B. Tech. Mechanical Engineering

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
MADANAPALLE
(UGC-AUTONOMOUS)
www.mits.ac.in

DEPARTMENT OF MECHANICAL ENGINEERING
Course structure

For the students admitted to

B. Tech. Regular Four Year Degree Programme from the academic year 2020-21

and

B. Tech. Lateral Entry Scheme from the academic year 2021-22

B.TECH. MECHANICAL ENGINEERING
I. Induction Program and Holistic Development Activities

<table>
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<tr>
<th>Sl. No.</th>
<th>Title</th>
<th>Duration</th>
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<tbody>
<tr>
<td>1</td>
<td>Induction Program (Mandatory)</td>
<td>Three weeks’ duration at the start of First Year (Refer Annexure - I)</td>
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<tr>
<td>2</td>
<td>Holistic Development Activities (Every Student from Semester 2 – 8 should register for at least one activity)</td>
<td>Three hours per week (Activity list is enclosed in Annexure - I)</td>
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<td>3</td>
<td>Virtual Laboratory (Students are encouraged to choose and register for any of the Virtual laboratories he/she is interested)</td>
<td>As specified by the Virtual Laboratory</td>
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B. Tech. Mechanical Engineering

R20 - Curriculum Structure

I Year I Semester

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<tr>
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<th>Course Title</th>
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<tr>
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<td>20PHY101</td>
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<td>3</td>
<td>ESC</td>
<td>20EEE101</td>
<td>Basic Electrical Engineering</td>
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<td>4</td>
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<td>20CSE101</td>
<td>Programming for Problem Solving (Python)</td>
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I Year II Semester

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(L = Lecture, T = Tutorial, P = Practical, C = Credit)
**II Year I Semester**

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**II Year II Semester**

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(L = Lecture, T = Tutorial, P = Practical)
### Tentative Curriculum Structure from IIIrd Year Onwards

#### III Year I Semester

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* 2 Months internship during 2nd year summer vacation and to be evaluated in III Year I Semester

#### III Year II Semester

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(L = Lecture, T = Tutorial, P = Practical)
## IV Year I Semester

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* 2 Months’ internship during 3rd year summer vacation and to be evaluated in IV Year I Semester

## IV Year II Semester

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<td>Project Work, Seminar and Internship in Industry (6 months)</td>
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**Total** | 0 0 24 24 | 12 |

(L = Lecture, T = Tutorial, P = Practical)
THREE WEEK MANDATORY INDUCTION PROGRAMME

➢ Yoga and Meditation
➢ Sports and Games
➢ NSS
➢ NCC
➢ MITS Social Responsibility
➢ ClubManagement module
➢ Design Thinking
➢ Spoken and Written Communication

➢ Proficiency modules
  • Basic Computer Proficiency
  • Interpersonal Skills
  • Computer Graphics
  • Web Programming
  • Mobile Apps
  • Vocabulary Enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self-Development
7. Innovation
### OPEN ELECTIVE – I

(To be offered under MOOC’s Category from SWAYAM – NPTEL)

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<td>Soft Skills</td>
<td>English &amp; Training</td>
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<td>20ENG3M02</td>
<td>Developing Soft Skills and Personality</td>
<td>English &amp; Training</td>
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<td>20ENG3M03</td>
<td>Soft Skill Development</td>
<td>English &amp; Training</td>
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<td>20CE3M01</td>
<td>Integrated Waste Management for Smart City</td>
<td>Civil</td>
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<td>5</td>
<td>20CE3M02</td>
<td>Soil and Water Conservation Engineering</td>
<td>Civil</td>
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<td>20CE3M03</td>
<td>Engineering Geology</td>
<td>Civil</td>
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<td>7</td>
<td>20EEE3M01</td>
<td>Non-Conventional Energy Sources</td>
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<td>8</td>
<td>20EEE3M02</td>
<td>Design of Photovoltaic Systems</td>
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<td>Semiconductor Opto-Electronics</td>
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<td>Digital VLSI Testing</td>
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<td>Privacy and Security in Online Social Media</td>
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Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.
## OPEN ELECTIVE – II

(To be offered under Conventional Mode)

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<td>20PHY301</td>
<td>Optical Physics and its Applications</td>
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<td>LASER Physics and Advanced LASER Technology</td>
<td>Physics</td>
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<tr>
<td>5</td>
<td>20CHE301</td>
<td>Introduction to Petroleum Industry</td>
<td>Chemistry</td>
</tr>
<tr>
<td>6</td>
<td>20CHE302</td>
<td>Green Chemistry and Catalysis for Sustainable Environment</td>
<td>Chemistry</td>
</tr>
<tr>
<td>7</td>
<td>20CE301</td>
<td>Ground Improvement Techniques</td>
<td>Civil</td>
</tr>
<tr>
<td>8</td>
<td>20CE302</td>
<td>Environmental Impact Assessment</td>
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</tr>
<tr>
<td>9</td>
<td>20CE303</td>
<td>Watershed Management</td>
<td>Civil</td>
</tr>
<tr>
<td>10</td>
<td>20EEE301</td>
<td>Industrial Electrical Systems</td>
<td>EEE</td>
</tr>
<tr>
<td>11</td>
<td>20EEE302</td>
<td>Introduction to MEMS</td>
<td>EEE</td>
</tr>
<tr>
<td>12</td>
<td>20ECE301</td>
<td>Bio-Medical Electronics</td>
<td>ECE</td>
</tr>
<tr>
<td>13</td>
<td>20ECE302</td>
<td>VLSI Design</td>
<td>ECE</td>
</tr>
<tr>
<td>14</td>
<td>20CSE301</td>
<td>Database Management Systems</td>
<td>CSE</td>
</tr>
<tr>
<td>15</td>
<td>20CSE302</td>
<td>JAVA Programming</td>
<td>CSE</td>
</tr>
</tbody>
</table>
## OPEN ELECTIVE – III
(To be offered under MOOC’s Category from SWAYAM – NPTEL)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Course Offered by Department of</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20CE3M04</td>
<td>Remote Sensing and GIS</td>
<td>Civil</td>
</tr>
<tr>
<td>2</td>
<td>20CE3M05</td>
<td>Wastewater Treatment and Recycling</td>
<td>Civil</td>
</tr>
<tr>
<td>3</td>
<td>20EEE3M03</td>
<td>Introduction to Smart Grid</td>
<td>EEE</td>
</tr>
<tr>
<td>4</td>
<td>20ECE3M03</td>
<td>Introduction to Embedded Systems</td>
<td>ECE</td>
</tr>
<tr>
<td>5</td>
<td>20ECE3M04</td>
<td>Embedded System Design with ARM</td>
<td>ECE</td>
</tr>
<tr>
<td>6</td>
<td>20CSE3M04</td>
<td>Software Testing</td>
<td>CSE</td>
</tr>
<tr>
<td>7</td>
<td>20CSE3M05</td>
<td>Advanced Computer Architecture</td>
<td>CSE</td>
</tr>
<tr>
<td>8</td>
<td>20CSE3M06</td>
<td>Multi-Core Computer Architecture – Storage and Interconnects</td>
<td>CSE</td>
</tr>
<tr>
<td>9</td>
<td>20IE3M01</td>
<td>Introduction to Research</td>
<td>General</td>
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</tbody>
</table>

Any new Interdisciplinary Course offered by SMAYAM NPTEL can be appended in future.
## OPEN ELECTIVE – IV
(To be offered under Conventional Mode)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Course Offered by Department of</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20MAT303</td>
<td>Graph Theory</td>
<td>Mathematics</td>
</tr>
<tr>
<td>2</td>
<td>20MAT304</td>
<td>Mathematical Modelling and Numerical Simulation</td>
<td>Mathematics</td>
</tr>
<tr>
<td>3</td>
<td>20PHY303</td>
<td>Thin Film Technology and its Applications</td>
<td>Physics</td>
</tr>
<tr>
<td>4</td>
<td>20CHE303</td>
<td>Introduction to Nano Science and Technology</td>
<td>Chemistry</td>
</tr>
<tr>
<td>5</td>
<td>20CHE304</td>
<td>Computational Methods in Materials Science and Engineering</td>
<td>Chemistry</td>
</tr>
<tr>
<td>6</td>
<td>20CE304</td>
<td>Green Building and Energy Conservation</td>
<td>Civil</td>
</tr>
<tr>
<td>7</td>
<td>20CE305</td>
<td>Environmental Engineering</td>
<td>Civil</td>
</tr>
<tr>
<td>8</td>
<td>20EEE303</td>
<td>Robotics</td>
<td>EEE</td>
</tr>
<tr>
<td>9</td>
<td>20EEE304</td>
<td>Electrical Safety</td>
<td>EEE</td>
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<tr>
<td>10</td>
<td>20ECE303</td>
<td>Nano Electronics</td>
<td>ECE</td>
</tr>
<tr>
<td>11</td>
<td>20ECE304</td>
<td>Digital Image and Video Processing</td>
<td>ECE</td>
</tr>
<tr>
<td>12</td>
<td>20CSE304</td>
<td>Distributed and Cloud Computing</td>
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<td>13</td>
<td>20CSE305</td>
<td>Software Project Management</td>
<td>CSE</td>
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</table>
B. Tech. Mechanical Engineering

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Course Offered by Department of</th>
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<tbody>
<tr>
<td>1</td>
<td>20HUM301</td>
<td>Principles of Management</td>
<td>Humanities</td>
</tr>
<tr>
<td>2</td>
<td>20HUM302</td>
<td>Professional Ethics</td>
<td>Humanities</td>
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<tr>
<td>3</td>
<td>20HUM303</td>
<td>Intellectual Property Rights</td>
<td>Humanities</td>
</tr>
<tr>
<td>4</td>
<td>20HUM304</td>
<td>Human Resource Development</td>
<td>Humanities</td>
</tr>
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</table>
B. Tech. Mechanical Engineering

ANNEXURE – III

List of Professional Electives

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>20ME401</td>
<td>Production Planning and Control</td>
</tr>
<tr>
<td>2.</td>
<td>20ME402</td>
<td>Computational Fluid Dynamics</td>
</tr>
<tr>
<td>3.</td>
<td>20ME403</td>
<td>Tool and Die Design</td>
</tr>
<tr>
<td>4.</td>
<td>20ME404</td>
<td>Fluid Power Systems</td>
</tr>
<tr>
<td>5.</td>
<td>20ME405</td>
<td>Finite Element Methods</td>
</tr>
<tr>
<td>6.</td>
<td>20ME406</td>
<td>Fundamentals of Automobile Engineering</td>
</tr>
</tbody>
</table>

Any advanced courses can be appended in future.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>20ME4M01</td>
<td>Experimental Stress Analysis</td>
</tr>
<tr>
<td>2.</td>
<td>20ME4M02</td>
<td>System Design for Sustainability</td>
</tr>
<tr>
<td>3.</td>
<td>20ME4M03</td>
<td>Material Characterization</td>
</tr>
<tr>
<td>4.</td>
<td>20ME4M04</td>
<td>Design and Analysis of Experiments</td>
</tr>
<tr>
<td>5.</td>
<td>20ME4M05</td>
<td>Industrial Safety Engineering</td>
</tr>
<tr>
<td>6.</td>
<td>20ME4M06</td>
<td>Non-Conventional Energy Resources</td>
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Any other new Disciplinary Course which doesn’t exist in the Curriculum can be appended in future.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>20ME407</td>
<td>Design and Analysis of Welded Structures</td>
</tr>
<tr>
<td>2.</td>
<td>20ME408</td>
<td>Refrigeration and Air Conditioning</td>
</tr>
<tr>
<td>3.</td>
<td>20ME409</td>
<td>Internet of Manufacturing Things</td>
</tr>
<tr>
<td>4.</td>
<td>20ME410</td>
<td>Solar Energy for Process Heat and Power Generation</td>
</tr>
<tr>
<td>5.</td>
<td>20ME411</td>
<td>Industrial Corrosion and Tribology</td>
</tr>
</tbody>
</table>

Any advanced courses can be appended in future.
B. Tech. Mechanical Engineering

### Professional Elective – IV

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>20ME412</td>
<td>Industrial and Automobile Battery Technologies</td>
</tr>
<tr>
<td>2.</td>
<td>20ME413</td>
<td>Design of Pressure Vessels and Piping Systems</td>
</tr>
<tr>
<td>3.</td>
<td>20ME414</td>
<td>Design of Heat Exchangers</td>
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<tr>
<td>4.</td>
<td>20ME415</td>
<td>Non Destructive Testing</td>
</tr>
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<td>5.</td>
<td>20ME416</td>
<td>Total Quality Management</td>
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Any advanced courses can be appended in future.

### Professional Elective – V

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>20ME417</td>
<td>Mechanical Vibrations</td>
</tr>
<tr>
<td>2.</td>
<td>20ME418</td>
<td>Design of Gas Turbine Engines</td>
</tr>
<tr>
<td>3.</td>
<td>20ME419</td>
<td>Manufacturing of Composite Materials</td>
</tr>
<tr>
<td>4.</td>
<td>20ME420</td>
<td>Design of Power Plant Systems</td>
</tr>
<tr>
<td>5.</td>
<td>20ME421</td>
<td>Operations Research</td>
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Any advanced courses can be appended in future.
### Skill Oriented Course– I

<table>
<thead>
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<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>20ME601</td>
<td>Design Thinking and Product Innovation Laboratory</td>
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### Skill Oriented Course– II

<table>
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<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>20ENG601</td>
<td>Corporate Communication Laboratory</td>
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Any advanced courses can be appended in future.

### Skill Oriented Course– III

<table>
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<tbody>
<tr>
<td>1</td>
<td>20ME602</td>
<td>Computer Modeling for Mechanical Engineering-I Laboratory</td>
</tr>
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Any advanced courses can be appended in future.

### Skill Oriented Course– IV

<table>
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<tr>
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<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>20ME603</td>
<td>Computer Modeling for Mechanical Engineering-II Laboratory</td>
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Any advanced courses can be appended in future.

### Skill Oriented Course– V

<table>
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<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>20ME604</td>
<td>Mechatronics Laboratory</td>
</tr>
</tbody>
</table>

Any advanced courses can be appended in future.
B. Tech. Mechanical Engineering

B. Tech I Year I Semester

20MAT101 ENGINEERING CALCULUS

Pre-requisite: Mathematics at Intermediate or Equivalent Level

Course Description:
Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives: This course enables the student to –
1. To introduce the basic concepts of definite integrals, improper integrals, Beta and Gamma functions.
2. To acquire knowledge on mean value theorems in calculus.
3. To illustrate various techniques of testing the convergence of infinite series and introduces the functions of sine and cosine series.
4. To familiarize the knowledge of limit, continuity and the derivatives, extreme values in Multivariable.
5. To emphasize the role of Double and Triple integrals in dealing with area and volume of the regions.

UNIT I INTEGRAL CALCULUS
Definite integrals; Applications of definite integrals to evaluate area and length of curves, surface areas and volumes of revolutions; Beta and Gamma functions and their properties.

UNIT II DIFFERENTIAL CALCULUS
Rolle’s Theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders (without proofs); indeterminate forms, Maxima and minima.

UNIT III SEQUENCE AND SERIES
Sequence and Series, their Convergence and tests for convergence; Power series, Taylor’s series, Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval’s theorem.

UNIT IV MULTIVARIABLE DIFFERENTIAL CALCULUS
Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

UNIT V MULTIVARIABLE INTEGRAL CALCULUS
Multiple Integration: double integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes (double integration), triple integrals, gradient, curl and divergence, Green’s, Stokes and Gauss divergence theorems (without proofs).
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Course Outcomes:
At the end of the course, students will be able to:
1. Evaluate the definite integrals, Beta and Gamma functions and calculate length of curve and underlying area.
2. Relate the results of mean value theorems in calculus to Engineering problems.
3. Use the Power series and Fourier series for ascertaining the stability and convergence of various techniques.
4. Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.
5. Compute the area and volume by interlinking them to appropriate double and triple integrals.

Text Books:

Reference Books:

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination
B. Tech. Mechanical Engineering

B. Tech I Year I Semester

20PHY101 ENGINEERING PHYSICS

Pre-requisite

Plus two level physics course

Course Description:
Engineering Physics for Civil and Mechanical Engineers is a physics course which provides fundamental knowledge to understand the concepts of mechanics, waves and oscillations, interference, diffraction, polarization, lasers and fiber optics.

Course Objectives:
1. Expose students to the fundamental principles and laws of mechanics in Physics to understand the types of motion.
2. Demonstrate the ability to identify and apply the appropriate analytic, numerical, and mathematical reasoning, to situations of the physical world.
3. Analyze the concepts of mechanics, oscillations, waves and optics to prepare the students for advanced level courses.
4. Expose students to theoretical and mathematical aspects of interference and diffraction of light for testing of materials.
5. Adaptability to new developments in science and technology.

UNIT I MECHANICS OF PARTICLES 11 hours
Vectors, Algebra of vectors Velocity and Acceleration, Motion in one dimension, several dimensions, formal solution of kinematical equations. Polar Co-ordinates, velocity and acceleration in polar coordinates. Newton’s Laws, applications of Newton’s laws (Constraint equations, Block on string, Conical Pendulum, Block and Wedge).

UNIT II MOMENTUM & WORK ENERGY 12 hours
Momentum, law of conservation of linear momentum, flow of mass, Rocket Equation, Rocket in free space and in a gravitational field. Integrating equation of motion in one-dimension-work energy theorm, orbital velocity and escape velocity, Potential energy, Potential energy of a uniform force field, potential energy of an inverse square force, stability, conservation laws and particle collisions.

UNIT III WAVES AND OSCILLATIONS 12 hours
Simple Harmonic Motion, damped harmonic oscillations, forced harmonic oscillations, resonance, and quality factor. Superposition of vibrations along same direction (equal frequency) and in perpendicular directions, Lissajous figures. Transverse waves, solution of wave equation, velocity of a transverse wave along a stretched string, modes of vibration of stretched string, reflection and transmission waves at boundary, standing waves, standing wave ratio.

UNIT IV OPTICS 13 hours
Superposition of waves, interference of light by division of wavefront - Young’s double slit experiment, interference of light by division of amplitude- interference in thin film by reflection, Newton’s rings experiment. Diffraction, Farunhofer diffraction due to single slit, double slit and Diffraction grating (N-slit). Polarization, Types of polarization, Polarization by reflection, refraction and double refraction, Nicol’s prism. Half wave and Quarter wave plates
B. Tech. Mechanical Engineering

UNIT V  LASERS & FIBER OPTICS  12 hours
Fiber Optics: Principle, Construction and working of optical fiber, Acceptance angle, Numerical aperture, Types of fiber, Fiber optic communication system.

Course Outcomes:
Upon successful completion of this course, the students should be able to:
1. Describe and explain the fundamental physical principles and laws of Mechanics in Physics.
2. Explain the concepts conservation of momentum, energy, and predict the future state of a system based on its present state.
3. Apply the physical principles of waves together with logical and mathematical reasoning, to situations of the physical world of vibrations.
4. Define and evaluate the fundamentals of materials testing using Interference, Diffraction & Polarization techniques.
5. Acquire the basic knowledge of lasers and fiber optics.

Text Books:
2. Engineering Physics –Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company

Reference Books:
5. Theory of Vibrations with Applications — WT Thomson.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination
B. Tech. Mechanical Engineering

B. Tech I Year I Semester

20EEE101  BASIC ELECTRICAL ENGINEERING

L T P C
3 1 0 4

Pre-requisite  Intermediate Physics

Course Description:
This course equips the students with a basic understanding of Electrical circuits and machines for specific applications. In specific, the course covers basic of DC circuit & its analysis, introduction to single-phase and three-phase AC Systems, magnetic materials, transformers, DC & AC electrical machines, basic converters and Components of LT Switchgear.

Course Objectives:
1. To learn the basics of the D.C. circuit analysis.
2. To have an idea about single-phase and three-phase A.C. electrical circuits.
3. To gain knowledge about basic magnetic material and transformers.
4. To learn the construction and operation of D.C. and A.C. machines.
5. To understand the operation of basic rectifiers and various components of LT Switchgear.

UNIT I     DC CIRCUIT ANALYSIS  12 hours

UNIT II    AC CIRCUIT ANALYSIS  12 hours
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. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III  MAGNETIC MATERIALS AND TRANSFORMERS  12 hours
Magnetic materials, B-H characteristics, ideal and practical transformer, principle of operation, emf equation, equivalent circuit, losses in transformers, regulation and efficiency.

UNIT IV    DC AND AC MACHINES  12 hours

UNIT V     RECTIFIERS AND ELECTRICAL INSTALLATIONS  12 hours
PN junction diode, half wave, full wave and bridge rectifiers. Components of LT Switchgear: switch fuse unit (SFU), MCB, ELCB, MCCB, types of wires and cables – Current carrying capability, Insulation Strength; Earthing.
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Course Outcomes:
Upon successful completion of the course, students will be able to
1. To understand and analyze basic DC electric circuits.
2. To measure and analyze various electrical quantities of single phase and three AC electric circuits.
3. To understand magnetic materials and to analyze the transformers.
4. To study the working principles of electrical machines.
5. To create power converters for domestic applications with LT switchgear.

Text Books:

Reference Books:

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination
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B. Tech I Year I Semester

20CSE101  PROGRAMMING FOR PROBLEM SOLVING (PYTHON)  

Pre-requisite:  None

Course Description:
Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. This course provides knowledge on how to implement programs in python language and to solve computational problems using the various programming constructs including data structures, functions, string handling mechanisms and file handling concepts.

Course Objectives:
This course enables students to
1. Learn Python programming constructs.
2. Implement Python programs with conditional structures and loops.
3. Use functions for structuring Python programs.
4. Handle compound data using Python lists, tuples, and dictionaries.
5. Manipulate data using files handling in Python.
6. Getting exposed to the basics of Object Oriented Programming using Python

UNIT I: INTRODUCTION  
Algorithms, building blocks of algorithms (flow chart), History of Python, features of Python Programming, Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Data Types - Integers, Strings, Boolean.

UNIT II: OPERATORS AND EXPRESSIONS  
Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations. Control Flow - if, if-elif else, for, while, break, continue, pass.
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a) Swapping of two number with and without using temporary variable.
b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three.
c) Develop a program that performs arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard.
   The operator codes are as follows:
   - For code '+', perform addition.
   - For code '-', perform subtraction.
   - For code '*', perform multiplication.
   - For code '/', perform division.
d) Implement the python program to generate the multiplication table.
e) Implement Python program to find sum of natural numbers
f) If the first name of a student is input through the keyboard, write a program to display the vowels and consonants present in his/her name.
g) The marks obtained by a student in 5 different subjects are input through the keyboard. Find the average and print the student grade as per the MITS examination policy as shown below.

<table>
<thead>
<tr>
<th>% OBTAINED GRADE</th>
<th>GRADE</th>
</tr>
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<tbody>
<tr>
<td>90 - 100</td>
<td>O</td>
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<tr>
<td>80 - 89</td>
<td>A+</td>
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<td>70 - 79</td>
<td>A</td>
</tr>
<tr>
<td>60 - 69</td>
<td>B+</td>
</tr>
<tr>
<td>50 - 59</td>
<td>B</td>
</tr>
<tr>
<td>45 - 49</td>
<td>C</td>
</tr>
<tr>
<td>40 - 44</td>
<td>P</td>
</tr>
<tr>
<td>&lt; 40</td>
<td>F</td>
</tr>
</tbody>
</table>

h) Implement Python Script to generate prime numbers series up to N.
i) Given a number x, determine whether it is Armstrong number or not. Hint: For example, 371 is an Armstrong number since $3^3 + 7^3 + 1^3 = 371$. Write a program to find all Armstrong number in the range of 0 and 999.

UNIT-III: DATA STRUCTURES

12 hours


a) Write a Python script to
   - create a list
   - access elements from a list
   - slice lists
   - change or add elements to a list
   - delete or remove elements from a list
b) Write a Python script to read the values from a list and to display largest and smallest numbers from list.
c) Write a Python script to compute the similarity between two lists.
d) Write a Python script to read set of values from a Tuple to perform various operations.
e) Write a Python script to perform basic dictionary operations like insert, delete and display.
f) Write a Python program to count the occurrence of each word in a given sentence.
g) Define a dictionary named population that contains the following data.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shanghai</td>
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</tr>
<tr>
<td>Istanbul</td>
<td>13.3</td>
</tr>
<tr>
<td>Karachi</td>
<td>13.0</td>
</tr>
<tr>
<td>Mumbai</td>
<td>12.5</td>
</tr>
</tbody>
</table>

h) Write a Python script to create Telephone Directory using dictionary and list to perform basic functions such as Add entry, Search, Delete entry, Update entry, View and Exit.
i) Implement Python script to display power of given numbers using function.
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j) Implement a Python program that takes a list of words and returns the length of the longest one using function.

UNIT-IV:
String Handling -Modules: Creating modules, import statement, from import statement, name spacing
Files and Directories:
a) Implement Python program to perform various operations on string using string libraries.
b) Implement Python program to remove punctuations from a given string.
c) Write a Python program to change the case of the given string (convert the string from lower case to upper case). If the entered string is “computer”, your program should output “COMPUTER” without using library functions.
d) Implement Python program to capitalize each word in a string. For example, the entered sentence “god helps only people who work hard” to be converted as “God Helps Only People Who Work Hard.”
e) Write a Python script to display file contents.
f) Write a Python script to copy file contents from one file to another.
g) Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size.
h) Write a Python commands to perform the following directory operations.
   - List Directories and Files
   - Making a New Directory
   - Renaming a Directory or a File
   - Removing Directory or File

UNIT-V:
Python packages: Predefined Packages and User-defined Packages, Package Creation.
Object Oriented Programming using Python: Introduction to OOP, Creating Classes and Objects in Python
Brief Tour of the Standard Library: Turtle

a) Create a package named Cars and build three modules in it namely, BMW, Audi and Nissan. Illustrate the modules using class. Finally we create the __init__.py file. This file will be placed inside Cars directory and can be left blank or we can put the initialization code into it.
b) Create a class by name Student with instance variables such as roll_no, name, year_of_study, branch, section, and marks in any five subjects. The class should also contain one method for calculating the percentage of marks and the other method for printing a report as follows:

<table>
<thead>
<tr>
<th>Roll No.</th>
<th>Name</th>
<th>Year</th>
<th>Section</th>
<th>Branch</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>abc</td>
<td>I</td>
<td>A</td>
<td>CSE</td>
<td>58</td>
<td>68</td>
<td>95</td>
<td>47</td>
<td>56</td>
<td>64.8</td>
</tr>
</tbody>
</table>

b) Write a python script to display following shapes using turtle.

Course Outcomes:
At the end of the course, students will be able to
1. Understand problem solving techniques and their applications
2. Understand the syntax and semantics of python.
3. Demonstrate the use of Python lists and dictionaries.
4. Demonstrate the use of Python File processing, directories.
5. Describe and apply object-oriented programming methodology and Standard Library.
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Text Books:

References:

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B. Tech I Year I Semester

20ENG201 ENGLISH FOR PROFESSIONAL PURPOSES LABORATORY
(Common to all branches)

L T P C
0 0 2 1

Pre-requisite None

Course Description:
English language communication is a social phenomenon and students need to be able to function in
the society at large as the communicators before entering the professional world. The present course
equips the students with the basic functions of English language communication, which are required
not only in their day-to-day lives but also profoundly significant for their future professional,
academic training and their careers in the industry. The course mainly focuses on the achievement of
communicative proficiency of the students coupled with the necessary linguistic inputs.

Course Objectives:
This course enables the student to –
1. Get introduced with the basic communicative functions.
2. Engage effectively in learning various functions of English language communication.
3. Enhance their narration abilities in past experiences and future plans and goals/events.
4. Develop their abilities in expressing opinion.
5. Provide speaking practice in speech.

Course contents:
Greeting and Introductions (L & S)
- Greeting on different occasions and responding to greetings (L & S)
- Wishing on various occasions, taking leave and saying goodbye (L & S)
- Introducing oneself and others (L & S)
- Asking for introduction and responding to introduction (L & S)
- Developing a short personal profile (R &W)

Describing: (L, S, R & W)
- Using adjectives (Vocab)
- Degrees of comparison (Grammar)
- Common words, phrases, and expressions used for description (Vocab)
- Describing people, places and objects (L, S, R & W)
- Reading and writing descriptive paragraphs (R &W)

Narrating (L, S, R & W)
- Talking about past experiences and events (L & S)
- Talking about memorable incidents or events (L & S)
- Techniques of narration and narrative tenses (Grammar)
- Composing and narrating a story (R &W)

Planning and Predicting (L, S, R & W)
- Talking about future events (L & S)
- Making promises and giving assurances (L & S)
- Predicting future events (L & S)
- Writing and organising a short plan of an event (R &W)
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Instructions and directions (L, S, R & W)
- Forming imperative sentences (Grammar)
- Reading and writing short instruction manuals (R & W)
- Writing a recipe/ procedure (R & W)
- Giving directions

Enquiring: (L, S, R & W)
- Open and closed ended questions (Grammar)
- Asking for information and giving information (L & S)
- Telephonic enquiry (L & S)
- Official enquiries through emails and letters (R & W)

Requesting: (L, S, R & W)
- Polite expressions
- Modal verbs and key phrases for requesting (Grammar and vocab)
- Official requests through emails and letters (R & W)

Comparing and contrasting: (L, S, R & W)
- Words and phrases used for comparison and contrast (Vocab)
- Comparing qualities/properties/quantities of people, places and objects (L & S)
- Composing comparison and contrast paragraphs (R & W)

Expressing opinion: (L, S, R & W)
- Language expressions used for expressing opinions (Vocab)
- Developing opinion based paragraphs (R & W)
- Discourse markers and linkers used in opinion based paragraphs (R & W)

Public Speaking: (L, S, R & W)
- Techniques and strategies required for public speaking (L & S)
- Developing and organising a short speech (R & W)
- Presentation skills required for public speaking (L & S)

Course Outcomes:
At the end of the course, students will be able to
1. Develop their confidence while giving introduction, describing a place, & giving directions. (3,4,5)
2. Use various functions of English like asking for & giving information, inviting people for events/occasions, & requesting people. (3,4,5)
3. Narrate the past experiences and events in speaking and wring (3,4,5)
4. Express their views and opinions logically and appropriately in spoken and written format. (3,4,5,6)
5. Deliver logically organized speeches and present them without hesitations. (3,4,5, 6)

Text Books:
1. Leo Jones; Functions of English, Published by: Cambridge University Press.
2. Leo Jones; Let’s Talk Level 1, 2, 3, Published by: Cambridge University Press.
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3. Adrian Doff, Craig Thaine, Herbert Puchta, et al; *Empower: Intermediate (B1+)*; Published by: Cambridge University Press.

References:
2. Raymond Murphy; English Grammar in Use with CD; Cambridge University Press, 2013.
5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P. HUMPHREY, 2006
7. Writing Tutor; Advanced English Learners’ Dictionary; Oxford University Press, 2012
8. www.cambridgeenglish.org/in/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination
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B. Tech I Year I Semester

20PHY201 PHYSICS LABORATORY

\[ \text{L T P C} \quad 0 \quad 0 \quad 3 \quad 1.5 \]

Course Description:
Physics Practical course is meant for making the students to gain practical knowledge to correlate with the theoretical studies. It covers experiments on Principles of Mechanics and Optics, Measurement of Magnetic field and studying Resonance using LCR Circuit.

Course Objectives:
1. Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.
2. Illustrate the basics of mechanics, waves and optics to analyze the behavior and characteristics of various materials for its optimum utilization.
3. Develop an ability to apply the knowledge of physics experiments in the later studies.

LIST OF EXPERIMENTS:
{Out of 17 experiments any 12 experiments (minimum 10) must be performed in a semester}
1. Spring constant - Coupled Pendulums.
2. Study of resonance effect in series and parallel LCR Circuit.
4. Wavelength of a laser - Diffraction Grating
5. Wavelength of the spectral lines - Diffraction Grating.
6. Magnetic field along the axis of a current carrying coil - Stewart Gees’ Apparatus
7. Thickness of a given wire - Wedge Method.
8. Dispersive power of prism – Spectrometer.
12. Torsional Pendulum.
13. Determination of the numerical aperture of a given optical fiber and hence to find its acceptance angle.
14. Measurement of \(e/m\) of electron (Thomson’s method)
15. Energy gap of a material of p-n junction.
16. Determination of Planck’s constant.
17. Ferroelectric hysteresis (B-H Curve).

Course Outcomes:
Upon successful completion of this course, the students should be able to:
1. Apply the scientific process in the conduct and reporting of experimental investigations.
2. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
3. Verify the theoretical ideas and concepts covered in lecture by doing hands on in the experiments.
4. Know about the characteristics of various materials in a practical manner and gain knowledge about various optical technique methods.
5. Acquire and interpret experimental data to examine the physical laws.
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Reference Books:
1. Physics Laboratory Manual
4. Engineering Mechanics, 2nd ed. — MK Harbola
5. Introduction to Electrodynamics— David J Griffiths

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20EEE201 ELECTRICAL ENGINEERING LABORATORY

Prerequisite: None

Course Description:
The laboratory facilitates the students to deal with electrical instruments, which further strengthen the concepts & operation of various AC & DC circuits, and machines, and their characteristics. The lab also reinforce the concepts discussed in class with a hands-on approach which enable the students to gain significant experience with electrical instruments such as ammeter, voltmeter, digital multimeter, oscilloscopes, tachometer, switches, fuses and power supplies.

Course Objectives:
1. To provide hands on experience in setting up simple electrical circuits (DC and AC).
2. To get exposure to handle different electrical equipment’s.
3. To measure various electrical parameters with different measuring instruments.
4. To get hands on experience in operating DC and AC machines.
5. To understand the operation of basic converters and various components of LT Switchgear.

LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:

DEMONSTRATIONS:
2. Demonstration of voltage and current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). In star and delta connections.
3. Demonstration of cut-out sections of transformer and DC & AC machines.
5. Wavelength of the spectral lines - Diffraction Grating.
6. Familiarization of (i) different types of cables/wires and switches and their uses, (ii) different types of fuses & fuse carriers; MCB, ELCB, MCCB their ratings and uses (components of LT switchgear).

EXPERIMENTS:
1. Wiring of a simple circuit for controlling (1) a lamp/fan point, (2) Staircase or Corridor Winding.
2. Wiring of a power circuit for controlling an electrical appliance (16A Socket).
3. Verification of Kirchhoff’s current and voltage laws (KCL & KVL).
4. Verification of superposition theorem
5. Sinusoidal steady state response of R-L, and R-C circuits (impedance calculation and verification).
6. Measurement of voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
7. Measurement of voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
9. Speed control of separately excited DC motor.
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10. Wiring of a power distribution arrangement using single-phase MCB distribution board with ELCB, main switch and energy meter (or residential house wiring).
11. Regulated power supply for generating a constant DC Voltage.
12. Fabrication of a given electronic circuit on a PCB and test the same.

Course Outcomes:
Upon successful completion of the course, the students are expected to
1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of various power electronic converters.

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20ENG101 PROFESSIONAL ENGLISH

Pre-requisite: None

Course Description:
Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives: This course enables the student to –
1. Engage effectively in a professional environment
2. Understand the intricacies and implications of professional communication
3. Use linguistic skills in any given context
4. Conduct self in a learning environment
5. Be better prepared for employment

UNIT I  GRAMMAR & VOCABULARY  9 hours
Grammar - Tense, Reported Speech, Modals, Conditionals; Vocabulary development - prefixes, suffixes, compound words, synonyms & antonyms.

UNIT II  READING SKILLS & WRITTEN COMMUNICATION  9 hours
Reading - short comprehension passages, practice in skimming, scanning and predicting; Writing-completing sentences, developing hints; Paragraph writing- topic sentence, main ideas, coherence.

UNIT III  VERBAL & NON-VERBAL ASPECTS  9 hours
Verbal - Introducing oneself, exchanging personal information, Using ‘Wh’- Questions, asking and answering, yes or no questions- asking about routine actions and expressing opinions; Non-Verbal – Use of body language, combating nervousness.

UNIT IV  CONVERSATIONS  9 hours
Listening-short texts & conversing, formal and informal conversations, short group conversations, speaking about oneself, sharing information of a personal kind speaking about one’s friend.

UNIT V  BUSINESS ENVIRONMENT & ETIQUETTES  9 hours
Greeting & taking leave; Writing e-mails, memos, reports, etc.
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Course Outcomes:
At the end of the course, students will be able to:
1. Read articles and understand professional communication
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind and personal letters and emails in English.

Text Books:
1. Guy Brook Hart & Norman Whitby; Cambridge English-Business Benchmark: Pre-Intermediate to Intermediate; Published by: Cambridge University Press.
2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Intermediate (B1+); Published by: Cambridge University Press.

Reference Books
2. Raymond Murphy; English Grammar in Use with CD; Cambridge University Press, 2013.
5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P. HUMPHREY, 2006

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B. Tech I Year II Semester
20MAT102 LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

Pre-requisite 20MAT101

Course Description:
The course is an introduction to Linear Algebra and Differential Equations. Methods for solving system of linear equations, ordinary and partial differential equations are covered. Basics of matrices and its applications are highlighted. The methods of solving first and second order ordinary differential equations and partial differential equations have been introduced.

Course Objectives:
1. To solve the system of linear equations and find the eigenvalues and eigenvectors.
2. To formulate and solve first order ordinary differential equations.
3. To solve second order differential equations of various kinds to familiarize the knowledge of Laplace transform.
4. To introduce Fourier series and the classical methods for solving boundary value problems
5. To obtain the solutions of partial differential equations representing initial and boundary value problems in engineering.

UNIT I LINEAR ALGEBRA 9 hours
Introduction to matrices - Rank and inverse of a matrix - system of linear equations, Eigenvalues and Eigen vectors - Cayley-Hamilton theorem, diagonalization of matrices.

UNIT II FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 hours
Introduction - General Remarks on Solutions, Families of Curves, Orthogonal Trajectories - Homogeneous Equations - Exact equation, Integrating Factors - Linear differential equations and Bernoulli’s equation.

UNIT III SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 hours

UNIT IV LAPLACE TRANSFORMS 9 hours
Laplace Transform - Inverse Laplace transform - Convolution theorem - applications to solve Integral equations and ordinary differential equations.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 9 hours
Definition and formulation of partial differential equations - Eigen values and Eigen functions method of separation of variables, one dimensional wave equation; One dimensional heat flow, solution of the heat equation.
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Course Outcomes:
At the end of the course, the students should be able to:
1. Solve the system of linear equations occurring in various fields of Engineering and obtain Eigen values and Eigenvectors.
2. Understand and solve first order ordinary differential equations.
3. Apply the knowledge of identifying, formulating and solving engineering problems represented by second order differential equations.
5. Represent the relevant engineering system into pertinent partial differential equation, solve it and interpret the results.

Text Books:

Reference Books:

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B. Tech I Year II Semester

20CHE101 ENGINEERING CHEMISTRY

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:
Deals with the basic principles of various branches of chemistry like physical, organic, inorganic, analytical and nanomaterial chemistry.

Course Objectives:
Students will
1. Understand, analyse and determine the impurities present in the water.
2. Appreciate the synthetic organic reactions used in daily life
3. Learn the principles of spectroscopies to analyse them.
4. Value the basic concepts of thermodynamics and electrochemistry.
5. Be exposed to the importance of nano and engineering materials used in their daily life and industry

UNIT I    IMPURITIES PRESENT IN WATER AND WATER TREATMENT
9 hours

UNIT II    PERIODIC PROPERTIES AND ORGANIC REACTIONS
7 hours
Periodic properties: Electronic configurations, atomic and ionic sizes, ionization energies, oxidation states, molecular geometries. Organic Reactions: Introduction to substitution (SN1 and SN2), elimination (E1 and E2) - Addition, Condensation and Free Radical Polymerization Reaction (only the mechanism).

UNIT III    SPECTROSCOPY
8 hours
Basic Principle and Applications of UV-Visible, FT-IR, Raman, Microwave and Nuclear Magnetic Resonance (NMR) Spectroscopy

UNIT IV    THERMODYNAMICS AND ELECTROCHEMISTRY
11 hours
UNIT V  ENGINEERING MATERIALS, NANOSCIENCE & NANOTECHNOLOGY  10 hours


Course Outcomes:
At the end of the course, students will be able to:
1. Analyse and determine the impurities in water such as hardness, alkalinity for sustainable development.
2. Prepare organic compounds/polymers for environmental, safety and society need.
3. Comprehend the principles and applications of spectroscopies.
4. Apply the concept of free energy in thermodynamics, electrochemistry for solving the problems evolve in the engineering processes.
5. Acquire spotlight to the nanomaterials and basic engineering materials used in academics, industry, and daily life.

Text Books:

Reference Books

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20CSE102 C PROGRAMMING AND DATA STRUCTURES

Pre-requisite: 20CSE101

Course Description:
This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:
1. To make the student understand fundamentals of C programming language and problem solving.
2. To understand the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stack, queue, and linked list.

UNIT I INTRODUCTION TO C PROGRAMMING 9 hours
Structure of C Program, C Tokens: Variables, Data types, Constants, Identifiers, key words and Operators, Expressions.
Control Structures: Conditional Statements (Simple if, if-else, Nested -if-else, Switch). Iterative Statements (for, While, Do-While), Jump Statements (break, Continue).

UNIT II FUNCTIONS & ARRAY 9 hours
Functions Introduction, User defined function, Function prototype, Function Definition and Function Call, Storage classes, Recursion Arrays: Defining an array, processing an array, one dimensional arrays, two dimensional arrays. Passing array as an argument to function. Sorting: Bubble Sort, Insertion Sort, selection sort. Searching: Linear and binary search.

UNIT III STRINGS & POINTERS 9 hours
Strings: Declaring and defining a string, Initialization of strings, Strings Library functions.

UNIT IV STRUCTURES & FILES 9 hours
Structures: Defining a structure, processing a structure, Pointer to Structure, Unions.
Files: Opening and closing a data file, Reading and Writing a data file, File I/O Functions.

UNIT V DATA STRUCTURES 12 hours
Stack: stack operations, stack implementations using arrays.
Queue: queue operations, queue implementations using array, Applications of stack and queue.
Linked List: Single linked list operations.

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand fundamentals of C programming language and its constructs.
2. Design and implement applications using functions, arrays, sorting and searching techniques.
3. Design and implement applications using strings and pointers.
4. Design and implement applications using structures and File processing.
5. Choose appropriate linear data structure depending on the problem to be solved.
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Text Books:

Reference Books:
4. Byron Gottfried , Jitender Chhabra , Programming with C (Schaum's Outlines Series)

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20ME101  ENGINEERING GRAPHICS

Pre-requisite: None

Course Description:
Introduction to AutoCAD commands, simple drawings, orthographic projections, projection of points, lines, planes; auxiliary projections; projections and sections of solids; development and intersection of surfaces; isometric projections.

Course Objectives:
1. Engineering Graphics is the primary medium for development and communicating design concepts.
2. Through this course the students are trained in Engineering Graphics concepts with the use of AutoCAD.
3. The latest ISI code of practice is followed while preparing the drawings using AutoCAD.
4. Computerized drawing is an upcoming technology and provides accurate and easily modifiable graphics entities.
5. Storage and Retrieval of Drawings is also very easy and it takes very less time to prepare the drawings. Also enhances the creativity.

UNIT I  INTRODUCTION TO AUTO CAD  12 hours
Introduction to AutoCAD commands, simple drawings using AutoCAD, Introduction to orthographic Projections – Theory, techniques, first angle projections and third angle projections.

UNIT II  PROJECTIONS OF POINTS & LINES  12 hours
Projections of points: Positions, notation system and projections. Projections of lines: Positions, terms used, different cases, traces of lines and finding true length.

UNIT III  PROJECTIONS OF PLANES & SOLIDS  12 hours
Projections of planes: Positions, terms used, different cases and projections procedure.
Projections of Solids: Projections of Regular Solids inclined to one plane (resting only on HP).

UNIT IV  SECTIONS AND DEVELOPMENTS OF SOLIDS  12 hours
Section of solids: Sectional view of right regular solids (Prism and cylinder), true shapes of the sections.
Development of Surfaces: Development of surfaces of right regular solids (Prism, Cylinder and their Sectional Parts).

UNIT V  INTERSECTIONS & ISOMETRIC PROJECTIONS  12 hours
Intersections of surfaces of solids: Intersection between prism Vs prism, prism Vs cylinder, cylinder Vs cylinder.
Isometric Projections: Theory of isometric drawing and orthographic views, Conversion of isometric view into orthographic views.
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Course Outcomes:
Student will be able to
1. Identify various commands in AutoCAD software and apply AutoCAD skills to develop the new designs.
2. Draw the projections of points, straight lines using AutoCAD.
3. Draw the projections of the planes, solids using AutoCAD
4. Sketch the developments of solids, sections of solids using AutoCAD.
5. Draw the conversion of the isometric views to orthographic views and intersections of surfaces using AutoCAD.

Text Books:

Reference Books:

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20CHE201 CHEMISTRY LABORATORY

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:
It deals with basic principles of volumetric and instrumental analytical methods.

Course Objectives:
This Engineering Chemistry Laboratory is common to all branches of I Year B Tech. At the end of the course the student is expected to

1. Learn to estimate the chemical impurities present in water such as hardness, alkalinity, chloride, etc.
2. Understand and experience the formation of inorganic complex and analytical techniques for trace metal determination.
3. Be trained to use the instruments to practically understand the concepts of electrochemistry.
4. Bridge theoretical concepts and their practical engineering applications, thus
5. Highlighting the role of chemistry in engineering.

LIST OF EXPERIMENTS
1. Estimation of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of dissolved oxygen by Winkler’s method.
4. Determination of molecular weight of a polymer by using Ostwald’s viscometer.
5. Determination of rate constant of an ester hydrolysis (Pseudo First Order reaction).
6. Determination of strength of a Strong acid (conc. H$_2$SO$_4$) by conductometric titration (Neutralisation Titration).
7. Conductometric titration of BaCl$_2$ Vs Na$_2$SO$_4$ (Precipitation Titration).
8. Dissociation constant of weak electrolyte by Conductometry.
10. Estimation of ferrous ion by Potentiometric titration (Redox Titration).
11. Saponification value of oil.

Course Outcomes:
After the completion of the Engineering Chemistry Laboratory experiments, students will be able to
1. Develop and perform analytical chemistry techniques to address the water related problems (for e.g., hardness, alkalinity present in water) technically.
2. Handle electro-analytical instruments like digital conductivity meter and potentiometer to perform neutralization, precipitation, and redox titrations, respectively.
3. Acquire practical skills to handle spectro-photochemical methods to verify Beer Lambert’s Law.
4. Operate various instruments for the analysis of materials and produce accurate results in a given time frame.
5. Think innovatively and improve the creative skills that are essential for solving engineering problems.
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Textbook:

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20CSE201  C PROGRAMMING AND DATA STRUCTURES LABORATORY

Prerequisite: 20CSE101

Course Description:
This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:
1. To make the student understand fundamentals of C programming language and problem solving.
2. To get hands-on practices with the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stacks, queues, and linked lists.

LIST OF EXPERIMENTS
1. a) Write a C program to swap the two numbers.
b) Write a C Program to find the eligibility of admission for a Professional course based on the following criteria:
   i. Marks in Maths >=65
   ii. Marks in Physics  >=55
   iii. Marks in Chemistry>=50
   OR
   iv. Total in all three subject >=180
2. a) Write a C program to compute the factorial of a given number.
b) Write a program that reads numbers which are in the range 0 to 100, till it encounters -1. Print the sum of all the integers that you have read before you encountered -1.
3. a) Write a C program to accept a coordinate point in a XY coordinate system and determine in which quadrant the coordinate point lies.
b) The digital root (also called repeated digital sum) of a number is a single digit value obtained by an iterative process of summing digits. Digital sum of 65536 is 7, because 6+5+5+3+6=25 and 2+5 = 7.Write a program that takes an integer as input and prints its digital root.
4. a) Write a C program to find the series of prime numbers in the given range.
b) Write a C program to generate Tribonacci numbers in the given range.
5. a) Write a C program to find sum of digits, Decimal to Binary conversion, reversal of numbers using functions.
b) Write a C program to find Factorial, Greatest Common Divisor, and Fibonacci using recursion.
6. Your program should take as input: dimension of a square matrix N, two matrices of size N x N with integer values, and one operator symbol (+, -, *). It must perform the corresponding operation given below;
   a) Matrix Addition   b) Matrix Subtraction     c) Matrix Multiplication
7. Implement the following sorting techniques.
a) Bubble sort   b) Insertion sort   c) Selection sort.
8. Implement the following searching techniques.
a) Linear Search   b) Binary Search
9. a) Write a program in C to find the frequency of characters in a string.
b) Write a C program to implement all string operations (string length, string copy, string compare, string concatenation and string reverse) without using string library functions.
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10. a) Write a C program to get \( N \) elements in an array and sort it using Pointer.
    b) Write a C program to swap two integers using pass by reference.
    c) Write a C program to find the largest element using Dynamic Memory Allocation.
11. a) Write a program in C to count the number of vowels, consonants, digits, special symbols, words in a string using a pointer.
    b) Write a C program to print all permutations of a given string using pointers.
12. a) Write a C program to add two distances in the inch-feet system using structures.
    b) Write a C program to calculate difference between Two Time Periods (in Hours, Minutes, Seconds format) using structures.
13. Develop an application to match parenthesis of a given expression using Stack.
14. Develop an application to identify Palindrome string using Stack and Queue.
15. Develop an application to add two Polynomial equations using Linked List.

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Understand fundamentals of C programming language and its constructs.
2. Design applications using functions, arrays, sorting and searching techniques.
3. Design and implement solutions using strings and pointers.
4. Design and develop solutions using structures and File processing.
5. Design and develop applications on stack, queue, and linked list depending on the problems to be solved.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination
B. Tech. Mechanical Engineering

B. Tech I Year I Semester

20ME201 WORKSHOP PRACTICE

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Pre-requisite: None

Course Description:
This course will provide students with a hands-on experience on various basic engineering practices. This course will also provide an opportunity to the students to experience the various steps involved in the industrial product fabrication.

Course Objectives:
1. Introduction to the use of Tools, Machinery and Power tools,
2. Hands on practice in Carpentry, Fitting, Forging, Tinsmith, Plumbing, Foundry, Welding, Fabrication of plastic components, Metrology, Fabrication of Polymer Composite materials, simple machine turning and wood turning, and basic electrical connections.
3. Introduction to 3 D Printing
4. Fabrication of final product at end of the semester

LIST OF TRADES
1. Carpentry (Cross half lap Joint and Miter Joint)
2. Fitting (Square and ‘V’ fit)
3. Turning (Ball pane hammer and handles)
4. Forging (S hook L hook)
5. Tin smithy (Square tray)
6. Plumbing (Wash basin and simple connection)
7. Foundry (Solid and Split pattern)
8. Welding (Arc and Gas welding)
9. Fabrication of plastic components (Pen Stand)
10. Metrology (Internal and External dimension)
11. Composite Material Sample Preparation (Demo Only)
12. Introduction of Power Tools and CNC (Demo Only)
13. Introduction to 3D Printing (Demo Only)

Course Outcomes:
On successful completion of this course, the student will be able to
1. Fabricate carpentry components with suitable joint and pipe connections including plumbing works.
2. Perform welding operation to join various structures.
3. Perform basic machining operations.
4. Create the models using sheet metal and plastic works.
5. Illustrate the operations of foundry, fitting and smithy
6. Fabricate a product using composite and plastic material
7. Design and fabricate a product using the tools and skills learned in the workshop
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Suggested Text/Reference Books:

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination
II YEAR I SEMESTER
B. Tech. Mechanical Engineering

B. Tech II Year I Semester

20MAT103  NUMERICAL METHODS

Course Prerequisite: 20MAT101 & 20MAT102

Course Description:

This course reviews and continues the study of computational techniques for solving system of algebraic and transcendental equations, interpolating the polynomials, evaluating the derivatives, integrals, ordinary differential equations and curve fitting. The course emphasizes on numerical and mathematical methods of solutions.

Course Objectives:

1. To introduce computation methods of solving algebraic and transcendental equations.
2. To familiarize the knowledge of interpolation.
3. To avail the basics of numerical techniques in calculus.
4. To use numerical methods for solving ordinary differential equations.
5. To introduce the empirical techniques for fitting the various curves.

UNIT I: SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS  
9 hours


UNIT II: FINITE DIFFERENCES AND INTERPOLATION  
9 hours

Finite differences, Newton’s forward and backward interpolation formulae - Lagrange’s and Newton’s divided difference formulae - Gauss forward and backward formulae, Stirling’s formula, Bessel’s formula.

UNIT III: NUMERICAL DIFFERENTIATION AND INTEGRATION  
9 hours


UNIT IV: NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS  
9 hours

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UNIT V: CURVE FITTING 9 hours

Introduction - Graphical method - Principle of least squares - Method of least squares - Fitting of straight line and parabola - Fitting of exponential and power curves

Course Outcomes:
At the end of this course, students should be able to

1. Solve the system of algebraic and transcendental equations.
2. Interpolate the equal and unequal spaced arguments of function.
3. Apply the numerical techniques to find derivatives and integrals in the field of Engineering.
4. Find the approximate numerical solutions to ordinary differential equations representing some Engineering problems.
5. Estimate the model parameters using the principles of least squares to a curve of best fit for the experimental observations.

Text Books:

Reference Books:

Mode of Evaluation: Assignments, Internal Examination and External End Examination.
B. Tech. Mechanical Engineering

B. Tech. II Year I Semester

20ME102 ENGINEERING MECHANICS

Course Prerequisite: Engineering Calculus

Course Objectives:
1. Determine the resultant force and moment for a given system of forces
2. To determine the forces in members of trusses, frames and problems related to friction.
3. To show the location of the center of gravity, centroid and moment of inertia for a system of discrete particles and a body of arbitrary shape.
4. To study particle motion along a straight line and curved line.
5. To develop the principle of work and energy, impulse and momentum for a rigid body and apply it to solve problems that involve force, velocity, and time.

UNIT-I: STATICS OF PARTICLES 9 hours

UNIT-II: ANALYSIS OF PIN JOINTED TRUSSES 9 hours
Classification of trusses - Reactions at supports and connections - Types of loading - Reaction for simply supported and over hanging beams - Analysis of Trusses (Simply supported and cantilever beams) Friction: Classification of friction - Laws of friction - Angle of repose - Force required to move a body along horizontal and inclines planes - Analysis of ladder, wedge and belt friction.

UNIT- III: CENTROIDS, CENTER OF GRAVITY AND MOMENTS OF INERTIA 9 hours
Center of Gravity and Centroid - Area and polar moment of inertia - Radius of Gyration – Parallel and Perpendicular Axis Theorems - Mass Moment of inertia – Problems on centroid and area moment of inertia of plane figures and buildup sections

UNIT –IV: KINEMATICS OF PARTICLES 9 hours
Displacements - Velocity and acceleration - their relationship, relative motion - Rectilinear Motion, Curvilinear motion - Projectile motion

UNIT V: DYNAMICS OF RIGID BODIES 9 hours
Course outcome:
Student will be able to
1. Solve the engineering problems in case of equilibrium conditions.
2. Calculate the reaction forces of various supports of different structures and frictions.
3. Determine centroid, center of gravity and moment of inertia of various surfaces and solids.
4. Calculate the characteristics of a particles subjected to a given motion
5. Solve the problems involving dynamics of rigid bodies

Textbook:

References:

Mode of evaluation: Assignments, Internal Mid Tests and External End Examinations.
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B. Tech. II Year I Semester

20ME103 BASIC THERMODYNAMICS

Course Prerequisite: Physics

Course Description:
Thermodynamics is one of the fundamental courses in the study of mechanical engineering. The principles of thermodynamics are applicable to a wide range of problems encountered in all branches of engineering. Also thermodynamics is an essential pre-requisite for subsequent courses in mechanical engineering like fluid mechanics, applied thermodynamics, heat transfer, gas dynamics, refrigeration and air conditioning, etc. This course is designed to equip the students with a thorough understanding of basic concepts of thermodynamics and with necessary skills and techniques to solve problems in thermodynamics through a systematic analysis using fundamental principles. The specific topics to be covered in the course include concepts of system and surroundings, energy, energy transfer by work and heat, properties of substances and property changes, first and second laws of thermodynamics.

Course Objectives:
1. To introduce the concepts of system, surroundings, energy interactions, thermodynamics properties of substances and to teach different techniques used for estimating the properties like gas laws and property tables
2. To explain the principles of work and energy.
3. To introduce the fundamentals of thermodynamic laws, concepts and principles.
4. To teach the systematic approach to be employed for effectively solving the problems in thermodynamics.
5. To explain the principles of various cycles and to apply the thermodynamic concepts in various applications like IC engines and Refrigeration and Air conditioning systems.

UNIT 1: THERMODYNAMIC BASICS
9 hours
Macroscopic versus Microscopic viewpoint, Thermodynamic system and control volume, Thermodynamic properties, processes and cycles, Homogeneous and heterogeneous systems, Thermodynamic equilibrium, Quasi-static process, Concept of continuum, Zeroth law of thermodynamics, temperature scale, Ideal gas, Work transfer, Heat transfer, First law of thermodynamics, Specific heat, Enthalpy, Internal energy, Steady flow energy equation and application, PMM1.

UNIT 2: PROPERTIES OF PURE SUBSTANCES
9 hours
Pure substance, Vapor-Liquid-Solid-Phase equilibrium in a pure substance, Independent properties of a pure substance, Phase boundaries, tables of thermodynamic properties, Thermodynamic surfaces, p-v and p-T diagram for a pure substance, p-v-T surface, T-s and h-s or Mollier diagram for a pure substance, dryness fraction, Steam Tables, Charts of Thermodynamic properties.
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UNIT 3: SECOND LAW OF THERMODYNAMICS AND ENTROPY  
Limitations of the first law of thermodynamics, Qualitative difference between heat and work, cyclic heat engine, Kelvin-Planck statement of second law, Clausius’ statement of second law, Refrigerator and heat pump, Equivalence of Kelvin-Planck and Clausius statement, Reversibility and Irreversibility, Carnot cycle, Carnot’s Theorem, Corollary of Carnot’s theorem, absolute thermodynamic temperature scale and Efficiency of heat engine, Entropy, Inequality of Clausius, Temperature-Entropy diagram, Entropy generation in an open and closed system and Entropy change in an Irreversible process.

UNIT 4: THERMODYNAMIC PROPERTY RELATIONS AND GAS MIXTURES  
Equation of state, Ideal gas, Real gas, Compressibility chart, Internal energy, enthalpy, entropy, specific heats and Gibbs free energy of gas mixture, Maxwell’s Equations, TdS equation, Difference in heat capacities, Ratio of heat capacities, Joule-Kelvin Effect, Clausius-Clapeyron equation, Properties of atmospheric air, Psychrometric chart and Psychrometric process.

UNIT 5: THERMODYNAMIC CYCLES  

Course Outcomes: 
On successful completion of the course, the student will be able to: 
1. Define the fundamentals of the zeroth and first laws of thermodynamics and explain their application to a wide range of systems. 
2. Apply the properties of steam to design steam systems. 
3. Apply the second law of thermodynamics for the design of heat engines, heat pumps and refrigerators. The student will also be able to evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations. 
4. Explain the cycles on which IC engines, Gas turbines, and refrigerator works. 
5. Explain the importance of Tds relations and be able to use psychometric charts for the design of air conditioning systems.

Text Books: 

References: 

Mode of Evaluation: Assignment, Mid Examination, End Examination
Course Prerequisite: None

Course Description: The purpose of this course is to introduce the student to enrich their knowledge on the materials science field. Begin with the microscopic level the structure at the atomic and their impact on the material properties are discussed. The relation between heat treatment, phases and alloying elements properties of materials is also highlighted. The course mainly discusses about the different types testing methods for materials. Final part of the course covers non-metallic materials such as ceramics and polymers.

Course Objectives:
1. To understand the relation between structure and properties of metallic materials.
2. To understand the strengthening mechanism of metals
3. To know the concept of phase transformation, phase diagrams and its influence on the properties of metals.
4. To learn the methods of improving properties by thermo, mechanical treatment.
5. To identify the importance of non-metallic materials like polymers, ceramics and composites, material standards and their applications.

UNIT I: STRUCTURE OF MATERIALS 9 hours


Crystallography and Metallic structures: Unit cell - Crystallographic directions and planes, FCC, BCC, HCP, SC and other structure - miller indices, Linear and planar densities - close-packed crystal structures. Packing of atoms in solids. Packing factor

UNIT II: CRYSTAL IMPERFECTIONS AND DIFFUSION 9 hours


UNIT III: HEAT TREATMENT PROCESS AND MECHANICAL PROPERTIES OF MATERIALS. 10 hours

Introduction and Concepts: Classification of metal working process- Mechanical Properties of Metals: Mechanical properties of materials: Elasticity and Plasticity, Stress–Strain curve, Young’s modulus – The yield strength. Tensile strength, Ductility, Brittleness, Malleability, Rigidity, Toughness, Resilience, Hardenability, Hardness, Hooke’s Law – Linear and non-
UNIT IV: PHASE DIAGRAMS AND PHASE TRANSFORMATIONS  9 hours

UNIT V: FERROUS, NONFERROUS & NONMETALLIC MATERIALS  8 hours

Course Outcomes:
At the end of the course students will be able:
1. To develop deep knowledge of crystal structure and effect of structure on the properties of the materials.
2. To understand various imperfections in crystal, dislocation mechanisms and diffusion mechanism in materials.
3. Student will be able understand various mechanical properties of materials and its testing and need for heat treatment process in materials.
4. To understand the concept of phases and to construct the equilibrium diagrams, Fe-Fe₃C phase diagram and TTT diagrams
5. To recognize the properties and applications of nonmetallic materials and Ferrous materials.

Text Books:

References:

Mode of Evaluation: Assignments, Internal Mid Tests and External End Examinations.
B. Tech. Mechanical Engineering

B. Tech. II Year I Semester

20ME105  FLUID MECHANICS AND HYDRAULIC MACHINERY

Course Prerequisite: Physics

Course Description:

Modelling and predicting the behaviour of fluid flow is an important part of many scientific and technological problems. Flow of fluid is an important aspect of atmospheric and oceanic circulation, combustion in engines, biological processes such as the flow of blood. From the days of Isaac Newton to the present day world, considerable progress has been made in the mathematical modelling of fluid flow. With the advent of enhanced computational ability, computational fluid dynamics has played a major role in solving complex fluid flow problems. In this course, the students are introduced to various fluid properties and to model fluids at rest. Flow of fluids is introduced to the students in two forms, namely, the Lagrangian and the Eulerian form. Eventually, both the integral and differential form of the governing equations of fluid dynamics are derived. Flow of fluids in closed conduits and over various geometries is also introduced. Basic design of hydraulic turbines and pumps are introduced to the students.

Course Objectives:
1. To provide a basic understanding of the properties and behavior of matter (fluids) by means of analytical equations.
2. To develop an understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
3. To determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.
4. Determine the force applied by a jet on stationary and moving vanes.
5. To understand the working principle of hydraulic machinery like turbines and pumps.

UNIT I: FLUID PROPERTIES AND KINEMATICS OF FLUID FLOW  9 hours
The Concept of a Fluid, Classification of fluid flows, System & Control volume, Density, Specific gravity, Thermodynamic Properties of a Fluid, Viscosity, Surface Tension, Capillarity, Vapor pressure and Cavitation. Lagrangian and Eulerian descriptions, material derivative, velocity and acceleration field, streamlines, path lines and streak lines.
Fluid statics: Barometer and atmospheric pressure, Manometry, Buoyancy and stability

UNIT II: GOVERNING EQUATIONS OF FLUID FLOW  8 hours
Reynold’s transport theorem, Integral form of the conservation of mass for moving or deforming control volumes and steady flow processes, Integral form of Energy equation, Integral form of linear momentum equation, Integral form of angular momentum equation. Derivation of the Bernoulli equation
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UNIT III: INTERNAL AND EXTERNAL FLOW 9 hours
Laminar and Turbulent flows, Entrance region, Laminar flow in pipes, Turbulent flow in pipes, Minor and Major losses. Orifice meter and Venturimeter. Flow over flat plate, Boundary layer equations, Displacement, Momentum and Energy thicknesses, Momentum integral technique for boundary layers, Boundary layers with pressure gradients.

UNIT IV: IMPACT OF JET VANES & HYDRAULIC TURBINES 10 hours
Hydrodynamic force of jet striking stationary and moving vanes, flat and curved vanes, jet impinging centrally and tangentially. Classification of hydraulic turbines- Impulse and reaction turbines; Basic equation of energy transfer in rotodynamic machines, specific speed; Components of Pelton turbine, Velocity triangles and power for Pelton turbine, Maximum efficiency of Pelton turbine; Types of reaction turbines, Components of Francis turbine, Velocity triangles, power and efficiency of Francis turbine. Kaplan turbine.

UNIT V: HYDRAULIC PUMPS 9 hours
Working principle and main parts of a centrifugal pump; Classification of centrifugal pumps; Static and Manometric head of a centrifugal pump; Efficiencies of centrifugal pump. Main parts and working of reciprocating pump; Discharge, work done and power required to drive a reciprocating pump; Slip of a reciprocating pump;

Course Outcomes:
The students after completing the course will be able to:

1. Interpret the properties of fluids and their applications, determine differential pressure using manometric principles, calculate the buoyant forces and estimate the stability of floating and immersed bodies.
2. Distinguish between a system and control volume approach and will be able to use the governing equations based on integral approach for solving fluid flow problems.
3. Have a clear understanding of internal flow physics and capable of estimating the major and minor losses observed in pipe flows. Similarly, they will be able to assess various flow parameters in external flows with and without pressure gradients.
4. Assess the forces acting on vanes with varied geometries and point of jet impact. Further, they can differentiate different turbines and estimate the performance parameters of various turbine used in hydraulic power plants.
5. Differentiate different pumps and calculate their performance characteristics.

Text Books:
B. Tech. Mechanical Engineering

References:

Mode of Evaluation: Assignments, Internal Mid Tests and External End Examinations.
B. Tech. Mechanical Engineering

B. Tech. II Year I Semester

20ME202    MATERIALS SCIENCE AND ENGINEERING LABORATORY

Course Prerequisite: None

Course Objectives:
The objective of this course is to expose the students to a broad knowledge of experimental and analyzing techniques useful in Mechanical as well as a metallurgical engineering field. The subject introduces the correlation of properties of materials and their structure. It revises student’s knowledge of crystal structure and phase diagrams of various alloy systems. This laboratory course offers practical knowledge of heat treatment applicable to ferrous materials and studies microstructural changes and hardness evaluation.

LIST OF EXPERIMENTS
2. Preparation and study of the micro-structure of metals like Iron, Al and their alloys and measurement of grain sizes.
3. Preparation and study of the microstructure of low carbon steels, Medium carbon and high carbon steels.
4. Experimentally analyzing the effect of quenching mild steel in air, water and oil on the hardness of the materials.
5. Experimentally analyzing the microstructure and hardness of various heat treatment process for steel: Annealing, Normalizing and Quenching.
6. Experimentally analyzing the hardenability of the mild steel by Jominy End Quench Apparatus.
7. Experimentally analyzing the effect of work hardening on steel by hardness measurements and its reversal by annealing.
8. Synthesis of Al₂O₃ pellet via powder metallurgy route, and microstructure study.
9. Synthesis of SiC single point lathe tool insert via powder metallurgy route.
10. Synthesis of Al – SiC Metal Matrix compounds via powder metallurgy process and microstructure study.

Course Outcomes:
1. The student will obtain knowledge on the microstructural analysis of various metals and alloys with regard to sample preparation via polishing and etching and use and analysis of optical microscopy.
2. This lab enables the student to select an analytical technique to evaluate and analyze the samples.
   Students learn to use the instruments and get exposed to specimen preparation, validation of the instrument, precise use of an instrument to accurately estimate the given samples.
3. Ability to perform different heat treatment operation and characterize the microstructure
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4. Perform simple calculations to qualify materials properties and microstructural characteristics.
5. Synthesis of various ceramic and MMC via powder metallurgy.

Text Book:
1. Lab manual provided by the department

References:

Mode of Evaluation: Internal Evaluation & End Semester Examination.
Course Description:
It is intended that the student would learn to use different techniques to measure
discharge and measure head losses through straight and bent pipes. He would also
learn the performance evaluation of centrifugal and reciprocating pumps along with
Pelton Wheel and Francis turbine

Course Objectives:
1. To impart practical exposure on the performance evaluation methods of various
   flow measuring equipment and hydraulic turbines and pumps.

Fluid Mechanics Practicals:
1. Calibration of Venturi meter
2. Calibration of Orifice meter
3. Impact of jet on vanes
4. Determination of friction factor for a given pipe line.
5. Determination of loss of head due to sudden contraction in a pipe line.
6. Turbine flow meter.
7. Flow through notches (Rectangular & V-type)
8. Verification of Bernoulli’s theorem

Fluid Machines Practicals
1. Performance test on Pelton wheel.
2. Performance test on Francis turbine.
3. Performance test on Kaplan turbine.
4. Performance test on single stage centrifugal pump.
5. Performance test on multi stage centrifugal pump.
6. Performance test on reciprocating pump.

Course outcomes:
After completion of the course students will be able to
1. Verify the Bernoulli’s theorem for incompressible flows.
2. Determine the co-efficient of discharge for a flow measuring devices like
   Venturi meter and Orifice meter.
3. Determine the co-efficient of vanes like flat and curved vanes.
4. Determine the performance and draw operating characteristic curves for Pelton
   wheel, Reciprocating pump and Multi-stage Centrifugal pump.
5. Determine the loss of head in pipe lines due to friction, sudden contraction,
   enlargement, bends and elbows.

Mode of evaluation: Internal Evaluation & End Semester Examination.
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B. Tech. II Year I Semester

20ME204  3-D MODELLING LABORATORY

Course Prerequisite:  Engineering Graphics

Course Description:
The course is about the theory and technique of three-dimensional (3D) modelling utilizing appropriate software. Topics include the creation and modification of 3D geometric shapes; and rendering techniques; and use of camera light sources, texture, and surface mapping.

Course Objectives:
1. During the term of the course, students will learn to work within virtual 3-D space.
2. Build volumetric objects including: vertices, splines, polygons, primitive shapes and Sub Patch geometry.
3. Students will use these tools to build complex objects then learn the basic 3-D rendering tools and techniques.
4. The student will able to produce 2D drawing from the 3D part geometry to assure the proper dimensioning of the parts.
5. To make the students to understand and draw assemblies of machine parts and to draw their sectional views.

List of Experiments
1. Introduction to 3D modelling
2. Assembly of Sleeve and Cotter Joint
3. Assembly of Socket and Spigot Joint
4. Assembly of Shaft Coupling
5. Assembly of Gib & Cotter Joint
6. Assembly of Knuckle Joint
7. Assembly of Universal Joint
8. Assembly of Screw Jack
9. Assembly of Plummer Block
10. Assembly of Simple Eccentric Joint
11. Assembly of Machine Vice
12. Introduction to Drafting
13. Introduction to Sheet Metal

Course Outcomes:
The students after completing the course will be able to:
1. Identify of different types of bolts, nuts, welding joints screw threads, keys and fasteners.
2. Visualize and prepare detail drawing of a given object.
3. Draw details and assembly of mechanical systems.
4. Read and interpret given drawing.
5. Create 3-D models using any standard CAD software.

Text Books:
Lab manual provided by the department

References:

Mode of Evaluation: Internal Evaluation & End Semester Examination.
B. Tech. Mechanical Engineering

Mandatory Course
B. Tech. II Year I Semester

20CHE901 ENVIRONMENTAL SCIENCE

Pre-requisite
Basic knowledge about sciences up to intermediate or equivalent level.

Course Description:
The course deals with basic concepts of environment, its impact on human, universe, consumption of energy sources, effects, controlling methods for pollution and the environmental ethics to be followed by human beings.

Course Objectives:
1. To make the students aware about the environment and its inter-disciplinary nature and to emphasize the importance of the renewable energy sources.
2. To familiarize the concept of Ecosystem and their importance.
3. To bring the awareness among students about the importance of biodiversity and the need for its conservation.
4. To make the students understand the adverse effects of environmental pollution, its causes and measures to control it.
5. To introduce the environmental ethics and emphasize the urgency of rain water harvesting along with water shed management.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES
6 hours

UNIT II ECOSYSTEMS
6 hours

UNIT III BIODIVERSITY AND ITS CONSERVATION
6 hours
Introduction, Definition: Value of biodiversity: consumptive use, productive use, social, ethical and aesthetic values. Biogeographical zones of India. Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and Endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
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UNIT IV ENVIRONMENTAL POLLUTION 6 hours
Definition, Cause, effects and control measures of pollution – Air, Water, Soil and Noise. Solid Waste Management: Effects and control measures of urban and industrial wastes.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT 6 hours

Course Outcomes:
At the end of the course, the students will be able to acquire
1. Ability to understand the natural environment, its relationship with human activities and need of the day to realize the importance of the renewable energy sources.
2. The knowledge of various ecosystems and their importance along with the concepts of food chains, food webs and ecological pyramids.
3. Familiarity with biodiversity, its importance and the measures for the conservation of biodiversity.
4. The knowledge about the causes, effects and controlling methods for environmental pollution, along with disaster management and solid waste management.
5. Awareness about the sustainable development, environmental ethics, social issues arising due to the environmental disorders.

Text Books:

Reference Books:

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.
II Year II Semester
B. Tech. Mechanical Engineering

B. Tech II Year II Semester

20HUM101  ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

Course Prerequisite: None

Course Description:
The Engineering Economics and Financial Accounting aims to provide an insight into production, cost analysis, market structure, Accounting Basic concepts and financial Statement Analysis. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and accounts. This course introduces the accounting system, principles, types of accounts, and financial statements etc. The ratio analysis and financial analysis are useful to know the position of financial statements. Funds flows statements and cash flow statements are explained to know the analysis of financial matters.

Course Objectives:
The course is intended to
1. Describe the nature of engineering economics in dealing with the issues of scarcity;
2. Know the supply, demand, production and cost analysis to analyze the impact of economic events on markets;
3. Explain the performance of firms under different market structures and Price determination in various market conditions.
4. Explain the accounting principles, types of accounting and preparation of final accounts; and
5. Describe the financial analysis through ratios, funds flow and cash flow statements.

UNIT I: DEMAND ANALYSIS  
Scope and Significance of Economics- Understanding the problem of scarcity and choice - Elements of market Economy: Demand, Supply and Market Equilibrium- Theory of Demand, Elasticity of Demand, Supply and Law of Supply.

UNIT II: PRODUCTION AND COST ANALYSIS  
Production Function – Short-run and long- run production – Cost Analysis: Cost concepts - Cost Structure of Firms and output decision- Break-Even Analysis (BEA) – Managerial significance and limitations of BEA - Determination of Break Even Point (Simple Problems).

UNIT III: MARKET STRUCTURE:  
Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic, Oligopoly, Duopoly – Price determination and various market conditions

UNIT IV: BASICS OF ACCOUNTING:  
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UNIT V: BASICS OF FINANCIAL ANALYSIS 9 hours
Ratio Analysis - Liquidity, Leverage, Solvency and Profitability Ratios - Interpretation of Financial Statements - Funds Flow Statement - Capital Budgeting

Course Outcomes:
At the end of the course, students will be able to
1. Understand Engineering economics basic concepts,
2. Analyze the concepts of demand, elasticity, supply, Production, Cost Analysis and its essence in floating of an organization,
3. Compare different market structures and identify suitable market,
4. Demonstrate an understanding and analyzing the accounting statements, and
5. Demonstrate the ability to apply knowledge of accounting concepts through Financial Statements Analysis.

Text Books:
2. Financial Accounting, S.N.Maheshwari, Sultan Chand, 2009
3. Financial Statement Analysis, Khan and Jain, PHI, 2009

References:

Mode of Evaluation: Assignments, Internal Mid Tests and External End Examinations.
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B. Tech. II Year II Semester

**20MAT108  PROBABILITY AND STATISTICS**

**Course Prerequisite:** 20MAT101, 20MAT107.

**Course Description:**
This course provides probability concepts, Univariate distributions, and Chebychev’s inequality, Reliability of systems, linear regression, hypothesis testing and Design of experiments.

**Course Objectives:**
1. To understand the concepts of probability, random variables and their importance in engineering.
2. To solve real time problems in engineering by using discrete and continuous probability distributions.
3. To study the problems related to Reliability system and Joint random variables.
4. To apply classical inference involving confidence intervals and hypothesis testing in engineering problems.
5. To analyze the statistical experimental designs.

**UNIT I: PROBABILITY AND RANDOM VARIABLES**
9 hours
Probability-Classical and axiomatic, theorems on probability, conditional probability, Multiplication rule and Bayes' rule.
Random Variables: Discrete random variable, discrete density function, Continuous random Variable, continuous density function cumulative distribution.

**UNIT II: UNIVARIATE PROBABILITY DISTRIBUTIONS**
9 hours
Expectation of a random variable, moment generating function, geometric, binomial and Poisson distributions. Gamma, exponential, normal distributions; Chebyshev's inequality.

**UNIT III: RELIABILITY AND JOINT DISTRIBUTIONS**
9 hours
Weibull distribution, Reliability, Hazard rate function, Reliability of Series and Parallel systems
Joint densities: discrete and continuous joint densities, marginal densities, independence, expectation and covariance.

**UNIT IV: LINEAR REGRESSION AND TESTS OF HYPOTHESIS**
9 hours
Correlation and linear regression. Sampling distribution, tests of significance: Null and alternative hypothesis, errors in sampling, critical region and level of Significance. Large sample tests - single and difference of means. Small sample tests: t- test for single mean, and difference of means. Test for ratio of variances.

**UNIT V: ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS**
9 hours
Analysis of Variance: One-way and two-way classifications. Principles experimental design, Randomized Block Design (RBD) and Latin Square Design.
B. Tech. Mechanical Engineering

Course Outcomes:
At the completion of the course, students should able to

1. Understand the probability and random variables and its applications in mechanical engineering.
2. Get the importance of and discrete and continuous probability distributions in engineering.
3. Solve real time problems in Reliability engineering and study about joint probability distributions.
4. Apply classical inference involving confidence intervals and hypothesis testing in engineering problems.
5. Analyze the statistical experimental designs.

Text Books:


Reference Books:


Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.
B. Tech. Mechanical Engineering

B. Tech. II Year II Semester

20ME106 MECHANICS OF SOLIDS

Course Prerequisite: Engineering Mechanics

Course Description: Fundamental principles of stress and strains, Temperature relations; Principal stresses and strains; Shear Forces and Moments diagrams for various types of beams with different types of loads; Flexural Stresses and Deflection of Beams; Torsion, deflections due to bending; Stability of equilibrium.

Course Objectives:
1. Student will understand the fundamental concepts of stress, strain and deformation of solids with applications to bars and beams
2. Student will understand the theory of elasticity including strain/displacement Hooke’s law relationships
3. Student will understand shear forces and bending moments in various beams with different loads.
4. To create clear awareness to the student to concept of design of columns.
5. The knowledge of this subject will help in understanding the Design & Theory of Machines courses

UNIT I: FUNDAMENTALS OF STRESSES & STRAINS

Simple Stresses & Strains: Elasticity and plasticity, Types of stresses & strains, Hooke’s law, stress, strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson’s ratio & volumetric strain, Bars of a varying section, Factor of Safety, composite bars, Temperature stresses. Strain energy, Resilience, Gradual, sudden, impact, and shock loadings.

Principal Stresses: Principal Stresses, Strains with uni-axial and bi-axial conditions. Mohr’s circle concepts, Mohr’s circle for uni-axial and bi-axial stresses.

UNIT II: SHEAR FORCE AND BENDING MOMENT

Shear Force (SF) and Bending Moment (BM): Definition of a beam, Types of beams, Concept of shear force, and bending moment. SF and BM diagrams for cantilever, simply supported and overhanging beams subjected to Point loads, UDL, UVL and combination of these loads, Point of contraflexure. Relation between S.F., B.M., and rate of loading at a section of a beam.

UNIT III: FLEXURAL STRESSES & DEFLECTION OF BEAMS

Flexural Stresses: Theory of simple bending, Assumptions, Derivation of bending equation: M/ I = f/y = E/R, Neutral axis, Determination bending stresses, section modulus of rectangular, circular sections (Solid and Hollow), I, T, Angle and Channel sections, Design of simple beam sections. Deflection of Beams (Statically Indeterminate Beams): Introduction of deflection of beams, slope, deflection, and radius of curvature, a Differential equation for the elastic line of a beam, Double integration and Macaulay’s methods Determination of slope and deflection for cantilever and simply supported beams subjected to point load uniformly varying load, Mohr’s theorems.
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UNIT IV: TORSION

UNIT V: BUCKLING
Buckling and Stability, Columns with Pinned Ends, Columns with Other Support Conditions (Derivations and Numerical Problems).

ENERGY METHODS

Course Outcomes:
The students after completing the course will be able to:
1. Estimate the fundamental stresses, strains, and principal stresses by analytical and Mohr’s circle.
2. Analyze the distribution of shear force and bending moment for various types of beams under different load conditions.
3. Evaluate bending stresses in beams and calculate the deflection and slope of beams with different types of load.
4. Design shafts for pure torsion.
5. Analyze the elastic stability of flexible columns.

Text Book:

Reference Books:
6. Mechanics of solids and structures by Dr. R. Vidyanathan and Dr. P. Perumal, Laxmi Publishers

Mode of evaluation: Assignments, Internal Mid Tests and External End Examinations.
Course Prerequisite: Engineering Mechanics, Mathematics (Calculus and equations)

Course Description: The objective of this course is to understand the theory involved behind the design of a machine/mechanism. After an introduction about the structure (links, joints), degrees of freedom (DOF), inversions of kinematic chains; the commonly used mechanisms derived from the 4-bar chain are then dealt. The graphical methods for performing velocity and acceleration analyses of the constituent links of lower pair mechanisms are included. The theory of gears, kinematics of gear trains, gyroscopic motion and its application, and governors, are also studied. Cam profile synthesis corresponding to different combinations of follower motions is included and so is balancing of rotating masses in machinery. Lastly, the course gives an insight into the basic concepts of vibration analysis in mechanical systems.

Course Objectives:
1. To introduce basic definitions, commonly used mechanisms and their applications.
2. To understand the kinematic analysis (velocity and acceleration analysis) of lower pair mechanisms.
3. To synthesize cam profiles; and to perform balancing calculation for rotating masses.
4. To learn the theory of gearing and kinematic analysis of gear trains; and understand about the practical application of gyroscopic couple and also working of governors.
5. To learn to formulate the equation of motion and solving same for analyzing mechanical vibrations.

UNIT I: SIMPLE MECHANISMS
Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom– Grashof law; kinematic inversions of four bar chain and slider crank chains; Limit positions – Mechanical advantage- Transmission angle; Description of some common mechanisms- Quick return mechanism, straight line generators.

UNIT II: VELOCITY & ACCELERATION ANALYSIS
Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations-kinematic analysis of simple mechanisms - Coriolis component of acceleration.

UNIT III: GYROSCOPE, GOVERNORS & GEARS
Gyroscopic effect - Principle and applications; Governors. Gear Profile: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting-helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

UNIT IV: BALANCING & CAMS
Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods. Cams: Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions-cam profile synthesis - pressure angle and undercutting
UNIT V: VIBRATION

Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems; forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.

Course Outcomes:
The students after completing the course will be able to:
1. Identify the different mechanisms and their inversions in real life applications.
2. Calculate the velocity and acceleration of simple mechanisms by graphical methods.
3. Understand the principle of working of a gyroscope and governors; and classify gears and gear trains and compute velocity ratio.
4. Estimate the unbalance mass in rotating machines using analytical and graphical methods and able to sketch the cam profiles for different follower motions.
5. To study the free and forced vibrations of single degree freedom systems.

Text Book:

Reference Books:
7. F. Haidery, Dynamics of Machines, 5/e, Nirali Prakashan, Pune, 2003

Mode of Evaluation: Assignments, Mid Examinations (1 & 2), End Examination.
B. Tech. Mechanical Engineering

B. Tech. II Year II Semester

20ME108 MANUFACTURING TECHNOLOGY- I

Course Prerequisite: None

Course Description:
Manufacturing is the creation, through one or several processing operations, of components or products from basic raw materials. The effectiveness of process selection will be based on the inter-related criterion of design parameters, material selection and process economies.

Course Objectives:
1. Working principle of different metal casting processes and gating system.
2. Classification of the welding processes, working of different types of welding processes and welding defects.
3. Nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
5. Classification, applications and manufacturing methods of plastics, ceramics and powder metallurgy

UNIT I: METAL CASTING PROCESS

UNIT II: METAL JOINING PROCESS
Fabrication methods, Physics of welding, type of joints, edge preparations, types of welding process, electric arc, gas welding, brazing, soldering, inert gas welding, special type of welding – resistance welding, spot welding, thermit welding, plasma arc welding laser beam welding, TIG and MIG welding, submerged arc welding, friction stir welding, welding defects, Heat Affected Zone, Non-destructive testing methods, and applications of welding. Calculations of welding parameters.

UNIT III: SHEET METAL PROCESS
Introduction, Shearing, sheet metal characteristics and formability, blanking, piercing, forming, bending, drawing, deep drawing, spinning, rubber forming, hydro forming, superplastic forming, hot stamping, stretch forming, calculation of forces, spring back, progressive die, compound die, combination die, working of mechanical press, hydraulic press.

UNIT IV: BULK DEFORMATION PROCESS
Forging – Introduction hot forging and cold forging, open die forging, impression die forging, closed die forging, upset forging, extrusion forging, calculation of forces. Extrusion – Introduction – Hot extrusion, backward and forward extrusion, cold extrusion,
extrusion defects, impact extrusion, design of extrusion dies, design considerations, extrusion equipment, and application of extrusion.

**Rolling** – Introduction – Flat rolling, friction forces, roll force and power requirements, different types of rolling process, defects in rolling, Types of rolling mills, die design and design considerations, Application of rolling, calculation of rolling forces.

**Drawing** – Introduction – Calculation for drawing force, wire drawing, flat drawing, lubrication, die design for drawing, drawing process, die design, die materials, defects, residual stresses, types of drawing equipment, Application of drawing, advantages and limitations, calculation of drawing forces.

**UNIT V: POWDER METALLURGY**


**Course Outcomes:**

On successful completion of the course, the student will be able to:

1. Selection of suitable manufacturing process for a given product by pattern making, design of gating systems, preparation of molding and poring of molten metal for casting and defects etc.
2. Selection of metal joining process for different metal using different welding techniques and production of defect free products.
3. Production of components on sheet metal by using processes like blanking, piercing, forming, bending, deep drawing process.
4. Compare cold working and hot working processes using rolling, extrusion process, rolling and drawing process.
5. Making products from powder form by employing different techniques.

**Text Books:**


**Reference Books:**


**Mode of Evaluation:** Assignments, Internal Mid Tests and External End Examinations.
B. Tech. Mechanical Engineering

B. Tech. II Year II Semester

20ME205  MANUFACTURING TECHNOLOGY– I LABORATORY

Course Prerequisite: None

Course Description:
Production Techniques practical lab contains Metal casting, Welding, Mechanical Press working and processing of Plastics. These practical inculcates the skill to the students starting from preparing a wooden pattern to completion of a casting which also comprises different Sand testing techniques. Students will also get good skill on Welding, mechanical press working, processing of plastics & composite which will be helpful to get an employment in Industries.

LIST OF EXPERIMENTS
1. METAL CASTING LAB:
   a. Pattern Design and making – for one casting drawing.
   b. Sand properties testing - Exercise - for strengths, and permeability
   c. Molding: Melting and Casting
2. WELDING LAB:
   Arc Welding: Lap & Butt Joint
   a. Spot Welding  b. TIG Welding  c. MIG welding  d. Brazing
3. MECHANICAL PRESS WORKING:
   a. Blanking & Piercing operation and study of simple, compound and progressive press tool.
   c. Bending and other operations.
4. PROCESSING OF PLASTICS & COMPOSITE:
   a. Injection Molding  b. Fabrication of Composite plate

Course Outcomes:
This practical course is designed to enrich practical knowledge about common production techniques used in manufacturing. The students after completing the course will be able to:
1. Produce real time casting on their own
2. Prepare various joints by using various welding process
3. Perform blanking, piercing and forming operations on the sheet metal.
4. Prepare bottle with cape by using injection and vacuum forming.
5. Bend a pipe to the required angle.

Text Book:
1. Manual provided by the department

Reference Book:

Mode of Evaluation: Internal Evaluation & End Semester Examination.
B. Tech. Mechanical Engineering

B. Tech. II Year II Semester

20ME206 MECHANICS OF SOLIDS LABORATORY

Course Prerequisite: None

Course Objectives:
The objective of this course is to expose the students to a broad knowledge of experimental methods and measurement techniques useful in Mechanical engineering. Following is the list of experimental set ups on which experiments shall be conducted. Complete modalities of operation of the laboratory such as the exact titles of experiments, reports submission and evaluation methodology etc. shall be announced at the beginning of laboratory session.

LIST OF EXPERIMENTS
1. Rockwell Hardness Testing & Brinell Hardness Testing
2. Tensile Test
3. Impact Testing
4. Torsion Test
5. Bending test on
   1. Simply supported beam
   2. Cantilever beam
6. Test on springs.
7. Compression test on UTM
8. Double shear test on UTM

Course Outcomes:
The students after completing the course will be able to:
1. Evaluate hardness value for various materials using Rockwell hardness tester
2. Plot the stress strain curve of a ductile material under tensile and compressive load using universal testing machine
3. Calculate the slope and deflection of simply supported beam under point load
4. Experiment on a spring to interpret the stiffness and shear modulus.
5. Apply the concept of impact loading and to determine impact values for various materials.

Text Book:
Lab manual provided by the department

Reference Book:

Mode of Evaluation: Internal Evaluation & End Semester Examination.
B. Tech. Mechanical Engineering

B. Tech. II Year II Semester

20ME207 DYNAMICS AND ELECTRICAL MACHINES LABORATORY

Course Prerequisite: Electrical Engineering Laboratory

Course Objectives:
1. To equip students with understanding of the fundamental principles and techniques for identify different types of dynamic systems and classify them by their governing equations
2. To develop a model of a mechanical system using a free body diagram
3. To develop equations of motion for translational and rotational mechanical systems
4. To develop an understanding of how property data is generated and reported.
5. To create a bridge between theoretical knowledge and application.

List of experiments - Dynamics Lab Practicals:
1. Study of gyroscopic effect and determination of gyroscopic couple
2. Watt governor
3. Proell governor
4. Porter governor
5. Hartnell governor.
6. Static and dynamic balancing of rotating masses
7. To verify the relation \( t = 2 \pi \sqrt{l/g} \) for a simple pendulum
8. Forced vibration of equivalent spring mass system
9. Longitudinal vibration
10. Torsional vibration of single rotor shaft system
11. Torsional vibration of two rotor shaft system
12. Single rotor system with viscous damping
13. Whirling speed of shaft
14. Determination of jump speed of cam-follower system

List of experiments – Electrical Machines Practicals:
3. Load Test on DC Compound Generator. Determination of Characteristics.
4. Hopkinson’s Test on DC Shunt Machines. Predetermination of Efficiency.
5. Fields Test on DC Series Machines. Determination of Efficiency.
6. Swinburne’s Test and Speed Control of DC Shunt Motor. Predetermination of Efficiencies.
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Additional Experiments:
1. Load Test on DC Series Generator. Determination of Characteristics.
2. Retardation Test on DC Shunt Motor. Determination of Losses at Rated Speed.
3. Separation of Losses In DC Shunt Motor.

Course Outcomes:
The students after completing the course will be able to:
1. Analyze the motion and response of free, forced and damped vibration systems.
2. Experiment with the static and dynamic balancing of rotating mass system
3. Assess the effect of Gyroscopic couple in a dynamic body.
4. Examine the phenomenon of whirling in shafts.
5. Experiment with Governors and cam-follower systems.

Text Books:
Manual provided by the department

Reference Book:

Mode of Evaluation: Internal Evaluation & End Semester Examination.
Pre-requisite: NIL

Course Description:
This course is designed to provide basic understanding on database systems and its design. The course material further used for developing any web-based applications in which database is back end. Course covers from all basic and advanced queries of SQL, PL/SQL programs, Relational algebra and calculus, normal forms, low level details such as representing data elements of database and indexed structures, transaction management and data recovery.

Course Objectives:
The course is intended to:
1. To know about Indian constitution;
2. To know about central and state government functionalities in India; and
3. To know about Indian society.

UNIT I INTRODUCTION 6 hours

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT 6 hours
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT 6 hours

UNIT IV CONSTITUTION FUNCTIONS 6 hours
Indian Federal System – Center – State Relations – President’s Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V INDIAN SOCIETY 6 hours
Society: Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.
Course Outcomes:
Upon completion of the course, students will be able to:
1. Understand the functions of the Indian government; and
2. Understand and abide the rules of the Indian constitution.

Text Books:

Reference Books:

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.
Skill Oriented Courses
B. Tech. Mechanical Engineering

Skill Oriented Course – I
20ME601 DESIGN THINKING AND PRODUCT INNOVATION LABORATORY

Course Prerequisite: Basic Engineering Mathematics and Physics

Course Description:
This course is an introductory course on Innovation and Design Thinking. It focuses on providing you with the knowledge and fundamental understanding of Creativity, Innovation, and some contemporary approaches to innovation including design thinking. The course will cover seminal models, key principles, and methods and techniques in innovation and design thinking, including their applications.

Course Objectives:
1. To Define Creativity and Innovation
2. Recognize the significance of innovation
3. Discuss both individual and contextual factors that are linked to creativity
4. Discuss key concepts and principles that guide innovative practices
5. Examine approaches to innovation practiced by various organizations

UNIT I: HISTORY OF MODERN DESIGN 6 hours
An insight into design, History of Modern design: Early innovations industrialization, new materials, nature of design, work design for survival and survival through design
- Design a mind map of design thinking
- Thirty circle Exercise --- ideation

UNIT II: DESIGN THINKING APPROACHES 6 hours
Design thinking: Design thinking as a systematic approach to innovation, brain storming, visual thinking, design challenges, product development
- Prepared a toothpick bridge (mock-up model)
- Build a wind power car (mock up model)
- Prepared a marble maze (mock up model)

UNIT III: DECISION MAKING 6 hours
Innovation, art of innovation, strategies for creativity, teams for innovation, design alternatives, decision making for new design
- Develop customer journey map for a given case
- Construct empathy maps for a given case study-1
- Construct empathy maps for a given case study-2

UNIT IV: DESIGN THINKING APPLICATIONS 6 hours
Design thinking for strategic innovation, application of design, thinking in business and strategy, linking design thinking solution to business challenges, enterprise creativity, competitive logic of business strategy, design thinking for start-ups
- Make a hydraulic elevator (mock up models)
- Make a paper prototype for user testing (mock-up model)
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UNIT V: DESIGN THINKING TECHNIQUES 6 hours
Creative thinking techniques: Linear thinking, constraints in design, design thinking to meet corporate needs, designing today for tomorrow
- Design and development of cell phone wallet (mock-up model)
- Design thinking using sprint base software

Course Outcomes:
The students after completing the course will be able to:
1. Grasp the fundamental capabilities in the methods used for practicing Design Thinking
2. Understand challenges and benefits of Design Thinking
3. Communicate clearly about Design Thinking
4. Innovate in multidisciplinary teams
5. Have a process and mindset suited to innovation and creative problem-solving

Text Books:

References:

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination
B. Tech. Mechanical Engineering

Skill Oriented Course – II

20ENG601 CORPORATE COMMUNICATION LABORATORY

L T P C
1 0 2 2

Pre-requisite: 18ENG201

Course Description:
English is practical and it is a must for any institution to provide students with opportunities to indulge in actively applying their language skills. Thus the Communication Skills Lab facilitates students with adequate opportunities to put their communication skills in use. It also accommodates peer learning by engaging students in various interactive sessions. This lab will be accompanied by a practical lab component.

Course Objectives:
This course enables the students to –
1. Focus on their interactive skills
2. Develop their communicative competency
3. Fortify their employability skills
4. Empower their confidence and overcome their shyness
5. Become effective in their overall performance in the industry

UNIT I LISTENING SKILLS 8 hours
Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures, discussions from TV/Radio/Podcast.

UNIT II SPEAKING 10 hours
Articulation of sounds; Intonation.; Conversational skills (Formal and Informal); Group Discussion; Making effective Oral presentations: Role play.

UNIT III READING SKILLS 8 hours
Reading for main ideas; Applying background knowledge to predict content; Skimming; Scanning; Making inferences; Reading different genres of texts ranging from newspapers to creative writing; Reading Comprehension.

UNIT IV WRITING SKILLS 9 hours
Writing an introduction; Essay structure; Descriptive paragraphs; Writing a conclusion. Writing job applications and resume; Emails; Letters; Memorandum; Reports; Writing abstracts and summaries; Interpreting visual texts.
Different types of interviews: Answering questions and offering information; Mock interviews; Body Language.

Course Outcomes:
At the end of the course, learners will be able to—
1. Read articles from magazines and newspapers
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind, draft Reports and personal letters and emails in English.

Text Books:

Reference:
1. Dr. M. Adithan; Study Skills for Professional Students in Higher Education; S.Chand & Co. Pvt., 2014.
6. Charles Browne, Brent Culligan 7 Joseph Phillips; In Focus (level 2); Cambridge University Press.
7. Steven Gershon; Present Yourself 2 (second edition); Cambridge University Press.
8. Leo Jones; Let’s Talk 3 (second edition); Cambridge University Press.
9. Nutall J. C.; Reading Comprehension; Orient Blackswan.
10 www.cambridgeenglish.org/in/

Mode of Evaluation: Continuous Internal Evaluation, Practical Examination.