Curriculum and Syllabi

for

B.Tech. (Mechanical Engineering)

(With Effect from Academic year 2018-19)

(Approved in Fifth Academic Council Meeting held on 6th May 2019)
**CURRICULUM**

The Curriculum of B.Tech. (Mechanical Engineering) is designed to fulfil the Program Educational Objectives (PEO) and the Program Outcomes (PO) listed below.

### PROGRAM EDUCATIONAL OBJECTIVES (PEO)

<table>
<thead>
<tr>
<th>PEO1</th>
<th>To provide necessary background in science, particularly in advanced mathematics, physics and chemistry that underlie modern mechanical engineering and technology (Fundamentals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEO2</td>
<td>To produce graduates who are strong in basics of technical education and prove their competency in diversified areas of mechanical engineering so that they can secure suitable positions in any technological enterprises, companies, organizations and industries both at national and international levels (Employability).</td>
</tr>
<tr>
<td>PEO3</td>
<td>To encourage a majority of our graduates to pursue advanced studies in thrust areas of mechanical engineering and to carry out scientific, industrial and defence research and development so as to meet/satisfy current requirements in respective sectors (Higher Studies).</td>
</tr>
<tr>
<td>PEO4</td>
<td>To prepare our graduates to improve their self-reliant capabilities, soft skills, leadership qualities which would help in building their own careers and make them become successful entrepreneurs to serve the nation and the society responsibly and ethically (Entrepreneurship).</td>
</tr>
<tr>
<td>PEO5</td>
<td>To familiarize our graduates with international and national codes and standards for good engineering practice in core and interdisciplinary fields and to help them evolve sustainable development in technological sphere with greater emphasis on mitigation of environmental impact (Professional Ethics).</td>
</tr>
</tbody>
</table>

### PROGRAM OUTCOMES (PO)

<table>
<thead>
<tr>
<th>PO1</th>
<th>Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO2</td>
<td>Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</td>
</tr>
<tr>
<td>PO3</td>
<td>Design/develpment of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.</td>
</tr>
<tr>
<td>PO4</td>
<td>Conduct investigations of complex problems: The problems: • that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline. • that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions. • that require consideration of appropriate constraints/requirements not explicitly given in the problem statement. (like: cost, power requirement, durability, product life, etc.). • which need to be defined (modelled) within appropriate mathematical framework. • that often require use of modern computational concepts and tools.</td>
</tr>
<tr>
<td>PO5</td>
<td><strong>Modern tool usage</strong>: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.</td>
</tr>
<tr>
<td>PO6</td>
<td><strong>The engineer and society</strong>: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.</td>
</tr>
<tr>
<td>PO7</td>
<td><strong>Environment and sustainability</strong>: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.</td>
</tr>
<tr>
<td>PO8</td>
<td><strong>Ethics</strong>: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</td>
</tr>
<tr>
<td>PO9</td>
<td><strong>Individual and team work</strong>: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</td>
</tr>
<tr>
<td>PO10</td>
<td><strong>Communication</strong>: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.</td>
</tr>
<tr>
<td>PO11</td>
<td><strong>Project management and finance</strong>: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.</td>
</tr>
<tr>
<td>PO12</td>
<td><strong>Life-long learning</strong>: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.</td>
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</table>

**PROGRAM SPECIFIC OUTCOMES (PSO)**

| PSO1 | Graduates are acquainted well with the concepts and principles of Mechanical Engineering required for understanding and solving practical industrial problems of current interests to core mechanical industries. |
| PSO2 | Graduates are initiated to work on Innovative Ideas that will eventually motivate them to pursue *Higher Studies and Research* in Mechanical & Allied Engineering and Management. |
| PSO3 | Graduates can function in a *Multidisciplinary Environment* by being able to associate and integrate their domain knowledge with other disciplines. |
Distribution of credits among the subjects grouped under various categories:

Courses are grouped under various categories and the credits to be earned in each category of courses are as follows:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>Credits</th>
<th>Course Category Code (CCC)</th>
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<tbody>
<tr>
<td>1</td>
<td>Humanities, Social Sciences and Management Courses</td>
<td>6 + 2 / 3 *</td>
<td>HSM</td>
</tr>
<tr>
<td>2</td>
<td>Basic Science Courses (Mathematics, Physics, Chemistry and Biology)</td>
<td>25</td>
<td>BSC</td>
</tr>
<tr>
<td>3</td>
<td>Engineering Science Courses (Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc.,)</td>
<td>25.5</td>
<td>ESC</td>
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<tr>
<td>4</td>
<td>Professional Core Courses</td>
<td>64.5</td>
<td>PCC</td>
</tr>
<tr>
<td>5</td>
<td>Professional Elective Courses (from chosen discipline)</td>
<td>15</td>
<td>PEC</td>
</tr>
<tr>
<td>6</td>
<td>Open Elective Courses (from other technical/ emerging disciplines)</td>
<td>10</td>
<td>OEC</td>
</tr>
<tr>
<td>7</td>
<td>Professional Activity Courses (Seminar, Entrepreneurship, Comprehensive Test, Internship, Project Work)</td>
<td>14</td>
<td>PAC</td>
</tr>
<tr>
<td>8</td>
<td>Mandatory non-Credit Courses (Induction, Environmental Sciences, Indian Constitution, Essence of Indian Traditional Knowledge, Professional Ethics)</td>
<td>Non-credit</td>
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*included in the 10 credits under open elective category
# Semester-wise Courses and Credits

## Semester I

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<td>CS201</td>
<td>Programming for Problem Solving</td>
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<tr>
<td>ME202</td>
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**CCC** - Course Category Code, **SET** – Semester Exam Type, **TY** – Theory, **LB** – Laboratory, **PR** - Project
### Semester III

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<tr>
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<td>Transforms, PDE and Statistics</td>
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<td>ME203</td>
<td>Engineering Mechanics</td>
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<td>TY</td>
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<tr>
<td>ME204</td>
<td>Fluid Mechanics and Hydraulic Machines</td>
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<tr>
<td>ME206</td>
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<tr>
<td>ME207</td>
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<tr>
<td>SH202</td>
<td>Indian Constitution</td>
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<tr>
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<tr>
<td>MEM01</td>
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### Semester IV

<table>
<thead>
<tr>
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<tr>
<td>SH201</td>
<td>Biology for Engineers</td>
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<tr>
<td>EC234</td>
<td>Elements of Electronics</td>
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<tr>
<td>ME208</td>
<td>Mechanics of Solids</td>
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<tr>
<td>ME209</td>
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<td>TY</td>
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<tr>
<td>ME210</td>
<td>Machining Technology</td>
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<td>TY</td>
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<td>ME211</td>
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<tr>
<td></td>
<td>( Fluid mechanics and machines/ Material</td>
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<tr>
<td></td>
<td>technology /Machine shop)</td>
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<tr>
<th>Course Code</th>
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<th>Periods</th>
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<td>MEH02</td>
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<td>TY</td>
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<td>MEM02</td>
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<td>PCC</td>
<td>TY</td>
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*ZZ in ZZOX is the Department Code of the department offering Open Elective
### Semester V

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
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<th>SET</th>
<th>Periods</th>
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<tr>
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<td>Heat and Mass Transfer</td>
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<td>ME214</td>
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<td>MEYXX</td>
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<tr>
<td>SH203</td>
<td>Essence of Indian Traditional Knowledge</td>
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<td>ME216</td>
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### Semester VI

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### Semester V

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### Semester VI

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*ZZ in ZZOXX is the Department Code of the department offering Open Elective
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*Included in the 10 credits under Open Elective category*
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**Programme**: B.Tech.  
**Semester**: First  
**Course Category Code**: MCC  
**Semester Exam Type**: -  

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**Prerequisite**

- The course will enable the student to

**Course Outcome**

- **CO1**: Acquire social awareness & knowledge for self-development
- **CO2**: Be aware of nature & environment conscious and of Innovative nature.
- **CO3**: Develop holistic attitude and harmony in the individual, family, and society
- **CO4**: Know about the art and culture, language and literature of this vast secular nation
- **CO5**: Integrating technical Education for betterment of society

### UNIT-I
**Proficiency in English**

Communication skills – Diagnostic test on Grammar – Synonyms, Antonyms, Tenses, Sentence Completion, Idioms & Phrases, One word substitution, Homophones, Homonyms, Use of Prepositions, Subject-verb agreement – Writing – Paragraph writing, Letter writing, Essay writing, Story Development.

**CO1**

### UNIT-II
**Bridge course in Mathematics**

Fundamentals of differential and integral calculus: Theory, Practice & Test.

- Limit of function-Fundamental results on limits-Continuity of a function- Concept of differentiation- Concept of derivative- Slope of a curve-Differentiation Techniques- Derivatives of elementary functions from first principle-

**CO2**

### UNIT-III
**Universal human values**

Current Status of the society (Sources of fear)-Reformation through education-Sanskar-What is success (getting good marks, college admission, Job etc)-What is aim of life (happiness, Prosperity and continuity of happiness and prosperity)-What is required for happiness (relationship, physical facilities)-Relationship involves all emotions and feelings-Physical facility-material things required for life-Difference between animal and human consciousness-Animal consciousness-depending on money, accumulating money by wrong means etc.-Human consciousness-right thinking, right understanding, right feeling-Happiness through Harmony in the individual, family, society and nature, leading to fearlessness in the society is the purpose of holistic education or value education.

**CO3**

### UNIT-IV
**Literary activities**

Team building activities – Quiz – Oral Exercises – Group discussion, Debate, Extempore, Role play.

**CO4**

### UNIT-V
**Creative arts**


**CO5**

<p>| Reference Periods: 60 | Tutorial Periods: - | Practical Periods: - | Total Periods: 60 |</p>
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### Prerequisite:
- 

#### Course Outcome

- **CO1**: To apply differential calculus to notions of curvature, evolutes and involutes and they will have a basic understanding of Beta and Gamma functions.
- **CO2**: The mathematical tools needed in evaluating multiple integrals and their usage.
- **CO3**: The effective mathematical tools for the solutions of differential equations that model physical processes.
- **CO4**: Able to solve simultaneous linear differential equations.
- **CO5**: Understands Vector calculus and its applications.

#### UNIT-I
**Differential Calculus**

Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties. **CO1**

#### UNIT-II
**Multi variable calculus**

Multiple Integrals, change of order of integration in double integrals, Applications: Plane areas (double integration), Change of variables (Cartesian to polar), Double and triple integrations, Volumes by triple integration – Mass, Center of mass and Gravity (constant and variable densities). **CO2**

#### UNIT-III
**First order Ordinary Differential Equation**

Exact equations, First order linear equations, Bernoulli’s equation, Equations not of first degree, equations solvable for p, equations solvable for y, equations solvable for x - Clairaut’s type - simple applications, orthogonal trajectories, growth and decay. **CO3**

#### UNIT-IV
**Higher Order Ordinary Differential Equation**

Linear differential equations of higher order - with constant coefficients, the operator D, Euler’s linear equation of higher order with variable coefficients, simultaneous linear differential equations, solution by variation of parameters method. **CO4**

#### UNIT-V
**Vector Calculus**

Gradient, divergence and curl, their properties and relations. Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integral, Theorems of Green, Stokes and Gauss divergence (without proof). Simple applications involving cubes, sphere and rectangular parallelepipeds. **CO5**

### Lecture Periods: 45
### Tutorial Periods: 15
### Practical Periods:
### Total Periods: 60

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<tbody>
<tr>
<td>MA202</td>
<td>Mathematics-II</td>
<td>3 L 1 T 4 P C</td>
<td>40 CA 60 SE 100 TM</td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite:** -

| Course Outcome | | |
|----------------|---------------------------------------------------------------|
| Unit 1 | Matrices | Periods: 12 |
| **CO1** | Understands Matrix theory |
| Unit 2 | Fourier Series | Periods: 12 |
| - | Dirichlet’s conditions - Expansion of periodic functions into Fourier series- Change of interval- Half-range Fourier series. Complex form of Fourier series - Root mean square value - Parseval’s theorem on Fourier coefficients - Harmonic analysis. |
| **CO2** | The tool of Fourier series for learning advanced Engineering Mathematics |
| Unit 3 | Fourier Transform | Periods: 12 |
| - | Fourier Integral Theorem(statement only)- Fourier transform, Inverse Fourier transform, definition and properties - Evaluation of integrals- Fourier cosine and sine transform, definitions and evaluation of integrals using cosine and sine transforms. |
| **CO3** | The tool of Fourier transform for learning advanced Engineering Mathematics |
| Unit 4 | Complex Valued function and Conformal Mapping | Periods: 12 |
| - | Definition of a Complex valued function \( f(z) \) and its derivative - Analytic functions - Necessary condition for a function \( f(z) \) to be analytic (in Cartesian) - Cauchy-Riemann equation - statement of C-R equation in polar form - sufficient condition for \( f(z) \) to be analytic(statement only)- harmonic function- Harmonic and orthogonal properties of analytic function – Construction of analytic functions. Conformal mapping – Simple and standard transformations like \( w = z^2 \), \( e^z \), \( z+c \), \( cz \), \( \sin z \), \( 1/z \), Bilinear transformation (excluding Schwarz- Christoffel transformation). |
| **CO4** | The tools of differentiation of functions of a complex variable that are used in various techniques dealing engineering problems. |
| Unit 5 | Complex Integration | Periods:12 |
| - | Cauchy’s Integral theorem, Cauchy’s integral formula (without proof) and problems, Taylor’s and Laurent’s theorem (without proof), Classification of singularities. Residues and evaluation of residues – Cauchy’s Residue theorem, Contour integration – Evaluation of real integrals – unit circle and semi-circular contour (excluding poles on boundaries). |
| **CO5** | The tools of integration of functions of a complex variable that are used in various techniques dealing engineering problems. |

**Reference Books:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH201</td>
<td>Physics</td>
<td>L 3 T 1 P -</td>
<td>C 4</td>
<td>CA 40 SE 60 TM 100</td>
</tr>
</tbody>
</table>

**Prerequisite:**

The course will enable the student to:

- **CO1** Understand electric and magnetic field & potential
- **CO2** Study the basics of dielectric materials and its importance
- **CO3** Understand the concepts of wave mechanics and its applications
- **CO4** To study the optical phenomena arising due to interference, diffraction and polarization
- **CO5** To discuss the fundamentals of Lasers, fiber optics and its real time applications

**UNIT-I Electromagnetic theory**

**Periods:** 12

Brief review of electrostatics, electric field and potential – divergence and curl of electrostatic field – Gauss law and its applications, Laplace’s equation in one, two and three dimension.

Brief review of magnetostatics, Biot-Savart law – divergence and curl of static magnetic field – Ampere’s law – magnetic vector potential – comparison of electrostatics and magnetostatics.

**UNIT-II Dielectrics**

**Periods:** 12


**UNIT-III Quantum mechanics**

**Periods:** 12

Matter Waves – de Broglie hypothesis – uncertainty principle – Schrödinger wave equations – time dependent – time independent – physical significance of wave function – application to particle in a one dimensional potential box – concept of quantum mechanical tunneling (without derivation) – applications of tunneling (qualitative) to alpha decay, tunnel diode, scanning tunneling microscope.

**UNIT-IV Wave optics**

**Periods:** 12

**Interference:** airwedge – Newton’s rings – Michelson’s interferometer – types of fringes – determination of wavelength of a light source.

**Diffraction:** concept of resolution of spectral lines – Rayleigh’s criterion – resolving power of grating, prism & telescope.

**Polarisation:** Basic concepts of double refraction – circular and elliptical polarization – quarter and half wave plates – optical rotation – specific rotatory power – Laurent’s half shade polarimeter.

**UNIT-V Lasers and Fiber optics**

**Periods:** 12


**Fiber optics:** Principle and propagation of light in optical fiber – numerical aperture and acceptance angle – step index and graded index fiber – qualitative ideas of attenuation in optical fibers – fiber optic communication (schematic), active and passive fiber optic sensors, endoscope.

Lecture Periods: 45  Tutorial Periods: 15  Practical Periods: -  Total Periods: 60
<table>
<thead>
<tr>
<th>Reference Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Avadhantul N. N. , Engineering Physics, S. Chand &amp; Co, 2007</td>
</tr>
</tbody>
</table>
Department: Physics  Programme: B.Tech.
Semester: First/Second  Course Category Code: BSC  Semester Exam Type: LB

<table>
<thead>
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<th>Course</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>PH202</td>
<td>Physics Laboratory</td>
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</table>

Prerequisite: -

The students will learn to experimentally measure:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Optical parameters related to the concepts included in theoretical curriculum</td>
</tr>
<tr>
<td>CO2</td>
<td>Characteristic parameters of Laser and optical fiber</td>
</tr>
<tr>
<td>CO3</td>
<td>Thermal conductivity and pressure coefficients</td>
</tr>
<tr>
<td>CO4</td>
<td>Magnetic field, electrical conductivity and Hall coefficient</td>
</tr>
<tr>
<td>CO5</td>
<td>Young’s modulus, Rigidity modulus and acceleration due to gravity</td>
</tr>
</tbody>
</table>

Choice of 10-12 experiments from the following:

1. Radius of curvature of a Lens - Newton’s rings
2. Thickness of a thin object by air – wedge
3. Spectrometer – resolving power of a prism
4. Spectrometer – resolving power of a transmission grating
5. Spectrometer - hollow prism / ordinary & extraordinary rays by calcite prism*
6. Lorent’s Half shade polarimeter – determination of specific rotatory power
7. Determination of wavelength of a laser source using transmission grating, reflection grating (vernier calipers) & particle size determination
8. Determination of numerical aperture & acceptance angle of an optical fiber
9. Determination of optical absorption coefficient of materials using laser*
10. Michelson’s interferometer*
11. Coefficient of thermal conductivity - radial flow method
12. Coefficient of thermal conductivity – Lee’s disc method
13. Jolly’s bulb apparatus experiment – determination of α*
14. Magnetism: I – H curve
15. Field along the axis of a coil carrying current
16. Vibration magnetometer – calculation of magnetic moment & pole strength
17. Electrical conductivity of semiconductor – two probe / four probe method*
18. Hall effect in a semiconductor*
19. Determination of Young’s modulus and rigidity modulus
20. Acceleration due to gravity - compound pendulum

*Demonstration experiments

Lecture Periods: 45  Tutorial Periods: -  Practical Periods: -  Total Periods: 45

Reference Books
1. Physics Practical Observation Manual, Department of Physics, Pondicherry Engineering College.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
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<tr>
<td>CY201</td>
<td>Chemistry</td>
<td>3 T 1 P 4 C</td>
<td>CA SE</td>
<td>40 60 100</td>
</tr>
</tbody>
</table>

**Course Prerequisite:**

- To analyse microscopic chemistry in terms of orbitals, structure and intermolecular forces
- To rationally analyze the bulk properties and processes
- To study the concepts of electrochemistry and its applications
- To understand the mechanism of chemical reactions and synthesis of molecules
- To comprehend the concepts of analytical techniques.

**UNIT-I: Chemical bonding and isomerism**

- Structural and stereos isomerism-geometric isomerism in alkenes. Optical isomerism-optical activity, chiral carbon. Optical isomerism in lactic acid and tartaric acid. Enantiomers, diastereomers and meso compounds.
- Resolution of racemic mixtures, racemization, asymmetric synthesis, Walden inversion.

**UNIT-II: Water chemistry and reaction kinetics**


**UNIT-III: Electrode potential and corrosion**


**UNIT-IV: Introduction to reaction mechanism**


**UNIT-V: Analytical techniques**


**Lecture Periods:** 45  |  **Tutorial Periods:** 15  |  **Practical Periods:** -  |  **Total Periods:** 60

**Reference Books**

## Department : Chemistry  
Programme: B.Tech.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td></td>
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### Prerequisite
- 

### Course Outcome

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Determine rate constants and order of reactions</td>
</tr>
<tr>
<td>CO2</td>
<td>Measure molecular/system properties such as surface tension, viscosity, partition coefficient, hardness of water, adsorption, saponification value and acid value</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze quantitatively the contents of samples</td>
</tr>
<tr>
<td>CO4</td>
<td>Use conductivity, potentiometric and chromatographic techniques</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyse a salt sample</td>
</tr>
</tbody>
</table>

### Choice of 10-12 experiments from the following:

1. Kinetic study of acid hydrolysis of ethyl acetate  
2. Determination of surface tension and viscosity  
3. Partition of benzoic acid between benzene and water  
4. Total hardness of water - Determination by EDTA method  
5. Freundlich adsorption isotherm - Adsorption of acetic acid on charcoal  
6. Saponification value and acid value of an oil  
7. Chloride content of water - Determination by Mohr’s method  
8. Determination of oxalic acid by permanganometry  
9. Determination of ferrous by permanganometry  
10. Determination of ferrous and ferric by dichrometry  
11. Determination of carbonate and bicarbonate in a mixture  
12. Beer-Lamberts law - Determination of ferrous by colorimetry  
13. Magnesium content in water - Determination by EDTA method  
14. Acetic acid content in vinegar  
15. Dissolved oxygen content in water - Determination by Winkler’s method.  
17. Conductometric titration  
18. Potentiometric titration  
19. Thin layer chromatography  

### Lecture Periods:  
Tutorial Periods: -  
Practical Periods: 45  
Total Periods: 45

### Reference Books

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>HS201</td>
<td>English for Communication</td>
<td>2</td>
<td>3</td>
<td>40</td>
</tr>
</tbody>
</table>

### Prerequisite

- CO1: To help the learners to develop their technical communication skills
- CO2: To equip the learners with skills required for developing their reading prowess.
- CO3: To enhance the writing skills of learners by providing practice in writing.
- CO4: To instil confidence in learners to develop their speaking skills and enable them to articulate with ease.
- CO5: To facilitate vocabulary enhancement and grammatical correctness in communication.

#### UNIT-I

**TECHNICAL COMMUNICATION**


CO1

#### UNIT-II

**COMPREHENSION AND ANALYSIS**


CO2

#### UNIT-III

**PRACTICE IN WRITING**


CO3

#### UNIT-IV

**SPEAKING PRACTICE**


CO4

#### UNIT-V

**GRAMMAR AND VOCABULARY BUILDING**


CO5

### Lecture Periods: 30 | Tutorial Periods: - | Practical Periods: 30 | Total Periods: 60

#### Reference Books

8. Relevant material from newspapers, magazines and journals will be used for integrated practice.
Department: Mechanical Engineering  
Programme: B.Tech.

Semester: First/Second  
Course Category Code: ESC  
Semester Exam Type: LB

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ME201</td>
<td>Workshop and Manufacturing Practice</td>
<td>0 0 3 1.5</td>
<td>40 60 100</td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite**

- **CO1**: To convey the basics of mechanical tools used in carpentry section and establish hands on experience in making the different carpentry joints
- **CO2**: To gain knowledge on types of tools and machines used in sheet metal shop and perform some exercises
- **CO3**: To develop basic welding and fitting joints using the hand tools and establish the importance of joints and fitting in engineering applications
- **CO4**: To gain knowledge of the different machines used in manufacturing processes which are commonly employed in the industry, to fabricate components using different materials
- **CO5**: To carry out simple manufacturing operations in lathe, drilling and shaping machine

**UNIT-I**  
Carpentry  
Periods: 9

Study of tools and machines in carpentry  

**UNIT-II**  
Sheet Metal  
Periods: 9

Study of tools and machineries in sheet metal shop  
1.Frustum of cone  2.Waste collection tray and 3.Rectangular box

**UNIT-III**  
Welding and Fitting  
Periods: 9

Lectures/demonstrations/videos on Welding and fitting operations with simple exercise. 1. Filing and Job preparation 2. V-Fitting and 3. Simple lap joint

**UNIT-IV**  
Study of tools and machines  
Periods: 6

Study of tools and machines in manufacturing lab  

**UNIT-V**  
Simple Exercises in Lathe/Drilling machine/Shaper  
Periods: 12

Simple operations in lathe, drilling and shaping  

Lecture Periods: 3  
Tutorial Periods: -  
Practical Periods: 42  
Total Periods: 45

**Reference Books**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ME202</td>
<td>Engineering Graphics and Computer Aided Drawing</td>
<td>2 - 4 3</td>
<td>40 60 100</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Prerequisite</th>
<th>Course Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>CO1 Students learn to properly dimension and annotate engineering drawings as per standards of engineering drawing practice.</td>
</tr>
<tr>
<td>-</td>
<td>CO2 Students are made to follow and understand the basics of engineering drawing with simple solids.</td>
</tr>
<tr>
<td>-</td>
<td>CO3 Students can properly apply and produce sectional views.</td>
</tr>
<tr>
<td>-</td>
<td>CO4 Students are able to properly create multi-view orthographic drawings from three dimensional diagrams. Students are able to present a drawing in orthographic and isometric projections.</td>
</tr>
<tr>
<td>-</td>
<td>CO5 Students learn the application of engineering graphics through computer-aided drafting.</td>
</tr>
</tbody>
</table>

**UNIT-I**

Periods: 18

Introduction to Engineering graphics, Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning, Projection of Lines, Projection of Planes

**UNIT-II**

Periods: 18

Projections of simple solids

**UNIT-III**

Periods: 18

Sections of solids and Development of surfaces

**UNIT-IV**

Periods: 18

Isometric Projections and Orthographic Projections

**UNIT-V**

Periods: 18

Introduction to Computer Graphics and Drafting, Auto CAD, 2-D diagrams of simple geometries using Auto-CAD script.

**Lecture Periods:** 30  **Tutorial Periods:** -  **Practical Periods:** 60  **Total Periods:** 90

**Reference Books**

**Department**: Electrical and Electronics Engineering  
**Programme**: B.Tech.

**Course Category Code**: ESC  
**Semester Exam Type**: TY

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Periods / Week</th>
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<tbody>
<tr>
<td>EE201</td>
<td>Basic Electrical Engineering</td>
<td>3</td>
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**Course Prerequisite**: -

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>To understand the basic concepts of DC circuits and theorems.</td>
</tr>
<tr>
<td>CO2</td>
<td>To explain the concepts of AC circuits and resonance.</td>
</tr>
<tr>
<td>CO3</td>
<td>To understand the basic concepts of magnetic circuits and transformer.</td>
</tr>
<tr>
<td>CO4</td>
<td>To explain the working principle, construction, applications of electrical machines.</td>
</tr>
<tr>
<td>CO5</td>
<td>To Gain knowledge of working of power plants and fundamentals of switch gear and earthing.</td>
</tr>
</tbody>
</table>

**UNIT-I**  
**DC Circuits**
Periods: 12

**UNIT-II**  
**AC Circuits**
Periods: 12
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Resonance: Series and parallel resonance. Three-phase balanced circuits: voltage and current relations in star and delta connections – Power measurement by two Wattmeter method.

**UNIT-III**  
**Transformers**
Periods: 12

**UNIT-IV**  
**Electrical Machines**
Periods: 12
Elementary concept of rotating machines – Flemming’s right hand and left hand rule – DC Machines: Construction and working of DC Machines - Generator and Motors – Emf equation of DC generator and back emf of DC motor – characteristics - Types of DC Machines. AC Machines: Construction and working of Single phase & three phase induction motors and synchronous generator (qualitative approach only).

**UNIT-V**  
**Power Plants and LT Switch gear**
Periods: 12
Power Plants: Layout of thermal, hydro and nuclear power generation (block diagram approach only). Components of AC transmission and distribution systems – One-line diagram. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables. Earthing. Elementary calculations for energy consumption.

**Lecture Periods**: 45  
**Tutorial Periods**: 15  
**Practical Periods**: -  
**Total Periods**: 60

**Reference Books**
Department: Electrical and Electronics Engineering  
Programme: B.Tech.

Semester: First/Second  
Course Category Code: ESC  
Semester Exam Type: LB

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Periods / Week</th>
<th>Credit</th>
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<tbody>
<tr>
<td>EE202</td>
<td>Basic Electrical Engineering Laboratory</td>
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<td>40</td>
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</tbody>
</table>

Prerequisite: -

Course Outcome:

- **CO1**: To understand the principles of domestic wiring and electrical components.
- **CO2**: To illustrate handling of measuring instruments and demonstrate the concepts of network theorems.
- **CO3**: To analyze RL, RC, RLC circuits.
- **CO4**: To introduce concepts of single/three phase circuits.
- **CO5**: To demonstrate the working principle of electrical machines.

Any 10 experiments:

1. Study of Basic safety precautions. Concepts of domestic wiring- wires, switches, plugs, sockets, fuses and lamp holders. CO1
2. Study of fan and tube light connections and earthing.
3. Stair case wiring.
5. Use of measuring instruments. Verification of Kirchoff’s voltage and current law. CO2
6. Verification of Thevenin and Norton theorems.
7. Verification of Superposition Theorem.
8. Impedance calculation of R-L, R-C & R-L-C circuits and verification.
11. Measurement of various line and phase quantities for a three phase star/delta ac circuit. CO4
13. Energy measurement using single phase energy meter.
14. Load test on a single phase transformer.
15. Load test on a single phase induction motor. CO5

Lecture Periods: -  
Tutorial Periods: -  
Practical Periods: 45  
Total Periods: 45

Reference Books:

1. Laboratory Manual, Department of Electrical and Electronics Engineering, Pondicherry Engineering College.
### Course: Programming for Problem Solving

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>CS201</td>
<td>Programming for Problem Solving</td>
<td>3</td>
<td>3</td>
<td>40 60 100</td>
</tr>
</tbody>
</table>

#### Prerequisite

- None

#### Course Outcome

- **CO1**: Understood the phases of problem solving techniques for simple problems.
- **CO2**: Able to write programs using the basic language constructs.
- **CO3**: Able to build a larger programs using function oriented approaches.
- **CO4**: Could write efficient programs using advanced concepts to optimize the memory.
- **CO5**: Could write programs to access data from the secondary storage efficiently.

### UNIT-I

**Algorithmic Problem Solving**  
Periods: 9

- Generations of Programming Languages – Introduction to Number System.  

#### CO1

### UNIT-II

**Data, Expressions, Statements**  
Periods: 9


#### CO2

### UNIT-III

**Arrays and Functions**  
Periods: 9

- Arrays – Two dimensional arrays, Multidimensional arrays. Character arrays.  
- Strings – String I/O functions, String Library functions – Storage classes.

#### CO3

### UNIT-IV

**Structures, Unions and Pointers**  
Periods: 9


#### CO4

### UNIT-V

**File Management**  
Periods: 9


#### CO5

### Lecture Periods

- 45

### Reference Books

Department: Computer Science and Engineering
Programme: B.Tech.
Semester: First/Second
Course Category Code: ESC
Semester Exam Type: LB

<table>
<thead>
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<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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</tbody>
</table>

Course Code: CS202
Course: Programming Laboratory
Periods / Week: 3
Credit: 1.5
Maximum Marks: 100

Prerequisite:

Course Outcome:

CO1: Understood the program editing and compilation environment.
CO2: Able to write simple C programs using most frequently used control structures.
CO3: Apply the methods problems using arrays and functions.
CO4: Learnt to handle data processing using structures for simple applications.
CO5: Write programs that could handle file i/o and pointers.

Programming Using C:

1. Study of Compilation and execution of simple C programs
2. Basic C Programs
   a. Arithmetic Operations
   b. Area and Circumference of a circle
   c. Swapping with and without Temporary Variables
3. Programs using Branching statements
   a. To check the number as Odd or Even
   b. Greatest of Three Numbers
   c. Counting Vowels
   d. Grading based on Student’s Mark
4. Programs using Control Structures
   a. Computing Factorial of a number
   b. Fibonacci Series generation
   c. Prime Number Checking
   d. Computing Sum of Digit
5. Programs using Arrays
   a. Sum of ‘n’ numbers
   b. Sorting an Array
   c. Matrix Addition, Subtraction, Multiplication and Transpose
6. Programs using Functions
   a. Computing nCr
   b. Factorial using Recursion
   c. Call by Value and Call by Reference
7. Programs using String Operations
   a. Palindrome Checking
   b. Searching and Sorting Names
8. Programs using Structure
   a. Student Information System
   b. Employee Pay Slip Generation
   c. Electricity Bill Generation
9. Programs using Pointers
   a. Pointer and Array
   b. Pointers as argument and return value
   c. Pointer and Structure
10. Programs using File Operation
    a. Counting No. of Lines, Characters and Black Spaces
    b. Content copy from one file to another
    c. Reading and Writing Data in File

Lecture Periods: -
Tutorial Periods: -
Practical Periods: 45
Total Periods: 45

Reference Books: -
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
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<th>SE</th>
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<tbody>
<tr>
<td>CE201</td>
<td>Environmental Science</td>
<td>3</td>
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<td>-</td>
<td>Non-Credit</td>
<td>-</td>
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</table>

**Prerequisite**
- CO1: Able to understand about the environment and natural resources available
- CO2: Able to design the Rainwater harvesting and adopting the methods for recycle and reuse of domestic water
- CO3: Able to address the environmental issues namely pollution, depletion of natural resources and degrading ecosystem
- CO4: Able to develop models for resource and energy management, which are environmental friendly and work for sustainable development of the humanity.
- CO5: Able to participate in the Green initiatives in the society i.e. Energy conservation and Tree plantation.
- CO6: Able to make the solid waste segregation and conduct events related environmental issues.

**Course Outcome**

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity – 2</td>
<td>Periods: 9</td>
<td>CO2: Rainwater Harvesting-Methodology, components, design of rainwater harvesting system for a single house (as per IS:15797–2008)</td>
</tr>
<tr>
<td>Activity – 3</td>
<td>Periods: 9</td>
<td>CO3: Domestic waste water- Definition, Characteristics, Recycling and Reuse of domestic waste water.</td>
</tr>
<tr>
<td>Activity – 4</td>
<td>Periods: 9</td>
<td>CO4: Air Pollution- definition, classification, causes, Sources, effects and control measures, Air Act (1981)</td>
</tr>
<tr>
<td>Activity – 5</td>
<td>Periods: 9</td>
<td>CO5: Solid Waste management – Causes- effects and control measures of Urban and industrial waste, Waste management initiatives in India for human well-being.</td>
</tr>
<tr>
<td>Activity – 6</td>
<td>Periods: 9</td>
<td>CO6: Renewable and non-renewable energy resources- use of alternating energy sources – Energy management.</td>
</tr>
<tr>
<td>Activity – 7</td>
<td>Periods: 9</td>
<td>CO7: Green Buildings- Definition, Importance, building envelope, Problems in existing buildings, Energy use in Buildings, Greenhouse gas emissions and indoor air pollution, green construction materials, Green building assessment system, Case study</td>
</tr>
<tr>
<td>Activity – 8</td>
<td>Periods: 9</td>
<td>CO8: Importance of Tree Plantation, Display of usefulness of trees, Method of tree planting, Identify the trees available in the PEC campus, Mass Plantation inside/outside the campus in association with the H2EC /NSS of PEC, Store the trees to the planted by the dignitaries with the help of horticulture of PEC.</td>
</tr>
<tr>
<td>Activity – 9</td>
<td>Periods: 9</td>
<td>CO9: Collection and segregation of solid waste in the PEC campus in association with the H2EC /NSS of PEC</td>
</tr>
<tr>
<td>Activity – 10</td>
<td>Periods: 9</td>
<td>CO10: Invite guest Lectures from the Environmental experts of DSTE (for environmental issues)/REAP (for energy efficient buildings)/Town and Country Planning/PWD of Puducherry, conducting competitions to students in the topics of slogan making, poster and seminar presentations, debate and observing the important national and international days on environmental issues to bring awareness among the students and public.</td>
</tr>
</tbody>
</table>

**Reference Books**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA204</td>
<td>Transforms, Partial Differential Equations and Statistics</td>
<td>3  1  0  4  40  60  100</td>
<td></td>
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</table>

**Prerequisite:**

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understands Transform Calculus</td>
</tr>
<tr>
<td>CO2</td>
<td>Understands how to form partial differential equations</td>
</tr>
<tr>
<td>CO3</td>
<td>Solve the Partial Differential Equations</td>
</tr>
<tr>
<td>CO4</td>
<td>Gain knowledge on solving Boundary Value Problems</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand basic statistics and distributions</td>
</tr>
</tbody>
</table>

**UNIT-I**  
**LAPLACE TRANSFORMS**  
Periods: 12  
Definition of Laplace Transform, Inverse Laplace Transform, Linearity property, Laplace transform of unit step function, Unit impulse function and some elementary functions, Change of scale and first shifting property, Derivatives and integrals of Laplace transform, Transform of derivatives and integrals, Application: Solution of single ordinary linear differential equation with constant coefficients-Laplace transform of Periodic functions.

**UNIT-II**  
**PARTIAL DIFFERENTIAL EQUATIONS**  
Periods: 12  
General and Singular solution of PDE, Complete Solution of First order Non-linear PDE, Lagrange’s linear equation of first order, Solution of the simultaneous equations by the method of grouping and multipliers.

**UNIT-III**  
**HIGHER ORDER PDE AND BOUNDARY VALUE PROBLEMS**  
Periods: 12  
Homogeneous linear PDE of higher order with constant coefficients. Solution of partial differential equation by the method of separation of variables. Application of PDE: Variable separable solutions of the one dimensional wave equation, Transverse vibration of a stretched string.

**UNIT-IV**  
**ONE DIMENSIONAL AND TWO DIMENSIONAL HEAT FLOW**  
Periods: 12  
Heat Equation, Variable and separable solution of one dimensional heat equation, Temperature distribution with zero and non-zero boundary values, Two dimensional heat flow under steady state conditions(Cartesian).

**UNIT-V**  
**PROBABILITY AND STATISTICS**  
Periods: 12  
Probability, Events, Sample space, Axioms of probability, Random variable (Discrete and Continuous), Expectation, Probability Distribution: Binomial, Poisson & Normal distribution and statistical parameters of these distributions, Correlation and Regression, Rank correlation.

Lecture Periods: 45  
Tutorial Periods: 15  
Practical Periods: -  
Total Periods: 60

**Reference Books:**

**Course Code:** ME203  
**Course:** Engineering Mechanics

<table>
<thead>
<tr>
<th>Course Category Code: ESC</th>
<th>Semester Exam type: TY</th>
</tr>
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<tbody>
<tr>
<td>Periods/ week</td>
<td>Credit</td>
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<td>T</td>
</tr>
<tr>
<td>ME203</td>
<td>Engineering Mechanics</td>
</tr>
</tbody>
</table>

**Prerequisite:**

- **CO1** Students will be able to determine the resultant force and moment for a given force system.
- **CO2** Students will be able to analyse planar and spatial systems to determine the forces in members of trusses, frames.
- **CO3** Determination of friction force/torque requires to operate the machine elements.
- **CO4** Students will be able to determine the centroid and second moment of area/mass through theoretical and experimental techniques.
- **CO5** Students will be able to calculate the motion parameters for a rigid body subjected to a given force system through Kinematics and Kinetics approaches.

**Unit-I**  

**Unit-II**  
Friciton: Laws of friction, Static dry friction, simple contact friction problems, simple screw jack, and Belt friction, Friction clutches, Rolling friction, Journal bearing and thrust bearing friction.

**Unit-III**  

**Unit-IV**  

**Unit-V**  
Simple harmonic motion – vibration of mechanical systems - basic elements of a vibrating system – spring mass model – undamped free vibrations – Determination of natural frequency of 1D free vibration systems- equilibrium method, energy method, Rayleigh’s method – longitudinal, Translational and torsional systems.

**Total Contact Hours:** 45  
**Total Tutorials:** 15  
**Total Practical Classes:**  
**Total Hours:** 60

**Reference Books:**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME204</td>
<td>Fluid Mechanics &amp; Hydraulic</td>
<td>3 1 0 4</td>
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<tr>
<td></td>
<td>Machines</td>
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<tr>
<td></td>
<td></td>
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<td>60</td>
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<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course name</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<td>100</td>
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</table>

Prerequisite: Basic laws of Physics

**Course Outcome**

- **CO1**: Able to determine the fluid properties of fluid, calculate fluid pressure using manometer, solve problems on fluid statics.
- **CO2**: Able to understand types of fluid motion, various mathematical functions, calculate velocity and acceleration, apply conservation of mass and energy to solve fluid flow problems.
- **CO3**: Able to solve problems on flow though pipes, perform dimensional & model analysis for fluid flow problems, and understand boundary layer flow.
- **CO4**: Able to apply impulse momentum principle to calculate power required/developed by hydraulic machines.
- **CO5**: Able to understand the performance characteristics of hydraulic machines.

**UNIT-I**

<table>
<thead>
<tr>
<th>Periods: 12</th>
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</table>

**UNIT-II**

<table>
<thead>
<tr>
<th>Periods: 12</th>
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</thead>
<tbody>
<tr>
<td>Kinematics of fluid flow: types of fluid flow, continuity equation in rectangular and cylindrical coordinate systems-velocity and acceleration-stream lines, path lines, streak lines and flow net-types of motion – rotation-velocity potential function and stream function. Dynamics of fluid flow: Equations of motion- Euler’s equation. Bernoulli’s equation and its applications: Venturi meter, Orifice meter and Pitot tube.</td>
</tr>
</tbody>
</table>

**UNIT-III**

<table>
<thead>
<tr>
<th>Periods: 12</th>
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</thead>
<tbody>
<tr>
<td>Reynolds experiment: Flow through pipes: flow of viscous fluid through circular pipe and Hagen Poiseuille formula. Energy losses: major loss and minor losses - Darcy Formula-Compound pipe and equivalent pipe. Dimensional analysis- Application of Buckingham Pi theorem for problems in fluid mechanics-model analysis-Similitude-dimensionless numbers Introduction to Boundary layer flow: Flow over a flat plate (theoretical treatment only)</td>
</tr>
</tbody>
</table>

**UNIT-IV**

<table>
<thead>
<tr>
<th>Periods: 12</th>
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</table>

**UNIT-V**

<table>
<thead>
<tr>
<th>Periods: 12</th>
</tr>
</thead>
</table>

Lecture Periods: 45  Tutorial Periods: 15  Practical Periods: Nil  Total Periods: 60
<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
</table>
Course Code: ME205  
Course Name: Engineering Thermodynamics

<table>
<thead>
<tr>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<td>1</td>
<td>0</td>
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</tbody>
</table>

Prerequisite:

- CO1 Application of the first law of thermodynamics for simple closed and open systems under steady and unsteady conditions.
- CO2 Application of the second law of thermodynamics to thermodynamic cycles, calculation of entropy changes and performing exergy analysis of processes.
- CO3 Use of modified equations of state for gases and use of tables / charts for properties of steam.
- CO4 Derivation of relations involving properties of ideal gases and calculation of property changes in psychrometric processes.
- CO5 Calculation of air/fuel ratio during combustion of fuel, application of first law of thermodynamics to combustion.

UNIT-I

<table>
<thead>
<tr>
<th>Periods: 12</th>
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UNIT-II

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<th>Periods: 12</th>
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UNIT-III

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<th>Periods: 12</th>
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UNIT-IV

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<th>Periods: 12</th>
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UNIT-V

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<tr>
<th>Periods: 12</th>
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</thead>
</table>


Lecture Periods: 45  
Tutorial Periods: 15  
Practical Periods: -  
Total Periods: 60

Reference Books:

### Course Code: ME206  Materials Technology

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME206</td>
<td>Materials Technology</td>
<td>3 L 0 T 0 P 3 C</td>
<td>CA 60 SE 40 TM 100</td>
<td></td>
</tr>
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</table>

#### Prerequisite:

- **CO1**: At the end of the course, the student will be able to: Mastery of the knowledge in Material selection
- **CO2**: Understanding the concepts of phase diagrams including iron-carbon diagram
- **CO3**: Examining the properties of ferrous and non-ferrous materials for different applications
- **CO4**: Applying the different mechanical testing methods
- **CO5**: Examining the different failure mechanism of metals

#### Course Outcome

<table>
<thead>
<tr>
<th>UNIT-I</th>
<th>Periods: 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystal structures (BCC, FCC and HCP systems), atomic packing factor, density, Crystalline perfections; point defects, line defects- edge and screw dislocations, surface defects, volume defects. Mechanism of Elastic &amp; plastic deformation (slip and twinning), slip, work hardening theory, Changes in properties due to cold working &amp; hot working. Microscopy, specimen preparation.</td>
<td>CO1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT-II</th>
<th>Periods: 9</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>UNIT-III</th>
<th>Periods: 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat treatment of steels: Annealing, Normalising, Hardening &amp; Tempering, quenching media, other treatments such as Martempering, Austempering, Ausforming. temper embrittlement, quench cracks, Hardenability &amp; hardenability testing, Defects due to heat treatment and remedial measures. Classification of surface hardening treatments, Carburising, heat treatment after Carburizing, Nitriding, Carbo-nitriding, Flame hardening, and Induction hardening.</td>
<td>CO3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT-IV</th>
<th>Periods: 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonferrous metals and alloys: Copper, Aluminium, Nickel, Zinc and Lead based alloys. Heat treatment of Nonferrous metals: Precipitation/ Age Hardening, solid solution strengthening, dispersion strengthening.</td>
<td>CO4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT-V</th>
<th>Periods: 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study of destructive testing, Tensile test, engineering stress-strain curve, true stress-strain curve, types of stress-strain curves, compression test, different hardness tests-Vickers, Rockwell, Brinell, Micro Hardness Test, Impact test, fatigue test, creep test.</td>
<td>CO5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lecture Periods: 45</th>
<th>Tutorial Periods: 0</th>
<th>Practical Periods: 0</th>
<th>Total Periods: 45</th>
</tr>
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</table>

#### Reference Books:

### Course Information

**Department:** Mechanical Engineering  
**Programme:** B.Tech.(ME)  
**Semester:** Third  
**Course Category Code:** PCC  
**Semester Exam Type:** TY

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME207</td>
<td>Machine Drawing</td>
<td>2 0 3 3 40 60 100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite:**

- CO1: At the end of the course, the student will be able to: Students can prepare production drawing and assembly drawings required for manufacturing of any product.
- CO2: Acquire skill in preparing production drawings pertaining to various design
- CO3: Acquire the knowledge of assembly of various machine or engine components and miscellaneous machine components
- CO4: Draw the assembled views for the part drawings of miscellaneous machine components.
- CO5: Perform basic sketching techniques to draw engineering components.

### Course Content

**PART - A**

<table>
<thead>
<tr>
<th>Periods: 30</th>
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</thead>
</table>

Conventions for sectioning and dimensioning, screw threads, rivets, bolts, nuts, pins, keys, cotter, gear, springs and welds. Introduction to geometrical tolerance -Component drawing assigning fits and tolerance machine symbol, surface finish - Introduction to AUTOCAD software, Introduction to Production drawing and concepts of P-7 drawing.

**PART - B**

<table>
<thead>
<tr>
<th>Periods: 45</th>
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</thead>
</table>

Preparation of drawings of parts and assembly of:

- **Joints**
  - Riveted joints - butt joints and lap joints
  - Pin joints - knuckle joints
  - Cotter joints -sleeve, socket and spigot joints

- **Couplings**
  - Split muff couplings, flexible type flange coupling, universal coupling

- **Bearing**
  - Pedestal bearing, swivel bearing, Plumber block
  - Screw jack
  - Connecting rods
  - Tail stock

  steam stop valve

**Lecture Periods:** 30  
**Tutorial Periods:** -  
**Practical Periods:** 45  
**Total Periods:** 75

### Reference Books:

Department: Humanities and Social Sciences  
Programme: B.Tech.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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</thead>
<tbody>
<tr>
<td>SH202</td>
<td>Indian Constitution</td>
<td>2</td>
<td></td>
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</tbody>
</table>

Prerequisite |

The course will enable the students to:

**Course Outcome**

- **CO1**: understand the essence and significance of the constitution
- **CO2**: recognize one's fundamental duties and rights
- **CO3**: appreciate the structure and functions of legislature, executive and judiciary
- **CO4**: understand the functioning of state governments and union territories
- **CO5**: understand the centre-state relations and functioning of constitutional bodies

**UNIT-I**  
**Introduction of Indian Constitution**  
Periods: 09

The Making of Indian Constitution - The Constituent Assembly - Sources of Indian Constitution - Preamble and the Supreme Court’s Judgments on Preamble.

**UNIT-II**  
**State, Rights and Duties**  
Periods: 09


**UNIT-III**  
**Union Government**  
Periods: 09

Union Government - The Powers and Functions of the President, Vice-President, Council of Ministers, Prime Minister, Judiciary, Supreme Court - Judicial Review - Judicial Activism - Public Interest Litigation - Power and Functions of the Parliament - Budget Power and Functions of Parliament, Speaker of Lok Sabha.

**UNIT-IV**  
**State Governments**  
Periods: 09

State Governments – Governor - State Council of Ministers - Chief Minister - Legislative Assembly - High Courts - Union Territories - Panchayati Raj Institutions - 73rd and 74th Constitutional Amendment - Gram Panchayats - Block Panchayats - Municipalities.

**UNIT-V**  
**Union - State Relations, Constitutional Bodies**  
Periods: 09

Centre – State Relations - Public Service - Election Commission - NITI Aayog, Emergency Powers of the President- Constitution Amendment Procedure- Right to Information Act - Right to Education. Major Constitutional Amendments and their impact on Indian Political System.

Lecture Periods: 45  
Tutorial Periods:  
Practical Periods:  
Total Periods: 45

**Reference Books:**

6. Rajeev Bhargava - ‘The Promise of India’s Secular Democracy’, 2010
7. Chakrabarty, Bidyut, India’s Constitutional Identity: Ideological Beliefs and Preferences (Routledge, 2019)
12. Laxmikanth, M. &quot;INDIAN POLITY&quot;: McGraw-Hill Education &quot;Constitution of India&quot;: Ministry of Law and Justice, Govt. of India.
### Course Details

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>MEH01</td>
<td>Engineering Optimization</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**Prerequisite:**

At the end of the course the student is able to understand: Knowledge in formulation of Optimization Problem

Understanding the Single Variable Optimization Problems

To get knowledge about Multivariable Optimization Algorithms

Explain the methods of optimization

Able to write algorithm to obtain optimal systems.

### Units

#### UNIT-I


**CO1**

#### UNIT-II


**CO2**

#### UNIT-III


**CO3**

#### UNIT-IV


**CO4**

#### UNIT-V


**CO5**

### Lecture Periods: 45 | Tutorial Periods: 15 | Practical Periods: Nil | Total Periods: 60

### Reference Books:

Course Code | Course Name | Periods / Week | Credit | Maximum Marks
--- | --- | --- | --- | ---
MEM01 | Heat Power Engineering | 3 | 1 | 4 | 40 | 60 | 100

Prerequisite: Studied a course on Thermodynamics in Basic Sciences

### Course Outcome

- **CO1** Upon Completion students will be able to convey the basics of the thermodynamic principles
- **CO2** Able to understand IC Engines, its performance and analyse air standard cycles
- **CO3** Able to understand power plants, its components and analyse vapour power cycles
- **CO4** Able to understand the role of refrigeration and Air-conditioning as energy systems
- **CO5** Able to understand the Principles, Performance and working of air machines

### UNIT-I

Energy conversion and efficiencies of steam and nuclear power plants, internal combustion engines, gas turbine and refrigeration systems—Thermodynamic systems, properties and state—Thermodynamic equilibrium—path and point functions—Temperature—Zeroth law of thermodynamics—First law of Thermodynamics, Second law of Thermodynamics.

### UNIT-II

IC engines—Classification—Working principles—diesel and petrol engines: two stroke and four stroke engines—Merits and demerits—Port and Valve timing diagrams—Air standard cycles—Otto and Diesel—Testing of IC engines.

### UNIT-III

Power Generation Systems—Conventional and Non-Conventional—Layout of a modern steam power plant, Steam generators Classification—Constructional features—Boiler mountings and accessories—Merits and demerits—Applications—Steam turbines: Classification.

### UNIT-IV


### UNIT-V


**Lecture Periods:** 45 **Tutorial Periods:** 15 **Practical Periods:** Nil **Total Periods:** 60

### Reference Books:

Department: Chemistry
Programme: B.Tech.
Semester: Fourth
Subject Category: BSC
Semester Exam Type: TY

Course Code | Course Name                  | Periods / Week | Credit | Maximum Marks |
---          | ---                          | ---            | ---    | ---           |
| SH201       | Biology for Engineers        | L | T | P | C | CA | SE | TM |
|             |                             | 3 | - | - | 2 | 40 | 60 | 100 |

Prerequisite: -

Course Outcome:

After studying the course, the student will be able to:

- **CO1**: Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical, and ecological.
- **CO2**: Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.
- **CO3**: Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine.
- **CO4**: Gain a basic understanding of enzyme action and factors affecting their activity.
- **CO5**: Identify and classify microorganisms.

UNIT-I Classification

Classification outline based on (a) cellularity - Unicellular or multicellular (b) ultrastructure prokaryotes or eukaryotes (c) Energy and Carbon utilisation - Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion - aminotelic, uricotelic, ureotelic (e) Habitats - aquatic or terrestrial (f) Molecular taxonomy three major kingdoms of life.

UNIT-II Genetics


UNIT-III Biomolecules


UNIT-IV Metabolism


UNIT-V Microbiology


Lecture Periods: 45  Tutorial Periods:  |
Practical Periods: | Total Periods: 45

Reference Books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M.L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Maximum Marks</th>
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<tbody>
<tr>
<td>EC234</td>
<td>Elements of Electronics</td>
<td>3 L 0 T 0 P</td>
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### Prerequisite
Nil

### Course Outcome

<table>
<thead>
<tr>
<th>CO1</th>
<th>Understanding the basic theory of semiconductors and diodes.</th>
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<tbody>
<tr>
<td>CO2</td>
<td>Knowledge about various transistor configurations and also could comprehend the need for proper biasing of devices.</td>
</tr>
<tr>
<td>CO3</td>
<td>Understanding the operation of Field Effect Transistor devices.</td>
</tr>
<tr>
<td>CO4</td>
<td>Gain knowledge on Thyristors and optical devices.</td>
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<tr>
<td>CO5</td>
<td>Acquire knowledge on Transducers and Sensors.</td>
</tr>
</tbody>
</table>

### UNIT – I

**Semiconductor Fundamentals and PN junction diode:** Introduction to semiconductors – Types of semiconductors -Energy band diagram of semiconductor - Diode equivalent circuit -Diode current equation - Construction, working and VI characteristics of PN junction diode – Energy band structure of open circuited PN junction- Effect of temperature on PN junction diodes - Capacitance effects –Types of breakdown – Zener diode - Application of diode as half wave, full wave and bridge rectifiers, Clipper and Clamper circuits. Regulators - Zener diode as Voltage regulator.

### UNIT-II

**Bipolar Junction Transistor:** Construction- Types of configurations: Operation of NPN and PNP transistors- working and characteristics of CE, CB and CC configurations –Early effect - Thermal runaway – Heat sinks - Need for transistor biasing – dc load line – Q point-Voltage divider bias - Application of BJT as amplifier and switch.

### UNIT-III

**Field Effect Transistor:** Types – Construction and operation of N-channel and P-channel JFET – Characteristics and parameters of JFET- JFET biasing circuits –fixed bias and potential divider bias (derivations not required) Construction ,working and characteristics of E-MOSFET and Depletion MOSFET - Working and application of CMOS as inverter.

### UNIT-IV

**Thyristors and Optical Devices:** Construction, working and characteristics of SCR, DIAC , TRIAC, UJT. Construction, working and characteristics of LED, LASER, PIN diode, APD, Optocoupler. LDR, photo multiplier, LCD.

### UNIT-V


### Lecture Periods: 45 | Tutorial Periods: | Practical Periods: | Total Periods: 45

### Reference Books:

**Course Code** | **Course Name** | **Periods / Week** | **Credit** | **Maximum Marks**
--- | --- | --- | --- | ---
ME208 | Mechanics of solids | 3 | 1 | 0 | 4 | 40 | 60 | 100

CO1: Students will able to analyse stresses, shear force and bending moment diagrams, deflections for different types of beams.

CO2: Students will follow and understand the basics of Mechanics of solids.

CO3: Students will be able to learn the basic concept (elementary) of thin shells, thick shells and buckling of columns.

CO4: Student will be able to develop natural curiosity to explore the various facets of Mechanics of solids.

CO5: Students will able to demonstrate about various types of loading and stresses induced in the machine components.

**UNIT-I**

Simple Stresses and Strain – Relation between three modulus and Poisson’s ratio – Thermal Stress – Principal stress and Principal planes - Shear Force – Bending Moment – Cantilever and simply supported beams subjected to point loads and uniformly distributed loads.

**UNIT-II**

Theory of simple bending - stress variation in beam cross Section; Normal and Shear stress in Beams – Beam of uniform strength for bending, combined direct and bending stresses.

**UNIT-III**

Deflection of beams -Double integration method – moment area method.

**UNIT-IV**

Torsion of circular solid and Hollow shafts – Shafts in Series and parallel – Combined bending and torsion - Application of Torsion in helical springs: Open and closed coil springs, Leaf Springs.

**UNIT-V**


**Lecture Periods:** 45  **Tutorial Periods:** 15  **Practical Periods:** Nil  **Total Periods:** 60

**Reference Books:**

### Course Information

**Department:** Mechanical Engineering  
**Programme:** B.Tech.(ME)  
**Semester:** Fourth  
**Course Category Code:** PCC  
**Semester Exam Type:** TY

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME209</td>
<td>Thermal Engineering - I</td>
<td>3 L 1 T 0 P 4 C</td>
<td>40 CA 60 SE 100 TM</td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite:**

- CO1: Able to analyse air standard cycles, know the properties of fuel and perform combustion calculations
- CO2: Able to identify different components & systems of IC Engines, combustion phenomena and analyse engine performance
- CO3: Able to analyse vapour power cycles and understand the functions of different components of modern steam power plant
- CO4: Able to analyse the performance of steam turbines and nozzles
- CO5: Able to understand the functioning of high pressure boilers, condensers and cooling towers and analyse the performance of condenser

### Course Outcomes

**UNIT-I**  
Periods: 12  
- Fuels and Combustion: Fuel properties and their determination - Stoichiometry – reactant and product quantities

**UNIT-II**  
Periods: 12  
- IC Engines-Classification-Four stroke and two stroke cycles- SI and CI Engines-Port and Valve timing diagrams.  
- Combustion in SI engines-Ignition lag-Flame propagation-abnormal combustion-Knocking-Rating of SI engine fuels. Combustion in CI engines-Delay period-knocking-Rating of CI engine fuels  
- Introduction to fuel supply, Cooling and Lubrication systems of SI and CI Engines  
- Testing of IC engines-Heat balance test-Engine performance characteristics

**UNIT-III**  
Periods: 12  
- Analysis of vapour power cycles-Rankine cycle- Reheat cycle-regeneration cycle- Reheat- regenerative cycle-binary vapour power cycle.  
- Layout of a modern steam power plant.

**UNIT-IV**  
Periods: 12  
- Steam turbines: Classification-impulse and reaction turbines-compounding- velocity diagram- work done and efficiencies: blade efficiency, stage efficiency  
- Steam nozzles-types-flow of steam through nozzles-condition for maximum discharge – friction-supersaturated flow through nozzle – general relationship between area, velocity and pressure in nozzle flow.

**UNIT-V**  
Periods: 12  
- Boilers: Classification- High pressure boilers-supercritical boilers  
- Condensers: Classification- Jet condensers and surface condensers- Air removal-vacuum measurement-vacuum and condenser efficiency – cooling water requirement for condensation of steam-Cooling towers and their types

### Reference Books:

**Course Information**

**Department:** Mechanical Engineering  
**Programme:** B.Tech. (ME)  
**Semester:** Fourth  
**Course Category Code:** PCC  
**Semester Exam Type:** TY

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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</thead>
<tbody>
<tr>
<td>ME210</td>
<td>Machining Technology</td>
<td>3 L 0 T 0 P 3 C</td>
<td>40 CA 60 SE 100 TM</td>
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</table>

**Prerequisite:**

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>At the end of the course, the student shall be able to, Describe the details and operations on lathe.</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the mechanism of metal cutting in drilling and milling machines.</td>
</tr>
<tr>
<td>CO3</td>
<td>Identify the basic parts and operations of shaper, planner and slotting machines.</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the evolution, classification and need of unconventional machining technology in modern manufacturing.</td>
</tr>
<tr>
<td>CO5</td>
<td>Select cutting fluids and cutting tool materials for improving machinability and tool life.</td>
</tr>
</tbody>
</table>

**UNIT-I**  
**Periods:** 9  
Lathe – Types, Designation, Work holding devices – Cutting Speed, Feed and Depth of Cut, Material Removal Rate - Operations, Machining Time.  

**UNIT-II**  
**Periods:** 9  
Drilling Machine – Types, Operations, Machining Time - Boring, Reaming and Tapping (Definition of operations only).  

**UNIT-III**  
**Periods:** 9  

**UNIT-IV**  
**Periods:** 9  
Unconventional Machining Process - Classification, Laser Beam Machining, Electric Discharge Machining, Electrochemical Machining, Electrochemical Grinding, Ultrasonic Machining, Abrasive Jet Machining.  

**UNIT-V**  
**Periods:** 9  
Cutting fluids – Functions, characteristics and types, Selection of cutting fluids.  

**Lecture Periods:** 45  
**Tutorial Periods:** Nil  
**Practical Periods:** Nil  
**Total Periods:** 45

**Reference Books:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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</thead>
<tbody>
<tr>
<td>ME211</td>
<td>Kinematics of Machines</td>
<td>3</td>
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</table>

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME211</td>
<td>Kinematics of Machines</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

### Prerequisite

**Course Outcome**

- **CO1**: Students will be able to understand and visualise any given practical machines as simple kinematic chain.
- **CO2**: Students will be able to determine velocity and acceleration at any point in the given planar mechanism.
- **CO3**: Student will be able to design Four bar and slider crank mechanism for simple applications.
- **CO4**: Students will be able to analyse follower motion of the CAM from kinematic point of view and suggest suitable CAM drive for the given application.
- **CO5**: Able to design gears with interference problem and also able to determine speed of different gear trains given.

### Reference Books:

### Course Information

**Department:** Mechanical Engineering  
**Programme:** B.Tech. (ME)

**Semester:** Fourth  
**Course Category Code:** PCC  
**Semester Exam Type:** LB

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME212</td>
<td>Mechanical Engineering Lab-I (Fluid Mechanics &amp; Machines/Material Technology/Machine Shop)</td>
<td>0 0 3 1.5 40 60 100</td>
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<td></td>
</tr>
</tbody>
</table>

**Prerequisite:** Study of Fluid Mechanics & Machines/ Materials Technology/Machining Technology.

### Course Outcome

At the end of the course, the student will be able to

- **CO1** Understand the basics of fluid mechanics with applications
- **CO2** Understand the principles and working of Fluid machines
- **CO3** Understand the practical aspects of specimen preparation for micro structural Examination
- **CO4** Students will be able to understand the microstructures of ferrous and non-ferrous materials
- **CO5** Students gain hands on practical learning in shaping and milling in machines

### Fluid Mechanics & Machines Lab:

1. Determination of Minor and Major losses in a fluid flow system  
2. Determination of the coefficient of discharge of given Orifice meter and Venturimeter  
3. Conducting experiments and drawing the characteristics curves of centrifugal pump and Submersible Pump  
4. Conducting experiments and drawing the characteristics curves of Reciprocating and Gear Pump  
5. Conducting experiments and drawing the characteristics curves of Impulse and Reaction turbine (Pelton and Francis)

### Materials Technology Lab:

- Microstructural examination of mild steel and copper

### Machining Technology Lab:

1. Step turning, and Taper turning  
2. grooving and chamfering, V – thread cutting  
3. Cube milling and Step milling  
4. Shaping and grooving in shaping machine  
5. Cylindrical grinding  
6. Spur gear hobbing

**Lecture Periods:** Nil  
**Tutorial Periods:** Nil  
**Practical Periods:** 45  
**Total Periods:** 45

### Reference Books

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>MEH02</td>
<td>Production Drawing &amp; Cost Estimation</td>
<td>L:3 T:0 P:1 C:4</td>
<td>CA:40 SE:60</td>
<td>TM:100</td>
</tr>
</tbody>
</table>

Prerequisite: Machine drawing

**Course Outcome**

- **CO1**: Acquiring the knowledge of conventions used in the Production drawing.
- **CO2**: Interpret and perform calculations on tolerances and reading different notations GD&T
- **CO3**: Understand the importance of cost estimation and solve simple cases.
- **CO4**: Grading and judging the cost estimation parameters of different jobs
- **CO5**: Designing by studying the machining time of different jobs

**UNIT-I**

Periods: 12

Standards and Conventions-ISO-Conventions representation for dimensioning, sectioning and common machine elements - screw threads, rivets, bolts, nuts, pins, keys, cotter, gear, springs, welds and surfaces textures. Elements of Production Drawing, 2D and 3D—Need for Production drawing – Advantages and disadvantages. **CO1**

**UNIT-II**

Periods: 12

System of tolerance- Deviation and Fits – Geometric tolerance – Symbols, Terms and rules, Datum, Form, Orientation, Position, Location, Coaxiality, Concentricity and Symmetry, Runout and Profile – Simple Problems. **CO2**

**UNIT-III**

Periods: 12


**UNIT-IV**

Periods: 12

Types of cost estimates-methods- estimates development - data requirements and sources – allowances in estimation- Estimation different types of jobs – Forging - Welding - Foundary **CO4**

**UNIT-V**

Periods: 12


Lecture Periods: 45  Tutorial Periods:  | Practical Periods: 15  | Total Periods: 60

**Reference Books:**

**Department:** Mechanical Engineering  
**Programme:** B.Tech.(ME)-Minor  
**Semester:** Fourth  
**Course Category Code:** PCC  
**Semester Exam Type:** TY

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEM02</td>
<td>Manufacturing Technology</td>
<td>4 L 0 T 0 P</td>
<td>4 C</td>
<td>40 CA 60 SE</td>
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</table>

**Prerequisite:**

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CO1</td>
<td>At the end of the course, the student shall be able to: Gain theoretical and practical knowledge in various metal casting processes.</td>
</tr>
<tr>
<td>CO2</td>
<td>Discuss in detail about various welding processes and the physics of welding.</td>
</tr>
<tr>
<td>CO3</td>
<td>Study the details of various metal forming processes and techniques associated.</td>
</tr>
<tr>
<td>CO4</td>
<td>Identify, understand and apply various surface finishing processes.</td>
</tr>
<tr>
<td>CO5</td>
<td>Explain the steps involved in powder metallurgy technique for preparation of products.</td>
</tr>
</tbody>
</table>

**UNIT-I**  
Periods: 12  
Metal Casting Processes – Casting, steps involved in making a casting, advantages and applications of metal casting, pattern making, types of pattern, pattern allowances, mould materials, moulding tools and equipment, properties of moulding sand, solidification of casting, special casting processes-centrifugal, investment, die casting, continuous casting, casting defects.  

**UNIT-II**  
Periods: 12  
Metal Joining Processes – Classification of welding process, advantages and disadvantages of welding, applications of welding, types of welded joints, MIG and TIG welding, Resistance welding, spot welding, projection welding, ultrasonic welding, friction welding, heat affected zone, welding defects, soldering, brazing.  

**UNIT-III**  
Periods: 12  
Metal Forming Processes – Roll forming, flexible die forming, peen forming, swaging, cold heading, thread rolling, spinning, drawing, types of presses and press tools, blanking, piercing, bending, embossing, coining.  

**UNIT-IV**  
Periods: 12  
Surface Finishing Processes – Grinding, Types of grinding, Types of grinding machines and specifications, grinding operations, grinding fluids, different types of abrasives and bond types, lapping, honing, polishing and buffing.  

**UNIT-V**  
Periods: 12  
Powder Metallurgy – Introduction to powder metallurgy process, preparation of powders, types & function of binders, green compaction, sintering process and its effect on the product, advantages of powder metallurgy products, applications of powder metallurgy products.  

**Lecture Periods:** 60  
**Tutorial Periods:** Nil  
**Practical Periods:** Nil  
**Total Periods:** 60

**Reference Books:**

Department: Mechanical Engineering  
Programme: B.Tech.(ME)  
Semester: Fifth  
Course Category Code: PCC  
Semester Exam Type: TY

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<th>Course Code</th>
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<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ME213</td>
<td>Heat and Mass Transfer</td>
<td>3</td>
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<td></td>
<td></td>
<td>0</td>
<td>4</td>
<td>40</td>
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<tr>
<td></td>
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<td>CA</td>
<td>60</td>
</tr>
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<td></td>
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<td>100</td>
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<td></td>
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<td></td>
<td>TM</td>
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</tr>
</tbody>
</table>

Prerequisite:

Course Outcome

| CO1 | At the end of the course the student is able to distinguish clearly different modes of heat and mass transfer |
| CO2 | to apply methods of estimation of heat transfer |
| CO3 | to apply the knowledge to design of heat exchangers |
| CO4 | to apply methods of estimation of mass transfer suitably |
| CO5 | to apply the knowledge to real-time applications |

UNIT-I

Periods: 12


UNIT-II

Periods: 12


UNIT-III

Periods: 12


UNIT-IV

Periods: 12


UNIT-V

Periods: 12

Similarity between phenomena of heat transfer and mass transfer – diffusion mass transfer, Fick’s Law of diffusion, species conservation equation-initial and boundary conditions, steady state molecular diffusion-diffusive mass transfer and convective mass transfer– momentum, heat and mass transfer analogies, convective mass transfer correlations, evaporation of water into air.

Lecture Periods: 45  
Tutorial Periods: 15  
Practical Periods:  
Total Periods: 60

Reference Books:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
<th>CA</th>
<th>SE</th>
<th>TM</th>
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<tbody>
<tr>
<td>ME214</td>
<td>Manufacturing Processes</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>40</td>
<td>60</td>
<td>100</td>
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Prerequisite:

**Course Outcome**

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Students will able to get good exposure about the manufacturing processes</td>
</tr>
<tr>
<td>CO2</td>
<td>Mastery in casting design and process</td>
</tr>
<tr>
<td>CO3</td>
<td>to choose and demonstrate proper metal joining process</td>
</tr>
<tr>
<td>CO4</td>
<td>Demonstrate knowledge in metal forming and surface finishing operations</td>
</tr>
<tr>
<td>CO5</td>
<td>Explain the different types of polymers and their industrial applications</td>
</tr>
</tbody>
</table>

**UNIT-I**

Introduction to manufacturing processes – classification – steps involved in casting process – different types of casting – pattern and core making – materials, types and allowances – moulding tools and equipment - properties of moulding sand - casting defects and remedies.

**UNIT-II**


**UNIT-III**

Classification of metal forming processes – Rolling, Forging, Extrusion, Drawing and other Sheet metal operations: terminology used, processes, machines and defects.

**UNIT-IV**


**UNIT-V**


Lecture Periods: 60  Tutorial Periods:   Practical Periods:  Total Periods: 60

Reference Books:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>ME215</td>
<td>Dynamics of Machines</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**Prerequisite:**

- **CO1**: Students will able to Mastery of the knowledge in dynamics of slider crank mechanism.
- **CO2**: Students will Understand and design of simple single degree freedom longitudinal vibrating systems subjected to free and forced damped/undamped vibrations.
- **CO3**: Students will able to calculate natural frequencies of simple single degree transverse and torsional vibrating systems of design such systems.
- **CO4**: Student will Explain the principles of mechanisms used for speed control (Flywheel & centrifugal Governors).
- **CO5**: Students will able to get knowledge about stability of Automobiles, ships and airplanes

**UNIT-I**

- **Periods: 12**
- **D’Alembert’s Principle**-Inertia forces of reciprocating parts, Dynamic analysis of four link and slider–crank mechanisms, Engine force Analysis Turning moment on crankshaft, Dynamically Equivalent system, Inertia forces in a reciprocating engine, Turning Moment diagrams, Fluctuations of Energy and speed, Flywheel.

**UNIT-II**

- **Periods: 12**

**UNIT-III**

- **Periods: 12**
- Transverse vibrations of beams-Natural frequency by energy method, Dunkerly’s method, Whirling of shafts calculation of whirling speed for loaded shafts. Torsional vibrations-causes of Torsional vibration. Torsional Vibration of two and three rotor systems. Equivalent shaft system, Geared system.

**UNIT-IV**

- **Periods: 12**

**UNIT-V**

- **Periods: 12**
- Static and dynamic balancing of rotating masses in different planes - partial balancing of reciprocating masses of inline, V, W and radial engines.

**Lecture Periods: 45**  **Tutorial Periods: 15**  **Practical Periods: Nil**  **Total Periods: 60**

**Reference Books:**

<table>
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<tr>
<th>Course Code</th>
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<th>Credit</th>
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<tr>
<td>SH203</td>
<td>Essence of Indian Traditional</td>
<td>2</td>
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| Prerequisite |                                    |                |        |               |

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>The course will enable the student to:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CO1</td>
</tr>
<tr>
<td></td>
<td>understand connect up and explain basics of Indian traditional knowledge in modern scientific perspective</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT-I</th>
<th>Periods: 23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic structure of Indian knowledge system, Modern science and Indian knowledge system, Yoga and holistic health care.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>UNIT-II</th>
<th>Periods: 22</th>
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</thead>
<tbody>
<tr>
<td>Philosophical tradition, Indian linguistic tradition, Indian artistic tradition.</td>
<td></td>
</tr>
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</table>

| Lecture Periods: 45 | Tutorial Periods: | Practical Periods: | Total Periods: 45 |

<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Fritzof Capra, Tao of Physics.</td>
</tr>
<tr>
<td>4. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.</td>
</tr>
<tr>
<td>Course Code</td>
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<tr>
<td>-------------</td>
</tr>
<tr>
<td>ME216</td>
</tr>
</tbody>
</table>

**Prerequisite:** Study of Fluid Mechanics & Machines/ Materials Technology/Machining Technology.

**Course Outcome:**

- **CO1** know how to avoid resonance and proper use of dampers for different applications.
- **CO2** Select a governor for given applications, tactics to balance rotary machineries and to tackle gyroscopic effects in Automobiles, ships and airplanes.
- **CO3** Develop process planning of any simple product manufacturing.
- **CO4** Estimate machining time involved and its cost analysis.
- **CO5** Understands basics of thermodynamics and heat transfer with applications
- **CO6** Understands the principles and working of different heat transfer equipment

**Dynamics Lab:**

1. Determination of radius of gyration of a given compound pendulum
2. Determination of radius of gyration, moment of inertia – bifilar suspension method – trifilar suspension method
3. Determination of characteristic curves of Watt, Porter, Proell and spring loaded governors.
4. Resonance frequency of equivalent spring mass system – undamped and damped condition (a)To plot amplitude Vs frequency graph for different damping.
5. Whirling of shafts/ determination of critical speed with and without Rotors

**Special Machines Lab:**

<table>
<thead>
<tr>
<th>Lathe:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Turning between centers</td>
</tr>
<tr>
<td>2. Square thread cutting</td>
</tr>
<tr>
<td>3. Multi start thread cutting</td>
</tr>
<tr>
<td>5. Milling Machine: Spur gear in milling</td>
</tr>
</tbody>
</table>

**Heat Transfer Lab:**

<table>
<thead>
<tr>
<th>Heat Transfer Lab:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determination of Heat transfer coefficient by natural convection</td>
</tr>
<tr>
<td>Determination of Heat transfer coefficient by forced convection</td>
</tr>
<tr>
<td>Determination of thermal conductivity and thermal resistance of composite wall</td>
</tr>
<tr>
<td>Determination of temperature distribution and effectiveness for Pin fin apparatus by forced / natural convection.</td>
</tr>
</tbody>
</table>

**Reference Books:**

3. Engineering Thermodynamics By PK.Nag
### Course Information

**Department:** Mechanical Engineering  
**Programme:** B.Tech.(ME)-Honours

**Semester:** Fifth  
**Course Category Code:** PCC  
**Semester Exam Type:** TY

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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</thead>
<tbody>
<tr>
<td>MEH03</td>
<td>Computational Biological Thermo-Fluid Mechanics</td>
<td>3</td>
<td>1</td>
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</tr>
</tbody>
</table>

**Prerequisite:**

**CO1** Mechanism of transport phenomena at the level of species, momentum, energy and charge taking place at multi scales of temporal and spatial contexts

**CO2** Use of mathematical/computer models for virtual prototyping of medical devices and implants

**CO3** Understanding of fundamental physical principles and interaction with complex physiological systems

**CO4** Introducing Multidisciplinary and Multi-physics nature of computational investigation and analysis

**CO5** Role of computational modelling as indispensable tool for skill set development

#### UNIT-I

Periods: 12

Review of Modelling and Simulation in Medicine and Biology – Types, Scaling, ODEs – Examples, Solver implementations

**CO1**

#### UNIT-II

Periods: 12

PDEs – Modelling, Equations, Boundary Conditions, Numerical Solution – FDM, FEM and FVM

**CO2**

#### UNIT-III

Periods: 12

Solid Mechanics and Electrical Stimulation – Respirator Strap tension, Myocardial shear, Electrode disc resistance, Nerve Cuff, Deformation Analysis of Cornea

**CO3**

#### UNIT-IV

Periods: 12

Fluid Mechanics, Heat Transfer and Species Diffusion – Physiology, Drug delivery, Modelling blood flow, Intraventricular Flow analysis, RF Atrial Ablation

**CO4**

#### UNIT-V

Periods: 12

Model based diagnostics, Multiscale Modelling, Evolutionary computing – global optimization, natural selection, types, GA, GP, Cellular Automata - Applications

**CO5**

**Lecture Periods:** 45  
**Tutorial Periods:** 15  
**Practical Periods:**  
**Total Periods:** 60

### Reference Books:

### Course Description

**Course Code:** MEM03  
**Course Name:** Machine Design

**Prerequisite**

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Students will able To understand the fundamentals of Machine Design.</td>
</tr>
<tr>
<td>CO2</td>
<td>Students will To understand the different theories of failure and Manufacturing process.</td>
</tr>
<tr>
<td>CO3</td>
<td>Students will be able to design simple joints and belt drives.</td>
</tr>
<tr>
<td>CO4</td>
<td>Student will be able to design shafts and couplings for simple configurations.</td>
</tr>
<tr>
<td>CO5</td>
<td>Students will able to select rolling element bearings and cylinders.</td>
</tr>
</tbody>
</table>

**UNIT-I**  
**Periods:** 12  
Introduction to design - Design philosophy, Optimised design. Review of common engineering materials and their properties, Different types of materials – Metallic Ferrous, Non Ferrous, Non-metallic, Composites, ceramic, Plastics, Polymers, etc. Improvement of properties through heat treatment and alloying.

**UNIT-II**  
**Periods:** 12  
Modes of failure, Review of stress calculation in various situations - axial, bending, torsion loads and combined effect, stress concentration, Factor of safety, Theories of failure and choice of failure theory of design. Manufacturing aspects of design – Manufacturing processes (casting, forming, machining, welding etc.) Fit and tolerance, surface roughness.

**UNIT-III**  
**Periods:** 12  

**UNIT-IV**  
**Periods:** 12  
Design of Shaft, key and splines- Couplings.

**UNIT-V**  
**Periods:** 12  
Design of rolling element bearings – Thin cylinders and Thick Cylinders.

**Lecture Periods:** 45  
**Tutorial Periods:** 15  
**Practical Periods:**  
**Total Periods:** 60

**Reference Books:**

## Industrial Economics and Management

**Course Code:** HS202  
**Course Name:** Industrial Economics and Management  
**Periods / Week:** L 3, T 0, P 0, C 3  
**Credit:** 40  
**Maximum Marks:** 60  
**Total Periods:** 45

### Prerequisite:
- **CO1**: Assess the knowledge of mathematics to understand industrial micro economics/macroeconomics.
- **CO2**: Implement various management techniques based on the needs.
- **CO3**: Implement various investment evaluation based on the needs.
- **CO4**: Apply formula and workout problem.
- **CO5**: Case studies on General, Production and Financial management.

### UNIT-I  
**Periods:** 9  

### UNIT-II  
**Periods:** 9  
**MANAGEMENT TECHNIQUES:** Types and Principles of Management – Elements of Management – Planning, Organising, Staffing, Directing, Coordinating Controlling – Scope of Management – Types of Organization Merits and Demerits – Types of (Ownership) of a firm Merits and Demerits.

### UNIT-III  
**Periods:** 9  

### UNIT-IV  
**Periods:** 9  

### UNIT-V  
**Periods:** 9  

### Reference Books:
2. Dutt & Sundaram, “Indian Economy” S Chand & Co New Delhi 2015  
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ME217</td>
<td>Thermal Engineering - II</td>
<td>3</td>
<td>1</td>
<td>4</td>
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</table>

**Prerequisite:** Studied a course on Thermodynamics

**Course Outcome**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Identify different types of refrigeration systems, and calculate the performance of vapour compression refrigeration system.</td>
</tr>
<tr>
<td>CO2</td>
<td>Able to understand principle of vapour absorption system, types &amp; properties of refrigerants and fundamentals of cryogenics</td>
</tr>
<tr>
<td>CO3</td>
<td>Identify the different types of air-conditioning systems and their components</td>
</tr>
<tr>
<td>CO4</td>
<td>Calculate load on air conditioning system and subsequently estimate the capacity of air-conditioner</td>
</tr>
<tr>
<td>CO5</td>
<td>Able to analyse the performance of reciprocating and rotary air handling equipment.</td>
</tr>
</tbody>
</table>

**UNIT-I**

Air refrigeration system- Reversed Carnot cycle –Carnot COP-limitations-reversed Brayton cycle - Unit of refrigeration - simple vapour compression system: p-h and T-s diagrams - Effect of evaporator pressure, condenser pressure, sub-cooling and super heating on performance- Actual vapour compression cycle - Analysis and problems

**UNIT-II**

Simple and practical vapour absorption refrigeration system- comparison between vapour compression and vapour absorption refrigeration-COP. Refrigerants: classification: primary and secondary refrigerants – Nomenclature - desirable properties of refrigerants – Selection of refrigerants- ODP & GWP. Introduction to Cryogenics (Theoretical treatment only): Liquefaction – Air liquefaction system- simple Linde cycle-Claude cycle

**UNIT-III**


**UNIT-IV**

Sources of heat load – Conduction load – Sun load – Load from occupants – Equipment load – Infiltration air-load – Load from moisture gain – Fresh air load – ASHRAE standards –room sensible heat factor-grand sensible heat factor-effective room sensible heat factor- Calculation of load on air-conditioning system

**UNIT-V**

Air machines: Compressor-classification, reciprocating compressor – single stage compressor with and without clearance-multistage compressor with inter cooling-calculation of power required and efficiencies


**Lecture Periods:** 45  **Tutorial Periods:** 15  **Practical Periods:** Nil  **Total Periods:** 60

**Reference Books:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ME218</td>
<td>Metrology and Measurements</td>
<td>4</td>
<td>4</td>
<td>40</td>
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</table>

**Prerequisite:**

- CO1: Ability to understand the significance of measurement in industrial applications.
- CO2: Understanding the correct procedure to be adopted to measure the dimension of the components.
- CO3: Identify the uses of gauges, comparators, coordinate measuring machine in industries.
- CO4: Study various methods and handling of geometric form like flatness, roundness, thread, gear measuring instruments.
- CO5: Interpret measurements of field variables like force, torque and pressure and comprehend the fundamentals of thermo-couple and strain measurement.

**UNIT-I**


**UNIT-II**


**UNIT-III**


**UNIT-IV**

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

**UNIT-V**


**Lecture Periods:** 60  **Tutorial Periods:** Nil  **Practical Periods:** Nil  **Total Periods:** 60

**Reference Books:**

Department: Mechanical Engineering  
Programme: B.Tech.(ME)  
Semester: Sixth  
Course Category Code: PCC  
Semester Exam Type: TY

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<th>Credit</th>
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<tbody>
<tr>
<td>ME219</td>
<td>Design of Machine Elements</td>
<td>3</td>
<td>1</td>
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<td>40 60 100</td>
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Prerequisite:

Course Outcome

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Students will be able to design simple machine components based on 1-D assumptions.</td>
</tr>
<tr>
<td>CO2</td>
<td>Demonstrate understanding of various design considerations.</td>
</tr>
<tr>
<td>CO3</td>
<td>Design machine elements for static as well as dynamic loading</td>
</tr>
<tr>
<td>CO4</td>
<td>Design machine elements on the basis of strength/rigidity concepts</td>
</tr>
<tr>
<td>CO5</td>
<td>Use design data books in designing various components</td>
</tr>
</tbody>
</table>

UNIT-I  
Periods: 12  
Fundamentals of machine design - Design philosophy - Engineering Materials - Brief overview of design and Manufacturing - Principal Stresses - Failure Theories - Design of Welded Joints - Types - Strength - Eccentric Loaded welded joints – Welded joints subjected to fluctuating load. \( \text{CO1} \)

UNIT-II  
Periods: 12  
Strength and Stability Criteria, Design of Power Screws. Threaded Joints – Bolted Joints under fluctuating load, Combined Stresses, and eccentric loading. \( \text{CO2} \)

UNIT-III  
Periods: 12  
Design of Couplings – Design of Rigid and flange Couplings – Types of Clutches and Design of Clutches. Types of Brakes – Design of Brakes. \( \text{CO3} \)

UNIT-IV  
Periods: 12  
Introduction to Design of Helical Springs-Design of Helical Springs for Variable Load-Design of Leaf Springs- Design of Pipe Joints – Cotter and Knuckle joints. \( \text{CO4} \)

UNIT-V  
Periods: 12  
Design of Shafts under static load: members subjected to Eccentric loading – stresses in curved beams. Design of Shafts under Fluctuating Load: Design for Finite and Infinite life – Soderberg and Goodman equations – combined stresses. \( \text{CO5} \)

Lecture Periods: 45  
Tutorial Periods: 15  
Practical Periods: Nil  
Total Periods: 60

Reference Books:

4. T. Jagadeesha, Design of Machine Elements, Universities Press(India) Private limited, Hyderabad, 2018
8. Design Data Hand Book, PSG College of Technology, Coimbatore
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ME220</td>
<td>Seminar</td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
</tbody>
</table>

**Course Outcome**

- **CO1**: To write technical documents and give oral presentations related to the work completed
- **CO2**: To utilize technical resources
- **CO3**: To work in actual working environment
- **CO4**: To identify, understand and discuss current, real-world issues.
- **CO5**: To apply principles of ethics and respect in interaction with others.

Seminar is a course in which students are trained for presentation skills. Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for a total of 100 marks. Presentation will take place during weekly class session. The following etiquette are to be followed:

- Dress properly
- Behave well
- Portray good image as a professional

**Lecture Periods:** -

**Tutorial Periods:** -

**Practical Periods:** 45

**Total Periods:** 45
**Department:** Mechanical Engineering  
**Programme:** B.Tech. (ME)  
**Semester:** Sixth  
**Course Category Code:** PCC  
**Semester Exam Type:** LB

<table>
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<tr>
<th>Course Code</th>
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<th>Periods / Week</th>
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<tbody>
<tr>
<td>ME221</td>
<td>Mechanical Engineering Lab-III (Thermal Engg. Lab/ Measurements lab/ Modelling, Simulation &amp; Analysis lab)</td>
<td>0 0 3</td>
<td>1.5</td>
<td>40 60 100</td>
</tr>
</tbody>
</table>

**Prerequisite:** Study of Thermodynamics, Heat Transfer, Thermal Engineering/ Metrology & Measurements/design of machine elements, Engineering Mechanics, Mechanics of Solids.

**Course Outcome**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understands fundamentals of heat transfer, IC engines and Refrigeration and air conditioning and its applications</td>
</tr>
<tr>
<td>CO2</td>
<td>Understands the principles and working of IC engines, calorimeters and HVAC.</td>
</tr>
<tr>
<td>CO3</td>
<td>Calibrate the simple mechanical measurement instrumentation and their uses.</td>
</tr>
<tr>
<td>CO4</td>
<td>Demonstrate different measurement Techniques for the precise measurement of Industrial Components.</td>
</tr>
<tr>
<td>CO5</td>
<td>Get the skill of solving the problems using computer programming.</td>
</tr>
<tr>
<td>CO6</td>
<td>Get the skill of using computer aided drafting and modelling software available in industries where they get employed.</td>
</tr>
</tbody>
</table>

**Thermal Lab:**

1. Determination of flash point and fire point and calorific values of gaseous fuel using Junkers gas calorimeter.
2. Determination of kinematic viscosity using Redwood viscometer and determination of calorific values of solid/ liquid fuels using Bomb calorimeter.
3. Performance test on Vapour compression refrigeration system.
4. Performance test on single/ multi cylinder diesel / petrol engine.

**Measurements Lab:**

4. Study of Displacement using LVDT and RVDT.
6. Inspection of gear tooth profile using profile projectors.

**Modelling, Simulation and Analysis Lab:**

1. Plane Stress Analysis on Plate with Central hole
2. SF and BMD diagrams for all kinds of beams
3. 1-D heat transfer analysis of a simple plate.
4. Computer aided design of machine components
   - Design and drafting of the following components using FORTRAN / C or C++/ Matlab
     - Transmission shafts, b) Journal bearings, c) Flange couplings etc.
6. Assembly modelling of components having a minimum of six machine elements.

**Lecture Periods:** Nil  
**Tutorial Periods:** Nil  
**Practical Periods:** 45  
**Total Periods:** 45

**Reference Books**

1. IC engines – V. Ganesan.  
**Department:** Mechanical Engineering  
**Programme:** B.Tech.(ME)-Honours  
**Semester:** Sixth  
**Course Category Code:** PCC  
**Semester Exam Type:** TY

<table>
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<th>Maximum Marks</th>
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<tr>
<td>MEH04</td>
<td>Product Design and Development</td>
<td>3</td>
<td>1</td>
<td>4</td>
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**Prerequisite:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td>Students will develop cross-discipline products and prototype them using product realization tools in a multi-disciplinary team setting.</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>Students know how to apply mechanical engineering design theory to identify and quantify machine elements in the design of commonly used mechanical systems.</td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td>Students know the variety of mechanical components available and emphasize the need for quality and continue earning.</td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td>Students get the knowledge of patenting a new product</td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td>Students know the product manufacturing aspects.</td>
</tr>
</tbody>
</table>

**UNIT-I**

| Periods: 12 | Introduction to product design and manufacturing, product design: definition and evolution, Product design morphology, Product design morphology: Preliminary and detailed design, NPD and PAP | CO1 |

**UNIT-II**


**UNIT-III**

|             | Quality monitoring: Control charts for processes, Quality monitoring: Control charts for attributes and defects, Quality Assurance. |

**UNIT-IV**

| Periods: 12 | Patenting: Creativity versus Innovation, Patenting: need and processes, Prototyping: Basics and Principles of Prototyping, methods of prototyping. | CO4 |

**UNIT-V**


| Lecture Periods: 45 | Tutorial Periods: 15 | Practical Periods: Nil | Total Periods: 60 |

**Reference Books:**

**Department:** Mechanical Engineering  
**Programme:** B.Tech.(ME)-Minor

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Periods / Week</th>
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<tr>
<td>MEM04</td>
<td>Quality Control and Improvement Techniques</td>
<td>3</td>
<td>1</td>
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</tbody>
</table>

**Prerequisite:**

- **CO1** Understanding the importance of improving quality of a product/process to meet the target specifications and reduce wastages.
- **CO2** Knowledge on how Quality control measures directly improve cost benefits, reliability factors and overall productivity.
- **CO3** Procedures for Process reversal by estimating the shift in target value by scrutinizing the defectives and defects.
- **CO4** Overview of the adaptation of sampling & inspection procedures to maintain quality throughout the transformation process.
- **CO5** Learn the fundamental methods of measurement, precision & accuracy, measurement devices & testing methods.

**UNIT-I**  
Periods: 12  
Importance of quality, meaning of quality, quality dimensions, quality control, SQC, Quality assurance, quality costs, economics of quality, quality and productivity, quality and reliability, quality loss function.  
**CO1**

**UNIT-II**  
Periods: 12  
Process variation, Statistical basis, 3 – sigma control limits, Rational sub-grouping, X, R and S charts, Interpretation of charts, warning and modified control limits, operating characteristic curve for X – chart, SPC - process capability analysis – Cp, CPK, Cpm, Machine capability, Gauge capability.  
**CO2**

**UNIT-III**  
Periods: 12  
P, np, C, U and ku charts, demerits control chart, Multi – variable chart, individual measurement charts – moving average and moving range charts, quality control in service sector.  
**CO3**

**UNIT-IV**  
Periods: 12  
Need for Acceptance sampling, economics of sampling, sample selection, single and Double sampling – O.C. curves, Average outgoing quality (AOQ), Average sample Number (ASN), Average total inspection (ATI), Multiple and sequential sampling, sampling plans – military standards, Dodge – Roming, IS 2500.  
**CO4**

**UNIT-V**  
Periods: 12  
**CO5**

**Lecture Periods:** 45  
**Tutorial Periods:** 15  
**Practical Periods:** Nil  
**Total Periods:** 60

**Reference Books:**
4. Statistical Quality Control, M. Mahajan, Dhanpat Rai & co (P) Ltd 2012
# Operation Research

**Course Code:** ME222  
**Course Name:** Operation Research  
**Periods / Week:** L: 3, T: 1, P: 0, C: 4  
**Credit:** 4  
**Maximum Marks:** 40, 50, 60, 100

### Prerequisite:
- CO1: At the end of the course the student is able to understand about operations research problem.
- CO2: Understanding the necessity of Inventory Control and its problems.
- CO3: To get knowledge about Linear Programming.
- CO4: Explain the various methods.
- CO5: Able to solve problems to obtain optimal systems.

---

**UNIT-I**  
Periods: 12  

**UNIT-II**  
Periods: 12  
Inventory Control: Necessity for Maintaining Inventory, Inventory Costs, Inventory Control Problem, Classification of Fixed Order Quality Inventory Models, Inventory Models with Deterministic Demand, Model 1(a). Classical EOQ Model (Demand Rate Uniform, Replenishment Rate Infinite), Model 1(b). (Demand Rate Non-Uniform, Replenishment Rate Infinite), Model 1(c). (Demand Rate Uniform, Replenishment Rate finite), Model 2(a). (Demand Rate Uniform, Replenishment Rate Infinite, shortage allowed), Model 2(b). (Demand Rate Uniform, Production Rate finite, shortage allowed), Inventory Models with Probabilistic Demand, Inventory.

**UNIT-III**  
Periods: 12  

**UNIT-IV**  
Periods: 12  

**UNIT-V**  
Periods: 12  
The Assignment Model: Definition of the Assignment Model, Mathematical Representation of the Assignment Model, Comparison with the Assignment Model, The Hungarian Method for Solution of the Assignment Problems, Formulation and solution of the Assignment Models, Variations of the Assignment Problem, The Travelling Salesman Problem. Sequencing Models-Sequencing problems, Assumptions in Sequencing Problems, Processing n Jobs through one Machine, Processing n Jobs through two Machines, Processing n Jobs through three Machines, Processing two Jobs through m Machines, Processing n Jobs through m Machines, Problems related to Sequencing (Routing Problems in Networks), Minimal Path Problem.

### Lecture Periods: 45  
### Tutorial Periods: 15  
### Practical Periods: -  
### Total Periods: 60

### Reference Books:
4. Operations Research, an Introduction by Hamdy Taha
5. Introduction to Operations Research by Hillier & Lieberman
Department: Mechanical Engineering  
Programme: B.Tech. (ME)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ME223</td>
<td>Industrial Engineering and Management</td>
<td>3 L 0 T 0 P 3 C</td>
<td>40 CA 60 SE 100 TM</td>
<td></td>
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</table>

Prerequisite:
CO1 At the end of the course the student will be able to have an ability to identify, formulate, and solve engineering problems
CO2 an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
CO3 an ability to design and conduct experiments, as well as to analyze and interpret data
CO4 an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
CO5 the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

UNIT-I  
Periods: 9

Material Handling: functions – principles – classification of material handling equipments (only classification and no description) - factors to be considered in selection of material handling equipment.

UNIT-II  
Periods: 9

WORK STUDY: Method Study: objectives - basic procedure - various recording techniques – process charts, multiple activity charts, SIMO chart, Flow diagram, string diagram, cyclegraph and chronocyclegraph - principles of motion economy – Therbligs - micromotion study & memomotion study.
Work Measurement: purpose - basic procedure – various techniques of work measurement – stop watch time study – time study equipments – different systems of performance rating – time allowances – PMTS - work sampling – simple problems involving the determination of standard time and compensation

UNIT-III  
Periods: 9


UNIT-IV  
Periods: 9


UNIT-V  
Periods: 9


Lecture Periods: 45  Tutorial Periods: -  Practical Periods: -  Total Periods: 45
### Reference Books:

Department: Mechanical Engineering
Programme: B.Tech. (ME)
Semester: Seventh
Course Category Code: PCC
Semester Exam Type: TY

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<tr>
<td>ME224</td>
<td>Advanced Manufacturing</td>
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Prerequisite:

Course Outcome:

- CO1 Get a broad view about automated manufacturing system
- CO2 Useful for modern industrial environment using NC, CNC, DNC
- CO3 Work in automated production environment using robotics
- CO4 Familiarize with group technology and flexible manufacturing systems
- CO5 Explore the concepts of additive manufacturing

UNIT-I


UNIT-II

NC machines – Introduction, Types, Advantages and Applications. CNC, DNC (Direct and Distributed) and Adaptive Control. Introduction to Programming languages, APT Programming, Examples on CNC Turning, Milling & Drilling operations.

UNIT-III


UNIT-IV


UNIT-V


Lecture Periods: 60  Tutorial Periods:  Practical Periods: Total Periods: 60

Reference Books:

Department : IEDC
Programme : B.Tech.
Semester : Seventh
Course Category Code: PAC
Semester Exam Type: TY

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP201</td>
<td>Entrepreneurship</td>
<td>3 0 0 2</td>
<td>CA SE TM</td>
<td>40 60 100</td>
</tr>
</tbody>
</table>

Prerequisite:

**Course Outcome**

<table>
<thead>
<tr>
<th>Course</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>The student will gain conceptual understanding of Entrepreneurship and design thinking.</td>
</tr>
<tr>
<td>CO2</td>
<td>The students will become knowledgeable about business model development and MVP</td>
</tr>
<tr>
<td>CO3</td>
<td>The students will gain knowledge about costing and revenue.</td>
</tr>
<tr>
<td>CO4</td>
<td>The students will learn about marketing and sales.</td>
</tr>
<tr>
<td>CO5</td>
<td>Student will get understanding of team formation and compliance requirements.</td>
</tr>
</tbody>
</table>

**UNIT-I**

Periods: 9

**PROBLEM AND CUSTOMER:** Effectuation, Finding the flow. Entrepreneurial style, business opportunity, problems worth solving, methods for finding problems, problem interviews. Design Thinking, Consumer and customer, market types, segmentation and targeting, early adopters, Gains, Pains and “Jobs-To be done, Value Proposition Canvas (VPC), Identifying Unique Value Proposition (UVP). CO1

**UNIT-II**

Periods: 9

**BUSINESS MODEL AND VALIDATION:** Types of Business Models, Lean Canvas, Risks. Building solution demo, solution interviews, problem-solution test, competition, Blue Ocean Strategy. MVP- Build-Measure-Learn feedback loop, MVP Interviews, MVP Presentation. CO2

**UNIT-III**

Periods: 9

**REVENUE AND COST:** Revenue Streams-Income, costs, gross and net margins - primary and secondary revenue streams- Different pricing strategies - product costs and Operations costs; Basics of unit costing. Financing New Venture- various sources - investor expectation- Pitching to Investors. CO3

**UNIT-IV**

Periods: 9

**MARKETING AND SALES:** Difference between product and brand - positioning statement. Building Digital Presence, Social media- company profile page – Sales Planning - buying decisions, Listening skills, targets. Unique Sales Proposition (USP), sales pitch, Follow-up and closing a sale. CO4

**UNIT-V**

Periods: 9

**TEAM AND SUPPORT:** Team Building - Shared leadership - role of a good team - team fit - defining roles and responsibilities - collaboration tools and techniques- project management, time management, workflow, delegation of tasks. Business regulations - starting and operating a business - compliance requirements. CO5

| Lecture Periods: 45 | Tutorial Periods: | Practical Periods: | Total Periods: 45 |

Reference Books:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ME225</td>
<td>Professional Ethics</td>
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</tr>
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</table>

### Prerequisite:

CO1: Upon completion of this course the students are motivated to strive for higher ethical standards.

CO2: Student will be capable of understanding basic cultural / social issues inherent in the discipline of Mechanical Engineering.

CO3: Student will be capable of understanding legal / safety issues inherent in the discipline of Mechanical Engineering.

CO4: Student will be capable of understanding moral issues inherent in the discipline of Mechanical Engineering.

CO5: Students will be capable of understanding the societal responsibilities and human rights.

### Lecture Periods: 45  |  Tutorial Periods: -  |  Practical Periods: -  |  Total Periods: 45

### Reference Books:

8. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011.
**Course Code**: MEH05  
**Course Name**: Surface Engineering

**Prerequisite**: 
- CO1: Explain the important of surface engineering in industries
- CO2: To control the factors that affects the metal corrosion.
- CO3: Explain the process and mechanism of different coating process
- CO4: To prevent corrosion by coatings and inhibitors, etc.
- CO5: To explore the possibility of various testing methods in corrosion

**Course Outcome**

**UNIT-I**

<table>
<thead>
<tr>
<th>Periods</th>
<th>CO1</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Introduction tribology, surface degradation, wear and corrosion, types of wear, roles of friction and lubrication- overview of different forms of corrosion, introduction to surface engineering, importance of substrate- surface cleaning- selection and classification of cleaning processes.</td>
</tr>
</tbody>
</table>

**UNIT-II**

<table>
<thead>
<tr>
<th>Periods</th>
<th>CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Surface pre-treatment, deposition of copper, zinc, nickel and chromium - principles and Practices, alloy plating, electro composite plating, Electroless plating of copper, nickel phosphorous, nickel-boron; Electroless composite plating; application areas, properties, test Standards (ASTM) for assessment of quality deposits.</td>
</tr>
</tbody>
</table>

**UNIT-III**

<table>
<thead>
<tr>
<th>Periods</th>
<th>CO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>SURFACE MODIFICATION PROCESSES: Thermal spray coatings – chemical Vapour disposition coating processes– plasma-enhanced chemical Vapour deposition – physical Vapour deposition coating processes – vacuum deposition – reactive evaporation and gas evaporation – sputter deposition – ion plating - ion-beam-assisted deposition – arc deposition – ion implantation – diffusion coatings</td>
</tr>
</tbody>
</table>

**UNIT-IV**

<table>
<thead>
<tr>
<th>Periods</th>
<th>CO4</th>
</tr>
</thead>
</table>

**UNIT-V**

<table>
<thead>
<tr>
<th>Periods</th>
<th>CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>TESTING: Purpose of corrosion testing - Classification - Susceptibility tests for intergranular corrosion- Stress corrosion test. Salt spray test humidity and porosity tests, accelerated weathering tests. ASTM standards for corrosion testing and tests for assessment of wear</td>
</tr>
</tbody>
</table>

**Reference Books:**

**Department:** Mechanical Engineering  
**Programme:** B.Tech.(ME)-Minor

**Semester:** Seventh  
**Course Category Code:** PCC  
**Semester Exam Type:** TY

<table>
<thead>
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<th>Course Code</th>
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<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEM05</td>
<td>Process Planning &amp; Cost Analysis</td>
<td>3 L 1 T 0 P</td>
<td>4</td>
<td>40 CA 60 SE 100 TM</td>
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**Prerequisite:**

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>At the end of the course the student will be able to: do effectively process planning for a manufacturing industry</td>
</tr>
<tr>
<td>CO2</td>
<td>Conduct method study and apply the principles of motion economy in a manufacturing</td>
</tr>
<tr>
<td>CO3</td>
<td>Use process planning and method study to increase the productivity</td>
</tr>
<tr>
<td>CO4</td>
<td>Estimate the cost of a product</td>
</tr>
<tr>
<td>CO5</td>
<td>Estimate the machining time for various operations</td>
</tr>
</tbody>
</table>

**UNIT-I**  
Periods: 12  
**INTRODUCTION TO PROCESS PLANNING:** Introduction - methods of process planning - Drawing interpretation - Material evaluation – steps in process selection - Production equipment and tooling selection.  
**CO1**

**UNIT-II**  
Periods: 12  
**PROCESS PLANNING ACTIVITIES:** Process parameters calculation for various production processes - Selection of jigs and fixtures - selection of quality assurance methods - Set of documents for process planning - Economics of process planning - case studies.  
**CO2**

**UNIT-III**  
Periods: 12  
**INTRODUCTION TO COST ESTIMATION:** Importance of costing and estimation - methods of costing - elements of cost estimation - Types of estimates - Estimating procedure - Estimation labour cost, material cost - allocation of overhead charges - Calculation of depreciation cost.  
**CO3**

**UNIT-IV**  
Periods: 12  
**PRODUCTION COST ESTIMATION:** Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop.  
**CO4**

**UNIT-V**  
Periods: 12  
**MACHINING TIME CALCULATION:** Estimation of Machining Time - Importance of Machine Time Calculation - Calculation of Machining Time for Different Lathe Operations, Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning - Machining Time Calculation for Grinding.  
**CO5**

| Lecture Periods | 45 |
| Tutorial Periods | 15 |
| Practical Periods |     |
| Total Periods    | 60 |

**Reference Books:**

Department: Mechanical Engineering  |  Programme: B.Tech.(ME)
Semester: Eighth  |  Course Category Code: PAC  |  Semester Exam Type: -

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>ME226</td>
<td>Comprehensive Test</td>
<td>0 0 3 1</td>
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<td>- 100</td>
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</table>

Prerequisite:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Student will be able to explain the satisfactory operation of any mechanical system</td>
</tr>
<tr>
<td>CO2</td>
<td>Student will possess the knowledge of principles of operation of all mechanical machines, devices and equipment</td>
</tr>
<tr>
<td>CO3</td>
<td>Student will exhibit his talent in adopting procedural methods in design and manufacturing of mechanical components</td>
</tr>
<tr>
<td>CO4</td>
<td>Student will become capable to identify any trouble shooting in mechanical systems</td>
</tr>
<tr>
<td>CO5</td>
<td>Student will become capable of understanding the basic principles of the Mechanical Engineering subjects</td>
</tr>
</tbody>
</table>

The student is required to take a comprehensive test on a scheduled date in the beginning of the VIII semester. Comprehensive test is meant for testing the higher order and critical thinking of the student in the respective domain. This test will have the standard of GATE examination.

The comprehensive test is conducted through an objective type examination of 3 hours’ duration. The test shall carry 100 marks and cover the syllabi of all mechanical core courses. The question paper contains 50 questions of 2 marks each. The question shall be framed to test the critical thinking of the students and of the standard of any national level competitive examination.

A committee comprising of two faculty members will coordinate the conduct and evaluation of comprehensive test.

Lecture Periods: -  |  Tutorial Periods: -  |  Practical Periods: 45  |  Total Periods: 45
Course Code | Course Name | Periods / Week | Credit | Maximum Marks | L | T | P | C | CA | SE | TM
--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---
ME227 | Internship | 0 | 0 | 3 | 2 | 100 | - | 100

Course Code

| Course Code | Course Name | Periods / Week | Credit | Maximum Marks | L | T | P | C | CA | SE | TM |
--- | --- | --- | --- | --- | --- | --- | --- | --- |
ME227 | Internship | 0 | 0 | 3 | 2 | 100 | - | 100

Course Outcome

| Prerequisite: | Course Outcome | Description |
--- | --- | ---
CO1 | Experience of applying existing engineering knowledge in similar or new situations; to identify when new engineering knowledge is required, and apply it |
CO2 | Ability to integrate existing and new technical knowledge for industrial application |
CO3 | Ability to demonstrate the impact of the internship on their learning and professional development |
CO4 | Understanding of lifelong learning processes through critical reflection of internship experiences and to provide students with the skills and experience |
CO5 | Opportunity to seek, identify and further develop an appropriate level of professionalism |

Final year students of B. Tech program undergo a mandatory semester long internship in leading organizations as a part of their curriculum. This enables them to get exposure in tackling live problems that occur in the working of an individual entity. These internships, along with various industrial visits keep the students informed about latest industrial trends.

This is a two credit course, compulsory for all students where the student is evaluated by a committee comprising of two faculty members by evaluating the internship report and the oral presentation by the student.

The duration of the internship is of 12 weeks between January to April, making the student a comprehensive package for the industry.

The main purpose of the internship is to enhance the general professional outlook and capability of student to advance his chances of improving the career opportunities. The students should get approval from the head of the department before undertaking the internship and submit a detailed report after completion for the purpose of assessment.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>ME228</td>
<td>Project Work</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**Prerequisite:**

CO1: Student will become competent to model / produce any mechanical system and component and test their strength and performance using advanced techniques.

CO2: Student will exhibit his/her ability to design parts of mechanical machines, devices and equipment using prevailing norms and standards.

CO3: Student will expose his/her skill to execute different mechanical operations through a coordinated approach with team mates.

CO4: Student will reveal his/her knowledge in handling modern tools and machines involved in fabrication and assembling of mechanical components.

CO5: Student will demonstrate capability to develop suitable numerical or mathematical methods for off-line performance analysis of mechanical systems and components individually or collectively.

The student shall carry out a project work in the eighth semester. The student is given an option to carry out this project either in the institute or in an industry/Research laboratory/Higher learning Institute. The project would be carried out under the supervision of a project guide from the department. In the case of students carrying out the project outside the college an external guide from relevant organization shall be assigned in addition to the internal guide from the department.

The project work is to acquaint the student in the analysis of problems posed to him in the method of conducting a detailed literature survey and reviewing the state of art in the area of the problem. The work may be purely theoretical / analytical / completely experimental / design and fabrication. In few cases the project can also involve the above all.

At the end, a student or a group of students shall prepare and submit a project report which is expected to show clarity of thought and expressions, critical appreciation of the existing literature and analytical/experimental/design streams. The project work should be of relevant nature for the current and the future needs of the country.

The project work will be continuously monitored and assessed by the guide / project evaluation committee as a part of internal evaluation and at the end project work and the report will be examined by the panel of examiners through viva-voce.

Lecture Periods: - | Tutorial Periods: - | Practical Periods: 45 | Total Periods: 45
Professional Elective Courses
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods/week</th>
<th>Credit</th>
<th>Maximum marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEY01</td>
<td>Energy and Environmental Engineering</td>
<td>3 0 0 3 40 60 100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite** --

**Course Outcome**

| CO1 | to know different energy conversion systems and pollutions |
| CO2 | to understand how energy management could effectively be applied from the point of view of conservation |
| CO3 | to understand the methods of energy conservation through case studies |
| CO4 | To identify different types of pollutants and their impact on environment |
| CO5 | to implement pollution control measures to be adopted for major sources of pollution |

**Unit – I**


**Unit – II**


**Unit – III**

| Periods: 9 | Energy conservation in boilers – procedure for efficiency calculation – energy conservation in industries: pumps, fans, compressed air systems, refrigeration and air conditioning system, DG sets, electrical motors, variable speed motors. |

**Unit – IV**


**Unit – V**


**Lecture Periods: 45**  **Tutorials Periods:**  **Practical Periods:**  **Total Periods: 45**

**Reference books:**

5. http://nptel.iitm.ac.in/courses/Webcourse-contents
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEY02</td>
<td>Metal Forming Processes</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Prerequisite:**
- Upon completion of the course, the students should have the ability to understand the importance of the metal forming processes,
- To choose right metal forming machine tools,
- To select suitable processes to fabricate an engineering product,
- Students are expected to determine the forming force, stress and strain experimentally as well as analytically
- To understand the mechanisms of different High Energy Rate forming processes

**Course Outcome**

**UNIT-I**


**UNIT-II**


**UNIT-III**


**UNIT-IV**

| Drawing of rods, wires and tubes-Determination of drawing loads through conical dies, sheet metal forming: Shearing, blanking, bending, punching, piercing, stretch forming, deep drawing, rubber pad forming –Applications | Periods: 9 | CO4 |

**UNIT-V**


**Lecture Periods:** 45  
**Tutorial Periods:**  
**Practical Periods:**  
**Total Periods:** 45  

**Reference Books:**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEY03</td>
<td>Engineering Tribology</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Prerequisite:**
- CO1: Students will be able to identify the surface related problems which lead to failure of the components.
- CO2: Students are made to follow and understand the basic of Engineering Tribology.
- CO3: Students will be able to come up with ideas to design against tribological problems based on genesis and theories of friction.
- CO4: Students are made to solve problems on Reynolds Equation journal And thrust bearings.
- CO5: Students will be able to understand the basic concepts of lubrication

**UNIT-I**

| Periods: 9 |
| Introduction to tribology-Factors influencing Tribological phenomena-Engineering surfaces-Surface Characterization, Computation of surface parameters. Surface measurement techniques-Apparent and real area of contact |

**UNIT-II**

| Periods: 9 |

**UNIT-III**

| Periods: 9 |

**UNIT-IV**

| Periods: 9 |
| Surface modification techniques-Improving wear resistance-Surface coating techniques such as electrochemical depositions, anodizing, thermal spraying, Chemical Vapour Deposition (CVD), Physical Vapour Deposition (PVD), etc. and their applications. |

**UNIT-V**

| Periods: 9 |

**Lecture Periods:** 45  **Tutorial Periods:**  **Practical Periods:**  **Total Periods:** 45

**Reference Books:**
10. R.C. Gunther,Lubrication, Baily Brothers and Swinfen Limited.
Department: Mechanical Engineering  
Programme: B.Tech.(ME)  
Semester: Fifth  
Course Category Code: PEC  
Semester Exam Type: TY

<table>
<thead>
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<th>Course Code</th>
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<th>Maximum Marks</th>
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</thead>
<tbody>
<tr>
<td>MEY04</td>
<td>Automobile Engineering</td>
<td>L 3 T 0 P 0 C 3</td>
<td>CA 40</td>
<td>SE 60 TM 100</td>
</tr>
</tbody>
</table>

Prerequisite:
- CO1: understand the layout and arrangement of principal parts of an automobile
- CO2: understand the power transmission system of an automobile
- CO3: understand the suspension system of an automobile
- CO4: understand the braking system of an automobile
- CO5: know automobile electrical and air conditioning and passengers safety features

UNIT-I  

UNIT-II  

UNIT-III  
Suspension system – requirements - rigid axle and independent suspension - types of suspension - leaf spring - coil spring - torsion rod and air suspension - shock absorbers. Front axle : types - front wheel geometry - conditions for true rolling. Steering geometry - Ackerman and Davis steering - steering linkages - steering gear box-power and power assisted steering. Wheel alignment - Tyres: materials and types static and rolling properties of pneumatic tyres.

UNIT-IV  
Braking system - hydraulic braking systems - drum type and disc type brakes - power and power assisted brakes - factors affecting brake performance - tests on brakes - skid and skid prevention. Chassis - types of bodies - chassis frame - integral body - vehicle stability.

UNIT-V  

Lecture Periods: 45  
Tutorial Periods:  
Practical Periods:  
Total Periods: 45

Reference Books:
### Department: Mechanical Engineering  
### Programme: B.Tech.(ME)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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</thead>
<tbody>
<tr>
<td>MEY05</td>
<td>Mechatronics</td>
<td>L T P C CA SE TM</td>
<td>3 0 0 3 40 60 100</td>
<td></td>
</tr>
</tbody>
</table>

### Prerequisite:

- CO1: Students understands the role of electronics in different mechanical systems.
- CO2: Emphasize the importance of mechatronics in engineering design, measurements and mechanical systems.
- CO3: Students understands the role of interfacing and image processing in different mechanical systems.
- CO4: Students understands how to develop models in different mechanical systems.
- CO5: Students understands the role of electronics in different bio-mechanical systems

### UNIT-I


### UNIT-II


### UNIT-III


### UNIT-IV

Introduction-model categories-fields of application-model development-model verification-model validation model simulation-design of mixed systems-electro mechanics design-model transformation-domain-independent description forms-simulator coupling.

### UNIT-V


### Lecture Periods: 45  
Tutorial Periods:  
Practical Periods:  
Total Periods: 45

### Reference Books:
Course Code: MEY06
Course Name: Fluid Power Automation

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>MEY06</td>
<td>Fluid Power Automation</td>
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</tbody>
</table>

Prerequisite:

On completion of the course the students will be able to apply the concepts of fluid power and pneumatic circuits for automation in mechanical field, devices associated and operation, maintenance and safety of such systems.

Course Outcome:

CO1: students will be able to apply the concepts of fluid power for control systems

CO2: students will be able to apply the concepts of fluid power for actuating mechanism.

CO3: students will be able to apply the concepts of fluid power for actuating mechanism.

CO4: students will be able to apply the concepts of pneumatic circuits for automation in mechanical devices.

CO5: students will be able to apply the concepts of combined fluid power and pneumatic circuits for automation in mechanical systems.

UNIT-I


UNIT-II

Pressure – Direction - Flow control valves, relief valves, non-return and safety valves - Accumulators - Linear circuits - Regenerative circuits- Intensifier circuits - metering - In our circuits.

UNIT-III

Reciprocation operation of multi cylinder - Quick return - Sequencing - Accumulator circuits - Use of pressure switches & limit switches - Hydrostatic transmission circuits - Fluid power maintenance and safety.

UNIT-IV

Basic principles of Pneumatics – Types of Compressors – Elements of Pneumatic systems – Filters, lubricator, Muffler – Types of directional control valve - Air motors - Air cylinder

UNIT-V

Basic Pneumatic circuits - Speed control - Sequencing of motion - Hydro pneumatic circuits - cascade methods - Automation and Principle of circuit design – PLC- SCADA-Pneumatic control applications in machine tool and other mechanical fields – Maintenance

Lecture Periods: 45
Tutorial Periods: 5
Practical Periods: 1
Total Periods: 45

Reference Books:

### Course Name: Automotive Fuels, Pollution and Control

**Course Code:** MEY07  
**Credit:** 3  
**Maximum Marks:** 100  
**Periods / Week:** L 3, T 0, P 0, C 3  

**Prerequisite:**
- **CO1:** At the end of the course the student is able to understand the applications of different types of automotive fuels, its properties.
- **CO2:** At the end of the course the student is able to understand the harmful emissions from SI Engines /automobiles and the methods of control of pollution.
- **CO3:** At the end of the course the student is able to understand the harmful emissions from CI Engines /automobiles and the methods of control of pollution.
- **CO4:** At the end of the course the student is able to understand the emission standard and testing of emission.
- **CO5:** At the end of the course the student is able to understand the emission standard and the role of alternate fuels in reducing pollution and replacing conventional fuels.

### UNIT I
**Periods:** 9  
**CO1:** Liquid fuels: gasoline and diesel – thermo-chemistry - properties-testing of fuels-specific gravity-calorific value, boiling range, flash point, ignition temperature, viscosity, cloud and pour point, flammability limits, Octane rating and Cetane rating-fuel additives-requirement of additives, petrol and diesel fuel additives-fuel specification. Different pollutant from IC engines-their effect on human health and environment.

### UNIT II
**Periods:** 9  
**CO2:** SI engine pollutants-mechanism of formation of unburnt hydrocarbon, carbon monoxide and nitrogen oxides. Factors affecting the formation of Pollutants- effect of engine variables. Emission control methods in SI engines thermal and catalytic reactors, oxidation ,reduction and 3 way catalytic reactors, closed loop feedback control catalysts and substrates-recent development in SI engine for emission control-lean burn engine-stratified charge engine-multipoint fuel injection.

### UNIT III
**Periods:** 9  
**CO3:** CI engine pollutants-formation of hydrocarbons, oxides of nitrogen and particulate matter-smoke and its types factors affecting smoke formation-diesel engine emission control—effect of engine variables-recent developments in CI engine for emission control-low heat rejection engine-dual fuel engine-common rail diesel injection system ultra-high pressure diesel injection- HCCI engine-lean de-NOx catalysts-diesel particulate filters.

### UNIT IV
**Periods:** 9  
**CO4:** Emission standards, test procedures, driving cycles. Measurement of CO, HC, NOx, PM and smoke -Bosch smoke meter-Hatridge smoke meter-measurement of particulate meter.

### UNIT V
**Periods:** 9  
**CO5:** Alternative fuels for emission control: biodiesel and ethanol, gashol. Gaseous fuels: LPG, natural gas-biogas-producer gas, hydrogen, physical and chemical properties- Engine combustion performance and emission characteristics.

### Lecture Periods: 45  
**Reference Books:**
Department: **Mechanical Engineering**  
Programme: **B.Tech.(ME)**  
Semester: **Sixth**  
Course Category Code: **PEC**  
Sem. Exam. Type: **TY**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods/week</th>
<th>Credit</th>
<th>Maximum marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEY08</td>
<td>Maintenance and Safety</td>
<td>3 0 0 3 40 60 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite**

At the end of the course the student is able

**Course Outcome**

- CO1 to understand the objectives of maintenance
- CO2 to identify the methods of maintenance to match with applications
- CO3 to understand the trouble shooting in devices with examples
- CO4 to understand the necessity for safety so as to avoid accidents
- CO5 to know safety measures and standards to be followed as precautions

| Unit – I | Periods: 9
---|---

| Unit – II | Periods: 9
---|---

| Unit – III | Periods: 9
---|---

| Unit – IV | Periods: 9
---|---

| Unit – V | Periods: 9
---|---

**Lecture Periods: 45**  
**Tutorials Periods: Nil**  
**Practical Periods: Nil**  
**Total Periods: 45**

**Reference books:**

5. Garg, H.P., Industrial Maintenance, S.Chand & Co Ltd., New Delhi, 1990
### Course Code: MEY09  
**Course Name:** Computer Aided Design

<table>
<thead>
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<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>MEY09</td>
<td>Computer Aided Design</td>
<td>L 0 T 0 P 3</td>
<td>C 40</td>
<td>60 100</td>
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#### Prerequisite:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
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<tbody>
<tr>
<td>CO1</td>
<td>At the end of the course, the student will be able to Students will understand the basic working principle of drafting and modelling software.</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand geometric construction</td>
</tr>
<tr>
<td>CO3</td>
<td>Student will get ability to use standards for model transformation.</td>
</tr>
<tr>
<td>CO4</td>
<td>Get idea about how to write effective software with proper data base to develop an expert system.</td>
</tr>
<tr>
<td>CO5</td>
<td>Get knowledge about Computer aided design and the application of computer aided design in research and development areas.</td>
</tr>
</tbody>
</table>

#### Reference Books:

### Course Information

**Department:** Mechanical Engineering  
**Programme:** B.Tech.(ME)  
**Semester:** Seventh  
**Course Category Code:** PEC  
**Semester Exam Type:** TY

<table>
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<th>Course Code</th>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>MEY10</td>
<td>Cryogenic Engineering</td>
<td>L 3 T 0 P 0 C 3</td>
<td>CA 40</td>
<td>SE 60</td>
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**Prerequisite:**

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CO1</td>
<td>At the end of the course the student is able to understand operation of low-temperature technologies.</td>
</tr>
<tr>
<td>CO2</td>
<td>to analyse cryogenic liquefaction systems and components effectively.</td>
</tr>
<tr>
<td>CO3</td>
<td>to analyse select cryogenic refrigeration systems in accordance with applications.</td>
</tr>
<tr>
<td>CO4</td>
<td>to choose and design cryogenic systems according to requirements.</td>
</tr>
<tr>
<td>CO5</td>
<td>to solve problems associated with real-time applications.</td>
</tr>
</tbody>
</table>

**UNIT-I**  
**Periods:** 9  

**UNIT-II**  
**Periods:** 9  
Gas liquefaction systems: Production of low temperature: Joule-Thomson effect – Inversion curve – Adiabatic expansion – Cryogenic liquefaction systems: Linde-Hampson system, pre-cooled Linde-Hampson system, Linde dual pressure system, Claude system, pre-cooled Claude system, Kapitza system, Heylandt system, Collin’s helium liquefaction system and Simon helium-liquefaction system.

**UNIT-III**  
**Periods:** 9  

**UNIT-IV**  
**Periods:** 9  

**UNIT-V**  
**Periods:** 9  

**Lecture Periods:** 45  
**Tutorial Periods:**  
**Practical Periods:**  
**Total Periods:** 45

**Reference Books:**
Department: Mechanical Engineering  
Programme: B.Tech. (ME)  
Semester: Seventh  
Course Category Code: PEC  
Semester Exam Type: TY

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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>MEY11</td>
<td>Nano Technology and surface Engineering</td>
<td>3 0 0 3</td>
<td>40 60 100</td>
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</table>

Prerequisite:  
CO1 Get a broad view about nanotechnology concepts and basics  
CO2 Expose to methods of synthesis of nano materials  
CO3 Know characterization techniques  
CO4 Familiarize with Metal cleaning and preview on surface engineering  
CO5 Explore the concepts of Tribological Aspects of Surfaces and surface coatings

UNIT-I  
Periods: 9  
Introduction to Nano Technology: Elements of Nano science and Nano technology, fundamentals and overview of Nano science, Nano revolution of the 20th century, Properties at Nano scale (optical, electronic and magnetic). Theory, definitions and scaling  

UNIT-II  
Periods: 9  
Synthesis of Nano materials, Synthesis of bulk Nano – structured materials, sol gel processing, Mechanical alloying and mechanical milling and Inert gas condensation technique. Nano lithography, chemical synthesis, CVD, wet deposition techniques, self-assembly (Supra molecular approach), Molecular design and modelling.

UNIT-III  
Periods: 9  

UNIT-IV  
Periods: 9  
Metal cleaning and preview on surface engineering: Need And Relevance Of Surface Engineering, Pre-Treatment Of Coating, General Cleaning Process For Ferrous And Non-Ferrous Metals And Alloys, Selection Of Cleaning Process – Alkaline Cleaning – Emulsion Cleaning- Ultrasonic Cleaning – Acid And Pickling Salt Bath Descaling – Abrasive Bath Cleaning– Polishing And Short Peening – Classification Of Surface Engineering Processes.

UNIT-V  
Periods: 9  

Lecture Periods: 45  
Tutorial Periods:  
Practical Periods:  
Total Periods: 45

Reference Books:  
**Department:** Mechanical Engineering  
**Programme:** B.Tech. (ME)  
**Semester:** Seventh  
**Course Category Code:** PEC  
**Semester Exam Type:** TY

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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>MEY12</td>
<td>Design of Transmission Systems</td>
<td>3 L 0 T 0 P 3 C</td>
<td>40 CA 60 SE 100 TM</td>
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**Prerequisite:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Outcome</th>
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</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Students will be able to understand the design principles of various transmission systems.</td>
</tr>
<tr>
<td>CO2</td>
<td>Students are made to get knowledge in bearing and bearing materials.</td>
</tr>
<tr>
<td>CO3</td>
<td>Students will be able to come up with ideas to design of belt drives and types based on Buckingham equation.</td>
</tr>
<tr>
<td>CO4</td>
<td>Students will be able to select bearings for a given application from the manufacturers catalogue.</td>
</tr>
<tr>
<td>CO5</td>
<td>Students will be able to solve design problems on gear drives and wear criteria.</td>
</tr>
</tbody>
</table>

**UNIT-I**  
Periods: 9  

**UNIT-II**  
Periods: 9  

**UNIT-III**  
Periods: 9  
Advantage of gear drives over other drives, nomenclature, failures of gear tooth, design of spur gears & helical gears - based on bending and wears criteria – based on Lewis and Buckingham equation.  

**UNIT-IV**  
Periods: 9  
Bevel gears - nomenclature, design of gears – based on bending and wear criteria – based on Lewis and Buckingham equation, worm and worm wheel – nomenclature – design procedure.  

**UNIT-V**  
Periods: 9  
Geometric progression – standard step ratio – ray diagram, kinematics layout – design of sliding mesh gear box – constant mesh gear box – design of multi speed gear box.  

**Reference Books:**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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</thead>
<tbody>
<tr>
<td>MEY13</td>
<td>Power Plant Engineering</td>
<td>3 L 0 T 0 P 3 C</td>
<td>40 CA 60 SE 100 TM</td>
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</table>

**Prerequisite:**
- CO1: Able to understand essential components of steam power plant
- CO2: Able to understand components of gas turbine power plants
- CO3: Able to the design and working of Hydroelectric power plants
- CO4: Able to the design and working of nuclear power plants
- CO5: Able to understand load estimation and the economics of power plants

**UNIT-I**

**UNIT-II**
Gas turbine plant-site selection-classification – layout-classification of gas turbines-fuels-constant pressure and constant volume combustion turbines-effect of operating variables on thermal efficiency-combined gas turbine and steam plant cycles

**UNIT-III**
Hydro Electric Power Plant: Application-advantages and disadvantages-Site selection - Essential elements like catchment area, reservoir, dam, spill way etc., Classification of Hydro Electric Power Plant (Low, medium and high head). Hydrology-hydrologic cycle, measurement of run-off-hydrographs- flow duration curve-mass curve.

**UNIT-IV**
Nuclear Power Plant: General aspects of nuclear engineering- nuclear reactors-classification- PWR, BWR-

**UNIT-V**
Power Plant Economics and Tariffs: Load curve, load duration curve, different factors related to plants and consumers, Cost of electrical energy, depreciation, generation cost, effect of load factor on unit cost. Fixed and operating cost of different plants, role of load diversity in power system economy. Objectives and forms of Tariff: Causes and effects of low power factor, advantages of power factor improvement, different methods for power factor improvements.

Lecture Periods: 45  Tutorial Periods: Nil  Practical Periods: Nil  Total Periods: 45

**Reference Books:**
Department: Mechanical Engineering  
Programme: B.Tech.(ME)

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>MEY14</td>
<td>Total Quality Management</td>
<td>3</td>
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<td>60</td>
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Prerequisite:  
- CO1: At the end of the course the student is able to understand basics about TQM concepts
- CO2: Understanding the necessity of TQM in an organization and its problems
- CO3: To get knowledge about TQM approach
- CO4: Explain the various QC tools
- CO5: Able to solve problems on quality system

UNIT-I  
Periods: 9  
Introduction to TQM, Concept of quality, Need for quality, Evolution of quality, Dimensions of manufacturing and service quality, Basic concepts of TQM, Definition of TQM, TQM Framework, Barriers to TQM, quality control and quality management

UNIT-II  
Periods: 9  
TQM Principles, Leadership, Strategic quality planning, Quality statements, Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal, Continuous process improvement, PDSA cycle, 5s, Kaizen - Supplier partnership, Partnering, Supplier selection, Supplier Rating

UNIT-III  
Periods: 9  

UNIT-IV  
Periods: 9  
The seven traditional tools of quality, New management tools, Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT, Bench marking, Reason to benchmark, Benchmarking process, FMEA – Stages, Types, Quality circles, Quality Function Deployment (QFD), Taguchi quality loss

UNIT-V  
Periods: 9  
Statistical process control and quality deployment techniques, controlling quality through measurement and through counting, Quality system and I.S.O. 9000 series, Quality assurance. Reports on quality, quality audit, quality training, newer quality management approaches, Quality tools.

Lecture Periods: 45  
Tutorial Periods: Nil  
Practical Periods: Nil  
Total Periods: 45

Reference Books:
3. Total Quality Management (TQM), R. Ashley Rawlins, Autherhouse, 2008
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>MEY15</td>
<td>Finite Element Method</td>
<td>L 0 T 0 P 3 C</td>
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<td>40 60 100</td>
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</table>

Prerequisite:

- **CO1**: Students will be able to understand the fundamentals of finite element method.
- **CO2**: Students will be able to apply finite element method for bar and truss applications.
- **CO3**: Students will be able to apply finite element method for plane stress, plane strain and axisymmetric conditions.
- **CO4**: Students will be able to determine temperature distribution in one and two dimensional engineering applications.
- **CO5**: Students will get idea about how to implement finite element method using isoparametric elements and introduction to ANSYS software.


UNIT-II: One-Dimensional Elements: Coordinate system types-global, local and natural, shape function of 1D bar element - finite element formulation - stiffness matrix, load vector, boundary condition and assembly of global equation - 1D bar element and two node truss element - problems in 2D truss. Introduction to beam element.


Lecture Periods: 45  Tutorial Periods: Nil  Practical Periods: Nil  Total Periods: 45

Reference Books:

Open Elective Courses
### Course Information

**Department:** Mechanical Engineering  
**Programme:** B.Tech.  
**Semester:** Third to Eighth  
**Course Category Code:** OEC  
**Semester Exam Type:** TY

<table>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>MEO01</td>
<td>Renewable Energy</td>
<td>L 0 T 0 P 3</td>
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**Prerequisite:**

<table>
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<th>Course Outcome</th>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>CO1</td>
<td>MEO01</td>
<td>Renewable Energy</td>
</tr>
<tr>
<td>To understand the basic concept of solar radiation and different types of active and passive solar system and photovoltaic principle</td>
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<tbody>
<tr>
<td>CO2</td>
<td>MEO01</td>
<td>Renewable Energy</td>
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<tr>
<td>To identify the site selection and wind data estimation and also study safety, environmental aspects of wind power generation</td>
<td></td>
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<th>Course Outcome</th>
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<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO3</td>
<td>MEO01</td>
<td>Renewable Energy</td>
</tr>
<tr>
<td>Understand the concepts and energy conversion principle of geothermal power plants.</td>
<td></td>
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<table>
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<tr>
<th>Course Outcome</th>
<th>Course Code</th>
<th>Course Name</th>
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</thead>
<tbody>
<tr>
<td>CO4</td>
<td>MEO01</td>
<td>Renewable Energy</td>
</tr>
<tr>
<td>Understand the concepts and energy conversion principle of ocean and hydrogen energy systems</td>
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<tbody>
<tr>
<td>CO5</td>
<td>MEO01</td>
<td>Renewable Energy</td>
</tr>
<tr>
<td>To understand the biogas, ethanol and bio diesel production.</td>
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</table>

### Course Details

**UNIT-I**


**UNIT-II**


**UNIT-III**


**UNIT-IV**


**UNIT-V**


**Lecture Periods:** 45  
**Tutorial Periods:** Nil  
**Practical Periods:** Nil  
**Total Periods:** 45

### Reference Books

<table>
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<tr>
<th>Course Code</th>
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<th>Periods / Week</th>
<th>Credit</th>
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<td>T</td>
<td>P</td>
<td>C</td>
<td>CA</td>
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<tr>
<td>MEO02</td>
<td>Solar Power Engineering</td>
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</table>

Prerequisite:

- CO1: Able to analyse the techniques and methods involved in solar energy harvesting systems.
- CO2: Able to design and develop a prototype model of solar power system.
- CO3: Able to synthesise a new option for a solar power system.
- CO4: Able to evaluate the performance characteristics of a solar direct power system.
- CO5: Able to analyse the suitability of application of solar system over conventional system.

### UNIT-I

Periods: 9


- CO1

### UNIT-II

Periods: 9


- CO2

### UNIT-III

Periods: 9


- CO3

### UNIT-IV

Periods: 9


- CO4

### UNIT-V

Periods: 9

Solar power systems – electrical power generation – solar thermal power plants – low, medium and high temperature power generation systems: using flat plate collectors or solar ponds, concentrating collectors, central receiver and solar chimneys – solar energy process economics.

- CO5

Lecture Periods: 45  Tutorial Periods: Nil  Practical Periods: Nil  Total Periods: 45

### Reference Books:

7. G.D. Rai Non-Conventional Energy Sources Published 2011 by Khanna Publishers
8. Dr. R.K. Singal, Non-conventional energy resources. S.K. Katara publication limited.
Department: Mechanical Engineering         Programme: B.Tech.
Semester: Third to Seventh       Course Category Code: OEC               Semester Exam Type: TY

<table>
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<th>Course Code</th>
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<tr>
<td>MEO03</td>
<td>Fluid and Thermal Machines</td>
<td>3</td>
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Prerequisite:

- CO1: At the end of the course the student is able to gain knowledge about fluid mechanics problem.
- CO2: Understanding the necessity of hydraulic machines and its problems.
- CO3: To get knowledge about turbines and pumps.
- CO4: Explanation on various pumps and its efficiency.
- CO5: Performance and characteristics of Steam turbine power plant.

UNIT-I

Periods: 9
Fluid mechanics-Introduction; Reynolds Transport Theorem; Integral form of continuity, momentum and energy equations; Eulerian and Lagrangian view-points; Constitutive relations; Navier Stokes equations

UNIT-II

Periods: 9
Exact solutions; Potential flow; Boundary layer theory; Separation and drag; Turbulent flow: Reynolds averaged equations; Turbulent flows in pipes and channels; compressible flows

UNIT-III

Periods: 9

UNIT-IV

Periods: 9
Similitude - Types of similarities, Dimensionless number and their significance, Unit and Specific Quantities, Model Testing: - Application to hydraulic turbine and hydrodynamic pumps, Miscellaneous Water Lifting Device: - Air lift pumps, Hydraulic Ram, Submersible pump, Regenerative pumps

UNIT-V

Periods: 9

Lecture Periods: 45 Tutorial Periods: Practical Periods: Total Periods: 45

Reference Books:

5. Fluid Mechanics, John F. Douglas, Pearson
### Course Details

<table>
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<tr>
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<th>Credit</th>
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<tbody>
<tr>
<td>MEO04</td>
<td>Marketing Management</td>
<td>3</td>
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</table>

**Prerequisite:**

- CO1: At the end of the course the student will be able to explain the different strategies that are used for different markets.
- CO2: Identify the components of the marketing environment and how they impact marketing.
- CO3: Understand the theories and practices behind the marketing mix variables.
- CO4: Demonstrate an understanding of the entire marketing process.
- CO5: Distinguish between the specific nature of different markets, goods and services.

### Course Outcomes

- **CO1**: At the end of the course the student will be able to explain the different strategies that are used for different markets.
- **CO2**: Identify the components of the marketing environment and how they impact marketing.
- **CO3**: Understand the theories and practices behind the marketing mix variables.
- **CO4**: Demonstrate an understanding of the entire marketing process.
- **CO5**: Distinguish between the specific nature of different markets, goods and services.

### Course Content

#### UNIT-I
**Periods:** 9

**Marketing Process:** Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

**Course Outcome:**

- **CO1**: At the end of the course the student will be able to explain the different strategies that are used for different markets.

#### UNIT-II
**Periods:** 9

**Buying Behaviour and Market Segmentation:** Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

**Course Outcome:**

- **CO2**: Identify the components of the marketing environment and how they impact marketing.

#### UNIT-III
**Periods:** 9

**Product Pricing and Marketing Research:** Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

**Course Outcome:**

- **CO3**: Understand the theories and practices behind the marketing mix variables.

#### UNIT-IV
**Periods:** 9

**Marketing Planning and Strategy Formulation:** Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

**Course Outcome:**

- **CO4**: Demonstrate an understanding of the entire marketing process.

#### UNIT-V
**Periods:** 9

**Advertising, Sales Promotion and Distribution:** Advertising: Characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing, Modern Trends, e-Marketing.

**Course Outcome:**

- **CO5**: Distinguish between the specific nature of different markets, goods and services.

### Lecture Periods

- **Lecture Periods:** 45
- **Tutorial Periods:**
- **Practical Periods:**
- **Total Periods:** 45

### Reference Books

Department: Mechanical Engineering  
Programme: B.Tech.  
Semester: Third to Seventh  
Course Category Code: OEC  
Semester Exam Type: TY

<table>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>MEO05</td>
<td>Elements of Project Management</td>
<td>3 0 0 3</td>
<td>40 60 100</td>
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</table>

Prerequisite:

Course Outcome

- **CO1**: At the end of the course the student will be able to identify key components of a project.
- **CO2**: Describe the stages of a project and how each stage can be effectively managed.
- **CO3**: Outline some of the tools and techniques that can be helpful when planning a project.
- **CO4**: Explain the concept of risk management, as relevant to projects, and describe some techniques for identifying and managing risks.
- **CO5**: Explain the importance of evaluating the effectiveness of a project and describe ways of doing this.

**UNIT-I**  
Periods: 9  
Indian project management scenario, Projects - Project ideas and preliminary screening. Developments - Project planning to Project completion - Pre-investment phase, Investment phase, operational phase - Governmental Regulatory framework. Capital Budgeting: Capital cost-time-value (CTV) system, managing project resources flow.

**UNIT-II**  
Periods: 9  
Stages - Opportunity studies - General opportunity studies, specific opportunity studies, pre-feasibility studies, functional studies or support studies, feasibility study expansion projects, data for feasibility study. Market and Technical Appraisal: Market and Demand analysis, Market Survey, Demand forecasting. Technical analysis - Materials and inputs, Choice of Technology, Product mix, Plant location, capacity, Machinery and equipment.

**UNIT-III**  
Periods: 9  

**UNIT-IV**  
Periods: 9  

**UNIT-V**  
Periods: 9  
Forms of Project Organization, Project Planning, Implementation, and Control - Network construction, CPM, PERT, Development of Project schedule, Crashing of Project Network, Scheduling based on the availability of Resources (Manpower and Release of Funds). Introduction to Foreign collaboration projects - Governmental policy framework, Need for foreign technology, Royalty payments, Foreign investments and procedural aspects.

Lecture Periods: 45  
Tutorial Periods:  
Practical Periods:  
Total Periods: 45

Reference Books:

5. UNIDO Series on Project Management
Department: Mechanical Engineering  
Programme: B.Tech.

Semester: Third to Seventh  
Course Category Code: OEC  
Semester Exam Type: TY

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Periods / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>MEO06</td>
<td>Introduction to Nano Science and Nano Technology</td>
<td>3 0 0 3</td>
<td>40 60 100</td>
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Prerequisite:

Course Outcome

- **CO1**: Get a broad view about nanoscience concepts and basics
- **CO2**: Expose to Supramolecular nanostructures and biological materials
- **CO3**: Know Nanostructures and its applications
- **CO4**: Familiarize with Emerging technologies for environmental remediation
- **CO5**: Explore the concepts of Semiconductor nanoparticles – applications

UNIT-I

Evolution of Nano science: Introduction, length scale of different structures, definition of Nano science and nanotechnology - Electronic structure of various nanostructures - Discovery of fullerenes and the evolution of Nano science, Size dependent properties, size dependent absorption - Phonons in nanostructures.

UNIT-II

Supramolecular nanostructures and biological materials: Supramolecular structures, transition metal mediated type, dendritic molecules, and supramolecular dendrimers. Solid disordered nanostructures: Metal Nano cluster composite glasses. biological nanostructures, polypeptide nanowire and protein nanoparticles, nucleic acids, and protein synthesis, examples of biological nanostructures.

UNIT-III

Nanostructures and its applications: Classifications of nanomaterials - Zero dimensional, one-dimensional and two dimensional nanostructures- Kinetics in nanostructured materials- multilayer thin films and super lattice- clusters of metals, semiconductors and nanocomposites.

Application of Nano materials in Electronics, Medicine, Military, Defense, textiles etc.

UNIT-IV

Emerging technologies for environmental remediation: Use of nanoparticles for environmental remediation and water treatment- Role of Dendrimer- single enzyme-nanoparticle and metalloprotein. Case studies and Regulatory Needs.

UNIT-V

Semiconductor nanoparticles – applications: Optical luminescence and fluorescence from direct band gap semiconductor nanoparticles, surface-trap passivation in core-shell nanoparticles, carrier injection, polymer-nanoparticle, LED and solar cells, electroluminescence, light emission from indirect semiconductors, light emission form Si Nano dots.

Lecture Periods: 45  
Tutorial Periods: -  
Practical Periods: -  
Total Periods: 45

Reference Books:

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<td>MEO07</td>
<td>Industrial Automation</td>
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Prerequisite:

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<th>Course Outcome</th>
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<tr>
<td>CO1</td>
<td>Students understand the various automation processes</td>
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<tr>
<td>CO2</td>
<td>Students understand the various automation techniques in manufacturing processes</td>
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<tr>
<td>CO3</td>
<td>Students understand the various automations in machining processes</td>
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<tr>
<td>CO4</td>
<td>Students understand the various automations in robotics</td>
</tr>
<tr>
<td>CO5</td>
<td>Students understand the various planning and implementation processes</td>
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UNIT-I


UNIT-II


UNIT-III

Turning and Machining Centres – Description and types of ATC, Applications. NC Part Programming – Types – Introduction to programming languages, APT Programming, Examples on CNC Turning, Milling & Drilling operations. Preliminary study on simulation of CAD based NC programming.

UNIT-IV

Robot anatomy and Configuration, Work Volume, End effectors – Types of grippers, tool as end effectors.

Robot Sensors – External and Internal, Types - Position sensors, Velocity sensors, Tactile, Proximity and range sensors, Machine vision – Applications.

Automated Material Handling and Storage Systems – Types, Design and Interfacing Preliminaries

UNIT-V


Lecture Periods: 45  Tutorial Periods: Nil  Practical Periods: Nil  Total Periods: 45

Reference Books:

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<thead>
<tr>
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<th>Maximum Marks</th>
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<td>MEO08</td>
<td>Quantitative Techniques for Engineers</td>
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**Prerequisite:**

- CO1: At the end of the course the student is able to understand Quantitative Techniques
- CO2: Understanding the concepts of operation research
- CO3: To get knowledge about various operation techniques
- CO4: Explain about Queuing Theory
- CO5: Understanding of financial management

**UNIT-I**

<table>
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**UNIT-II**

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<tbody>
<tr>
<td>Linear Programming – Graphical and Simplex Methods, Duality and Post – Optimality Analysis – Transportation and Assignment Problems</td>
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**UNIT-III**

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<tbody>
<tr>
<td>Inventory Control - EOQ - Quantity Discounts - Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control</td>
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**UNIT-IV**

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<tr>
<td>Mathematical Analysis of Queuing Theory: Introduction, Mathematical Analysis of Queuing Process, Properties of Queuing System, Notations, Service System, Single Channel Models, Multiple Service Channels, Erlang Family of Distribution of Service Times, Applications of Queuing Theory, Limitations of Queuing Theory</td>
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**UNIT-V**

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<th>Periods: 9</th>
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**Lecture Periods:** 45  | **Tutorial Periods:** Nil  | **Practical Periods:** Nil  | **Total Periods:** 45

**Reference Books:**

Department: Mechanical Engineering  
Programme: B.Tech.  
Semester: Third to Seventh  
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Prerequisite:

**Course Outcome**

CO1 At the end of the course the student is able to understand the fundamentals of finite element method.

CO2 Apply finite element method for bar and truss applications.

CO3 Apply finite element method Heat Transfer Problems.

CO4 Apply finite element method Solid Mechanics Problems.

CO5 Implement finite element method using ANSYS software.

**UNIT-I**  
**Periods: 9**

INTRODUCTION- Historical Background – Basic Concepts – comparison of FEM and Exact Solutions – General Procedure – Examples- Finite Element formulation from Governing differential equations

**UNIT-II**  
**Periods: 9**


**UNIT-III**  
**Periods: 9**


**UNIT-IV**  
**Periods: 9**


**UNIT-V**  
**Periods: 9**


**Reference Books:**

5. Robert D. Cook, s. David, Malkus Michael E. Plesha, Concepts and Applications of Finite