Understand the limits of materials and the change of their properties with use.
- Create a new material that will have some desirable properties.
- Prepare advanced composite materials for space and missile application.
MEE 3103: STRENGTH OF MATERIALS

Objective: Strength of materials deals with the study of internal resisting forces acting on the elastically deformable bodies having prismatic cross-section under different kinds of loading conditions to determine the expressions for stress, strain and displacements.

Credits: 04

<table>
<thead>
<tr>
<th>Semester III</th>
<th>L–T–P: 3–1–0</th>
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</thead>
<tbody>
<tr>
<td>Module No.</td>
<td>Content</td>
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<tr>
<td>------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>I</td>
<td><strong>Stress and Strain:</strong>  simple stress, types of stresses and strains, hook’s law, principle of superposition, Elastic constants, bars of varying section, uniformly tapered bars, elongation of bar due to self-weight, compound bars, Indeterminate structures, Thermal stresses in uniform bars. Strain energy, impact loading. <strong>Simple Bending of Beams:</strong> Theory and assumptions of Pure Bending, Stresses in Beams Under Different Types of Loads, Beam of uniform strength, Direct shear stresses in beams. <strong>Torsion:</strong> Torsion of Circular shafts, design of shaft, Non-uniform torsion, stress and strain in pure shear, Statically indeterminate torsional member, strain energy in torsion.</td>
</tr>
<tr>
<td>II</td>
<td><strong>Compound stress and strain:</strong> Introduction, plane stress, principle planes, principle stresses and maximum shear stresses, Mohr’s circle for plane stress, hook’s law for plane stress, tri-axial stress, transformation equations for plane stress, plane strain. <strong>Theories of Elastic failures:</strong> Rankine’s theory, St. Venent theory, Guest’s theory, Haigh’s theory, Maximum distortion energy theory, graphical representation and their comparison. <strong>Slope and Deflection of Beams:</strong> Slope and Deflection of Statically Determinate Beams Using Macaulay’s Method, Area-Moment and Energy Methods, Castigliano’s Theorem, Statically Indeterminate Beams Under Different Types of Loads.</td>
</tr>
<tr>
<td>III</td>
<td><strong>Columns:</strong> Euler’s Theory of Buckling of A Column, Middle-Third and Middle-Quarter Rules, End Conditions For Columns, Different Empirical Formulae For Columns. <strong>Pressure Vessels:</strong> Stresses and Strains in Thin and Thick Cylinders and Spheres Subjected to Internal and External Pressures.</td>
</tr>
</tbody>
</table>

| Teaching Hours | 16 | 16 | 10 |

Text Book

Reference Books:
- Timoshenko and Young “Strength of Materials”, Affiliated East-West.

Outcome: Derived expression of stress, strain and displacements under various loading conditions can be used to safe, economical and effective design of the mechanical elements.
EEE3071: ELECTRICAL MACHINES AND AUTOMATIC CONTROL

**Objective:** The objective of this course is that students will understand basic concept of transformer and more common types of rotating electrical machines. The basic treatment of control system along with analysis and stability also will be grasping by student at the end of course.

**Credits:** 04

**Semester:** III

**L–T–P:** 3–1–0

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Three-Phase Transformer: Three-Phase Transformer connections and its applications. DC Motors: Torque equation, starting of DC motors, speed control. Three-Phase Induction Motor: Torque equation, torque-slip characteristics, speed control: v/f control, rotor resistance control.</td>
</tr>
</tbody>
</table>

**Text Books:**
- B.S. Manke, Linear Control Systems, Khanna Publishers.

**Reference Books:**
- K. Ogata, “Modern Control Engineering”, Prentice Hall of India.

**Outcome:** After completion of course student will be able to learn
- Understand the concept of transformer and rotating electrical machines such as D.C. Motor, Three Phase Induction Motor and Synchronous Machines.
- Understand time response and frequency response analysis and stability of control system.
- Implement different numerical stability technique to analysis the stability of control system.
- Understand the concept of analogous system and their Electrical-Mechanical analogy.
- Understand the concept of controller in scenario of control system.
Prerequisites: Differential and Integral Calculus, Ordinary Differential Equations, Coordinate Geometry, Fourier series, Green’s theorem, Algebra of complex numbers.

Objectives: To make the students understand the concepts of Partial Differential equations, Laplace Transforms, and Complex analysis by giving more emphasis to their applications in engineering.

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours (Approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Partial Differential Equations (PDEs):</strong> Introduction, 1st order Lagrange’s linear PDEs, n-th order linear PDEs, Classification of 2nd order PDEs, Method of separation of variables, One dimensional wave equation, D’Alembert solution, One dimensional heat flow equation.</td>
<td>13</td>
</tr>
<tr>
<td>II</td>
<td><strong>Laplace Transforms:</strong> Properties of Laplace transform, Laplace transform of derivatives and integrals, Unit step, Dirac - delta and periodic function, Properties of inverse Laplace transform, convolution theorem, Application to ordinary differential equations.</td>
<td>13</td>
</tr>
<tr>
<td>III</td>
<td><strong>Complex Analysis:</strong> Analytic functions, C – R equations, Harmonic Functions, Line integral in a complex plane, Cauchy’s integral theorem and formula, Cauchy integral formula for derivatives, Taylor and Laurent series (without proof), Singularities, Residue at a pole, Residue theorem and its application in evaluation of real integrals (excluding poles on the real axis).</td>
<td>14</td>
</tr>
</tbody>
</table>

Outcomes:
After studying these topics, the student will be able to
- Solve Partial Differential Equations of 1 and higher orders.
- Apply Fourier series in applications of PDEs to wave and heat flow equations.
- Know about the use of transforms in solving differential equations.
- Understand the use of special function like unit step and dirac delta.
- Grasp the concept of Analytic function and its applications in engineering.

Text Books:

Reference Books/Text Books/Cases:
AHS 3001: ENVIRONMENTAL STUDIES

Credits: 02  Semester III/IV  L–T–P: 2–0–0

Objective: To create awareness towards various environmental issues like global warming, urbanization, pollutions, ozone layer depletion etc; their causes and remedial steps for protecting impacted society.

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>

Text Book:

Reference Books:
- AK De “Environmental Studies” New Age International Publisher, New Delhi.
- Agarwal and Sangal, “Environment & Ecology” Krishna’s Educational Publisher’s Meerut

Outcome:
- Students will be able to understand the environmental issues pertaining to day-to-day living; gain awareness for the need of environmental education vis-à-vis education for sustainable development.
- Students will acquire knowledge in ecological perspective and value of environment, biotic components, ecosystem process: energy, food chain, water cycle etc.
- Students will be able to understand water quality standards and parameters, assessment of water quality, air pollution, pollutants, acid rain, global climate change and green house gases.
- Students will learn to understand variety of social issues associated with environmental deterioration involving human components such as population, ethics and urban settlements.
Objective: The course aims to develop a logical understanding of morality and society. It is to develop a critical perspective to the assumptions and prejudices which we use in decision making process. It is to foster the understanding of professional ethics. It is to train students to rationalize the problems of life and profession to learn the problem solving and decision making skills. It is to help students in identifying normative commitments of technological knowledge and artifacts.

Credits: 02

Semester III/IV
L–T–P: 2–0–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Conceptual Foundations</strong>: Foundations of Morality; Professional Ethics; Professional Standards in Engineering Practice; Major Theories of Ethics and Different Ethical Approaches; Normativity of Science and Technology. <strong>Professions and Moral Dilemmas</strong>: Contemporary Ethical Issues; Conflict of Interests; Contracts; Rights and Violations; Consent and Dissent; Privacy and Confidentiality; Consultancy; Allocation of Burdens and Benefits; Direct and Indirect Responsibility; Patents, Piracy and Clones</td>
<td>14</td>
</tr>
<tr>
<td>II</td>
<td><strong>Decision Making</strong>: Theoretical Bases; Foundational Values; Greater Welfare Approach; Risk-Benefit Analysis; Right-based Approach; Priority Allocation; Binding Grounds of Decisions; Public Norms and Professional Guidelines.</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td><strong>Social Responsibility</strong>: Individual and Collective Responsibility; Corporate Social Responsibility; Justice and Fairness; Beneficence and Safety; Respect for Humanity, Life, and Nature; Sustainable Development.</td>
<td>11</td>
</tr>
</tbody>
</table>

References:
- https://www.google.co.in/#q=references+for+Kantianism%2C+Libertarianism+and+Virtue+Theory
- http://www.blackwellreference.com/public/tocnode?id=g9780631201199_chunk_g978063120119917
- http://www.iep.utm.edu/libertar/
- http://www.youtube.com/watch?v=kBdfeR-8hEY
- http://www.youtube.com/watch?v=002Rq4HJbxw
- http://www.youtube.com/watch?v=Qw4lIw0rkjs
- http://www.youtube.com/watch?v=MGygyiXMzRk
- http://www.youtube.com/watch?v=KqzW0eHzDSQ
- http://www.youtube.com/watch?v=8rv-4aUbZsQ
- http://www.youtube.com/watch?v=AUbReMT5uqA
- http://www.youtube.com/watch?v=18IHlIdzt6bU9list=PLF2900CF84737E005

Outcome: The Students taking the course can potentially develop:
- The enhanced ability to understand the ethical problems of personal, social & professional life.
- Well constructed professional approach to rationalize the life issues through developed life-skills.
- Improvised Decision Making Ability, Understanding of Professional Ethics & Development of Ethical Attitude.
- Well Structured Ethics of Engineering, Rationally Driven Communicational Abilities, & Informed Professional Personality.
AHE 3083: ENGLISH FOR PROFESSIONAL PURPOSES - I

Credits: 02  Semester III  L–T–P: 0–0–4

Objective: The objectives of the course are as follows:

- To acquaint the students with different facets of communication;
- To enhance the students’ awareness about the challenges and strategies of effective communication in various socio-cultural domains;
- To develop the writing skills of the students with a focus on formal correspondence including e-mail, report writing etc;
- To boost the students’ interpersonal skills through group presentations, skits and role-playing exercises;
- To equip the students with advanced skills in English grammar with a focus on the identification and correction of common errors.

Oral Skills:

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>Importance of English in Communication</td>
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<td></td>
<td>Barriers to Communication</td>
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<td>Seven ‘C’ s of Effective Communication</td>
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<td></td>
<td>Planning Presentations</td>
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<td>Group Presentations (Jointly drafting a presentation, doing GD &amp; making group-presentations)</td>
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<tr>
<td>II</td>
<td>Paragraph Writing: Methods of Paragraph Development; Accuracy, Brevity and Clarity in Writing; Cohesion &amp; Coherence in Paragraph Writing (Through jumbled sentences/paragraph)</td>
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<tr>
<td></td>
<td>Coherence Markers as Lexical Bundles</td>
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<td>E-mail: Formality &amp; Persuasiveness</td>
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<td></td>
<td>Practice on Short Paragraph Writing, Précis Writing, Summary Writing and Short Report Writing</td>
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<td>III</td>
<td>Speech/Opinion on a given Topic</td>
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<td>Situational Role Play</td>
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<td>Skit Performance</td>
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</table>

Verbal Ability:

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
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<tbody>
<tr>
<td>I</td>
<td>Parts of Speech identification</td>
<td>10</td>
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<tr>
<td></td>
<td>Clausal Analysis: Subject, Object, Predicate and Complement</td>
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<td>Auxiliary Verbs, Linking Verbs and Modals</td>
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<td>Tense: Past, Present and Future</td>
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<td>Reading Comprehension: Level I</td>
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<td>Subject – Verb Agreement</td>
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<td>Question Based Learning: Level I</td>
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<tr>
<td>II</td>
<td>Determiners</td>
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<td>Passive and Causative Construction</td>
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<td>Narration</td>
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<td>Word Formation</td>
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<td></td>
<td>Reading Comprehension: Level II</td>
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<tr>
<td></td>
<td>Question Based Learning: Level II</td>
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</table>
Course Curriculum (w.e.f. Session 2017-18)
B.Tech. (Mechanical Engineering)

DEPARTMENT OF MECHANICAL ENGINEERING

### STUDY & DRILL MATERIAL/REFERENCE BOOKS:

- V.N. Arora. *Improve Your Writing*, OUP
- M. Ashraf Rizvi. *Effective Technical Communication*, TMH
- *Common Errors in English*. Kiran Prakashan

### Outcome:
The expected outcomes at the completion of the delivery of the course are as follows:

- The topics dealing with communication aspects will train the students hands on, by enabling them understand/identify and appreciate the barriers to communication, ways to overcome, process & type of communication etc.
- The students will be able to understand the needs & requirements of the target audience based on their exposure and knowledge of the subject and will be able to communicate accordingly with certain level of accuracy.
- The writing skills of the students will be enhanced to such an extent that they could easily prepare and manage materials and strategies of formal correspondence themselves.
- The students will be equipped with interpersonal skills through group presentations, skits and role-playing exercises. The exercises will help in getting rid of stage-fear, nervousness and hesitation during deliveries of official nature.
- The students will be able to identify and rectify grammatical errors in written communication.

| III | Non-finite structure: Gerund, Infinitive, Participial Conjunctions and Connectives Simple, Complex and Compound Sentences Different Degrees of Comparison Reading Comprehension: Level III Question Based Learning: Level III | 8 |

III Non-finite structure: Gerund, Infinitive, Participial Conjunctions and Connectives Simple, Complex and Compound Sentences Different Degrees of Comparison Reading Comprehension: Level III Question Based Learning: Level III
MEE 3081: FLUID MECHANICS LAB

Objective: This lab is run in conjunction with the theory course. It is an introductory course where flow behavior, fluid forces and analysis tools are introduced. It covers measuring devices and techniques, error analysis in experimental works and analysis of assumptions in the theory of fluid mechanics. The laboratory provides training to undergraduate and graduate students in flow measurements.

Credits: 01  
Semester III  
L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>List of Experiments:</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>• To Determine Coefficient of Discharge of Given Shape of Orifice.</td>
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<tr>
<td></td>
<td>• To Determine Coefficient of Discharge of Given Shape of Venturimeter.</td>
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<td></td>
<td>• To Demonstrate the Transition From Laminar to Turbulent Flow and to</td>
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<td>Determine Lower Critical Reynolds Number.</td>
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<td></td>
<td>• To Determine the Loss of Heads for Pipe Fittings.</td>
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<tr>
<td></td>
<td>• To Determine Coefficient of Discharge of Given Shape of Mouth Piece.</td>
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<tr>
<td></td>
<td>• To Determine the Meta Centric Height of the Given Ship Model</td>
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<tr>
<td></td>
<td>Experimentally.</td>
<td></td>
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<tr>
<td></td>
<td>• To Determine Coefficient of Discharge of A Given Shape of V-Notch.</td>
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<tr>
<td></td>
<td>• To Verify Bernoulli's Theorem Experimentally.</td>
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<tr>
<td></td>
<td>• To Study the Boundary Layer Velocity Profile Over A Flat Plate and to</td>
<td></td>
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<tr>
<td></td>
<td>Determine the Boundary Layer Thickness.</td>
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<td></td>
<td>• To Verify Momentum Theorem Using Momentum Theorem Apparatus.</td>
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<td></td>
<td>• To Determine Coefficient of Discharge for Flow Over A Rectangular</td>
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<td>Weir.</td>
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<td></td>
<td>• To Determine the Friction Factor for Flow Through Pipes.</td>
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<tr>
<td></td>
<td>• Measurement of Drag and Lift on Aerofoil In Wind Tunnel.</td>
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<tr>
<td></td>
<td>• Virtual Demonstration of Velocity, Viscosity and Pressure Measuring</td>
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<tr>
<td></td>
<td>Devices.</td>
<td></td>
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<tr>
<td></td>
<td>• Demonstration of Open Circuit Wind Tunnel.</td>
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</tr>
</tbody>
</table>

Outcome: The student will be able to know:

- Knowledge of basic principles of fluid mechanics.
- Ability to analyze fluid flow problems with the application of the momentum and energy equations.
- To understand basic working principles of various flows and pressure measuring equipments.
- An ability to use the techniques, skills and modern engineering tools necessary for fluid engineering practice. Ability to deduce fluid physics information from flow visualization.
MEE 3082: MATERIAL SCIENCE AND TESTING LAB

Objective: Materials science is an understanding of the microstructure of solids in reference to solids viewed at the subatomic (electronic) and atomic levels, and the nature of the defects at these levels. The microstructure of solids at various levels profoundly influences the mechanical, electronic, chemical, and biological properties of solids. The phenomenological and mechanistic relationships between microstructure and the macroscopic properties of solids are, in essence, what materials science is all about.

Credits: 01

Semester III

L−T−P: 0−0−2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>List of Experiments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• To Prepare Specimen for Micro Structural Examination-Cutting, Grinding, Polishing, Etching.</td>
<td></td>
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<tr>
<td></td>
<td>• To Study Crystal Structures and Crystals Imperfections Using Ball Models.</td>
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<td></td>
<td>• To Study Bravais Lattice With Help of Models.</td>
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<td></td>
<td>• To Determine the Grain Size of A Given Specimen.</td>
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<tr>
<td></td>
<td>• Make A Comparative Study of Microstructures of Different Given Specimens after Micro Structural Examination (Mild Steel, Gray C.I., Brass, Copper Etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Heat Treatment Experiments Such As Annealing, Normalizing, Quenching, Case Hardening and Comparison of Hardness before and After.</td>
<td></td>
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<tr>
<td></td>
<td>• To Determine the Strength By Testing of A Given Mild Steel Specimen on UTM With Full Details and Plot on the Machine.</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>• To Conduct Shear and Bend Tests on UTM.</td>
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<td></td>
<td>• To Conduct Impact Testing on Impact Testing Machine Like Charpy, Izod or Both.</td>
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<tr>
<td></td>
<td>• To Conduct Hardness Testing of Given Specimen Using Rockwell and Vickers/Brinell Testing Machines.</td>
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<td></td>
<td>• To Calculate the Deflection of Beam and Young’s Modulus of Elasticity of a Material of a Beam Simply Supported at the Ends.</td>
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<td></td>
<td>• To Conduct Torsion Testing of A Rod on Torsion Testing Machine.</td>
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<tr>
<td></td>
<td>• To Determine the Spring Index Testing on Spring Testing Machine.</td>
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<td></td>
<td>• To Plot A Curve Between Strain Vs Time (Ε−T) for Creep Testing on Creep Testing Machine.</td>
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<tr>
<td></td>
<td>• Study the Microstructure of Welded Component and HAZ (Heat Affected Zone) Macro and Micro Examination.</td>
<td></td>
</tr>
</tbody>
</table>

Outcome: Materials engineering builds on the foundation of materials science and is concerned with the design, fabrication, and optimal selection of engineering materials that must simultaneously fulfill dimensional, property, quality control, and economic requirements with an emphasis on the fundamentals of structure-property-application relationships.
Objective: To provide a hands-on experience on the various Electrical Machines and control system components. To give a fair knowledge about the testing and characteristics of DC and AC Machines. To provide a practical insight of the various control system components.

Credits: 01
Semester III
L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
|           | • To Obtain Magnetization Characteristics of A D.C. Shunt Generator.  
• To Obtain Load Characteristics of A Compound Generator (A) Cumulatively Compounded (B) Differentially Compounded.  
• To Obtain Load Characteristics of A D.C. Shunt Generator  
• To Obtain Efficiency of A Dc Shunt Machine Using Swinburne’s Test.  
• To Perform Hopkinson’s Test and Determine Losses and Efficiency of DC Machine.  
• To Obtain Speed–Torque Characteristics of A Dc Shunt Motor.  
• To Obtain Speed Control of Dc Shunt Motor Using (A) Armature Resistance Control  
• (B) Field Control  
• To Study Polarity and Ratio Test of Single Phase and 3-Phase Transformers.  
• To Obtain Efficiency and Voltage Regulation of A Single Phase Transformer by Sumpner’s Test. | |

Outcome: After completion of this course student will be:

• Able to perform testing of DC and AC motors.
• Able to obtain External and Internal Characteristics of DC and AC motors.
• Able to perform parallel operation of Alternators.
• Able to study and obtain the characteristics of a control system.
AHE 3081: SOFT SKILLS - I

After Two Courses on Spoken English Namely Spoken English-1 & 2, This Course Focuses More on the Use of English, Specifically in Business Situations. the Course is Based on Diverse Range of Business Themes Which Help Students Visualize the Expectations From A Professional.

**Objective:** Soft Skills-I Program Will Ensure That the Students Gain Confidence and Belief in What They Are Doing and Do Not Overly Doubt Themselves. Being Aware of Learning What They Need Both in and Out of the Classroom, They Will Acquire Clarity on what is Expected from Them.

**Credits:** 01

**Semester III**

L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Who Am I and Why Am I Here, Change is the Only Constant, Learning To Learn, Technology Know–How for A Fresher, Knowledge On Tools, Application Orientation, Career Management (Journey and Options),</td>
<td>10</td>
</tr>
<tr>
<td>II</td>
<td>Business Communication, Service Mindset, Customer Mindset, Myths About Business, Values In Business, Business Etiquette, Email Etiquette, Telephone Etiquette, Team Building, Role of A Manager</td>
<td>10</td>
</tr>
<tr>
<td>III</td>
<td>Attitude for Success, Role Models, Handling Peer Competition, Building Relationships, Branding Yourself.</td>
<td>10</td>
</tr>
</tbody>
</table>

**Reference Books:**

- Cook S., “The Effective Manager( e-book)”, IT Governance Publishing
MEE 4001: MEASUREMENT AND METROLOGY

Objective: Measurement and metrology is essential in every discipline of knowledge. To make students familiar about various techniques available to measure various physical quantities. To interrelate interdisciplinary knowledge in making measuring devices. It explains how measuring devices are useful in accurate measurement of various physical parameters.

Credits: 04

Semester IV

L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Measurements</strong>: General Concepts- Units and Standards – Measuring Instruments – Sensitivity, Readability, Accuracy and Precision, Static and Dynamic Response – Repeatability, Hysteresis – Systematic and Random Errors, Calibration.  &lt;br&gt;&lt;br&gt;<strong>Metrology and Inspection</strong>: Standards of Linear Measurement, Line and End Standards, Limit, Fits and Tolerances. Interchangeability and Standardization. &lt;br&gt;&lt;br&gt;Measurement of Geometric Forms Like Straightness, Flatness, Roundness.  &lt;br&gt;&lt;br&gt;<strong>Sensors and Transducers</strong>: Introduction to Sensors and Transducers.</td>
<td>16</td>
</tr>
<tr>
<td>II</td>
<td><strong>Measurement of Pressure</strong>: Gravitational, Elastic and Indirect Type Pressure Transducers, Measurement of Very Low Pressures.  &lt;br&gt;&lt;br&gt;<strong>Strain Measurement</strong>: Types of Strain Gauges and Their Working, Strain Gauge Circuits, Temperature Compensation, Strain Rosettes, Calibration.  &lt;br&gt;&lt;br&gt;<strong>Measurements of Force and Torque</strong>: Introduction to Devices for Measuring Force and Torque.  &lt;br&gt;&lt;br&gt;<strong>Temperature Measurement</strong>: Thermometers, Bimetallic Thermocouples, Thermistors and Pyrometers.  &lt;br&gt;&lt;br&gt;<strong>Vibration and Noise</strong>: Seismic Instruments, Vibration Pick Ups and Decibel Meters, Vibrometers, Accelerometers.</td>
<td>15</td>
</tr>
<tr>
<td>III</td>
<td>Linear and Angular Measurements Devices, Sine Bar and System Comparators: Sigma, Johansson’s Microkrator.  &lt;br&gt;&lt;br&gt;<strong>Interferometry</strong>: Principle and Use of Interferometry, Optical Flat. Measurement of Screw Threads and Gears.  &lt;br&gt;&lt;br&gt;<strong>Surface Texture</strong>: Surface Roughness, Quantitative Evaluation of Surface Roughness and Its Measurement. Limit Gauging. Limit Gauges Classification, Taylor’s Principle of Gauge Design, Comparators.</td>
<td>10</td>
</tr>
</tbody>
</table>

Text Books:
- Kumar D.S., “Mechanical Measurements and Control”, Metropolitan, N. Delhi.

Reference Books:
- Doblin Ernest, “Measurement Systems Application and Design”, TMH.

Outcome: After completing this subject students will be able to:
- Base on knowledge gained in these subject students will be able to measure physical parameters such as: surface texture, electrical current, micro forces and so many.
- Students can further develop project based on measuring devices.
# Course Curriculum (w.e.f. Session 2017-18)

## B.Tech. (Mechanical Engineering)

### MEE 4102: MANUFACTURING SCIENCE AND TECHNOLOGY - I

**Objective:** To impart the comprehensive insight into various manufacturing processes such as metal casting, sheet metal, welding and advanced welding processes.

**Credits:** 04  
**Semester IV**  
**L-T-P:** 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Importance of Manufacturing. Classification of Manufacturing Processes and Its Applications.  
**Outcomes:** learner will able to understand the various metal casting methods, designing of risering and gating system along with casting defects and their analysis. | 14 |
| II         | **Welding:** Introduction and Concept of various Welding Processes, Electric Arc Welding, Resistance Welding, Atomic Hydrogen Welding, Gas Welding.  
**Outcomes:** learner will able to understand the types of welding according to materials application and various advanced welding method and there requirements. | 12 |
**Outcomes:** learner will able to understand the processing of various conventional and advanced metal forming processes and parameters. | 16 |

### Recommended Books:
- Sharma P.C., “Manufacturing Engineering”, S. Chand New Delhi
- Ghosh and Malik, “Manufacturing science”, East West Pvt. Ltd.

**Outcomes:** learner will able to understand the Intricacies involved in sand mould castings, pressure die castings, Design requirement of forging load for different materials manufacturing processes such as casting, rolling, forging, extrusion and drawing.
# MEE 4003: APPLIED THERMODYNAMICS

**Objective:** To apply basics of thermodynamics and physics in design of thermodynamic system. To prepare base for engineering applications of basic thermodynamic laws in power plant engineering. Energy and exergy analysis can be performed by thermodynamics relations.

**Credits:** 04  
**Semester IV**  
**L-T-P:** 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Thermodynamics Relation: Helmholtz and Gibbs Function, Maxwell Relation, Clapeyron Equation, Joule Thompson Coefficient and Inversion Curve, Coefficient of Volume Expansion, Adiabatic and Isothermal Compressibility. <strong>Availability and Irreversibility:</strong> Available and Unavailable Energy, Availability and Irreversibility, Second Law Efficiency. <strong>Steam Generator:</strong> Function of Boilers, Classification of Boilers, Modern Boilers, Working of Fire Tube and Water Tube Boiler, Mountings and Accessories, Draught and Its Calculation, Performance of Boilers.</td>
<td>13</td>
</tr>
</tbody>
</table>

**Text Books:**
- Kearton W.J., “Theory of Steam Turbine”, Dhanpat Rai and Sons

**Reference Books:**
- Yunus A. Cengel. And Michael A. Boles, “Thermodynamics : An Engineering Approach”, Mcgraw Hill Education
- McConkey A. and Eastop T., “Applied Thermodynamics for Engineering Technologists” Pearson India

**Outcome:** After completing this subject students will be able to:
- Apply their knowledge to develop broad understanding in making of thermal devices.
- Construction, installation and operation of steam generators can be understood after taking this subject. Operation and performance analysis can be understood.
- Steam nozzle design and analysis can be performed after having knowledge of applied thermodynamics.
MEE 4004: KINEMATICS OF MACHINES

Objective: To explain various governing laws to understand mechanism, to develop machines based on simple mechanism and understand forces involved. To understand different types of gears based on link mechanisms.

Credits: 04 Semester IV L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Introduction:</strong> Links-Types, Kinematics Pairs-Classification, Constraints-Types, Degree of Freedom, Grubler’s Criterion, Kutzbach Equation, Linkage Mechanisms, Inversions of Four Bar Linkage, Slider Crank Chain and Double Slider Crank Chain. <strong>Velocity in Mechanisms:</strong> Velocity of Point in Mechanism, Relative Velocity Method, Instantaneous Point in Mechanism, Kennedy’s Theorem, Instantaneous Center Method. <strong>Acceleration in Mechanisms:</strong> Acceleration Diagram, Coriolis Component of Acceleration, Klein’s Construction for Slider Crank and Four Bar Mechanism, Analytic Method for Slider Crank Mechanism.</td>
<td>13</td>
</tr>
<tr>
<td>III</td>
<td><strong>Cams:</strong> Cams and Followers – Classification &amp; Terminology, Cam Profile By Graphical Methods for Uniform Velocity, Simple Harmonic Motion, Cycloidal and Parabolic Motion of Followers, Analytical Cam Design – Tangent and Circular Cams. <strong>Gears:</strong> Classification &amp; Terminology, Law of Gearing, Tooth Forms, Interference, Under Cutting, Minimum Number of Teeth on Gear and Pinion to Avoid Interference, Simple, Compound and Planetary Gear Trains.</td>
<td>16</td>
</tr>
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</table>

Text Books:
- S. S. Tatan, Theory of Machine, TMH

Reference Books:

Outcome: After studying this subject students will be able to understand:
- How different types are link mechanism when joined properly complex machines can be developed which can perform very complex functions
- Students will be able to prepare small and simple engineering project based on kinematic link theory.
CSE 4070: DATA STRUCTURES AND APPLICATIONS
(B. TECH. (EC/ME/EE/EN))

Objective: The objective of this course is that students will construct and application of various data structures and abstract data types including lists, stacks, queues, trees and graphs.

Credits: 03

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td><strong>Queues</strong>: Operations on Queue - Add, Delete operations, Implementation of Queue Using Array and Linked List, Circular Queues, Dequeue and Priority Queue. <strong>Trees</strong>: Basic Terminology, Array Representation and Dynamic Representation; Complete Binary Tree, Extended Binary Trees, Tree Traversal Algorithms - Inorder, Preorder and Postorder. <strong>Search Trees</strong>: Binary Search Trees (BST), Insertion and Deletion in BST, Introduction to B tree.</td>
<td>13</td>
</tr>
<tr>
<td>III</td>
<td><strong>Graphs</strong>: Terminology, Adjacency Matrices, Adjacency List, Graph Traversal - Depth First Search and Breadth First Search; Spanning Trees, Minimum Cost Spanning Trees - Prims and Kruskal Algorithm; Shortest Path Algorithm - Dijkstra Algorithm. <strong>Searching</strong>: Sequential Search, Binary Search. <strong>Sorting</strong>: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Two Way Merge Sort, and Heap Sort. <strong>Hashing</strong>: Hash Function, Collision Resolution Strategies.</td>
<td>13</td>
</tr>
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</table>

Text Book:

Reference Books:

Outcome: After completion of course, student will be able to:
- Understand the concepts of data structure, data type and array data structure.
- Analyze algorithms and determine their time complexity.
- Implement linked list data structure to solve various problems.
- Understand and apply various data structure such as stacks, queues, trees and graphs to solve various computing problems using C programming language.
AHE 4083: ENGLISH FOR PROFESSIONAL PURPOSES - II

**Objective:** The main objective of the course is to provide the students an opportunity to be exposed to different aspects of English language. The course has two major components - firstly, Verbal aptitude with reference to English language and secondly, Drills on oral communication through GD, individual and group presentations and mock-interviews. Peer-learning is an essential component of the course. The participants will be expected to offer their free, constructive feedback to their counterparts.

**Credits: 02**

**Semester III**

**L–T–P: 0–0–4**

### Oral Skills:

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Extempore (peer evaluation), debate (on pre-assigned topics), GD: small group discussion, large group discussion (on pre-assigned topics), Cover letter, résumé writing: practice &amp; assignment</td>
<td>10</td>
</tr>
<tr>
<td>II</td>
<td>Pre-presentation skills: Preparation- Library research, pooling resources, visual aids, referencing norms, ideal slide, dos and don'ts of presentation Presentation- feedback by the instructor, (body language: posture, spelling convention, smooth transition/turn taking, voice-modulation, proxemics of presentation, handling questions)</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td>Just a minute (JAM) Pre-interview preparation: know the prospective company, grooming- dressing and attitude, interview etiquettes Peer mock-interview Discussion on most frequently asked questions in interview External (faculty) interview</td>
<td>8</td>
</tr>
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</table>

### Verbal Ability:

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>PoS identification- I FIB on PoS Theme detection Error correction (subject-verb agreement) Error correction (Usage of tense) I &amp; II Error correction (determiners) Quiz- S-V agreement &amp; Tense Quiz- Determiners &amp; PoS Paragraph forming: Jumbled paragraph-1 Quiz- Jumbled Paragraph &amp; Theme detection Commonly confused spellings &amp; mispronounced words</td>
<td>10</td>
</tr>
<tr>
<td>II</td>
<td>Reading comprehension- summarization; Syn-Ant- I Error correction- Preposition- I &amp; II One word substitution Common errors in Passive and Causative construction Quiz: CCS and MW&amp; OWS Paragraph forming (jumbled paragraphs)- I</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td>Reading comprehension- II Non-finite structure: Gerund, Infinitive, participial FIB on modals Quiz: Gerund, Infinitive, participial &amp; causative and passive Word formation: Inflection, Derivation, Clipping, Compounding, Abbreviation, Acronym</td>
<td>8</td>
</tr>
<tr>
<td>Conditionals: theory &amp; Error correction</td>
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<tr>
<td>Quiz: Conditionals, Conjunction and connective</td>
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<tr>
<td>Error correction (Misplaced &amp; dangling modifiers)</td>
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<tr>
<td>Quiz: Word formation</td>
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<tr>
<td>Paragraph forming - II</td>
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<tr>
<td>Quiz: Term I &amp; Term II</td>
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<tr>
<td>Quiz: Term III</td>
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</tbody>
</table>

**STUDY & DRILL MATERIAL/REFERENCE BOOKS**

- Allegheny college career services: interviewing skills [http://sitesALLEGHENY.edu/career/interviewing/](http://sitesALLEGHENY.edu/career/interviewing/)
- J.D. O’Connor. *Better English Pronunciation*, CUP
- M. Ashraf Rizvi. *Effective Technical Communication*, TMH.
- Peter Roach. *English Phonetics and Phonology*, CUP

**Outcome:** On the completion of this course, the students will be able to do the following things-

- They will be able to communicate in simple formal situations such as meetings and discussions.
- They will be able to interact in organizational setting with basic level of appropriateness and fluency.
- They will develop a sense of language use in relation to place, person and time.
- They will be able to identify and correct basic level errors in written English.
- They will develop some sense of common errors in English grammar.
# MEE 4081: MEASUREMENT AND METROLOGY LAB

**Objective:** To educate students on different measurement systems and on common types of errors. To introduce different types of sensors, transducers and strain gauges used for measurement. To give knowledge about thermocouples, thermometers and flow meters used for measurements. To introduce measuring equipments used for linear and angular measurements. To familiarize students with surface roughness measurements on machine Components.

**Credits:** 01  
**Semester:** IV  
**L–T–P:** 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
</tr>
</thead>
</table>
| I          | List of Experiments:  
|            | • To Find Out the Error in the Shape of the Cube and Parallelism Among the Surfaces of the Cube Using Vernier Caliper.  
|            | • To Analyzed the Deviation in Diameter of A Given Specimen Using Micrometer.  
|            | • To Determine the Speed of A Motor Using Tachometer (Contact Device).  
|            | • To Measure the Angle of A Given Specimen (Wooden Block) Using Sine Bar and Slip Gauges.  
|            | • To Study the Limit Gauge For Better Understanding of Limits, Fits and Tolerances.  
|            | • To Observe the Angular Measurements of A Given Specimen Using Bevel Protector.  
|            | • To Measure and Adjust the Spark Plug Gap Using the Feeler Gauges.  
|            | • To Perform Strain Measurement in Cantilever Beam Using Strain Gauge By Applying the Different Loads.  
|            | • To Find Out the Circularity of A Cylindrical Rod Using Dial Gauge Indicator and V-Block.  
|            | • To Find Out the Speed of Any Rotating Part (I.E., Ceiling Fan) Using Stroboscope (Non-Contact Device).  
|            | • To Measure the Height of A Given Specimen Using Height Gauge.  
|            | • To Determine the Temperature of A Heat Bath Using Resistance Type Detector (RTD) and Thermocouple.  
|            | • To Measure the Linear Displacement Using Linear Variable Differential Transformer (LVDT).  
|            | • To Measure the Pressure Using Bourdon Gauge and Strain Gauge.  
|            | • To Determine the Torque of A Rotating Shaft Using Strain Gauge Coupled With Torque Sensor.  
|            | • To Find Out the Flatness of A Surface Plate Using Spirit Level. |

| Teaching Hours | 24 |

**Outcome:** After studying this subject students will be able to understand:  
• Measure the given mechanical elements and assemblies using linear and angular analog/digital measuring instruments.  
• Check geometrical accuracy of given application.  
• Explain surface roughness checking instruments.  
• Measure and derive important dimensions of various thread forms and gears.
MEE 4182: MANUFACTURING SCIENCE & TECHNOLOGY - I LAB

Objective: The purpose of this lab is to enable the students to have the practical skills for basic manufacturing operations e.g. Preparation of Sand, Making Pattern with allowances, Preparation of different types of moulds with cores for various castings. The student will also have practical exposure to Press work and die assembly and machining processes on various machine tools such as Spur gear on milling machine, knurling Bush on Capstan Lathe and preparation of Single point cutting tool on Tool Grinding machine.

Credits: 01

Semester IV

L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | List of Experiments -
- To study and analyze Induction Melting Furnace.
- To design and fabricate the pattern for a given component considering different allowances and surfaces with required machining.
- (a). Square Block as per given dimensions.
- (b). Hollow Step pulley.
- To make a casting for half bush gland by self hanging core mould as per given dimensions.
- (a) To make a casting for Square Block with the help of green sand mould.
- To make a casting for hollow step pulley with the help of green sand mould.
- (a). To forge a bar of circular cross section from square bar keeping length constant and analyze the change in grain structure at cross section & also evaluate the hardness before & after forging.
- (b). To forge the circular ring by use of forge welding operation & join the same by upsetting.
- To make a single point cutting tool with the help of tool grinding machine according to the given tool signature.
- To carry out the sand testing and determine the Grain Fineness Number (GFN) by use of Sieve Shaker apparatus.
- To make the component of plastic granular by use of Injection Moulding Machine.
- To machine the Cast Iron Block on shaper machine and to maintain the as per desire surface roughness finishing.
- To make a Butt joint by the use of gas welding with different type of flames. | 24 |

Outcome: On successful completion of this lab, the students will be able to:
- Demonstrate an understanding of and comply with Foundry Shop.
- Able to use tools for mould preparation, cores for manufacturing the casting objects and identify the defects produced in castings.
MEE 4085: MACHINE DRAWING LAB

Objective: Students have an ability to apply knowledge of Modeling, science & engineering. Student can model this drawing even in CAD/CAM software by applying the basic knowledge of machine drawing. Students will able to demonstrate an ability to design and conduct experiments, analyze and interpret data and assembly and disassembly drawings knowledge will be provided.

Credits: 01 Semester IV L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Orthographic Projections** (1 drawing sheet)  
Principle of first angle and third angle projection, drawing of machine elements in first angle projection, selection of views, sectional views.  
**Screwed fasteners** (2 drawing sheet)  
Thread nomenclature, Forms of thread, Thread series, designation, Representation of threads, Bolted joints, Locking arrangements of nuts, Foundation bolts.  
**Keys, Cotter Joint and Pin joint** (1 drawing sheet)  
Types of keys, Cotter joint or Knuckle joint.  
**Shaft Couplings** (1 drawing sheet)  
Rigid Coupling or Flexible coupling.  
**Riveted joints** (1 drawing sheet)  
Types of rivet heads, Types of riveted joints, Boiler joint.  
**Assembly Drawing** (1 drawing sheet)  
Engine parts-stuffing box, cross head, Assembly drawing of eccentric, lathe tail stock, air valve, screw jack, connecting rod safety valve etc.  
**Free hand sketching** (sketch sheet)  
Free hand sketching of foundation bolts, studs, pulleys, couplings, helical gear, bevel gear, crank, connecting rod, belt pulley, piston etc.  
**Production Drawing** (2 drawing sheets)  
Types, Examples of simple machine elements like helical gear, bevel gear, crank, connecting rod, belt pulley, piston etc.  
**Computer Aided Drafting** (2 drawings)  
Introduction, input, output devices, introduction to software like AutoCAD, Pro-E, basic commands and development of 2D and 3D drawings of simple parts. | 24 |

Outcome: After studying this subject students will be able to understand:
- Analysis of complex design systems related to mechanical Engineering.
- Making use of appropriate laboratory tools and design innovative methods.
- To motivate students to develop new innovative methods for measuring product characteristics.
- Improving skills to adopt modern methods in mechanical engineering as continuous improvement.
Objective: To teach students various data structures and to explain them algorithms for performing various operations on these data structures.

<table>
<thead>
<tr>
<th>Credits: 01</th>
<th>Semester IV</th>
<th>L–T–P: 0–0–2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module No.</td>
<td>Content</td>
<td>Lab Hours</td>
</tr>
</tbody>
</table>
| I           | • Program to implement various operations in a singly linked list.  
              • Program to implement insertion, deletion and traversal in a doubly linked List.  
              • Program to implement polynomial addition using linked list.  
              • Program to demonstrate the various operations on stack.  
              • Program to convert an infix expression into postfix expression.  
              • Program to evaluate a given postfix expression.  
              • Program to demonstrate the implementation of various operations on linear and circular queue.  
              • Program to demonstrate the implementation of insertion and traversals on a binary search tree.  
              • Program to search a given element as entered by the user using sequential and binary search to search a given element as entered by the user.  
              • Implementation of various sorting algorithms like Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort and Heap Sort. | 24 |

Outcome:
- Understand the concept of Dynamic memory management, data types, and algorithms.
- Understand basic data structures such as arrays, linked lists, stacks and queues.
- Describe the hash function and concepts of collision and its resolution methods.
- Solve all kinds of sorting algorithms.
- Solve problem involving graphs, trees and heaps.
AHE 4081: SOFT SKILLS-II

Introduction: This Course on Soft Skills Would Help the Students in Getting A Deeper Insight in Acquisition of Four Skills of LSRW. Various Activities and Exercises on Conversation, Discussion, Mini Presentations, Skimming, Scanning and Detailed Reading Etc. Will Provide the Students Enough of Opportunities & Exposure to Sharpen Their Soft Skills.

Objective:
- To Make the Students Aware of the Primary Skills and Sub Skills Involved in Using English Effectively At the Contemporary Corporate Workplace With A Global Presence.
- To Provide Practice and Guidance to Enhance Skills to the Proficiency Level Expected by Any Organization.

Credits: 01  Semester IV  L-T-P: 0-0-2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>• Introduction to English and Grammar.</td>
<td>10</td>
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<tr>
<td></td>
<td>• Speaking Face to Face Vs. Over the Phone.</td>
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<td></td>
<td>• Auxiliary and Modal Verbs.</td>
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<td></td>
<td>• 4 Techniques of Reading- Skim, Scan, Intensive, Extensive</td>
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<td></td>
<td>• ABC of Writing, the KISS Concept.</td>
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<td></td>
<td>• Presenting Ideas, Information and Opinions With Clarity.</td>
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<td></td>
<td>• Listening for Information and Making Inferences.</td>
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<td>• Intonation, Word Stress, Pacing, Sound Clarity</td>
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<tr>
<td>II</td>
<td>• Second Level of Reading to Interpret Information</td>
<td>10</td>
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<tr>
<td></td>
<td>• Subject Verb Agreement</td>
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<tr>
<td></td>
<td>• Understanding Ideas and Making Inferences</td>
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<td>• Indianism, Question Tags, Phrasal Verbs</td>
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<td>• Prepositions, Active and Passive Voice</td>
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<td>• Third Level Reading and Data Interpretation</td>
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<td>• Sentence Stress, Connected Speech</td>
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<td>• Tenses</td>
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<td>III</td>
<td>• Adverbs, Adjectives, Modifiers, Collocation</td>
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<tr>
<td></td>
<td>• Discussing Data and Coming to Conclusions</td>
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<td>• Link Expressions, Compound Nouns</td>
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<td>• Negotiation Skills</td>
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<td></td>
<td>• Business Quiz, Idioms and Phrases</td>
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<td>• Individual Presentation on Speaking and Writing</td>
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<td></td>
<td>• Feedback and Poster Creation</td>
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</tbody>
</table>

Reference Books:
- Infosys modules on English lab.
- PPT slides & videos provided by Infosys.

Material:
- Audio-Video Material available in the language Lab.
MEE 5201: MANUFACTURING SCIENCE AND TECHNOLOGY– II

Objective: In this course students acquire the ability to formulate problems in Traditional and advanced metal cutting and evaluate the cutting parameters, establish a complete solution to metal cutting problems using mathematical or graphical techniques.

Credits: 04 Semester V L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
**Grinding:** Grinding Wheel, Abrasive & Bonds, Grinding Wheel Specifications, Grinding Wheel Wear, Attritions Wear & Fracture Wear, Dressing & Truing, Surface Grinding, Cylindrical Grinding & Center less Grinding  
*Outcomes:* learner will able to understand the various machining processes and parameters and its effects according to tools and materials application. | 14 |
| II | **Machine Tools:** Working Principle, Constructions and Operations of Turret and Capstan Lathe, Tool Lay Out Turret and Capstan Lathe, Shaper, Planer, Slotter, Milling, Dividing Head and Indexing,  
Introduction to Rapid Prototyping Technology (RPT), Rapid Manufacturing, Rapid Tooling Application and Advancement.  
Introduction of Solid Based (SB), Liquid Based (LB), Powder Based (PB) Rapid Prototyping.  
*Outcomes:* learner will able to understand the basics of various machine tools and other advanced manufacturing processes. | 14 |
| III | **Advanced Machining:** Working Principle & Applications of Laser Beam Machining (LBM), Electron Beam Machining (EBM), Electro chemical Machining (ECM), Electric Discharge Machining (EDM), abrasive Jet Machining (AJM), Ultrasonic Machining (USM) and Plasma Arc Machining(PAM)  
Introduction of Hybrid Machining.  
**Super-Finishing Process:** Honing, Lapping & Buffing, Magnetic Abrasive Finishing (MAF)  
*Outcomes:* learner will able to understand the processing of various advanced machining and finishing processes according to materials and utility. | 12 |

Recommended Books:
- Ghosh and Malik, “Manufacturing science”, East West Pvt. Ltd.

Outcome: Upon completion of this course, students will have demonstrated the ability to apply the engineering mathematics to solve the basic problems of metal cutting, Apply analytical tools from a variety of their technical courses, Perform cutting force analysis of metal cutting machines.
MEE 5102: MACHINE DESIGN – I

Objective: To make students able to know the basic design process, to understand the uses of standards in design process, to underline modes of failure, to examine theories of failures for different machine component subjected to static load, to understand fatigue failures of machine component, to understand the design process of various machine components.

Credits: 04  
Semester V  
L-T-P: 3-1-0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
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</table>
Manufacturing Consideration in Design: Statistical Considerations, Selective Assembly, Design Consideration in Machining, Castings, Forgings, Welding.  
Design Against Static Load: Modes of Failure, Factor of Safety, Principal Stresses, Stresses Due to Bending and Torsion, Theories of Failure.  
| II         | Design of Riveted Joints: Types of Riveted Joints, Failure of Riveted Joint, Efficiency of Riveted Joint, Design of Boiler Joints, Eccentric Loaded Riveted Joint.  
Design of Threaded Joint: Design of Bolted Joint, Eccentrically Loaded Bolted Joint.  
Design of Welded Joints: Stresses in Butt and Fillet Welds, Eccentrically Loaded Joint.  
| III        | Keys and Couplings: Types of Keys, Splines, Design of Square & Flat Keys, Couplings- Design of Rigid and Flexible Couplings.  
Mechanical Springs: Types, Material for Helical Springs, End Connections for Compression and Tension Helical Springs, Stresses and Deflection of Helical Springs of Circular Wire, Design of Helical Springs Subjected to Static and Fatigue Loading, Design of Leaf Spring.  
Power Screws: Forms of Threads, Multiple Threads, Efficiency of Square Threads, Trapezoidal Threads, Stresses in Screws, Design of Screw Jack.  
Note: Design Data Book Is Allowed in the Examination |

Text Books:

Reference Books:
- Spott M.F., “Machine design”, Prentice Hall India.

Outcome: Upon completion of this course, students will able to demonstrate:
- The design process of machine elements.
- Analyze and identify the failure criteria of machine component under static and variable load.
- Design an individual machine member by applying various theories of failure depends upon its application.
MEE 5003: DYNAMICS OF MACHINES

Objective: The objective of this course is to provide the details of the concepts of generalized forces and Static and dynamic force analysis, concepts of static and dynamic mass balancing. To introduce the approaches and mathematical models used dynamical analysis of machinery. To teach students concepts of free Vibration of Single Degree of Freedom Systems, Vibration Measurement and Applications, Modal Analysis.

Credits: 04
Semester V
L-T-P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Governors: Terminology, Centrifugal Governors-Watt Governor, Dead Weight Governors-Porter &amp; Froell Governor, Spring Controlled Governor-Hartnell Governor, Sensitivity, Stability, Hunting, Isochronism, Effort and Power of Governor, Controlling Force Diagrams for Porter Governor and Spring Controlled Governors. Friction: Pivots and Collar Friction-Uniform Pressure and Uniform Wear, Frictional, Centrifugal Clutches, Belt and Pulley Drive, Length of Open and Cross Belt Drive, Ratio of Driving Tensions for Flat Belt Drive, Centrifugal Tension, Condition for Maximum Power Transmission, V Belt Drive. Brakes &amp; Dynamometers: Shoe Brake, Band Brake, Band and Block Brake, Absorption and Transmission Type Dynamometers.</td>
<td>13</td>
</tr>
</tbody>
</table>

Text Books:
- Rattan S.S., “Theory of Machines”, TMH.

Reference Books:

Outcome: Upon completion of this course, students will able to:
- Take notice of importance of the balancing and learn procedures of the basic balancing.
• understand the implications of computed results in dynamics to improve the design of a mechanism. Understand how to determine the natural frequencies of continuous systems starting from the general Equation of displacement.

• knowledge of dynamics of machines so that he can appreciate problems of dynamic force balance, transmissibility of forces, and isolation of systems, vibrations, instrumentation and standards.
**Objective:** To give an introductory knowledge of the governing laws for heat and mass transfer. To understand the fundamentals of heat transfer mechanisms in fluids and solids for steady state and transient conduction and their applications in various heat transfer equipments in industry.

**Credits:** 04

**Semester V**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Introduction to Heat Transfer:</strong> Concepts of the Mechanisms of Heat Flows; Conduction, Convection and Radiation; Effect of Temperature on Thermal Conductivity of Materials; Introduction to Combined Heat Transfer Mechanism. <strong>Conduction:</strong> One-Dimensional General Differential Heat Conduction Equation in the Rectangular, Cylindrical and Spherical Coordinate Systems; Initial and Boundary Conditions. <strong>Steady State One-Dimensional Heat Conduction:</strong> Composite Systems in Rectangular, Cylindrical and Spherical Coordinates With and Without Energy Generation; Thermal Resistance Concept; Analogy Between Heat and Electricity Flow; Thermal Contact Resistance; Critical Thickness of Insulation. <strong>Fins:</strong> Heat Transfer From Extended Surfaces, Fins of Uniform Cross-Sectional Area. <strong>Transient Conduction:</strong> Transient Heat Conduction; Lumped Capacitance Method; Time Constant; Unsteady State Heat Conduction in One Dimension Only, Heisler Charts.</td>
<td>16</td>
</tr>
<tr>
<td>II</td>
<td><strong>Natural Convection:</strong> Physical Mechanism of Natural Convection; Characteristic Length, Empirical Heat Transfer Relations for Natural Convection Over Vertical Planes and Cylinders, Horizontal Plates and Cylinders. <strong>Forced Convection:</strong> Basic Concepts; Hydrodynamic Boundary Layer; Thermal Boundary Layer; Flow Over A Flat Plate; Empirical Heat Transfer Relations; <strong>Introduction to Mass Transfer:</strong> Introduction; Fick’s Law of Diffusion; Steady State Equimolar Counter Diffusion; Steady State Diffusion Though A Stagnant Gas Film, Different Dimensionless Number.</td>
<td>10</td>
</tr>
<tr>
<td>III</td>
<td><strong>Radiation:</strong> Gray Body; Shape Factor; Black-Body Radiation; Radiation Exchange Between Diffuse Non Black Bodies in An Enclosure; Radiation Shields; Electrical Analog of Radiation Heat Transfer; Solar Radiation. <strong>Heat Exchanger:</strong> Types of Heat Exchangers; Fouling Factors; Overall Heat Transfer Coefficient; Logarithmic Mean Temperature Difference (LMTD) Method; Effectiveness-NTU Method; Compact Heat Exchangers. <strong>Condensation and Boiling:</strong> Introduction to Condensation Phenomena; Drop wise Condensation; Heat Pipes; Boiling Modes, Pool Boiling;</td>
<td>14</td>
</tr>
</tbody>
</table>

**Text Books:**
- Rajpoot, R.K. “Heat and Mass Transfer”, S. Chand
- D.S.Kumar, “Heat and Mass Transfer” S.K Kataria & sons

**Reference Books:**
- Bayazitouglu & Ozisik, “Elements of Heat transfer”, T.M.H.
Course Curriculum (w.e.f. Session 2017-18)

B.Tech. (Mechanical Engineering)

- Gupta, Vijay, "Heat Transfer", New Age International (P) Ltd. Publishers

**Outcome:** Upon completion of this course, students will have the:

- Ability to design and analyze the performance of heat exchangers and evaporators.
- Ability to design and analyze reactor heating and cooling systems.
- Ability to analyze and calculate heat transfer in complex systems involving, several heat transfer mechanisms. Students will learn about the diffusional mass transfer. Operation of cooling tower will be clearly understood. Ability to Explain the basic modes of boiling and condensation heat transfer.
- Use the appropriate correlations to calculate heat transfer coefficient and heat flux for a range of boiling heat transfer situations.
Objective: The objectives of the course are to have students identify and practice the object-oriented programming concepts and techniques, practice the use of C++ classes, class libraries and features.

Credits: 03  Semester V  L-T-P: 3–0–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction**: Structured versus Object-Oriented development, characteristics of Object-Oriented programming.  
**Introduction of Class and Objects**: class specification, class objects, accessing class members, defining member functions, outside member functions as inline, accessing member functions within a class, data hiding, access boundary of objects revisited, empty classes, pointers within a class, passing objects as arguments, returning objects from functions.  
Friend function and friend classes, constant parameters and member functions, static data and member functions, nested classes.  
Constructors and its type, destructor, constructor overloading, order of construction and destruction, nameless objects, dynamic initialization through constructors, constructors with dynamic operations. | 14 |
| II         | **Polymorphism**: Function overloading, Operator overloading. Data conversion, Conversion between basic data types, conversion between objects and basic types, conversion between objects of different classes,  
**Inheritance**: Introduction, forms of inheritance, inheritance and member accessibility, multilevel inheritance, multiple inheritance, hierarchical inheritance, multipath inheritance and virtual base classes, hybrid inheritance. | 13 |
| III        | **Virtual functions**: Introduction, need for virtual functions, pointer to derived class objects, definition of virtual functions, array of pointers to base class objects, pure virtual functions, abstract classes, virtual destructors.  
**Generic programming with templates**: Introduction, function templates, overloaded function templates, nesting of function calls, multiple arguments function templates, user defined template arguments, class templates. | 13 |

References:


Outcome: After completion of course, student will be able to:

- Understand differences between procedures oriented and object oriented approach.
- Understand object-oriented design and programming.
- Create simple classes having data members and member functions.
- Understand the use of polymorphism and Inheritance.
- Understanding overloading and overriding concepts.
- Understand the concept of template classes and be able to instantiate objects from both regular and template classes.
Objective: The purpose of this lab is to enable the students to have the practical skills manufacturing operations and design Jig and Fixtures, Cutting Tools, Measuring Tools, Press Tools for washer making, design of a circular form tool, design the gang milling arrangement of cutters, tooth profile & tolerances for arbor, cutter & key, twist drill to machine the holes. The student will also have practical exposure to analysis the cutting force components of a tool point with design of various tool angles and machining variables.

Credits: 01

Module No. | Content | Teaching Hours
---|---|---
| To make the square thread OR V-threads on M.S. bar for square bolt on Centre lathe as per given figure. Mention all the specifications of Centre lathe. | | 4
| To machine a cast iron block and make a V-Block on its surface by use of shaper machine as per given figure. Also mentioned the technical specifications. | | 4
| To make the Tool layout of a Capstan and Turret lathe for a given component and then machine this component as per given drawing and sketch. | | 4
| To finish the surface of given work-piece on Surface Grinding Machine and mention all the technical specification of this machine, and analyze the surface texture & surface roughness. | | 4
| To study of the Milling machine and its specifications and prepare the plain spur gear of 27 teeth as per given figure by using compound indexing method. | | 4
| To prepare the 4-slots as per drawing on given M.S. bar on Slotting machine by use of indexing method. | | 4
| To prepare the following joints with an electric arc welding or by use of the Gas welding as per given figure and sketch and find the weld strength, microstructure of HAZ and various weld defects and their possible causes on remedies suggested by you. | | 8
| i) Lap Joints/T-joints. ii) Single-V Butt joints. | | 8
| To make the Lap-joints of G.I. sheet pieces by use of the following: | | 8
| i) Resistance Spot Welding. ii) Soldering process. | | 8
| Estimate the various forces during cutting in X-Y-Z direction and draw a curve with feed rate and Depth of cut (D.O.C.) along with temperature at cutting zone. | | 8
| Show the various of cutting forces with the changing in cutting angle and suggest the optimum condition with minimum cutting temperature with the help of cutting tool dynamometer. | | 8
| To prepare the pipe joint by use of: | | 8
| (a). TIG Welding (for root filling) | | 8
| (b). Joint test by Die Penetration (D.P.) Method. | | 8
| (c). Final weld by Submerged Arc Welding Machine. | | 8
| | 24

Outcome: On successful completion of this lab, the students will be able to demonstrate:

- An understanding of design of various machine tools, cutting tools & measuring tool layout and consideration of machining variables at different cutting conditions.
- Acquire practical skills in the designing of press tool along with die assembly and the operations performed on them.
- They would also be able to calculation of various cutting force components of a tool point.
MEE 5082: MACHINE DESIGN – I LAB

Objective: The primary objective of this course is to demonstrate how engineering design uses the many principles learned in previous engineering science courses and to show how these principles are practically applied. Estimate fatigue strengths of steel parts. Apply techniques of combined stress and Mohr’s circle in machine design situations.

Credits: 01

Semester V

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
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<tbody>
<tr>
<td>List of Experiments</td>
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</table>

Students are Advised to Use Design Data Book For the Design. Drawing Shall be Made Wherever Necessary (Using CAD-Software Such as AutoCAD).

- Design & Drawing of Cotter Joint.
- Design & Drawing of Knuckle Joint.
- Design of Machine Components Subjected to Combined Steady and Variable Loads.
- Design & Drawing of Eccentrically Loaded Riveted Joint.
- Design & Drawing of Boiler Riveted Joint.
- Design of Shaft for Combined Constant Twisting and Bending Loads.
- Design of Shaft Subjected to Fluctuating Loads.
- Design & Drawing of Flanged Type Rigid Coupling.
- Design & Drawing of Flexible Coupling.
- Design of Helical Spring.
- Design of Leaf Spring.
- Design of Helical Spring Subjected to Fluctuating Load.
- Design of Screw Jack.
- Design of Eccentrically Loaded Welded Joint.
- Design of Eccentrically Loaded Threaded Joint.

Outcome: On successful completion of this lab, the students will be able to demonstrate:

- Ability to compile engineering mechanics and engineering graphics concepts as they are used in the solution of the design problem.
- Ability to apply knowledge of mathematics, science, and engineering in the field of mechanical engineering.
- Ability to design a system, component, or process to meet desired needs in the field of mechanical engineering. Ability to identify, formulate and solve mechanical engineering problems Understanding of professional and ethical responsibility in the field of mechanical engineering.
MEE 5083: THEORY OF MACHINES LAB

Objective: Objectives of this Theory of Machines lab are to impart practical knowledge on design and analysis of mechanisms for the specified type of motion in a machine. With the study of rigid bodies motions and forces for the transmission systems, machine kinematics and dynamics can be well understood. Demonstration exercises are provided with wide varieties of transmission element models to understand machine kinematics. Various experiments with governors, gyroscopes, balancing machines and universal vibration facilities are available to understand machine dynamics.

Credits: 01  Semester V  L-T-P: 0-0-2

<table>
<thead>
<tr>
<th>Module No.</th>
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<tbody>
<tr>
<td></td>
<td><strong>List of Experiments</strong></td>
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<tr>
<td></td>
<td>• Study of Simple Linkage Models/Mechanisms and Verification of Grash off’s Criteria of Four Bar Linkages.</td>
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<td>• Determination of Velocity Ratio and Verification of Holding torque in Epicyclic Gear Trains.</td>
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<td>• Determination of Natural Frequency in Longitudinal Vibrating System.</td>
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<td></td>
<td>• Determination of Natural Frequency in Transverse Vibration System.</td>
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<td></td>
<td>• Experimental investigation of the Characteristics of Dead Weight Mechanical Governor.</td>
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<td>• Experimental investigation of the Characteristics of Spring Controlled Governor.</td>
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<td></td>
<td>• Determination of Critical Speed in Whirling of Shafts.</td>
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<td></td>
<td>• Study of the Principles of Gyroscope and Verification of the Equation of Gyroscopic Couple.</td>
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<td></td>
<td>• Study of the Concept of Statics &amp; Dynamic Balancing of Rotating Masses in Single and Multi Planes and Verification of Balancing Principles.</td>
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<tr>
<td></td>
<td>• Measurement of Slip in Flat Belt under Different Belt Tensions and Varying Load Conditions.</td>
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<tr>
<td></td>
<td>• Measurement of Slip in V Belt under Different Belt Tensions and Varying Load Conditions.</td>
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<tr>
<td></td>
<td>• Measurement of Creep in Flat Belt.</td>
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<td>• Measurement of Creep in V Belt.</td>
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<td></td>
<td>• Development of Displacement Curves of Cam and Determination of Jumping Speeds.</td>
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<td>• Determination of Carioles Component of Acceleration Using Hydraulic Analogy.</td>
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</table>

Outcome: Students will be able to understand:

- The different types of mechanism involved in the machine.
- They will understand the concept of whirling of shaft, effect of gyroscopic couple on aeroplane.
- They will also get knowledge about the slip and creep phenomena occur in belt drive and practically know how the governor apparatus works.
- They know the condition of Static and dynamic balancing.
- By demonstration of vibration they will understand the various types of vibratory motions.
MEE 5084: HEAT AND MASS TRANSFER LAB

Objective: Heat Transfer is one of the important subjects which is commonly applied in renewable energy, industrial, commercial and domestic systems. The experiments are designed to provide exposure of practical aspects of the various theoretical concepts developed under the course, Heat and Mass Transfer. The laboratory consists of experiments on various conductive, convective, radiative, boiling mechanisms of heat transfer.

Credits: 01

Module No. | Content | Teaching Hours
--- | --- | ---
| **List of Experiments**
- To Determine the Overall Heat Transfer Coefficient For A Composite Wall
- To determine the thermal Conductivity of A Metallic Rod and Draw A Graph Between Variation in Conductivity and Temperature.
- To Determine the Heat Transfer Rate Through the Composite Cylinder and the Overall Heat Transfer Coefficient of Composite System
- To Determine the thermal Conductivity of Liquid
- To Determine the thermal Contact Resistance of A Composite Wall
- To Determine the Critical Thickness of insulation of A Lagged Pipe.
- To Determine the Heat Transfer Through A Heat Pipe & Draw A Temperature Distribution Profile Under Steady State Condition
- To Determine the Heat Transfer & Temperature Distribution Along A Uniform Cross-Section Fin Under Steady State in Free Convection.
- To Determine the Heat Transfer & Temperature Distribution Along A Uniform Cross-Section Fin Under Steady State in Forced Convection.
- To Determine the Specific Heat of Air under Specified atmospheric Conditions.
- To Determine the Stefan Boltzmann Constant Under Given Condition.
- To Determine the Emissivity of A Test Plate.
- To Determine the View Factor /Shape Factor of A Given Arrangement.

Outcome: Students will be able to understand:
- Practically relate to concepts discussed in the Heat & Mass Transfer course.
- To conduct various experiments to determine thermal conductivity and heat transfer coefficient in various materials.
- To select appropriate materials & designs for improving effectiveness of heat transfer.
- Ability to measure the quantity of heat transfer between fluids and solid boundaries.
- Ability to carry out simple experimental work in radiative heat transfer.
Objective: Justify the philosophy of object-oriented programming by design, implement, test, and debug using C++ programming language.

Outcome:
- Able to create correctly formatted C++ programs.
- Able to create simple classes having data members and member functions.
- Able to build programs using constructor, friend function, polymorphism and Inheritance.
- Able to design the real world problem using C++.

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Lab Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Programs Based on the Concepts of: Class and Object, Reference Variable, Use of Scope Resolution Operator, Default Arguments, Inline Function.</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Programs Based on the Concepts of: Constructors, Destructors, Friend Function, Object as Parameter, Object as an Arguments and Keyword Static.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Programs Based on the Concepts of: Function Overloading, Operator Overloading and Type Conversion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Programs Based on the Concepts of: Inheritance, Virtual Function, Abstract Class, This Pointer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Programs Based on the Concepts of: Template.</td>
<td></td>
</tr>
</tbody>
</table>

Credits: 02  Semester VI  L–T–P: 0–0–4
AHE 5081: SOFT SKILLS-III

This Course Focuses on the Use of English, Specifically in Business Situations. The Course Is Based on Diverse Range of Business Themes Which Help Students Visualize the Expectations From A Professional.


Credits: 01 Semester V L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | Business Communication Skills.  
             English Language Enhancement.  
             Verbs, Tenses, Phrasal Verbs  
             Synonyms, Antonyms and Homonyms.  
             Descriptive Words, Combining Sentences, Business Idioms.  
             Indianism in English, Frequently Mispronounced Words, Signposts in English.  
             The Art of Communication.  
             The Communication Process, Effective Listening, Non Verbal Communication. | 10 |
| II         | Intrapersonal & interpersonal Relationship Skills.  
             Self-Awareness, Self Esteem & Confidence, Assertiveness and Confidence.  
             Dealing With Emotions, The Team Concept, Elements of Teamwork, Stages of Team formation, What Is An Effective Team?  
             Essential Building Blocks of Effective Teams, Team Player Styles. | 10 |

Reference Books:

- Cook, S., “The Effective Manager (e-book)”, IT Governance Publishing,
MEE 6001: FLUID MACHINERY

Objective: It is major branch of mechanics. It introduces students about fluid and its difference with solids. Geometry of fluid flow can be visualized. Its importance lies in its wide ranging applications in fluid power engineering and mechanics of fluid flow. It also discusses various empirical relations which are helpful in boundary layer applications. It provides basis for computational fluid dynamics.

Credits: 04

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Classification of Fluid Machines & Devices, Application of Momentum and Momentum, Equation to Flow Through Hydraulic Machinery, Euler's Fundamental Equation.  
**Impact of Jet:** Introduction to Hydrodynamic Thrust of Jet on A Fixed and Moving Surface (Flat & Curve), Effect of Inclination of Jet With the Surface.  
**Hydraulic System:** Hydraulic Accumulator, Special Duty Pumps, Intensifier, Hydraulic Press, Lift and Cranes, Theory of Hydraulic Coupling and Torque Converters, Hydraulic Ram, Jet Pumps, Air Lift Pumps. | 14             |
| II         | **Hydraulic Turbines:** Classification of Turbines, Impulse Turbines, Constructional Details, Velocity Triangles, Power and Efficiency Calculations.  
**Reaction Turbines:** Francis and Kaplan Turbines, Constructional Details, Velocity Triangles, Power and Efficiency Calculations, Degree of Reaction, Draft Tube, Cavitations in Turbines, Principles of Similarity, Unit and Specific Speed, Performance Characteristics, Selection of Water Turbines, Governing of Turbines. | 14             |
| III        | **Centrifugal Pumps:** Classifications of Centrifugal Pumps, Vector Diagram, Work Done by Impellor, Efficiencies of Centrifugal Pumps, Specific Speed, Model Testing, Cavitations & Separation and Their Control, Performance Characteristics.  
**Positive Displacement Pumps:** Reciprocating Pump Theory, Slip and Coefficient of Discharges, Indicator Diagram, Effect and Acceleration, Work Saved by Fitting Air Vessels, Comparison of Centrifugal and Reciprocating Pumps, Positive Rotary Pumps, Gear Pump and Vane Pump, Performance Characteristics. | 12             |

Text Books:
- Rajput, R K, “Hydraulic Machines”, S. Chand & co Ltd.
- Kumar, D. S., “Hydraulic Machines”, Khanna Publishers

Reference Books:
- Addison, Thomas, “Applied Hydraulics”, CBS Publishers
- Philip, M. Gerhart and Terry Wright, “Fluid Machinery- application Selection and Design”, CRS Pub

Outcome: Students will gain the knowledge to:
- Calculation of friction factor and its application in pipe design.  
- To calculate forces that acts in pipe bends.  
- Streamlined body design of cars, ships and airplanes.  
- Application of fluid mechanics in conversion of fluid power into mechanical and electrical energy.
MEE 6103: INTERNAL COMBUSTION ENGINE

Objective: To make students familiar with the design and operating characteristics of modern internal combustion engines. To apply analytical techniques to the engineering problems and performance analysis of internal combustion engines. To study the thermodynamics, combustion, heat transfer, friction and other factors affecting engine power, efficiency and emissions. To introduce students to the environmental and fuel economy challenges facing the internal combustion engine. To introduce students to future internal combustion engine technology and market trends.

Credits: 04  Semester VI  L-T-P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| II         | **SI Engines**: Combustion Details of SI Engine, Stages of Combustion, Flame Speed, Ignition Delay, Abnormal Combustion and Its Control, Types of Combustion Chamber, Carburetor, Fuel Injection System and Their Components, MPFI.  
**CI Engine**: Combustion Details of CI Engines, Stages of Combustion, Ignition Delay, Knock, Abnormal Combustion, Types of Combustion Chamber, Fuel Injection System of CI Engines and Their Components, Injection Timings. | 14 |
| III        | **Gas Turbine and Jet Propulsion**: Basic Concepts and Their Applications Types of Supercharging Methods, Supercharger and Turbocharger, Calculation of Supercharger. Basic Concepts of Advanced Engines. | 13 |

Text Books:

Reference Books:
- Rogowsky, “IC Engines”, International Book Co.
- E.F Obert, “IC Engine Analysis & Practice”, S. Chand.

Outcome: Students will gain the knowledge to:
- Differentiate among different internal combustion engine designs.
- Recognize and understand reasons for differences among operating characteristics of different engine types and designs.
- Exposure to the engineering systems needed to set-up and run engines in controlled laboratory environments. Develop skills to run engine dynamometer experiments. Learn to compare and contrast experimental results with theoretical trends.
MEE 6004: MACHINE DESIGN II

Objective: To make students able to know the guidelines for selection of bearings and to understand different terms of bearing design, to know the basic procedure for rolling contact and sliding contact bearing design, to understand the basic concept of gear trains and terminology related with gear, to know the procedure for spur gear, helical gear, warm gear, bevel gear design, to know the design process of different IC engine parts like cylinder head, piston, gudgeon pin, connecting rod, crank shaft etc.

Credits: 04  Semester VI  L–T–P: 3−1−0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>IC Engine Parts: Selection of Type of IC Engine, General Design Considerations, Design of Cylinder and Cylinder Head; Design of Piston, Piston Ring and Gudgeon Pin; Design of Connecting Rod; Design of Crankshafts.</td>
<td>11</td>
</tr>
</tbody>
</table>

Text Books:

Reference Books:

Outcome: Students will be able to:
- To identify the causes of bearing failures,
- To underline the guidelines for selection of bearing,
- To design rolling contact and sliding contact bearing,
- To demonstrate fundamental concepts of gear trains,
# MEE 6005: REFRIGERATION AND AIR CONDITIONING

**Objective:** To study the working of different Refrigerating and Air Conditioning System & Analysis of their performance parameters.

**Credits:** 04  
**Semester:** VII  
**L–T–P:** 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
**Refrigeration Equipment & Application:** Air Washers, Food Preservation, Cold Storage, Refrigerator, Ice Plant, Water Coolers, Electrolux Refrigerator. | 14 |

**Text Books:**
- Arora C.P, “Refrigeration and Air conditioning”, TMH.

**Reference Books:**
- Stoecker & Jones, “Refrigeration and Air conditioning”, TMH.

**Outcome:** Capability of understand and analysis of any Refrigerating and Air Conditioning System will be developed.
CSE6070: ESSENTIALS OF INFORMATION TECHNOLOGY
(B.TECH. (EC/ME/EE/EN))

**Objective:** To enhance effectiveness, boost efficiency with ability to identify the functions and features of various technology products, confidently understand the bigger picture, increase operational effectiveness by learning terminology and concepts that will allow to better communicate with IT professionals, effectively contribute to IT efforts with enhanced understanding of available technology solutions.

<table>
<thead>
<tr>
<th>Credits: 03</th>
<th>Semester VI</th>
<th>L–T–P: 3–0–0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module No.</strong></td>
<td><strong>Content</strong></td>
<td><strong>Teaching Hours</strong></td>
</tr>
<tr>
<td>I.</td>
<td><strong>Database Basics:</strong> Data, Data Storage, Need for DBMS, Functions of DBMS, Data Perspectives in DBMS, Types of DBMS / Data Models, Relational Model, Keys. Database Design - Database Life Cycle - Data Requirements, Logical Design - ER Modeling, Converting ER Model of Relational Schema, Functional Dependencies and Normalization.</td>
<td>13</td>
</tr>
<tr>
<td>II.</td>
<td><strong>Object Oriented (OO) Fundamentals and UML:</strong> Need for Object Oriented approach, Oriented concepts, Introduction of UML. Relationship - Aggregation, Association, Object Oriented Fundamentals Java Implementation: Object Oriented Fundamentals, Introduction to class concepts, variables &amp; Methods - Pass by Value, Pass by Reference, Recursive methods, this Reference, Programming Constructs in Java, Control Structures and Type Casting. Object Oriented constructs in Java: Arrays - Revisit, Strings, and Constructors - Default, Parameterized, Static: variable, method, block, Command line arguments, Method Overloading, Constructor Overloading, Types of Relationships, Inheritance, Keyword super, Method Overriding, Dynamic Polymorphism, Abstract, Interfaces, Packages.</td>
<td>13</td>
</tr>
</tbody>
</table>
Software Design Principles and Methods,

**References:**

**Outcome:** After completion of course, student will be able to:
- Do Problem Solving using algorithms
- Design and test simple programs to implement Object Oriented concepts using Java
- Document artifacts using common quality standards
- Design simple data store using RDBMS concepts and implement
- Basics of Software Engineering and Web Technology
MEE6081: FLUID MACHINERY LAB

Objective: To understand basic concept of Hydraulic Turbines, Reciprocating Pumps and Centrifugal Pumps and its application to hydro power generation.

Credits: 01                  Semester VI         L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>List of Experiments:</strong></td>
</tr>
<tr>
<td></td>
<td>• Demonstration of Working Principle of the Runner of Pelton Wheel,</td>
</tr>
<tr>
<td></td>
<td>Francis Turbine and Kaplan Turbine.</td>
</tr>
<tr>
<td></td>
<td>• To Find Efficiency and Performance Characteristics Curve of Pelton</td>
</tr>
<tr>
<td></td>
<td>Turbine.</td>
</tr>
<tr>
<td></td>
<td>• To Find Efficiency and Performance Characteristics Curve of Francis</td>
</tr>
<tr>
<td></td>
<td>Turbine.</td>
</tr>
<tr>
<td></td>
<td>• To Find Efficiency and Performance Characteristics Curve of Kaplan</td>
</tr>
<tr>
<td></td>
<td>Turbine.</td>
</tr>
<tr>
<td></td>
<td>• To Find the Performance Characteristics of A Centrifugal Pump and</td>
</tr>
<tr>
<td></td>
<td>To Find Its Specific Speed and Efficiency.</td>
</tr>
<tr>
<td></td>
<td>• To Find the Performance Characteristics of A Reciprocating Pump and</td>
</tr>
<tr>
<td></td>
<td>to Find the Slip.</td>
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<tr>
<td></td>
<td>• To Verify Momentum Equation Experimentally Through Impact of Jet</td>
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<tr>
<td></td>
<td>Experiment.</td>
</tr>
<tr>
<td></td>
<td>• To Create Hydraulic Jump and Verify Equation of Fluid Flow.</td>
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<td></td>
<td>• To Determine the Efficiency of Hydraulic Ram.</td>
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<tr>
<td></td>
<td>• Demonstration of Any Water Pumping Station/Plant Through Detailed</td>
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<tr>
<td></td>
<td>Visit.</td>
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<tr>
<td></td>
<td>• Demonstration of Working Model of Hydraulic Lift.</td>
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<tr>
<td></td>
<td>• Demonstration of Working Model of Hydraulic Brake.</td>
</tr>
<tr>
<td></td>
<td>• To Design the Impeller of Centrifugal Pump Using Single Arc Method</td>
</tr>
<tr>
<td></td>
<td>Through Auto Cad.</td>
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<tr>
<td></td>
<td>• To Design the Casing of Impeller Pump Through Auto Cad.</td>
</tr>
<tr>
<td></td>
<td>• To Investigate the Performance of A Gear Pump and to Plot the</td>
</tr>
<tr>
<td></td>
<td>Characteristics.</td>
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</table>

Outcome: On learning this subject students will be able to:

- Select a hydro turbine (Pelton wheel, Francis turbine, Kaplan turbine) or a pump on the basis of available head and discharge.
- Also students will be able to calculate various parameters like work done, efficiency, working proportions, specific speed etc.
- To some extent the students will get expertise about the design methodologies of various components of hydro turbine and pumps.
MEE 6084: MACHINE DESIGN - II LAB

Objective: Develop and evaluate alternatives for mechanical systems. Learn programming of design problems. Apply iterative techniques in design, including making estimate of unknown values for first computation and checking or revising and re-computing. Design Gears, Bearings and IC engine. Learn Modeling and Analysis on Software.

Credits: 01
Semester VI

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Design of Spur Gear</td>
<td></td>
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<tr>
<td></td>
<td>• Design of Helical Gear</td>
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<tr>
<td></td>
<td>• Design of Bevel Gear</td>
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<tr>
<td></td>
<td>• Design of Worm and Worm Gear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Design of Gear Assembly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Design of Project Report Consists of Different Types of Gears</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Design of Antifriction Bearing Assembly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Design of Journal Bearing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Design of Project Report Consists of Different Types of Bearings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Design of Cylinder and Cylinder Head.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Design of Piston, Piston Ring and Gudgeon Pin.</td>
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<tr>
<td></td>
<td>• Design of Connecting Rod.</td>
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</tr>
<tr>
<td></td>
<td>• Design of Crankshafts.</td>
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<tr>
<td></td>
<td>• The Design Project Consists of Two Imperial Size Sheets Drawn With 3D/2D CAD Software- One Involving Assembly Drawing With A Part List and Overall Dimensions and the Other Sheet Involving Drawings of Individual Components, Manufacturing Tolerances, Surface Finish Symbols and Geometric Tolerances Should be Specified So as to Make It Working Drawing. A Design Report Giving All Necessary Calculations of the Design of Components and Assembly Should Be Submitted. Students Are Required to be Submitted A Design Report Giving All Necessary Calculations of the Design of Components and Assembly. Develop the Programs in ‘C’ Language for All Design Components.</td>
<td></td>
</tr>
</tbody>
</table>

Outcome: Students will have the ability to:

- Use the techniques, skills, and modern tools necessary for the practice of mechanical engineering.
- An ability to work professionally in mechanical systems including the design and realization of such systems. Design projects of mechanical devices or systems.
- A complete set of working drawings of each of the designs.
- Written work in addition to the final design report.
Objective: To make students familiar with the various terms associated with Refrigeration & Air-conditioning. Various refrigeration systems and other cooling systems.

Credits: 01

Semester VII
L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>List of Experiments:</td>
</tr>
<tr>
<td></td>
<td>• Experiment on Refrigeration Test Rig and Calculation of Various Performance Parameters.</td>
</tr>
<tr>
<td></td>
<td>• To Study Different Types of Expansion Devices Used in Refrigeration System.</td>
</tr>
<tr>
<td></td>
<td>• To Study Different Types of Evaporators Used in Refrigeration Systems.</td>
</tr>
<tr>
<td></td>
<td>• To Study Basic Components of Air-Conditioning System.</td>
</tr>
<tr>
<td></td>
<td>• Experiment on Air-Conditioning Test Rig &amp; Calculation of Various Performance Parameters.</td>
</tr>
<tr>
<td></td>
<td>• To Study Air Washers.</td>
</tr>
<tr>
<td></td>
<td>• Study of Window Type Air Conditioner.</td>
</tr>
<tr>
<td></td>
<td>• Study &amp; Determination of Volumetric Efficiency of Compressor.</td>
</tr>
<tr>
<td></td>
<td>• Visit of A Central Air Conditioning Plant and Its Detailed Study.</td>
</tr>
<tr>
<td></td>
<td>• Visit of Cold-Storage and Its Detailed Study.</td>
</tr>
<tr>
<td></td>
<td>• Experiment on Ice-Plant to Find Out the Capacity of Plant.</td>
</tr>
<tr>
<td></td>
<td>• Experiment on Two Stage Reciprocating Compressor for Determination of Volumetric Efficiency, PV Diagram and Effect of Intercooling.</td>
</tr>
<tr>
<td></td>
<td>• Study of Compressors - Hermetically Sealed.</td>
</tr>
<tr>
<td></td>
<td>• Experiment on Desert Coolers.</td>
</tr>
<tr>
<td></td>
<td>• Study of Central Air-Conditioning Systems</td>
</tr>
</tbody>
</table>

Outcome: On completion of the lab students are able to describe various refrigeration systems and cooling systems and their calculations of coefficient of performance.
## CSE6090: INFORMATION TECHNOLOGY LAB
(B. TECH. (EC/ME/EE/EN))

**Credits: 01**  
**Semester VI**  
**L–T–P: 0–0–2**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Lab Hours</th>
</tr>
</thead>
</table>
| 1          | - Write the queries for Data Definition and Data Manipulation Language.  
            - Write SQL queries using logical operations (=, <, >, etc).  
            - Write SQL queries using SQL operators.  
            - Write SQL query using character, number, date.  
            - Write SQL query based on group functions.  
            - Write SQL queries for extracting data from more than one table.  
            - Write SQL queries for sub queries, nested queries.  
            - Concepts for ROLL BACK, COMMIT & CHECK POINTS.  
            - Program based on PL/SQL.  
            - Programs related to java class variables and methods.  
            - Program related to constructor and method overloading.  
            - Program related to keyword static for variables, method and class.  
            - Program related to Inheritance and Interfaces.  
            - Program related to Multithreading concept  
            - Program related to Exception Handling.  
            - Design web page using following HTML elements: Font, Color, Margins, Lists, Links, Graphics, Table, Bordering, Image, Cell Color, cell Alignment  
            - Design web page using different types of CSS  
            - Design web page for user registration with some constraints using JavaScript.  
            - Program based on JavaScript functions.  
            - Program based on XML parsing using JavaScript/Java. | 24 |

Credits: 01  
L–T–P: 0–0–2
AHE 6081: SOFT SKILLS- IV

It is well recognized by the industry that the soft skills are essential for entry level employees. Include:
Articulation, Competence in Reading, Writing, Effective Listening and Oral Communication Skills; Adaptability to cross cultural environment through creative thinking and problem solving; Personal Management with assertiveness and initiative; Interpersonal skills; The ability to work in teams. Enterprises define the entrants to be ‘industry ready’ when they possess these soft skills.

Objective: Understand what constitutes a professional environment. Develop positive group strategies & team spirit. Set specific measurable goals for themselves in their personal and/or professional life. Understand the skills and the intricacies involved in starting an entrepreneurial venture.

Credits: 01

Module No. | Content | Teaching Hours
--- | --- | ---
I | • Campus to Company  
  • The Corporate Fit-Dressing and Grooming. Corporate Dressing – Dress for Success.  
  • Business Etiquette.  
  • Basic Table Manners.  
  • Dealing With People.  
  • Communication Media Etiquette.  
  • Telephone Etiquette.  
  • Email Etiquette. | 10
II | • Group Discussions, Interviews and Presentations.  
  • Group Discussions.  
  • Group Discussions, Structured Group Discussions, Unstructured Group Discussions.  
  • Interviewing Skills.  
  • Interview Handling Skills.  
  • An Effective Resume.  
  • Resumes That Make An Impact – A Few Pointers.  
  • The Interview Process.  
  • The Interview Preparation Check List.  
  • at the Interview – Putting Your Best Foot Forward.  
  • Common Interview Mistakes.  
  • Presentation Skills.  
  • Voice, Body Language, Content and Visual Aids, Audience Management, Practice. | 10
III | • Entrepreneurial Skills Development.  
  • Goal Setting, Understanding Entrepreneurship.  
  • Studying Entrepreneurial Competencies.  
  • What Are the Entrepreneurial Competencies?  
  • Entrepreneurship in Daily Life.  
  • Venture Project Planning & Entrepreneurship Cycles.  
  • Planning the Project.  
  • Case Studies in Entrepreneurship.  
  • Reference Books and Links.  
  • Entrepreneurship Courses in India.  
  • Links to Venture Capitalists.  
  • Reference Books Used in This Manual. | 10

Reference Books:

Course Curriculum (w.e.f. Session 2017-18)

B.Tech. (Mechanical Engineering)

- Infosys modules
- PPT slides & videos provided by Infosys.

Material:
- Audio-Video Material available in the language Lab.
MEE 7101: AUTOMOBILE ENGINEERING

Objective: To make student aware of basic knowledge of automobile systems and sub systems. To make students aware of maintenance and overhauling of an vehicle. To show students how various system and sub-system in vehicle works together. To tell students about latest development in the field of automobile engineering.

Credits: 04  Semester VIII  L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Power and Transmission System:</strong> Power and Torque Characteristics,</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Rolling Resistance, Air Resistance, Gradient Resistance, Tractive Effort</td>
<td></td>
</tr>
<tr>
<td></td>
<td>on Power of Automobile, Concept of Gear Ratio, Gear Box and Their Types,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Selector Mechanism of Gear Box. Requirements of Good Transmission</td>
<td></td>
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<tr>
<td></td>
<td>Systems, Clutches and Their Types, Over Drive and Free Wheel, Torque</td>
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<td></td>
<td>Converters Differential Gear Mechanism, Automatic Transmission and Its</td>
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<td></td>
<td>Components, Propeller Shaft, Slip Joints, Universal Coupling, Final</td>
<td></td>
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<tr>
<td></td>
<td>Drive and their Types, Advances in Transmissions.</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td><strong>Vehicle Handling and Control System:</strong> Types of Steering Mechanism,</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Steering Geometry, Working of Electrical &amp; Hydraulic Power Steering,</td>
<td></td>
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<tr>
<td></td>
<td>Requirement of Braking System, Various Types of Braking System, Anti</td>
<td></td>
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<tr>
<td></td>
<td>Locking Braking System, EBD (Electronic Breaking Force Distribution),</td>
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<td></td>
<td>Frame and their Types, Load on Frame, Geometry of Suspension System,</td>
<td></td>
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<td></td>
<td>Dampers, Various Types of Suspension Springs Types of Front Axle</td>
<td></td>
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<tr>
<td></td>
<td>Independent Suspension System. Advances in Vehicle Handling &amp; Control</td>
<td></td>
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<tr>
<td></td>
<td>System.</td>
<td></td>
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<tr>
<td>III</td>
<td><strong>Electrical System:</strong> Types of Ignition System Used in Automobiles and</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Their Working, Alternator, Battery, Starting Motor, Lighting System,</td>
<td></td>
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<tr>
<td></td>
<td>Horn, Relays, Windscreen Wiper, Speedometer Etc.</td>
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<tr>
<td></td>
<td><strong>Cooling &amp; Lubrication System:</strong> Requirements, Various Components,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Types of Cooling and Lubrication Systems, Heating and Cooling Unit of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Automobiles. Features, Technical Specifications, Advances in Automobile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engineering.</td>
<td></td>
</tr>
</tbody>
</table>

Text Books:
- Jain K.K., Asthana R.B., “Automotive Engineering” TMH.

Reference Books:
- Newton and Steeds, Joseph Heither, “Automotive Mechanics”, C.B.S., Publisher & Distributors.

Outcome: Students understand:
- The basic principle of working of various systems of an vehicle.
- Students understands how various systems are comprised of small sub-system and components.
- Students can trouble shoot a vehicle and can do preventive maintenance.
- Students are now able to understand the importance of every component in the vehicle for proper functioning of automobile.
**MEE 7002: COMPUTER AIDED DESIGN**

**Objective:** To understand the use of information technology (IT) in the Design process. To understand the automation of Design process. To understand the mathematics of Design Process. To understand the integration of CAD and CAM system.

**Credits:** 04  
**Semester:** VII & VIII  
**L-T-P:** 3-1-0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I | Introduction:  
Introduction to CAD/CAED/CAE, Elements of CAD, Essential Requirements of CAD, Concepts of Integrated CAD/CAM, Necessity & Its Importance, Engineering Applications Computer Graphics-I  
Computer Graphics-II  
Geometric Transformations:  
World/Device Coordinate Representation, Windowing and Clipping, 2 D Geometric Transformations- Translation, Scaling, Shearing, Rotation & Reflection Matrix Representation, Composite Transformation, D Transformations, Multiple Transformation. | 12 |
| II | Curves:  
3D Graphics:  
Polygon Surfaces-Polygon Mesh Representations, Quadric and Superquadric Surfaces and Blobby Objects; Solid Modeling-Solid Entities, Fundamentals of Solid Modeling-Set Theory, Regularized Set Operations; Half Spaces, Boundary Representation, Constructive Solid Geometry, Sweep Representation, Color Models. Application Commands for AutoCAD & Pro-E Software | 12 |
| III | Numerical Methods With Programming in C/C++:  
Finite Element Method:  

**Text Books:**
Reference Books:


Outcome: Students will get aware about the:

- Accurately generated and easily modifiable graphical representation of the product.
- Improve visualization ability of machine components and assemblies.
- Understand the basic analytical fundamentals used for geometric modeling.
- Perform complex design analysis in short time.
- Design optimization Record and recall information with consistency and speed.
MEE 7003: COMPUTER AIDED MANUFACTURING

Objective: The use of a computer to assist in all operations of a manufacturing plant, including planning, management, transportation and storage. Its primary purpose is to create a faster production process and components and tooling with more precise dimensions and material consistency. To know about both the value of the most skilled manufacturing professionals through advanced productivity tools, while building the skills of new professionals through visualization, simulation and optimization tools.

Credits: 04  Semester VII  L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | Automation  
Numerical Control  
NC Part Programming  
(B) APT Programming. Geometry, Motion and Additional Statements, Macro-Statement. | 17 |
| II         | System Devices  
Introduction to DC Motors, Stepping Motors, Feed Back Devices Such as Encoder, Counting Devices, Digital to Analog Converter and Vice Versa.  
Interpolators  
Digital Differential Integrator-Principle of Operation, Exponential Deceleration; DDA Hardware Interpolator- Linear, Circular; DDA Software Interpolator.  
Control of NC Systems  
Open and Closed Loops. Control of Point to Point Systems- Incremental Open Loop Control, Incremental Close Loop, Absolute Close Loop; Control Loop in Contouring Systems. Computer Aided Inspection (CAI) and Computer Aided Testing (Cat). | 11 |
| III        | Computer Integrated Manufacturing System and Robotics  

Text Books:

Reference Books:
Outcome: Students will get aware about the:

- Students will get aware about the NC, CNC, EDNC technology used in manufacturing system.
- The use of Adaptive control in CNC Manufacturing.
- Brief knowledge about CIM, FMS and Robotic system.
- The necessity of using automation in Industries.
- The various programming techniques used in CNC machines.
MEE 7181: AUTOMOBILE ENGINEERING LAB

Objective: The main objective of this lab is to make students aware of various systems like braking system, steering system, suspension system and electrical system of a vehicle. This lab is also dedicated to engine testing and performance in which various parameters of engine are calculated. Working of some new and modern technology like automatic transmission and MPFI is also demonstrated to the students.

Credits: 01

Semester VIII

L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>List of Experiments:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Determination of Indicated H.P. of I.C. Engine by Morse Test.</td>
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<tr>
<td></td>
<td>• To Study the Working Principle of Gear Boxes.</td>
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<tr>
<td></td>
<td>• Trouble Shooting on Differential Gear Mechanism of Rear Axle.</td>
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<tr>
<td></td>
<td>• Measurement of Steering Geometry Angles and Their Impact on Vehicle Performance.</td>
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<tr>
<td></td>
<td>• Trouble Shooting on Automobile Braking System.</td>
<td></td>
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<tr>
<td></td>
<td>• Trouble Shooting on Ignition System of I.C. Engine.</td>
<td></td>
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<tr>
<td></td>
<td>• Trouble Shooting on Fuel Supply System of S.I. Engines- Carburetor, Fuel Injection Pump and MPFI.</td>
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<tr>
<td></td>
<td>• Trouble Shooting on Fuel Supply System of C.I. Engines- Injector &amp; Fuel Pump.</td>
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<tr>
<td></td>
<td>• Study of Air Conditioning System of an Automobile.</td>
<td></td>
</tr>
</tbody>
</table>

Outcome: Students have studied about:

- The principle and functioning of various systems and sub systems of Vehicle.
- They also analyzed the working of IC engine and its components by calculating various performance parameters.
MEE 7082: CAD/CAM LAB

Objective: To Study and acquire knowledge on various computer based designing and machining operations in special purpose machines and its applications in real life manufacture of components in the industry.

Credits: 01  
Semester VII  
L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total TEN Experiments are to Carry Out. FIVE Experiments Each From CAD and CAM.</td>
<td></td>
</tr>
<tr>
<td><strong>A. CAD Experiments</strong></td>
<td></td>
</tr>
<tr>
<td>• Line Drawing or Circle Drawing Experiment: Writing and Validation of Computer Program.</td>
<td></td>
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<tr>
<td>• Geometric Transformation Algorithm Experiment for Translation/Rotation/Scaling: Writing and Validation of Computer Program.</td>
<td></td>
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<tr>
<td>• Design of Machine Component or Other System Experiment: Writing and Validation of Computer Program.</td>
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</tr>
<tr>
<td>• Understanding and Use of Any 3-D Modeling Software Commands.</td>
<td></td>
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<tr>
<td>• Pro/E/Idea Etc. Experiment: Solid Modeling of A Machine Component</td>
<td></td>
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<tr>
<td>• Writing A Small Program for FEM for 2 Spring System and Validation of Program or Using A Fem Package.</td>
<td></td>
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<tr>
<td>• Root Findings or Curve Fitting Experiment: Writing and Validation of Computer Program.</td>
<td></td>
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<tr>
<td>• Numerical Differentiation or Numerical Integration Experiment: Writing and Validation of Computer Program.</td>
<td></td>
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<tr>
<td><strong>B. CAM Experiments</strong></td>
<td></td>
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<tr>
<td>• To Study the Characteristic Features of CNC Machine.</td>
<td></td>
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<tr>
<td>• Part Programming (in Word Address Format) Experiment for Turning Operation (Including Operations Such as Grooving and Threading) and Running on CNC Machine.</td>
<td></td>
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<tr>
<td>• Part Programming (in Word Address Format or ATP) Experiment for Drilling Operation (Point to Point) and Running on CNC Machine.</td>
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</tr>
<tr>
<td>• Part Programming (in Word Address Format or ATP) Experiment for Milling Operation (Contouring) and Running on CNC Machine.</td>
<td></td>
</tr>
<tr>
<td>• Experiment on Robot and Programs.</td>
<td></td>
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<tr>
<td>• Experiment on Transfer Line/Material Handling.</td>
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<tr>
<td>• Experiment on Difference between Ordinary and NC Machine, Study or Retrofitting.</td>
<td></td>
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<tr>
<td>• Experiment on Study of System Devices Such as Motors and Feed Back Devices.</td>
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<tr>
<td>• Experiment on Mecatronics and Controls.</td>
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</tbody>
</table>

Outcome: Upon successful completion students should be able to:

• Use an understanding of General and Machine (G & M) code to generate or edit a program which will operate a CNC Lathe.
• Apply mathematical methods to calculate Cartesian coordinates.
• Select cutting tool materials and tool geometries for different metals. Apply cutting mechanics to metal machining based on cutting force and power consumption.
• Operate lathe, shaping machines, drilling machines, etc.
Objective: Center Objective of operation research is OPTIMIZATION. To develop Decision-making skills. To Get clarity on various dimension of OR and their interconnection in business Organizations. To understand the various business situations.

Credits: 04 Semester VIII L-T-P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
**Linear Programming:** Introduction & Scope, Problem Formulation, Graphical Method, Simplex Method, Duality in Linear Programming, Artificial Variable Method, Degeneracy.  
**Assignment Problems:** Mathematical Formulation, Hungarian Method for Minimization and Maximization Problem, Degeneracy in Assignment Problem  
**Transportation:** Matrix Form, Feasible Solution, Basic Feasible Solution and Optimum Solution, Degeneracy in Transportation, Unbalanced-Problems, Travelling Salesman Problem, Redundancy. | 13 |
| II         | **Dynamic Programming:** Multistage Decision Problems & Solutions, Principle of Optimality.  
**Decision Theory:** Steps in Decision Making Approach, Decision Making Under Conditions of Certainty, Uncertainty & Risk, Maximum Likelihood & Expected Value Criterion, Decision Tree.  
**Game Theory:** Two Persons Zero Sum Game, Solution With/Without Saddle Point, Dominance Rule, Different Methods Like Algebraic, Graphical, Linear Programming Methods. Approximation Method for Solution of Game.  
**Sequencing Problem:** Introduction, Assumption, Johnson’s Procedure for N Jobs on Two Machines and N Jobs on Three Machines. | 13 |
| III        | **Stochastic Inventory Models:** Single & Multi Period Models With Continuous & Discrete Demands, Service Level & Re-Order Policy.  
**Simulations:** Simulation V/S Mathematical Modeling, Monte-Carlo Simulation, Simulation Languages, Uses, Advantages and Limitations.  
**Queuing Models:** Introduction, Poisson Distribution, Exponential Distribution, Characteristics of Queuing Models, Single Server and Multiple Servers Models, Cost Consideration.  
**Project Management:** Basic Concepts, Rules for Network Drawing CPM Calculations, Pert Calculations Such As Different Times and Different Floats, Crashing, Probabilistic Model. | 14 |

Text Books:

Reference Books:

Outcome: Students are able to know:
- Enables to define the Problem.
- Enables to measures the Key aspect of Process.
- Enables to analyse the data to investigate.
MEE 8002: INDUSTRIAL ENGINEERING

Objective: The educational objectives of the Industrial Engineering Program are to produce graduates who, are able to: Understand different fundamentals of industrial engineering principles. Be employed as a practicing engineer in fields such as design, research, development, testing, and manufacturing; understand the positions of leadership and responsibility within an organization; and contribute in system improvement decisions for their organizations.

Credits: 04 Semester VI L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td><strong>Management Economics:</strong> Break Even Analysis and Margin of Safety, Fixed and Variable Costs, Concept of Value Analysis and Value Engineering. Depreciation and Its Causes, Obsolescence and Basic Ideas of Replacement, Concept and Utility of Maintenance. <strong>Quality Control:</strong> Process Control, SQC Charts, Single, Double and Sequential Acceptance Sampling.</td>
<td>14</td>
</tr>
</tbody>
</table>

Text Books:
- Shanker Ravi, “Industrial Engineering”, Galgotia PVT Ltd.
- Telsang Martand, “Industrial Engineering and Production Management”, S. Chand, New Delhi

Reference Books:

Outcome: Students will be able to have:
- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to function on multidisciplinary teams.
- An ability to identify, formulate, and solve engineering problems by analyzing and interpreting data.
- An understanding of professional and ethical responsibility.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
MEE 5031: INDUSTRIAL ECONOMICS

**Objective:**
- To Familiarize Students with the Basic Concepts of Economics.
- To Enable the Students to Make Better Decisions in their Course of Action.

**Credits:** 02

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Basic Economic Concepts:</strong> Meaning, Nature and Scope of Economics, Methodology of Economics - Deductive vs Inductive, Economics - Statics &amp; Dynamics, Basic Economic Problems - Scarcity &amp; Choice, Relation among Science, Engineering, Technology and Economics. <strong>Market Demand:</strong> Demand, Meaning and Types, Law of Demand, Exceptions to the Law of Demand, Elasticity of Demand, Methods of Measuring Elasticity of Demand, Marginal Utility Analysis.</td>
<td>07</td>
</tr>
<tr>
<td>II</td>
<td><strong>Demand Forecasting:</strong> Meaning, Significance and Methods, Production Function, Laws of Returns to Scale &amp; Diminishing Returns to Scale. <strong>Cost Concepts:</strong> - Meaning and Types of Costs, Short Run and Long Run Cost Curves.</td>
<td>07</td>
</tr>
<tr>
<td>III</td>
<td><strong>Market Structure:</strong> Meaning of Market, Types of Market - Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition. <strong>Inflation and Business Cycles:</strong> Causes, Effects and Methods to Control Inflation, Concepts of Business Cycles, Concept of National Income and Measurement.</td>
<td>07</td>
</tr>
</tbody>
</table>

**Reference Books:**


**Outcome:**

- Students will become familiarize with the basic concepts of Economics used in the analysis of Firms and Industries.
- In Decision Making with the availability of limited resources in the organization these concepts will act as a guiding tool.
- For those who are willing for entrepreneurial activities, study of this subject will provide a good help.
MEE 8082: ADVANCED SOFTWARE LAB

Objective: To identify the role of the software in today's Design world.

Credits: 01
Semester VIII
L–T–P: 0–0–2

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Use of Pro/Engineer and Pro/Mechanical Software for Exercises in: Design and Analysis of Mechanical Component Design Studied in Subjects of MD-I and MD-II.</td>
</tr>
<tr>
<td></td>
<td>• Optimization of Mechanical Design of Components and Assemblies.</td>
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<td></td>
<td>• Reverse Engineering Tools and Their Use in Component Design.</td>
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<td></td>
<td>• Design Automation and User Defined Features, Advanced Assembly.</td>
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<tr>
<td></td>
<td>• Structural, Welding, Surfacing, Behavior Modeler and Other Advanced Modules Use and Demonstration of Case Studies.</td>
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<tr>
<td></td>
<td>• Application of Finite Element Methods to Elasticity Problems and Heat Transfer Problems. Using ANSYS, HYPERMESH, and FEM Software’s.</td>
</tr>
</tbody>
</table>

Outcome: Know the application of different software and to know the automation of design process as well as know the utility of analysis software.
MEE 7022: COMPUTATIONAL FLUID DYNAMICS

Objective: Computational Fluid Dynamics (CFD) is an elective course in the graduate Mechanical Engineering Curriculum. The course covers numerical methods for physical simulations of gas and liquid flows. The course is based on the finite difference method and the finite element method with emphasis on fluid dynamics and includes various computational problems in fluid dynamics such as boundary conditions and meshing. A computational project using Matlab/FLUENT completes the course.

Credits: 04 Semester VII & VIII L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>

Text Books:

Reference Books:

Outcome: Students are expected to learn:
- how to formulate and solve computational problems arising in the flow of fluids.
- They should be able to assess the accuracy of numerical solutions by comparison to known solutions of simple test problems and by mesh refinement studies.
- Students should learn how CFD is used to predict forces on airfoils.
MEE 8044: PRODUCT DEVELOPMENT & DESIGN

Objective: The goal of the subject is to present a clear and detailed way a set of product development methods while focusing together the marketing, design and manufacturing functions of the organization. Perspectives of marketing, design, and manufacturing into a single approach to product development. It includes managing the different factors in such a way that maximizes the success of the product.

Credits: 04 Semester VII & VIII L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td><strong>Reliability:</strong> Reliability Considerations: Reliability Analysis of Systems, Bath Tub Curve, Reliability of Systems in Series and Parallel. Failure Rate, Mean Time to Failure (MTTF) and Mean Time Between Failures (MTBF). <strong>Decision Theory:</strong> Decision Making Under Conditions of Certainty, Decision Making Under Conditions of Uncertainty, Decision Making Under Conditions of Risk, Maximum Likelihood Criterion, Variation of Expected Value Criterion. <strong>Break-Even Analysis:</strong> Fixed and Variable Costs, Assumptions of Break Even Analysis, Utility of Break Even Analysis, Limitation of Break Even Analysis.</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td><strong>Work-Study: Components:</strong> of Work Study, Tools of Method Analysis Such as Flow Process Chart and Flow Diagram, Time Study, Work Sampling. <strong>Statistical Quality Control (SQC):</strong> Advantages of Statistical Quality Control, Quality Control Charts, Types of Control Charts Such as X(Bar) and R Chart, P Chart and C Chart. <strong>Technological Forecasting:</strong> Characteristics and Importance of Technological Forecasting, Different Forecasting Methods.</td>
<td>12</td>
</tr>
</tbody>
</table>

Text Books:

Reference Books:
- Mayall W. H. Iffie, “Industrial Design for Engineers”, TMH.

Outcome: Students will be able to:
- face the different challenge associated with product development.
- They will be to understand better the customer preferences, Rival products.
- Decision making ability of the students will improve, they can take the right decisions regarding the product without the proper information.
- They are able to make a cost benefit analysis.
MEE 7023: MICRO MANUFACTURING

Objective: Meso and micro manufacturing are emerging as an important technology especially in the areas where miniaturization yields economic and technical benefits, namely, aerospace, automotive, optical, biomedical and similar other areas. The basic objective of the present course is to acquaint the participants with the principles, basic machine tools, developments in the micro-manufacturing processes, micro and nano metrology and research trends in the area of micro-manufacturing processes. Thus, this course will deal with various areas of micro manufacturing including.

Credits: 04  
Semester VII & VIII  
L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
**Micromachining**: Micro-Turning, Micro-Grinding, Bio-Machining, Genus-Based Metal Removal, Micro- and Nano Manufacturing by Focused Ion Beam. | 12 |
**Micro Molding**: A Soft Lithography Technique, Polymer Micro-Molding, Metal Injection Molding At Micro-Scales | 14 |

Text Books:

Reference Books:

Outcome: Upon successful completion of this course you should be able to:
- Define and describe the fundamentals and principals of micro manufacturing processes.  
- Apply relevant theories to solve micro manufacturing problems.  
MEE 8024: POWER PLANT ENGINEERING

Objective: To make student aware of the working of different power plants. To understand the various pollutions from different power plants. To understand the concept of power plant economics.

Credits: 04 Semester VII & VIII L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** The Sources of Energy, Development of Power Generation in India, Ranking Cycle, Reheat. Regeneration.  
**Steam Power Plant:** Plant Layout, Working of Different Circuits, Fuel and Handling Equipments, Types of Coals, Coal Handling, Coal Storage and Ash Handling Systems.  
**Feed Water Treatment, Plant Performance:** Maintenance, Efficiency. | 14 |
**Hydro Electric Power Plant:** Hydrological Cycle, Flow Measurement, Hydrographs – Storage and Pondage, Classification of Dams and Spill Ways. Plant Classification, Typical Layouts, Plant Auxiliaries, Plant Operation | 14 |
**Power Plant Economics and Environmental Considerations:** Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve, Economic Scheduling, Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor– Related Exercises.  
**Effluents From Power Plant:** Impact on Environment, Pollutants and Pollution Standards, Methods of Pollution Control. | 12 |

Text Books:

Reference Books:

Outcome: Students are enables to understand:
- The function of different elements of steam, hydro, diesel, nuclear etc. power plants.
- Enables to explain the working of different power plants.
- Enables to analyze the economics of power plants.
- Enables to explain the working of power plants based unconventional energy source.
MEE 8045: TURBO MACHINES

Objective: It is major branch of mechanics. It introduces students about fluid and its difference with solids. Geometry of fluid flow can be visualized. Its importance lies in its wide ranging applications in fluid power engineering and mechanics of fluid flow. It also discusses various empirical relations which are helpful in boundary layer applications. It provides basis for computational fluid dynamics.

Credits: 04  Semester VII & VIII  L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td><strong>Axial Flow Compressors:</strong> Vector Diagrams, Work Done Factor, Temp and Pressure Ratio, Degree of Reaction, Dimensional Analysis, Characteristics, Surging, Polytrophic and Isentropic Efficiencies. <strong>Flow Through Centrifugal Compressors:</strong> 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.</td>
<td>14</td>
</tr>
</tbody>
</table>

Text Books:

Reference Books:
- Sheppard “Principles of Turbo machinery”, Tata Mcgraw Hill.

Outcome: Students are enables to understand:
- Calculation of friction factor and its application in pipe design.
- To calculate forces that acts in pipe bends.
- Streamlined body design of cars, ships and airplanes.
- Application of fluid mechanics in conversion of fluid power into mechanical and electrical energy.
Objective: Robotics is a combined study of mechanical engineering, electrical engineering, electronic engineering and computer science, deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing and Flexible manufacturing systems are regarded as one of the most efficient methods to employ in reducing or eliminating problems in manufacturing industries.

Credits: 04

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>

Text Books:

Reference Books:

Outcome: Students are enables to understand:
- Embedded intelligence is now in products ranging from cars to domestic appliances.
- Intelligent systems range from unmanned vehicles in aerospace and robots in sub-sea exploration, to consumer products and the creative arts.
- FMS is not an end in itself, but a means to an end and the natural partner to integrate to existing CAD/CAM systems and progress toward CIM.
**MEE 8041: INDUSTRIAL AUTOMATION & CONTROL SYSTEMS**

**Objective:** Introduction to the concept of industrial automation, scope of automation and study of socio-economic effects. Introduction to the fluid power control and study of the different fluid power systems working. Introduction to the automated material handling system used in automated industry. Study of the working principle mechatronics devices and different types of controllers. Introduction to the control systems.

**Credits:** 04  
**Semester VII & VIII**  
**L–T–P:** 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Introduction:</strong> Concept and Scope of Industrial Automation, Socio-Economic Considerations, And Pneumatic Logic Circuits: Un-Complementation Algorithm.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Mechatronics:</strong> Mechanical System Interfacing, Simple Mechatronics Devices: Servo Motors, Stepping Motors, DC Motors, Analog / Digital Convertors. Types and Function of Controllers.</td>
<td>14</td>
</tr>
</tbody>
</table>

**Text Books:**
- Nagrath & Gopal "Control System", TMH.

**Reference Books:**
- Nise, "Control system Engineering" Willey.

**Outcome:** Students are enables to understand:
- Knowledge regarding key components and functioning of an automated industry.
- Knowledge regarding the working of elements such as hydraulic generator, hydraulic & pneumatic actuator, hydraulic & pneumatic valves used in heavy construction equipments.
- Knowledge regarding the methods used to handle the materials in automated industry, such as AGV’s.
MEE 8042: MECHANICAL VIBRATIONS

Objective: At the end of this course, the student will: fully understand and appreciate the importance of vibrations in mechanical design of machine parts that operate in vibratory conditions, be able to obtain linear vibratory models of dynamic systems with changing complexities like Single degree of freedom and Multi degree of freedom problems (SDOF, MDOF), be able to write the differential equation of motion of vibratory systems, be able to make free and forced (harmonic, periodic, non-periodic) vibration analysis of single and multi degree of freedom linear systems.

Credits: 04
Semester VII & VIII
L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Fundamentals of Vibration:</strong> Simple Harmonic Motion, Natural Frequencies and Resonance.</td>
<td>12</td>
</tr>
<tr>
<td>II</td>
<td><strong>Two Degree of Freedom Systems:</strong> Free and Forced Vibrations With and Without Damping, Principle and Normal Modes, Vibration Absorbers.</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td><strong>Vibration of Continuous Systems:</strong> Wave Equation, Transverse Vibration of Strings, Longitudinal Vibration of Bars, Lateral Vibrations of Beam.</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td><strong>Whirling of Shafts:</strong> Critical Speed and Effect of Damping.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Introduction to Non-Linear Vibrations.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Introduction to Condition Monitoring of Machinery, FFT.</strong></td>
<td></td>
</tr>
</tbody>
</table>

Text Book

Reference Books

Outcome: Students are enables to understand:
- Appreciating the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions.
- Ability to analyze the mathematical model of a linear vibratory system to determine its response.
- Ability to obtain linear mathematical models of real life engineering systems.
MEE 8023: MECHATRONICS

Objective: Communicate and translate customer requirements and effectively integrate multiple mechanical and electrical systems to specify, design, deploy, implement, troubleshoot, and maintain mechatronic systems. Analyze the produced system and formulate its economic impacts on the overall organization.

Credits: 04
Semester VII & VIII
L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td><strong>Electronics:</strong> Review of Logic Circuits, Op Amps, AD and DA Converters, Microcontrollers, Digital Signal Processing. Introduction to PLC. <strong>Study of Some Mechatronics Devices:</strong> Hard Disk Drive, Dot Matrix Printer, Optical Sensing and Control Mechanism in NC Machine Tools Etc.</td>
<td>14</td>
</tr>
</tbody>
</table>

Text Book

Reference Books

Outcome: Students are enables to understand:
- Apply concepts of circuit analysis, analog and digital electronics, automation and controls, motors, electric drives, power systems, instrumentation, and computers to aid in the design, characterization, analysis, and troubleshooting of mechatronics systems.
- Apply problem solving skills, including the ability to identify problems, conduct experiments, gather data, analyze data, and produce results.
MEE 8022: FINITE ELEMENT METHODS

Objective: To provide the fundamental concepts of the theory of the finite element method. To teach students how to model and analyze mechanical systems using finite element analysis. To develop proficiency in the application of the finite element method (modeling, analysis, and interpretation of results) to realistic engineering problems through the use of a major commercial general-purpose finite element code. To reinforce students' understanding of engineering through the analysis of real-world problems. To teach students the basic skills in using commercial finite element software and effective presentation of their analysis results.

Credits: 04  Semester VII & VIII  L-T-P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Finite Element Methods, History and Range of Applications.  
**Finite Elements:** Definition and Properties, Assembly Rules and General Assembly Procedure, Features of Assembled Matrix, Boundary Conditions. | 12 |

Text Book

Reference Books

Outcome: Upon successful completion of this course, the student will be able to:
- Understand the numerical methods involved in Finite Element Theory.
- Understand the role and significance of shape functions in finite element formulations and use linear, quadratic, and cubic shape functions for interpolation.
- Understand the formulation of one-dimensional, two dimensional and three dimensional elements.
MEE 8021: BASICS OF NANO TECHNOLOGY

Objective: Subject structure mainly concerned with detailed introduction of nanomaterials. Why nanomaterials different with macro scale and microscale materials adequately discussed in this subject. Different manufacturing and synthesis techniques for nanoscale material and devices are major focus of the subject structure design. Various characterization techniques along with application in nano-micro equipment design is aim of this subject.

Credits: 04 Semester VII & VIII L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Size and Shape Dependence of Material Properties at the Nanoscale, Why is Small Good? Limits to Smallness, Scaling Relations, Can Nanorobots Walk and Nanoplanes Fly? Nanoscale Elements in Conventional Technologies  
**Top-Down and Bottom-Up Nanofabrication:** The Intel-IBM Approach to Nanotechnology: Lithography, Etching, Ion Implantation, Thin Film Deposition, Electron Beam Lithography, Soft Lithography: Nano Imprinting and Micro Contact Printing, Solution/Plasma-Phase Nanofabrication, Sol-Gel Methods, Template Techniques. | 12 |
**Imaging/Characterization of Nanostructures:** General Considerations for Imaging, Scanning Probe Techniques: SEM, STM, AFM, And NSOM. | 14 |
| III        | **Metal and Semiconductor Nanoparticles:** Synthesis, Stability, Control of Size, Optical and Electronic Properties, Ultra-Sensitive Imaging and Detection With Nanoparticles, Bioengineering Applications, and Catalysis.  
**Semiconductor and Metal Nanowires:** Vapor/Liquid/Solid Growth and Other Synthesis Techniques, Nanowire Transistors and Sensors.  
**Carbon Nanotubes:** Structure and Synthesis, Electronic, Vibrational, and Mechanical Properties, How Can C Nanotubes Enable Faster Computers, Brighter TV Screens, and Stronger Mechanical Reinforcement.  
**Mechanics at Nanoscale:** Enhancement of Mechanical Properties With Decreasing Size, Nanoelectromechnical Systems, Nanomachines, Nanofluidics, Filtration, Sorting, Molecular Motors. | 14 |

Text Book:

Reference Books:
- Poole and Owens, “Introduction to Nanotechnology”, Wiley.

Outcome: Students will be able to understand:
- Difference in nano and macro material along with various approaches of manufacturing and synthesis of nanomaterials.
- Importance of characterization and characterization devices is main outcome of this subject.
- This subject provides expertise to develop new nanomaterials with the help of chemical synthesis and laser ablation techniques.
MEE 8043: MODERN MANUFACTURING PROCESS

Objective: Aims to provide broad overview of modern manufacturing technologies to ensure the students understand their fundamental principles and processes. Modern Manufacturing Process enhances the students’ appreciation for modern manufacturing technologies up to date applications from manufacturing industries are presented.

Credits: 04  Semester VII & VIII  L–T–P:  3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction: Limitations of Conventional Manufacturing Processes Need of Modern (Unconventional) Manufacturing Processes, Its Classification Based on Their Principal Mechanism and Resources. <strong>Modern Machining Process:</strong> Principle, Working and Applications of Modern Machining Processes Such as Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM), Ultrasonic Machining (USM), Electro–Discharge Machining (EDM).</td>
<td>12</td>
</tr>
<tr>
<td>II</td>
<td><strong>Modern Machining Process (Continued):</strong> Chemical Machining (CM), Electrochemical Machining (ECM), Electron Beam Machining (EBM), Laser Beam Machining (LBM), Plasma Arc Machining (PAM) Etc. <strong>Modern Forming Processes:</strong> Principle, Working and Application of High Energy Rate Forming (HERF) Processes Such as Explosive Forming, Electromagnetic Forming, Electro–Discharge Forming, Water Hameer Forming, Explosive Compaction Etc.</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td><strong>Modern Joining Processes:</strong> Principle, Working and Application of Modern Joining Processes Such as Ultrasonic Welding (USW), Electron Beam Welding (EBW), Laser Beam Welding (LBW), Plasma Arc Welding (PAW), Under Water Welding, Metalizing, Explosive Welding, Cladding Etc. <strong>Electronic-Device Manufacturing:</strong> Brief Description of Diffusion (I.E., Rapid Prototyping) and Photo- Lithography Processes for Electronic-Device Manufacturing.</td>
<td>14</td>
</tr>
</tbody>
</table>

Text Boks:

Reference Books:

Outcome: Students will be able to understand:
- Explain and apply the principles of a range of modern manufacturing technologies.
- Describe the specific process characteristics of various modern manufacturing technologies and identify their possible applications.
- Comparatively analyse and evaluate the benefits of modern manufacturing processes and discuss their limitations. Evaluate, critically analyse and design manufacturing processes to maximise value-add and equipment/manpower utilization.
MEE 7021: COMPOSITE MATERIALS

**Objective:** The objective for this course is to develop an understanding of the linear elastic analysis of composite materials. This understanding will include concepts such as anisotropic material behavior and the analysis of laminated plates. The students will undertake a design project involving application of fiber reinforced laminates. Detailed study of biaxial strength theories of orthotropic materials are also of interest. Fundamentals of engineering constants, special cases of laminates are emphasized. The students are introduced to reinforced materials, their base materials, selection and applications.

**Credits:** 04  
**Semester VII & VIII**  
**L-T-P:** 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I | **Introduction to Composite Materials:** Definition, Classification, Types of Matrices Material and Reinforcements, Characteristics & Selection, Fiber Composites, Laminated Composites, Particulate Composites, Prepeg, and Sandwich Construction.  
| II | **Micro Mechanical Analysis of A Lamina:** Introduction, Evaluation of the Four Elastic Moduli, Rule of Mixture, Numerical Problems.  
**Biaxial Strength Theories:** Maximum Stress Theory, Maximum Strain Theory, TSA-Hill Theory, Tsai, Wu Tensor Theory, Numerical Problems. | 14 |
| III | **Macro Mechanical Analysis of Laminate:** Introduction, Code, Kirchoff Hypothesis, CL T, A, B, and D Matrices (Detailed Derivation) Engineering Constants, Special Cases of Laminates, Numerical Problems.  
**Manufacturing:** Lay Up and Curing - Open and Closed Mould Processing, Hand Lay, Up Techniques, Bag Moulding and Filament Winding, Pultrusion, Pulforming, Thermoforming, Injection Moulding, Cutting, Machining and Joining, Tooling.  
**Application Developments:** Aircrafts, Missiles, Space Hardware, Automobile, Marine, Recreational and Sports Equipment-Future Potential of Composites.  
**Metal Matrix Composites:** Re-Inforcement Materials, Types, Characteristics and Selection, Base Metals, Selection, Applications. | 14 |

**Text Book:**

**Reference Books:**

**Outcome:** After successful completion of this course, the student will be able to:
- Elementary understanding of the concepts of stress and strain in mechanics of solids and structures and material properties.
Apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force-deformation, and stress-strain relationships to the solid and structural mechanics problems.

Apply rules of mixture by calculating the elastic moduli in different directions for new materials.

Physical insight into inelastic behavior of composites, failure theories of fiber composites and development of various structures in composites.

Basic understanding of the development of metal matrix composites (MMC).
MEE 7024: RELIABILITY AND MAINTENANCE ENGINEERING

Objective: The objective of the course is to provide the students with the fundamental concepts, maintenance workload analysis and calculations, maintenance work scheduling the necessary knowledge and the basic skills related to system reliability and systems maintenance functions.

Credits: 04
Semester VII & VIII
L-T-P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>

Text Book:

Outcome: The course intends to expose the students to:
- The concept of reliability and to help them learn the techniques of estimating reliability and related characteristics of components/systems.
- Moreover, it exposes them to the necessary engineering techniques used for analyzing, planning and controlling maintenance systems.
Objective: Study of total quality management will enable the students to develop their mental horizon by enhancing their knowledge and skills which will embed organizational skill & it would be overall beneficial for any organization. The main objective is to provide students with quality, organizational and people management skills and techniques to enable them to make a significant contribution to an organization’s quality policy.

Credits: 04  Semester VII & VIII  L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
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</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td><strong>Quality Solving Tools:</strong> Process of Solving Problems – Conventional Methods, 7 Modern Management Tools. <strong>Continuous Improvement Strategies:</strong> Deming Wheel, Zero Defect Concept, Benchmarking, Six Sigma (6σ), Preventive Techniques – Failure Mode &amp; Effect Analysis (FMEA), Five S of Housekeeping, Time Management, Total Productive Maintenance <strong>Human Dimensions of TQM:</strong> Top Management Commitment, Leadership for TQM, Motivational Strategies, Quality Circles, Team Development &amp; Building, Communication and Transactional Analysis.</td>
<td>14</td>
</tr>
</tbody>
</table>

Text Books:

Reference Books:

Outcome: At the end of the course the student should be able to:
- Explain complete range of topics, from quality concepts, basic and advanced quality.
- Describe tools & techniques, quality management systems, quality excellence methodologies.
- Explain continuous improvement methodologies, to the human development and motivation of people across an organization.
OPEN ELECTIVE

MEE 7065: SUPPLY CHAIN MANAGEMENT

Objective: Supply chain management is concerned with the efficient integration of suppliers, factories, warehouses and stores so that merchandise is produced and distributed: – In the right quantities – To the right locations – At the right time. In order to – Minimize total system cost – Satisfy customer service requirements – face global competition – Improve standardization.

Credits: 04

Semester VII & VIII

L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction to Supply Chain Management (SCM)</td>
<td>12</td>
</tr>
<tr>
<td>II</td>
<td>Capacity Planning and Forecasting in Supply Chains</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Demand Forecasting is Supply Chains, Aggregate Planning in Supply Chains, Managing Predictable Variability in Demand and Supply in Supply Chains, Managing Economics of Scale: Cycle Inventory, Managing Uncertainty in A Supply Chain: Safety Inventory, Determining the Optimal Level of Product Availability</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Design of Networks</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Designing Distribution Networks and Applications to E-Business, Network Design in the Supply Chain, Network Design in An Uncertain Environment, Sourcing Decisions in A Supply Chain, Pricing and Revenue Management in A Supply Chain, Information Technology in A Supply Chain, Coordination in A Supply Chain</td>
<td></td>
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</table>

Text Books:

Reference Books:

Outcome: Upon successful completion of this course, the students will be able to:
- To create activities in the supply chain that transcends the activities of particular entities in the chain.
- Managing supply chain and balancing act among competing interests.
- Add Value for Customers and Stakeholders.
# OPEN ELECTIVE

**MEE 7062: RENEWAL ENERGY RESOURCES AND ITS UTILIZATION**

**Objective:** To make students aware of importance of Energy. To tell students the importance of Renewable energy and its forms in India. To tell students how to harness the renewable energy. To make student aware of new R&D in the field on energy.

**Credits:** 04  
**Semester VII & VIII**  
**L–T–P: 3–1–0**

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
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</tr>
</thead>
</table>
**Solar Collector:** Introduction, Classification and Application.  
**Solar Pond:** Introduction and Its Types.  
**Application of Solar Thermal Energy:** Cooling, Drying, Distillation, Power Generation, Solar Cooking, Space Heating and Cooling, Solar Water Heating.  
**Solar Photovoltaic Systems:** Basic Concept, Operating Principles Its Application. | 15 |
| II         | **Wind Energy:** Principle of Wind Energy Conversion, Site Selection Criterion, Concept of Lift and Drag.  
**Biogas:** Properties and Utilization  
**Concept of Bio Diesel:** Development, Advantage and Limitation.  
**Ocean Thermal Energy Conversion (OTEC):** Basic Concept, Working Principle, Performance, Types and Limitations.  
**Tidal Wave:** Principle of Working, Performance, Types and Limitations. | 15 |
**Fuel Cells:** Basic Concept and Working Principle Fuel Cells, Application Advantage And Limitations.  
**Geo Thermal Energy:** Nature of Geothermal Sources, Principle, Location, Economics and Prospect. Classification of Resources, Utilization for Electric Generation and Direct Heating, Well Head Power Generating Units.  
**Energy Management:** Energy Economics, Energy Audit. Contribution of NCER At Global and Indian Level. | 10 |

**Text Books:**
Course Curriculum (w.e.f. Session 2017-18)

B.Tech. (Mechanical Engineering)

- Gabdel Andra, "A Handbook for Engineers and Economists", TMH.
- F.R. the MITTRE, "Wind Machines", by Energy Resources and Environmental Series.

Reference Books:

Outcome: Upon successful completion of this course, the students will be able to:
- Know the importance of renewable energy.
- Students are aware of that there is a very need of stopping exploitation of fossil fuel.
- Students knows how to utilize non conventional form of energy.
- Students are aware of various power plants used to produce power from renewable energy sources.
Objective: The main objective of an entrepreneurship development programme is to widen the base of entrepreneurship by development achievement motivation and entrepreneurial skills among the less privileged sections of the society. "Entrepreneurship Development Programme is designed to help an individual in strengthening his entrepreneurial motive and in acquiring skills and capabilities necessary for playing his entrepreneurial role effectively.

Credits: 04
Semester VII & VIII  L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td><strong>Introduction To Entrepreneurship:</strong> Evolution of the Concept of Entrepreneur, Functions of Entrepreneur, Characteristics of An Entrepreneur, Types of Entrepreneur, Concept of Entrepreneurship, Growth of Entrepreneurship, Barriers of Entrepreneurship, Role of Entrepreneurship in India, Entrepreneurial Motivation, Major Entrepreneurial Competencies. <strong>Small Scale Industries (SSI):</strong> Characteristics of Small Scale Industry, Basis for Classification of Small Scale Industry: Resource Based, Demand Based, Ancillary, Subsidiary Based or Sub – Controlled Type, Technology Based Etc. Government Policy for Small Scale Industry, Growth of SSI in Developing Countries, Role of National and State Agencies Providing Assistance To SSI’s, Relationship Between Small and Big Industries, Ownership Structure, Registration of SSI.</td>
<td>12</td>
</tr>
</tbody>
</table>

Text Books:
- Khanka S.S., “Entrepreneurial Development”, S. Chand & Company Ltd.

Reference Books:
• Holt David. H., “Entrepreneurship”, PHI Learning
• Roy Rajeev, “Entrepreneurship”, Oxford University Press.

Outcome: Upon successful completion of this course, the students will be able to know:
• Entrepreneurial development programmes have become imperative for exploiting vast untapped human skills and to channelize them into accelerating industrialization. It develop entrepreneurial abilities among the people.
• It will help a person with the required skills and knowledge needed for starting and running the entrepreneurship.
## Objective:
The main objectives of project management are as follows: Understand exactly what a project is meant to do and what it is meant to deliver. To learn the scope, timescales, cost and quality of a project. How to maintain a schedule and project plan. To estimate the cost of project. Different finance institute available for financial add. Deliver the agreed outcomes of the project to the right scope, timescales, cost and quality. Provide communications, reports and progress updates throughout the lifecycle of the project. To let students know how to manage risks, issues and dependencies.

## Credits: 04  Semester VII & VIII  L–T–P: 3–1–0

<table>
<thead>
<tr>
<th>Module No.</th>
<th>Contents</th>
<th>Teaching Hours</th>
</tr>
</thead>
</table>
| I          | **Introduction:** Project Characteristics, Attributes of A Good Project Manager, Taxonomy of Projects.  
**Project Identification & Formation:** Project Identification, Demand Forecasting, Project Preparation, Zero Based Project Formulation, Preliminary Project Report, Comparison of Project Alternatives.  
**Project Appraisal:** Technical Appraisal, Commercial Appraisal, Economical Appraisal, Management Appraisal, Social Cost Benefit Analysis, NPV, IRR, BCR, NBCR. | 14 |
| II         | **Financing of Projects:** Estimation of Cost Components of Projects. Sources of Finances, Role of Financial Institutions, Cash Inflow and Cash Outflow, Cost of Capital.  
**Project Planning & Scheduling:** Scheduling Techniques, PERT & CPM, Network Preparation, Updating Network, Line of Balance Technique, Performance Analysis of Projects, Cost Vs Time of Completion, Normal Time and Crash Time, Resource Allocation Techniques, Work Breakdown Structure. | 14 |
| III        | **Project Contracts:** Types of Contract, Sub-Contract, Tenders & Types of Payment to Contractors.  
**Computer Aided Project Management:** Essential Requirements of Software’s, Software Packages, Enterprise-Wide Project Management, Spread Sheets.  
Project Organization, Post Project Evaluation, Project Sickness – Causes, Prediction of Causes, Rehabilitation, Project Audit, Risk Analysis. | 12 |

### Text Books:

### Reference Books:
- Scelharaman S. & Rammath Vijay, “Project Management” Breweries; Education.

### Outcome:
Upon successful completion of this course, the students will be able to know:
- Provides students with additional portable knowledge, skills, techniques, and tools in order to be more successful in managing or delivering projects.
- Enhances career development prospects through having achieved recognized project management knowledge.