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**SYLLABUS OF**

**B. TECH.**

**MECHANICAL ENGINEERING**

**GYAN VIHAR SCHOOL OF**

**ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**EDITION 2018 - 2022**

**GYAN VIHAR SCHOOL OF ENGINEERING & TECHNOLOGY**

**B. TECH. MECHANICAL ENGINEERING – 4 YEARS PROGRAM**

**FEATURES OF B.TECH PROGRAM OF SGVU**

Bachelor of Technology in Mechanical Engineering (B. Tech) is a four year graduation degree programe in Mechanical Engineering. The course has been so designed that the students can meet all the demands of professionals in the field of Mechanical Engineering.

**NEED, OBJECTIVES, OUTCOMES & MAIN FEATURES OF B. TECH PROGRAM**

**NEED –**

* To develop a platform for higher studies in the field of Mechanical Engineering and its applications
* To develop the ability in students for understanding the basic concepts and their applications in the industries.
* To develop the capability in students for relevant research work.
* To obtain and generate an employment in computing field.

**OBJECTIVES**

* To provide broad exposure in all areas of Mechanical Engineering include mechanics, design, automobile engineering, robotics, manufacturing, energy engineering, etc.
* To enable the students to acquire practical experience in the Mechanical Engineering through lab projects.
* To create challenging environment for Learn to work in teams, develop leadership qualities and seamless communication skills
* To train the students and enable them to meet the technological challenges and diverse needs of industry and society in various areas of Mechanical Engineering and place them to excel in global industry.

**OUTCOMES**

Students will be able to:

1. Apply their knowledge in the domain of engineering mechanics, thermal engineering, fluid mechanics and other subjects to solve engineering problems utilizing advanced technology.
2. Successfully apply the principles of design, analysis and implementation of mechanical systems/processes.
3. Develop and implement new ideas on product design and development with the help of modern CAD/CAM/CAE tools, while ensuring best manufacturing practices.
4. Design mechanical devices to meet diversified needs of industries

**FEATURES OF BTECH CURRICULUM**

* 1st year of the program offered by SGVU is common to all B. Tech. programs covering courses related to Basic Sciences, Humanities Communication skills etc.
* 2nd year covers the areas of thermodynamics, machine design, mechanics of solids, material science, fluid mechanics, IC Engines, Instrumentation and control apart from machine design lab, strength of material lab, machine drawing lab, and fluid mechanics lab.
* 3rd year covers the subjects – dynamics of machine, heat and mass transfer, dynamics of machine, fundamental of aerodynamics apart from dynamics of machine lab, fluid machine lab, heat and mass transfer lab, mechanical vibration lab, and industrial engineering lab.
* B.Tech course contains the job oriented and advanced practical labs which help students understand the practical applications of the areas of mechanical engineering with the theoretical knowledge as well.
* B.Tech Mechanical Engineering Curricula includes the industry visits, Summer Training, Seminars Projects to develop the creativity and enhance the developed

Attitude towards the industrial sector.

**ROLE OF BTECH CURRICULUM IN NATIONAL DEVELOPMENT**

Mechanical engineering plays a major role in the employment as well as in the economy of the country, the curriculum plays an important role in the development of graduates who can serve world class services and take the nation forward.

**GLOBAL TRENDS REFLECTED IN B.Tech CURRICULUM**

There is always a demand of mechanical engineers globally. The department of mechanical engineering aims to produce high quality engineers in technology with a sound theoretical and practical knowledge who can under take responsibility to contribute effectively in the progress of the country and society.

**POSSIBILITY OF MOTIVATION & SELF DEVELOPMENT**

There are various possibilities of motivation and self development of the students through curriculum. The curriculum has been so designed that a student can

* understand the professional/industry environment
* understand team work and group dynamism.
* develop a sense of effective problem solving and decision making.
* think and develop projects independently.
* develop career as computer professional.

**PLACEMENT OPPORTUNITY**

Technical UG programs are basically a foundation for technical PG programs and research. Now a day because of the economy boom, there is high placement opportunities in industries in India and across the world as well. UG program of mechanical engineering includes study of various aspects of mechanical engineering to meet the requirements of various industries. A technical graduate can work for any industry big or small as a mechanical engineer and handle various roles like –

* Automobile engineer
* Production engineer
* Maintenance engineer
* Executive engineer

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | |
| **Department Of Mechanical Engineering**  **B.Tech Syllabus 3rd Sem Session 2018-2022 (Onwards)**  **to be implemented session 2019 - 2020** | | | | | | | | | |
| S.NO | Course Code | Course Name | Credit | Contact Hours/Week | | | Exam Hours | Weightage (%) | |
| L | T | P | CE | ESE |
|  |  | **UNIVERSITY CORE** |  |  |  |  |  |  |  |
| 1 | HS 203 | Economics and Social Sciences | 3 | 3 | - | - |  | 40 | 60 |
| 2 | EM 201 | Employability Skill 2 | 1 | - | 2 | - |  | 60 | 40 |
| 3 | MA 205 | Advance Maths | 3 | 3 | 0 | - |  | 40 | 60 |
| 4 | PC 201 | Proficiency in Co-Curricular Activities(PCA) III | 2 | - | - | - |  |  | 100 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 5 | ME 201 | Mechanics of Solids | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 6 | ME 203 | Engineering Thermodynamics | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 7 | ME 251 | Mechanics of Solid Lab | 2 | - | - | 4 | 3 | 60 | 40 |
| 8 | ME 253 | Industry Oriented Thermal Engineering Laboratory | 2 | - | - | 4 | 3 | 60 | 40 |
| 9 | ME 257 | Material Science Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 10 | ME 207 | Applied Material Science | 3 | 3 | - | - | 3 | 40 | 60 |
|  |  | **PROGRAME ELECTIVE (Select one subject & one lab )** |  |  |  |  |  |  |  |
| 11 | ME 211 | Manufacturing Technology | 3 | 2 | - | - | 3 | 40 | 60 |
| 12 | ME 259 | Manufacturing Technology Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 13 | ME 213 | Manufacturing Machines | 3 | 2 | - | - | 3 | 40 | 60 |
| 14 | ME 261 | Machine Practice Lab | 1 | - | - | 2 | 3 | 60 | 40 |
|  |  | **UNIVERSITY ELECTIVE(Select one subject / one lab )** |  |  |  |  |  |  |  |
| 15 | ME 209 | OOPS(Object Oriented Programming System) | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 16 | ME 263 | OOPS lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 17 | \*\*\*\*\* | Energy Storage Technologies | 2 | 2 | 1 | - | 3 | 40 | 60 |
|  |  | TOTAL | 30 | 15 | 5 | 8 |  |  |  |

Theory (19 Credit) + Lab (07 Credit) +Proficiency in Co-curricular Activities (2 Credit) + Employability skills (01 credit) = 30 Credit

**L= Lecture T=Tutorial CE=Continuous Evaluation**

**S= Seminar P= Practical ESE= End Semester Examination**

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | |
| **Department Of Mechanical Engineering**  **B.Tech Syllabus 4th Sem Session 2018-2022 (Onwards)**  **To be implemented in session 2019­2020** | | | | | | | | | |
| S.NO | Course Code | Course Name | Credit | Contact Hours/Week | | | Exam Hours | Weightage (%) | |
| L | T | P | CE | ESE |
|  |  | **UNIVERSITY CORE** |  |  |  |  |  |  |  |
| 1 | EM 202 | Employability Skill 3 | 1 | - | 2 | - |  | 60 | 40 |
| 2 | PC 202 | Proficiency in Co-Curricular Activities(PCA) IV | 2 | - | - | - |  | - | 100 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 1 | ME202 | Mechanics of Fluids | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 2 | ME 204 | Machine Element Design | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 3 | ME 210 | Internal Combustion Engine | 3 | 3 |  |  | 3 | 40 | 60 |
| 4 | \*\*\*\*\* | Kinematics of Machines | 3 | 3 |  |  | 3 | 40 | 60 |
| 5 | ME 252 | Fluid Mechanics Lab | 2 |  |  | 4 | 3 | 60 | 40 |
| 6 | ME258 | Industry Oriented Internal Combustion Engine Lab | 2 |  |  | 4 | 3 | 60 | 40 |
| 7 | ME 260 | Design/Simulation Lab(Software CREO/CATIA) | 1 |  |  | 2 | 3 | 60 | 40 |
| 8 | ME 256 | Kinematics of Machines Lab | 2 |  |  | 4 | 3 | 60 | 40 |
|  |  | **PROGRAME ELECTIVE (Select one subject with one lab )** |  |  |  |  |  |  |  |
| 9 | ME212 | Instrumentation & Control | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 10 | ME 250 | Instrumentation & Control Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 11 | ME 216 | Industrial Engineering | 2 | 2 | - | - | 3 | 40 | 60 |
| 12 | ME 262 | Industrial Engineering Lab | 1 | - | - | 2 | 3 | 60 | 40 |
|  |  | **UNIVERSITY ELECTIVE**  **(Select one subject and one lab )** |  |  |  |  |  |  |  |
| 13 | EE 214 | Electrical Machines | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 14 | EE 264 | Electrical Machines Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 15 | MCEH (T) | Electro Hydraulics | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 16 | MCEH (L) | Electro Hydraulics Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 17 | \*\*\*\*\* | Swatch Bharat Abhiyan | 2 | 2 | - | - | 3 | 60 | 40 |
|  |  | TOTAL | 30 | 14 | 4 | 11 |  |  |  |
| ***Note:- Summer Training: Professional Project Training for 30 days after 4th Semester Exams is compulsory.*** | | | | | | | | | |

Theory (18 Credit) + Lab (09 Credit) +Proficiency in Co-curricular Activities (2 Credit) + Employability skills (01 credit) = 30 Credit

**L= Lecture T=Tutorial CE=Continuous Evaluation**

**S= Seminar P= Practical ESE= End Semester Examination**

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | |
| **Department Of Mechanical Engineering B.Tech Syllabus 5th Sem Session 2018-2022 (Onwards)**  **To be implemented in session 2020 - 2021** | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |
| S.NO | Course Code | Course Name | Credit | Contact Hours/Week | | | Exam Hours | Weightage (%) | |
| L | T | P | CE | ESE |
|  |  | **UNIVERSITY CORE** |  |  |  |  |  |  |  |
| 1 | EM 301 | Employability Skill 4 | 1 | - | 2 | - |  | 60 | 40 |
| 2 | PT 301 | Practical Training Seminar I | 1 | - | - | 2 |  |  | 100 |
| 3 | PC 301 | Proficiency in Co-Curricular Activities (PCA) V | 2 | - | - | - |  |  | 100 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 4 | ME 317 | Hydraulic Machines | 3 | 3 | - | - | 3 | 40 | 60 |
| 5 | ME 307 | Dynamics of Machines | 3 | 3 | - | - | 3 | 40 | 60 |
| 6 | ME 315 | Machining Science and Machine  Tools | 3 | 3 | - | - | 3 | 40 | 60 |
| 7 | ME 303 | Machine Design | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 8 | ME 351 | Dynamics of Machine Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 9 | ME 355 | Industry Oriented Production Process Lab | 2 |  |  | 4 | 3 | 60 | 40 |
| 10 | ME 363 | Hydraulic Machines Lab | 1 | - | - | 2 | 3 | 60 | 40 |
|  |  | **PROGRAME ELECTIVE (Select one subject & one lab )** |  |  |  |  |  |  |  |
| 11 | ME 309 | Fundamental of Aerodynamics | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 12 | ME 311 | Mechanical Vibration & Noise Engineering | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 13 | ME 357 | Mechanical Vibration Lab | 2 |  |  | 4 | 3 | 60 | 40 |
|  |  | **UNIVERSITY ELECTIVE(Select one subject & one lab )** |  |  |  |  |  |  |  |
| 14 | MCPH (T) | Proportional  Hydraulics | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 15 | MCPH (L) | Proportional  Hydraulics Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 16 | ME 365 | Statistics for Decision Making | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 17 | \*\*\*\* | Global Engineering | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 18 | \*\*\*\* | Green Car Technology & Maintenance | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 19 | \*\*\*\* | Waste to Energy | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 20 | \*\*\*\* | Consumer Affairs | 2 | 2 | - | - | 3 | 40 | 60 |
|  |  | TOTAL | 30 | 15 | 4 | 10 |  |  |  |

Theory (18 Credit) + Lab (08 Credit) +Proficiency in Co-curricular Activities (2 Credit) + Employability skills (01 credit) = 30 Credit

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| **Department Of Mechanical Engineering B.Tech Syllabus 6th Sem Session 2018-2022 (Onwards)**  **To be implemented in session 2020 -2021** | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |
| S.NO | Course Code | Course Name | Credit | Contact Hours | | | Exam Hours | Weightage (%) | |
| L | T | P | CE | ESE |
|  |  | **UNIVERSITY CORE** |  |  |  |  |  |  |  |
| 1 | EM 302 | Employability Skills 5 | 1 | - | 2 | - |  | 60 | 40 |
| 2 | PC 302 | Proficiency in Co-Curricular Activities(PCA) VI | 2 | - | - | - |  |  | 100 |
| 3 | PE 302 | Project Stage­I (Minor Project) | 3 | - | - | 6 | 3 | 60 | 40 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 4 | ME 302 | Heat & Mass Transfer | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 5 | ME 306 | Automobile Engineering | 3 | 3 | - | - | 3 | 40 | 60 |
| 6 | ME 316 | Finite Element Analysis | 3 | 3 | - | - | 3 | 40 | 60 |
| 7 | ME 352 | Project Oriented Heat & Mass Transfer Lab | 2 | - | - | 4 | 3 | 60 | 40 |
| 8 | ME 354 | Automobile lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 9 | ME 362 | Software Lab (Solidwork/ANSYS) | 1 |  |  | 2 | 3 | 60 | 40 |
|  |  | **PROGRAME ELECTIVE (Select two Subjects & one Lab)** |  |  |  |  |  |  |  |
| 10 | ME 308 | Gas Dynamics & Propulsion | 3 | 3 | - | - | 3 | 40 | 60 |
| 11 | ME 304 | Mechatronics | 3 | 3 | - | - | 3 | 40 | 60 |
| 12 | ME 320 | Engg. Metrology and Measurement | 3 | 3 | - | - | 3 | 40 | 60 |
| 13 | ME 364 | Metrology Lab | 1 | - | - | 2 | 3 | 60 | 40 |
|  |  | **UNIVERSITY ELECTIVE(Select one subject and one lab )** |  |  |  |  |  |  |  |
| 14 | ME 310 | Numerical Analysis & Programming | 2 | 3 | - |  | 3 | 40 | 60 |
| 15 | ME 356 | Programming Lab­NMAS | 1 |  |  | 2 | 3 | 60 | 40 |
| 16 | MAS (T) | Sensoric | 2 | 3 | - |  | 3 | 40 | 60 |
| 17 | MAS (L) | Sensoric Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 18 | \*\*\*\*\* | Engineering Sustainability:  Analysis and Design | 2 | 3 | - |  | 3 | 40 | 60 |
| 19 | \*\*\*\*\* | Fuel Cell Technology | 2 | 3 | - |  | 3 | 40 | 60 |
| 20 | \*\*\*\*\* | Green Buildings and  Infrastructure | 2 | 3 | - |  | 3 | 40 | 60 |
| 21 | \*\*\*\*\* | Project Design, Evaluation  Management & Innovation | 2 | 3 | - |  | 3 | 40 | 60 |
|  |  | TOTAL | 30 | 15 | 3 | 10 |  |  |  |
| ***Note:- Industrial training for 45 days after 6th Semester Exams is compulsory.*** | | | | | | | | | |

Theory (19 Credit) + Lab (08 Credit) +Proficiency in Co-curricular Activities(2 Credit)+ Employibilty skills(01 credit) = 30 Credit

**L= Lecture T=Tutorial CE=Continuous Evaluation**

**S= Seminar P= Practical ESE= End Semester Examination**

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | |
| **Department Of Mechanical Engineering B.Tech Syllabus 7th Sem Session 2018-2022 (Onwards)**  **To be implemented in session 2021­2022** | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |
| S.NO | Course Code | Course Name | Credit | Contact Hours/Week | | | Exam Hours | Weightage (%) | |
| L | T | P | CE | ESE |
|  |  | **UNIVERSITY CORE** |  |  |  |  |  |  |  |
| 1 | EM 401 | Employability Skills 6 | 1 | 1 |  |  |  | 60 | 40 |
| 2 | PT 401 | Practical Training Seminar II | 1 | - | - | 2 |  |  | 100 |
| 3 | PE 401 | Project Stage­II | 3 | - | - | 6 | 3 | 60 | 40 |
| 4 | PC 401 | Proficiency in Co-Curricular Activities(PCA) VII | 2 |  |  |  |  |  | 100 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 5 | ME 401 | Refrigeration & Air-conditioning | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 6 | ME 409 | Renewable Energy Technology | 3 | 3 | - | - | 3 | 40 | 60 |
| 7 | ME 405 | Operation Research | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 8 | ME 451 | Refrigeration & Air-Conditioning Lab | 2 | - | - | 4 | 3 | 60 | 40 |
| 9 | ME 459 | Programming Software Lab (MATLAB) | 2 | - | - | 4 | 3 | 60 | 40 |
|  |  | **PROGRAME ELECTIVE (Select any TWO Subject)** |  |  |  |  |  |  |  |
| 10. | ME 403 | Power Plant Technologies | 3 | 3 | - | - | 3 | 40 | 60 |
| 11 | ME 413 | Computational Fluid Dynamics (use ANSYS CFX/ FLUENT software for tutorials) | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 12 | ME 417 | Engineering Nano Technology | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 13 | ME 419 | Non Destructive Evaluation & Testing | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 14 | \*\*\*\* | Digital Manufacturing | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 15 | \*\*\*\* | Advanced Innovation and  New Product Development | 3 | 3 | 0 | - | 3 | 40 | 60 |
|  |  | **UNIVERSITY ELECTIVE(Select One subject / one lab )** |  |  |  |  |  |  |  |
| 16 | MAP (T) | Basic Programmable Logic Controller | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 17 | MAP (L) | Programmable Logic Controller Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 18 | ME 421 | Disaster Management | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 19 | ME 423 | Principles & Practices of Management | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 20 | \*\*\*\* | Bio Robotics | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 21 | \*\*\*\* | Cloud Manufacturing | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 22 | \*\*\*\* | Smart cities and Automation | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 23 | \*\*\*\* | Energy auditing and energy  conservation in Thermal  systems | 2 | 2 | 0 | - | 3 | 40 | 60 |
|  |  | TOTAL | 30 | 12 | 2 | 16 |  |  |  |

Theory (19 Credit) + Lab (4 Credit) +Project (3) + Seminar (1) Proficiency in Co-curricular Activities (2 Credit) + Employability skills (01 credit) = 30 Credit

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | |
| **Department Of Mechanical Engineering B.Tech Syllabus 8th Sem Session 2018-2022 (Onwards)**  **To be implemented in session 2021­2022** | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |
| S.NO | Course Code | Course Name | Credit | Contact Hours/Week | | | Exam Hours | Weightage (%) | |
| L | T | P | CE | ESE |
|  |  | **UNIVERSITY CORE** |  |  |  |  |  |  |  |
| 1 | HS 402 | Intellectual Property Right | 2 | 2 | - | - |  | 40 | 60 |
| 2 | SM 402 | B.Tech seminar | 1 | - | - | 2 |  | 60 | 40 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 3 | ME 406 | Computer Aided Mechanical Design | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 4 | ME 404 | CNC Machines & Programming | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 5 | ME 414 | Non-Conventional Machining Methods | 3 | 3 | - | - | 3 | 40 | 60 |
| 6 | ME 462 | CAM lab | 1 |  |  | 2 |  | 60 | 40 |
| 7 | ME 464 | Solar Lab | 1 | - | - | 2 | 3 | 60 | 40 |
|  |  | **PROGRAME ELECTIVE**  **(Select any ONE Subjects)** |  |  |  |  |  |  |  |
| 8 | ME 402 | Robotics Engineering | 3 | 3 |  |  | 3 | 40 | 60 |
| 9 | ME 418 | Operation Management | 3 | 3 |  |  | 3 | 40 | 60 |
| 10 | ME 412 | Reliability & Maintenance Engg | 3 | 3 |  |  | 3 | 40 | 60 |
| 11 | ME 422 | Design & Manufacturing of Plastic Products | 3 | 3 |  |  | 3 | 40 | 60 |
|  |  | **UNIVERSITY ELECTIVE (Select one subject)** |  |  |  |  |  |  |  |
| 12 | ME 424 | Total Quality Management | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 13 | ME 426 | Human Resource Management | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 14 | ME 428 | Innovation and Entrepreneurship | 3 | 3 | 0 | - | 3 | 40 | 60 |
|  |  | TOTAL | 22 | 14 | 2 | 8 |  |  |  |

Theory (19 Credit) + Lab (02Credit)+ seminar(01 Credit) = 22 Credit

**L= Lecture T=Tutorial CE=Continuous Evaluation**

**S= Seminar P= Practical ESE= End Semester Examination**

**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**Distribution of Credits**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Semester** | **University Core** | **Program Core** | **Program Elective** | **University / Open Elective** | **Total credits** |
| **I** | **Autumn** | 22 | 6 | 0 | 0 | **28** |
| **Spring** | 20 | 9 | 0 | 0 | **29** |
| **II** | **Autumn** | 9 | 16 | 4 | 1 | **30** |
| **Spring** | 3 | 21 | 3 | 3 | **30** |
| **III** | **Autumn** | 4 | 17 | 6 | 3 | **30** |
| **Spring** | 6 | 14 | 7 | 3 | **30** |
| **IV** | **Autumn** | 7 | 15 | 6 | 2 | **30** |
| **Spring** | 3 | 13 | 3 | 3 | **22** |
| **Total Credits** | | **74** | **111** | **29** | **15** | **229** |
| **Percentage** | | **32.31%** | **48.47%** | **12.67%** | **6.55%** | **100%** |
| **IDEAL Distribution** | | **25%** | **50%** | **15%** | **10%** |  |

**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**LIST OF COURSES OFFERED**

**SESSION 2018­2022**

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| **S.N** | **Course Code** | **Course Name** | **Credit** | **Contact Hours/Week** | | | **Exam Hours** | **Weightage (%)** | |
| **L** | **T** | **P** | **CE** | **ESE** |
| 1 | HS 203 | Economics and Social Sciences | 3 | 3 | - | - |  | 40 | 60 |
| 2 | EM 201 | Employability Skill 2 | 1 | - | 2 | - |  | 60 | 40 |
| 3 | MA 205 | Advance Maths | 3 | 3 | 0 | - |  | 40 | 60 |
| 4 | PC 201 | Proficiency in Co-Curricular Activities(PCA) III | 2 | - | - | - |  |  | 100 |
| 5 | ME 201 | Mechanics of Solids | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 6 | ME 203 | Engineering Thermodynamics | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 7 | ME 251 | Mechanics of Solid Lab | 2 | - | - | 4 | 3 | 60 | 40 |
| 8 | ME 253 | Industry Oriented Thermal Engineering Laboratory | 2 | - | - | 4 | 3 | 60 | 40 |
| 9 | ME 257 | Material Science Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 10 | ME 207 | Applied Material Science | 3 | 3 | - | - | 3 | 40 | 60 |
| 11 | ME 211 | Manufacturing Technology | 3 | 2 | - | - | 3 | 40 | 60 |
| 12 | ME 259 | Manufacturing Technology Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 13 | ME 213 | Manufacturing Machines | 3 | 2 | - | - | 3 | 40 | 60 |
| 14 | ME 261 | Machine Practice Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 15 | ME 209 | OOPS(Object Oriented Programming System) | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 16 | ME 263 | OOPS lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 17 | \*\*\*\*\* | Energy Storage Technologies | 2 | 2 | 1 | - | 3 | 40 | 60 |
| 18 | EM 202 | Employability Skill 3 | 1 | - | 2 | - |  | 60 | 40 |
| 19 | PC 202 | Proficiency in Co-Curricular Activities(PCA) IV | 2 | - | - | - |  | - | 100 |
| 20 | ME202 | Mechanics of Fluids | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 21 | ME 204 | Machine Element Design | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 22 | ME 210 | Internal Combustion Engine | 3 | 3 |  |  | 3 | 40 | 60 |
| 23 | \*\*\*\*\* | Kinematics of Machines | 3 | 3 |  |  | 3 | 40 | 60 |
| 24 | ME 252 | Fluid Mechanics Lab | 2 |  |  | 4 | 3 | 60 | 40 |
| 25 | ME258 | Industry Oriented Internal Combustion Engine Lab | 2 |  |  | 4 | 3 | 60 | 40 |
| 26 | ME 260 | Design/Simulation Lab(Software CREO/CATIA) | 1 |  |  | 2 | 3 | 60 | 40 |
| 27 | ME 256 | Kinematics of Machines Lab | 2 |  |  | 4 | 3 | 60 | 40 |
| 28 | ME212 | Instrumentation & Control | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 29 | ME 250 | Instrumentation & Control Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 30 | ME 216 | Industrial Engineering | 2 | 2 | - | - | 3 | 40 | 60 |
| 31 | ME 262 | Industrial Engineering Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 32 | EE 214 | Electrical Machines | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 33 | EE 264 | Electrical Machines Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 34 | MCEH (T) | Electro Hydraulics | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 35 | MCEH (L) | Electro Hydraulics Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 36 | \*\*\*\*\* | Swatch Bharat Abhiyan | 2 | 2 | - | - | 3 | 60 | 40 |
| 37 | EM 301 | Employability Skill 4 | 1 | - | 2 | - |  | 60 | 40 |
| 38 | PT 301 | Practical Training Seminar I | 1 | - | - | 2 |  |  | 100 |
| 39 | PC 301 | Proficiency in Co-Curricular Activities (PCA) V | 2 | - | - | - |  |  | 100 |
| 40 | ME 317 | Hydraulic Machines | 3 | 3 | - | - | 3 | 40 | 60 |
| 41 | ME 307 | Dynamics of Machines | 3 | 3 | - | - | 3 | 40 | 60 |
| 42 | ME 315 | Machining Science and Machine Tools | 3 | 3 | - | - | 3 | 40 | 60 |
| 43 | ME 303 | Machine Design | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 44 | ME 351 | Dynamics of Machine Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 45 | ME 355 | Industry Oriented Production Process Lab | 2 |  |  | 4 | 3 | 60 | 40 |
| 46 | ME 363 | Hydraulic Machines Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 47 | ME 309 | Fundamental of Aerodynamics | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 48 | ME 311 | Mechanical Vibration & Noise Engineering | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 49 | ME 357 | Mechanical Vibration Lab | 2 |  |  | 4 | 3 | 60 | 40 |
| 50 | MCPH (T) | Proportional Hydraulics | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 51 | MCPH (L) | Proportional Hydraulics Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 52 | ME 365 | Statistics for Decision Making | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 53 | \*\*\*\* | Global Engineering | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 54 | \*\*\*\* | Green Car Technology & Maintenance | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 55 | \*\*\*\* | Waste to Energy | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 56 | \*\*\*\* | Consumer Affairs | 2 | 2 | - | - | 3 | 40 | 60 |
| 57 | EM 302 | Employability Skills 5 | 1 | - | 2 | - |  | 60 | 40 |
| 58 | PC 302 | Proficiency in Co-Curricular Activities(PCA) VI | 2 | - | - | - |  |  | 100 |
| 59 | PE 302 | Project Stage­I (Minor Project) | 3 | - | - | 6 | 3 | 60 | 40 |
| 60 | ME 302 | Heat & Mass Transfer | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 61 | ME 306 | Automobile Engineering | 3 | 3 | - | - | 3 | 40 | 60 |
| 62 | ME 316 | Finite Element Analysis | 3 | 3 | - | - | 3 | 40 | 60 |
| 63 | ME 352 | Project Oriented Heat & Mass Transfer Lab | 2 | - | - | 4 | 3 | 60 | 40 |
| 64 | ME 354 | Automobile lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 65 | ME 362 | Software Lab (Solidwork/ANSYS) | 1 |  |  | 2 | 3 | 60 | 40 |
| 66 | ME 308 | Gas Dynamics & Propulsion | 3 | 3 | - | - | 3 | 40 | 60 |
| 67 | ME 304 | Mechatronics | 3 | 3 | - | - | 3 | 40 | 60 |
| 68 | ME 320 | Engg. Metrology and Measurement | 3 | 3 | - | - | 3 | 40 | 60 |
| 69 | ME 364 | Metrology Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 70 | ME 310 | Numerical Analysis & Programming | 3 | 3 | - |  | 3 | 40 | 60 |
| 71 | ME 356 | Programming Lab­NMAS | 1 |  |  | 2 | 3 | 60 | 40 |
| 72 | MAS (T) | Sensoric | 3 | 3 | - |  | 3 | 40 | 60 |
| 73 | MAS (L) | Sensoric Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 74 | \*\*\*\*\* | Engineering Sustainability: Analysis and Design | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 75 | \*\*\*\*\* | Fuel Cell Technology | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 76 | \*\*\*\*\* | Green Buildings and Infrastructure | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 77 | \*\*\*\*\* | Project Design, Evaluation Management & Innovation | 2 | 2 | 1 |  | 3 | 40 | 60 |
| 78 | EM 401 | Employability Skills 6 | 1 | 1 |  |  |  | 60 | 40 |
| 79 | PT 401 | Practical Training Seminar II | 1 | - | - | 2 |  |  | 100 |
| 80 | PE 401 | Project Stage­II | 3 | - | - | 6 | 3 | 60 | 40 |
| 81 | PC 401 | Proficiency in Co-Curricular Activities(PCA) VII | 2 |  |  |  |  |  | 100 |
| 82 | ME 401 | Refrigeration & Air-conditioning | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 83 | ME 409 | Renewable Energy Technology | 3 | 3 | - | - | 3 | 40 | 60 |
| 84 | ME 405 | Operation Research | 4 | 3 | 1 | - | 3 | 40 | 60 |
| 85 | ME 451 | Refrigeration & Air-Conditioning Lab | 2 | - | - | 4 | 3 | 60 | 40 |
| 86 | ME 459 | Programming Software Lab (MATLAB) | 2 | - | - | 4 | 3 | 60 | 40 |
| 87 | ME 403 | Power Plant Technologies | 3 | 3 | - | - | 3 | 40 | 60 |
| 88 | ME 413 | Computational Fluid Dynamics (use ANSYS CFX/ FLUENT software for tutorials) | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 89 | ME 417 | Engineering Nano Technology | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 90 | ME 419 | Non Destructive Evaluation & Testing | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 91 | \*\*\*\* | Digital Manufacturing | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 92 | \*\*\*\* | Advanced Innovation and New Product Development | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 93 | MAP (T) | Basic Programmable Logic Controller | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 94 | MAP (L) | Programmable Logic Controller Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 95 | ME 421 | Disaster Management | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 96 | ME 423 | Principles & Practices of Management | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 97 | \*\*\*\* | Bio Robotics | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 98 | \*\*\*\* | Cloud Manufacturing | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 99 | \*\*\*\* | Smart cities and Automation | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 100 | \*\*\*\* | Energy auditing and energy conservation in Thermal systems | 2 | 2 | 0 | - | 3 | 40 | 60 |
| 101 | HS 402 | Intellectual Property Right | 2 | 2 | - | - |  | 40 | 60 |
| 102 | SM 402 | B.Tech seminar | 1 | - | - | 2 |  | 60 | 40 |
| 103 | ME 406 | Computer Aided Mechanical Design | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 104 | ME 404 | CNC Machines & Programming | 4 | 3 | 1 |  | 3 | 40 | 60 |
| 105 | ME 414 | Non-Conventional Machining Methods | 3 | 3 | - | - | 3 | 40 | 60 |
| 106 | ME 462 | CAM lab | 1 |  |  | 2 |  | 60 | 40 |
| 107 | ME 464 | Solar Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 108 | ME 402 | Robotics Engineering | 3 | 3 |  |  | 3 | 40 | 60 |
| 109 | ME 412 | Reliability & Maintenance Engg | 3 | 3 |  |  | 3 | 40 | 60 |
| 110 | ME 422 | Design & Manufacturing of Plastic Products | 3 | 3 |  |  | 3 | 40 | 60 |
| 111 | ME 418 | Operation Management | 3 | 3 |  |  | 3 | 40 | 60 |
| 112 | ME 424 | Total Quality Management | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 113 | ME 426 | Human Resource Management | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 114 | ME 428 | Innovation and Entrepreneurship | 3 | 3 | 0 | - | 3 | 40 | 60 |

**Theory Subject Assessment and Evaluation:**

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Method** | **What** | | **To whom** | **When/where**  **(Frequency in the course)** | **Max Marks** | **Evidence collected** |
| **DIRECT ASSMENT** | CIE | Mid Term Test | Student | Two tests | 20 | Midterm Answer books |
| Weekly Test | Two Weekly Test | 10 | Weekly Test Copies |
| Graded  Assignments | Two Assignments | 10 | Log of record |
| **Total** | **40** |  |
| ESE | End Sem Evaluation | End of the course | 60 | Answer scripts at BTE |
| **INDIRECT ASSESSMENT** | Student feedback | | Students | Middle of the course | -NA- | Feedback forms |
| End of Course survey | | End of course | Questionnaire |

**CIE** – Continuous Internal Evaluation **ESE** –End Semester Examination

|  |
| --- |
| **Composition of Educational Components:** |

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom’s taxonomy) such as:

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Educational Component** | **Weightage (%)** |
| 1 | Remembering and Understanding | 35 |
| 2 | Applying the knowledge acquired from the course | 25 |
| 3 | Analysis and Evaluation | 40 |

**Lab Assessment and Evaluation:**

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Method** | **What** | | **To whom** | **When/where**  **(Frequency in the course)** | **Max Marks** | **Evidence collected** |
| **DIRECT ASSMENT** | CIE | Performing 10 experiments | Student | Attendance | 10 | Lab Record |
| Lab Record + Performance + Viva | 30 |
| Term Project | 20 |
| **Total** | **60** |  |
| ESE | End Sem Evaluation | End of the course | 40 | Lab Record |
| **INDIRECT ASSESSMENT** | Student feedback | | Students | Middle of the course | -NA- | Feedback forms |
| End of Course survey | | End of course | Questionnaire |

**CIE** – Continuous Internal Evaluation **ESE** –End Semester Examination

|  |  |
| --- | --- |
| Course Title: Economics and Social Sciences | Course Code : HS 203 |
| Semester : **III** | Core / Elective :**University** **Core** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Course Objective**

* To understand the significance of the economic aspects of engineering and to become proficient in the evaluation of engineering proposals in terms of worth and cost
* To help students to grasp various economics concepts and theories towards making economic decision.

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| I | Definition of Economics - various definitions, Nature of Economic problem, Production possibility curve, Economic laws and their nature. Relation between Science, Engineering, Technology and Economics.  Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility - its practical application and importance | 7 |
| II | Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, factors effecting elasticity of demand, practical  importance & applications of the concept of elasticity of demand.  Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale. | 7 |
| III | Various concepts of cost - Fixed cost, variable cost, average cost, marginal cost, money cost, real cost opportunity cost. Shape of average cost, marginal cost, total cost etc. in short run and long run.  Meaning of Market, Types of Market - Perfect Competition, Monopoly, Oligoply, Monoplistic Competition (Main features of these markets) | 7 |
| IV | Supply and Law of Supply, Role of Demand & Supply in Price Determination and effect of changes in demand and supply on prices. | 7 |
| V | Nature and characteristics of Indian economy (brief and elementary introduction), Privatization - meaning, merits and demerits. Globalization of Indian economy - merits and demerits. Elementary Concepts of VAT, WTO,  GATT & TRIPS agreement | 7 |
|  | Total | 35 |

**Text Books:**

1, Vengedasalam, Deviga. Madhavan, Karunagaran, Principles of Economics, Oxford University Press.

2. R. Paneer Seelvan, “ Engineering Economics”, PHI

3. Ahuja,H.L., “Principles of Micro Economics” , S.Chand & Company Ltd

4. Riggs,J.L., Bedworth and Randhwa, “Engineering Economics”, McGraw Hill Education India

5.Paul, R.R., Money, Banking and International Trade, Kalyni Publishers

**Ref. Books**

1.Park, Chan.S, “Fundamental of Engineering Economics”, Pearson.

2. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson

3. Thuesen, G.J.,Fabrycky,. Engineering Economy, PHI.

4.Jhingan,M.L., “Macro Economic Theory”, Vrinda Publications Ltd

**Course Code: EM-201 Course Name:** Employability Skills – II

**LTPC:** 0201**Total Contact Hours**: 25

**COURSE CONTENTS**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Topic** | **Details** | **Contact Hrs** |
| 1 | Communication | Role Play, Reading, Formal writing skills Listening, Interaction Process, Interpersonal Relationship | 15 |
| 2 | Attitude& Manners | Motivation, Team Building, Winning Strategy, CAN DO, | 5 |
| 3 | Preparation, presentation | Presentation skills, Preparation Skills, | 4 |
| 4 | Industry | Concept & Importance of SIP, Industrial Mentoring & Networking | 1 |

|  |  |
| --- | --- |
| Course Title: ADVANCED MATHS | Course Code : MA 205 |
| Semester : **III** | Core / Elective :**University** **Core** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Pre-requisites:**

Basic maths

**Course Objectives:**

To know advancement of maths in engineering field

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | **8** | **20** |
| **UNIT-1** |  |  |
| Boundary value problems: Method of separation of variables - in the solution of wave equation in one dimension, Laplace’s equation in two dimensions, Diffusion equation in one dimension. |  |  |
| **UNITS-2** | **07** | **20** |
| Transform calculus : Laplace transform with its simple properties, applications to the solutions of ordinary and partial differential equations having constant co-efficient with special reference to wave and diffusion equation |  |  |
| **UNITS-3** | **07** | **20** |
| FOURIER TRANSFORM - Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant coefficient with special reference to heat equation and wave equation. |  |  |
| **UNIT-4** | **7** | **20** |
| Complex variable: Taylor’s series, Laurent’s series, poles, residues. Evaluations of simple definite real integrals using the theorem of residues. Simple contour integration. |  |  |
| **UNIT 5** | **07** | **20** |
| Numerical Methods: Finite differences and interpolation Numerical Differentiation and Integration. Solution of Algebraic and transcendental equations by graphical method, trisection method, regula – falsi method and Newton raphson method. |  |  |
| **TOTAL** | **36** | **100** |

**Course outcomes:**

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

1. Solve Advanced Mathematics problems in engineering field.

|  |  |
| --- | --- |
| Course Title:  **MECHANICS OF SOLID** | Course Code :  **ME 201** |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic mathematics and Engineering Mechanics

**Course Objectives:**

* To define the concept of load, stress, strain, stress vs strain diagram and elastic

constant relationship.

* To Solve engineering problems through the relationship between stress and strain.
* To determine shear force and bending moment diagrams for variously loading

Conditions

* Learn to solve problems for calculation of torsion and Twisting moment in solid and

hollow circular shafts.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **8** | **20** |
| **Introduction to Stress and strain:** Definition of Stress, Normal Stress in axially loaded Bar, Stress on inclined sections in axially loaded bar, Shear Stress, Analysis of normal and shear stress, Deterministic design of members, probabilistic basis for structural design. Tension test and normal Strain, Stress strain relation and Hooke's law. Poisson's ratio, Thermal strain and deformation. | 8 |  |
| **UNIT-2** | **7** | **20** |
| **Stress as a tensor:** stress at point, Cauchy stress tensor, equilibrium equations, analysis of deformation and definition of strain components  **Some properties of Stress and Strain Tensor:** Principal stresses and strains, stress and strain invariants, Mohr’s circle representation for plane stress and plane strain, thermal stresses and strains, volumetric stress and strain. | **7** |  |
| **UNIT-3** | **7** | **20** |
| **Application of Mechanics of Material in Different Problems:**  Shear Force and Bending Moment diagrams, Axially loaded members, Torsion of circular shafts, Stresses due to bending: pure bending theory, combined stresses. Deflections due to bending: moment-curvature relation, load-defection differential equation, area moment method, and superposition theorem, Stresses and deflections due to transverse shears, Springs: Helical and Leaf springs | 7 |  |
| **UNIT-4** | **7** | **20** |
| **Constitutive relations:** An short introduction to material symmetry transformations, Isotropic material, true and engineering stress-strain curves, Material properties for isotropic materials and their relations. Theories of failures for isotropic materials,Buckling of columns; Concept of creep, fatigue and fracture. | 7 |  |
| **UNIT-5** | **7** | **20** |
| **Energy Methods:** Strain energy due to axial, torsion, bending and transverse shear. Castigliano's theorem, reciprocity theorem etc. | 7 |  |
| **TOTAL** | **26** | **100** |

**Refrences:**

* S. C. Crandall, N. C. Dahl, and T. J. Lardner, An Introduction to the Mechanics of Solids, 2nd Ed, McGraw Hill, 1978.
* E. P. Popov, Engineering Mechanics of Solids, Prentice Hall, 1990.
* H. Shames, Introduction to Solid Mechanics, 2nd Ed, Prentice Hall, 1989.
* S. P. Timoshenko, Strength of Materials, Vols. 1 & 2, CBS publ., 1986.

**Course outcomes:**

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

* Find the basic mechanical properties of material, tension, compression, torsion, bending and combined stress using the fundamental concepts of stress, strain and elastic behavior of materials.
* Apply the stress- strain distributions, diagrammatically representation of shear force & bending moment for different beams under various load conditions by using suitable methods.
* Analyze the slope and deflections for different cross sectional beams and columns, torsion effect for shaft and springs under different load conditions.
* Solve the engineering problems by applying mechanical engineering concepts and theories.

|  |  |
| --- | --- |
| Course Title: **ENGINERING THERMODYNAMICS** | Course Code : ME 203 |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic of physics, basic of mathematics, first and , Zeroth law of thermodynamics, Carnot engine, Work

**Course Objectives:**

To study about thermodynamic System, properties and their types & state, Definition of work process & cycle internal energy & enthalpy, Specific heats; internal energy, enthalpy, Reversible process; heat engine, heat pump, refrigerator; Kelvin-Planck & Clausius statements, Concept of entropy; the Need of entropy definition of entropy; Available energy, Otto, Diesel and Dual cycle, Third Law of Thermodynamics.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **7** | **20** |
| Thermodynamic Systems, properties & state, process & cycle Definition of work and its identification, work done at the moving boundary, Zeroth law.  Thermodynamic Properties of Fluids: Pure substance, Concept of  Phase, Graphical representation of p-v-T data, Properties of steam. Steam tables, Mollier chart |  |  |
| **UNIT-2:** | **07** | **20** |
| First law for control mass & control volume for a cycle as well as for a change of state, internal energy & enthalpy, Specific heats; internal energy, enthalpy specific heat of ideal gases.  First law analysis of some elementary processes. Steady and unsteady flow energy equations. |  |  |
| **UNIT-3:** | **07** | **20** |
| Second Law of Thermodynamics: Heat engine, Heat pump and  refrigerator, Second law of thermodynamics, Equivalence of the Kelvin-Plank and Clausius statements. Reversible and Irreversible Processes, Carnot engine, Efficiency of a Carnot engine, Carnot principle, thermodynamic temperature scale, Clausius Inequality.  Entropy: Entropy, Calculation of Entropy change, Principle of entropy increase. Temperature-Entropy diagram, Second law analysis of a control volume. |  |  |
| **UNIT-4** | **08** | **20** |
| Available energy, reversible work irreversibility for control mass and control volume processes; second law efficiency.  Thermodynamic Relations: Thermodynamic variables, Independent and dependent variables, Maxwell’s thermodynamic relations, Thermodynamic relations involving entropy, Thermodynamic relations involving enthalpy and internal energy, Joule-Thomson coefficient, Clapeyron equation. |  |  |
| **UNIT-5** | **07** | **20** |
| Power Cycles: Otto cycle, Diesel cycle, Dual cycle, Brayton cycle and Ericsson cycle.  Vapour power cycle: Rankine cycle, effect of operating conditions on its efficiency, properties of ideal working fluid in vapour power cycle, Reheat cycle, regenerative cycle, bleeding extraction cycle, feed water heating co-generation cycle. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

* Sonntag R.E., Claus B. & Van Wylen G., "Fundamentals of Thermodynamics", John Wiley & Sons, 2000, 6th ed.
* GFC Rogers and Y R Mayhew, Engineering Thermodynamics Work and Heat Transfer 4e, Pearson 2003
* J P Howell and P O Bulkins, Fundamentals of Engineering Thermodynamics, McGraw Hill,1987
* Y A Cengal and M A Boles, Thermodynamics, An Engineering Approach, 4e Tata McGraw Hill, 2003.
* Michael J. Moran & Howard N. Shapiro, Fundaments of Engineering Thermodynamics, John Wiley & Sons, 2004, 4th ed

**Course outcomes:**

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

1. The students will be able to define the terms temperature, entropy and enthalpy.
2. The students will be able to explain the refrigeration and heat pump cycle
3. The students will be able to explain properties of pure substance.
4. The students will be able to understand working of different-different engines.

|  |  |
| --- | --- |
| Course Title:  **MECHANICS OF SOLID LAB** | Course Code : ME 251 |
| Semester : III | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Engineering Mechanics, Mechanics of solids theory

**Course Objectives:**

TO PERFORM VARIOUS EXPERIMENTS ON MECHANICS OF SOLIDS

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. Izod Impact testing.  2. Rockwell Hardness Testing.  3. Spring Testing  4. Column Testing for buckling  5. Torsion Testing  6. Tensile Testing  7. Compression Testing  8. Shear Testing  9. Brinell Hardness Testing  10. Bending Test on UTM.  11. Study of Fatigue Testing Machine. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

* S. C. Crandall, N. C. Dahl, and T. J. Lardner, An Introduction to the Mechanics of Solids, 2nd Ed, McGraw Hill, 1978.
* E. P. Popov, Engineering Mechanics of Solids, Prentice Hall, 1990.
* I. H. Shames, Introduction to Solid Mechanics, 2nd Ed, Prentice Hall, 1989.
* S. P. Timoshenko, Strength of Materials, Vols. 1 & 2, CBS publ., 1986.

**Course outcomes:**

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

1. Various type of strength calculation
2. Calculation of hardness
3. Calculation of toughness

|  |  |
| --- | --- |
| Course Title: **Industry Oriented Thermal Engineering Laboratory** | Course Code : ME 253 |
| Semester : III | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **30** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

ENGINEERING THERMODYNAMICS

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON THERMAL EQUIPMENTS

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **30** | **100** |
| 1. Comparative study of four stroke diesel and petrol engines.  2. Comparative study of two stroke petrol and diesel engines.  3. Studies of fuel supply systems of diesel and petrol engines.  4. Study of cooling, lubrication and ignition system in diesel and petrol engines.  5. To study various types of Boilers and to study Boiler mounting and accessories.  6. To study various types of Dynamometers.  7. To study Multi Stage Air Compressors.  8. To find the BHP, Thermal efficiency of four stroke diesel engine.  9. To prepare a comparison sheet of various automobiles (4 Wheeler and 2 Wheeler).  10. To study BHP, Thermal efficiency of four stroke diesel engine. | THREE hours for each experiment |  |
| **TOTAL** | **30** | **100** |

**Reference:**

1. Sonntag R.E., Claus B. & Van Wylen G., "Fundamentals of Thermodynamics", John Wiley & Sons, 2000, 6th ed.
2. GFC Rogers and Y R Mayhew, Engineering Thermodynamics Work and Heat Transfer 4e, Pearson 2003
3. J P Howell and P O Bulkins, Fundamentals of Engineering Thermodynamics, McGraw Hill,1987
4. Y A Cengal and M A Boles, Thermodynamics, An Engineering Approach, 4e Tata McGraw Hill, 2003.
5. Michael J. Moran & Howard N. Shapiro, Fundaments of Engineering Thermodynamics, John Wiley & Sons, 2004, 4th ed

**Course outcomes:**

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

1. Comparative study of four stroke diesel and petrol engines.

2. Comparative study of two stroke petrol and diesel engines.

3. Studies of fuel supply systems of diesel and petrol engines.

4. Study of cooling, lubrication and ignition system in diesel and petrol engines.

5. To study various types of Boilers and to study Boiler mounting and accessories.

|  |  |
| --- | --- |
| Course Title: MATERIAL SCIENCE LAB | Course Code : ME 257 |
| Semester : III | Core / Elective: PROGRAME  **ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **0:0:2** | Credits : **1 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Workshop technology, Engineering mechanics, Engineering drawing

**Course Objectives:**

TO STUDY PROPERTIES OF VARIOUS MATERIALS THEIR STRUCTURE AND BEHAVIOUR OF PHASE DIAGRAM.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **30** | **100** |
| 1. To study the Engineering Materials, significance and classifications.  2. Study of crystals structures, Study of Models BCC, FCC, HCP, stacking sequence, tetrahedral and Octahedral voids  3. To calculate the effective numbers of atoms, co-ordination no. packing factors, c/a ratio for BCC, FCC & HCP structures.  4. To prepare metallic samples for metallographic examination and to study the principle and construction of the Metallurgical Microscope.  5. Effect of carbon percentage on hardness of steel  6. Study of Phase Diagrams: concept of phase rule: Fe-C & Cu-Zn.  7. Study of Creep, Study of anistropy: Glass 'Fibre and Carbon' Fibre Composites.  9. Study of various types of fractures, Brittle fracture/ductile.  10. Study of Iron-Carbon Equilibrium Diagram and sketch the various structures present at room temperature. | Two hours for each experiment |  |
| **TOTAL** | **30** | **100** |

**Reference:**

1. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.

2.V. Raghavan, Materials Science and Engineering, Fifth Edition, Prentice Hall Of India, 2008.

3.G. E. Dieter, Mechanical Metallurgy, McGraw Hill, 1988.

4.W. F. Smith, Materials Science and Engineering (SIE), Tata-McGraw Hill, 2008.

5.AVNER, Introduction to Physical Metallurgy, Tata-McGraw Hill, 2008.

**Course outcomes:**

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

1. To differentiate between various materials
2. To understand structure of various material.
3. To Study of Iron-Carbon Equilibrium Diagram .

|  |  |
| --- | --- |
| Course Title: **APPLIED MATERIAL SCIENCE** | Course Code : ME 207 |
| Semester : III | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Element of Mechanical Engineering, Material Science

**Course Objectives:**

TO STUDY ABOUT BASICS OF MATERIAL, PROPERTIES AND THEIR STUCTURE.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **7** | **20** |
| **Structure of metal**: Crystal structure, miller indices, lattices, imperfections, elementarytreatment of point and line defects and their relation to mechanical properties.  **Deformation**: Slip, twinning, effect of cold and hot working on mechanical properties, principles of recovery, re-crystallization and gain growth. |  |  |
| **UNIT-2:** | **07** | **20** |
| **Creep:** Basic consideration in the selection of material for high and low temperature service,creep curve, effect of material variables on creep properties, brittle failure at low temperature.  **Solidification**: Phases in metal system, lever rule, solidification of metal and alloys, solid solution, eutectic, eutectoid and inter-metallic compounds, Iron carbon equilibrium diagram, TTT-diagram |  |  |
| **UNIT-3:** | **07** | **20** |
| **Heat Treatment**: Principles and purpose of heat treatment of plain carbon steels, annealing,normalizing, hardening, tempering, isothermal treatment, case hardening – carburizing, nitriding etc, precipitating hardening of aluminum alloys. |  |  |
| **UNIT-4:** | **07** | **20** |
| **Engineering Materials:** PlainCarbon steels, Effects of alloying elements , properties, uses, springs, and wear resisting steels, IS standards codes for steels. Low alloy steels. Stainless, Magnetic materials for high and low temperature service. Brasses and bronzes; Aluminum base alloys. Bearing Materials,. |  |  |
| **UNIT-5:** | **08** | **20** |
| **Corrosion**:Types of corrosion, Galvanic cell, rusting of Iron, Methods of protection from corrosion.  **Fiber Reinforced Composites**: General characteristics, Applications, Introduction to Fibers –glass, carbon, Kevlar 49 fibers. Matrix –Polymeric, Metallic, Ceramic Matrix, Coupling agents and fillers.. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.

2. V. Raghavan, Materials Science and Engineering, Fifth Edition, Prentice Hall Of India, 2008.

3. G. E. Dieter, Mechanical Metallurgy, McGraw Hill, 1988.

4. W. F. Smith, Materials Science and Engineering (SIE), Tata-McGraw Hill, 2008.

5. AVNER, Introduction to Physical Metallurgy, Tata-McGraw Hill, 2008.

**Course outcomes:**

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

1. Crystal structure, miller indices, lattices, imperfections, elementarytreatment of point and line defects and their relation to mechanical properties.
2. Principles and purpose of heat treatment of plain carbon steels, annealing,normalizing, hardening, tempering, isothermal treatment, case hardening – carburizing, nitriding etc, precipitating hardening of aluminum alloys..
3. Types of corrosion, Galvanic cell, rusting of Iron, Methods of protection from corrosion.

|  |  |
| --- | --- |
| Course Title: **MANUFACTURING TECHNOLOGY** | Course Code : ME 211 |
| Semester : **III** | Core / Elective : **Program** **Elective** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech (Mechanical Engineering)** | |

**Pre-requisites:**

Workshop technology, physics in Secondary Education, engineering drawing, engineering mechanics.

**Course Objectives:**

1. Apply the concept of different types of casting in manufacturing of product.
2. Apply the concept of different types of welding in manufacturing of product.
3. Apply the concept of smithy and forging in manufacturing of product.
4. Apply the concept of sheet metal work in manufacturing of product.
5. Apply the concept of bench work and fitting in manufacturing of product.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **MANUFACTURING TECHNOLOGY** | | |
| **UNIT I:** METAL CASTING PROCESSES | 08 | 20 |
| Sand Casting Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications: Melting furnaces : Blast and Cupola Furnaces: Principle of special casting processes : Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO2 process – Stir casting; Defects in Sand casting |  |  |
|  | | |
| **UNIT II:** **METAL JOINING PROCESSES** | 07 | 20 |
| Operating principle. basic equipment. merits and applications of : Fusion welding processes : Gas welding -Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding –Submerged arc welding – Electro slag welding: Operating principle and applications of : Resistance welding -Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding: Brazing and soldering: Weld defects: types.causes and cure. |  |  |
| **UNIT III: METAL FORMING PROCESSES** | 07 | 20 |
| Hot working and cold working of metals – Forging processes – Open, impression and closed die forging –forging operations. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion. |  |  |
|  | | |
| **UNIT IV:** **SHEET METAL PROCESSES** | 07 | 20 |
| Sheet metal characteristics – shearing. bending and drawing operations – Stretch forming operations –Formability of sheet metal – Test methods –special forming processes-Working principle and applications –Hydro forming – Rubber pad forming – Metal spinning– Introduction of Explosive forming. magnetic pulse forming. peen forming. Super plastic forming – Micro forming |  |  |
| **UNIT IV:** **POWDER METALLURGY** | 07 | 20 |
| Properties of Powder processed materials, Powder manufacturing, mechanical pulverization, sintering, Electrolytic  Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of Powder metallurgy.  **Rapid Prototyping Operations:** Introduction, subtractive processes, additive processes, Virtual Prototyping and applications |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1 James S Campbell, Principles of Manufacturing Materials and Processes, Tata McGraw Hill, 1995.

2 F.C. Flemmings, Solidification processing, Tata McGraw Hill, 1982

3 M J Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill, 1987.

4 G E Linnert, Welding Metallurgy, AWS, 1994.

5 P C Pandey and C K Singh, Production Engineering Sciences, Standard Publishers Ltd. 1980.

**Course outcomes:**

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

1. Apply the concept of different types of casting in manufacturing of product.
2. Apply the concept of different types of welding in manufacturing of product.
3. Apply the concept of smithy and forging in manufacturing of product.
4. Apply the concept of sheet metal work in manufacturing of product.
5. Apply the concept of bench work and fitting in manufacturing of product.

|  |  |
| --- | --- |
| Course Title: MANUFACTURING TECHNOLOGY LAB | Course Code : ME 259 |
| Semester : III | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:2** | Credits : **1 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Mechanical Workshop and Various shops used in first year.

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS BY USING VARIOUS MACHINES AND TOOL.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. To study of lathe machine, lathe tools cutting speed, feed and depth of cut.  2. To perform step turning, knurling and chamfering on lathe machine as per drawing.  3. Taper turning by tailstock offset method as per drawing.  4. To prepare the job by eccentric turning on lathe machine.  5. To perform square threading, drilling and taper turning by compound rest as per drawing.  6. To study shaper machine, its mechanism and calculate quick return ratio.  7. To prepare mould of a given pattern requiring core and to cast it in aluminium.  8. To perform moisture test and clay content test.  9. Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).  10. To perform permeability test  11. A.F.S. Sieve analysis test.  12. Hands-on practice on spot welding.  13. Hands-on practice on submerged arc welding  14. Hands-on practice on metal inert gas welding (MIG) and tungsten inert gas welding (TIG). | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1. James S Campbell, Principles of Manufacturing Materials and Processes, Tata McGraw Hill, 1995.

2. F.C. Flemmings, Solidification processing, Tata McGraw Hill, 1982

3. M J Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill, 1987.

3. G E Linnert, Welding Metallurgy, AWS, 1994.

4. P C Pandey and C K Singh, Production Engineering Sciences, Standard Publishers Ltd. 1980.

**Course outcomes:**

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

1. To provide various angles on single point cutting tool by using grinding machine.
2. Able to perform various operation on different different machine.
3. Calculate Speed, Feed and Depth of cut.

|  |  |
| --- | --- |
| Course Title: MANUFACTURING MACHINES | Course Code : ME 213 |
| Semester : III | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Workshop technology, Basic knowledge of machine shop

**Course Objectives:**

* To develop the machinery product by various machines.
* To study and calculations of machinery operations
* These objectives facilitate a method to achieve Program Outcomes [1, 2, 3, 4, 5, 7]

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **08** | **20** |
| **Elements of metal cutting processes**: Elements of tool geometry, cutting tool materials and applications.**Lathe**: Various types of lathe: Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe, CNC lathe, major difference between CNC lathe and conventional lathe. Major sub-assemblies of a lathe: Bed, headstock, tail stock, carriage consisting of saddle, cross-slide, compound slide, tool post and apron. Work holding devices: self centering three jaw chuck, independent four jaw chuck, collets, face plates, dog carriers, centers and mandrels. |  |  |
| UNIT-2: | **07** | **20** |
| **Lathe contd...** Driving mechanisms, apron mechanism, thread cutting mechanism and calculations, features of half-nut engagement – disengagement, indexing dial mechanism. Operations on lathe: taper turning, related calculations, thread cutting, facing, under-cutting, drilling, boring, parting-off, knurling, chamfering. |  |  |
| UNIT-3: | **07** | **20** |
| **Drilling Machines**: Constructional features of bench drilling machine, radial drilling machine, multi-spindle drilling machine, feed mechanism, work holding devices, Tool – holding devices. Different drilling operations: Drilling, reaming, counter boring and countersinking etc., estimation of drilling time. |  |  |
| UNIT-4: | **07** | **20** |
| **Milling Machines**: Types of general purpose milling machines: horizontal, vertical and universal. Types of milling cutters and their applications, different milling operations, work holding devices: vice, clamps, chucks, dividing head and its use, simple, compound and differential indexing. Indexing calculations and machining time calculations. Introduction to machining centers |  |  |
| UNIT-5: | **07** | **20** |
| **Grinding Machines**: Different types of grinding machines: cylindrical, surface and centre-less grinding machines, basic constructional features and mechanisms, specifications, different grinding operations, honing, lapping and super-finishing processes.. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. 1. P.N. Rao, “Manufacturing Technology: Metal Cutting & Machine Tools”, Tata McGraw Hill, Delhi, 2004.
2. 2. B.S. Raghuwanshi, “Workshop Technology”, Vol.2, Dhanpat Rai & Sons, 2003.
3. 3. Hazra Chandhari S.K., “Elements of Workshop Technology”, Vol.2, Media Promoters, 2003.

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**Course outcomes:**

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

1. Various types of lathe: Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe
2. Constructional features of bench drilling machine, radial drilling machine,multi-spindle drilling machine, feed mechanism, work holding devices, Tool – holding devices. Different drilling operations Implementation of stack and queue using array, using link lists
3. Different types of grinding machines: cylindrical, surface and centre-less grinding machines, basic constructional features and mechanism

|  |  |
| --- | --- |
| Course Title: **MACHINE PRACTICE LAB** | Course Code : ME 261 |
| Semester : III | Core / Elective: PROGRAME  **ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **0:0:2** | Credits : **1 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

To study of wide range of applications of mechanical engineering through assembly and disassembly of machines such as;

* Bicycle
* Sewing machine
* Printer
* Pumps
* Washing Machine
* Engines
* Air-conditioners
* Machine-tools

Note: *Student will be required to submit written report indicating the learning achieved by Hands on assembly/Disassembly.*

|  |  |
| --- | --- |
| Course Title: OOPS(Object Oriented Programming System) | Course Code : ME 209 |
| Semester : III | Core / Elective: UNIVERSITY ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | Introduction to Object Oriented Programming: Basic concepts: Class, Object, Method, Message passing, Inheritance, Encapsulation, Abstraction, Polymorphism. | 7 |
| **II** | Basics of C++ Environment: Variables; Operators; Functions; user defined, passing by reference, passing an array to the function, inline function, scope, overloading; Pointers: objects and lvalue, arrays and pointers, the new and delete operators, dynamic arrays, arrays of pointers and pointers to arrays, pointers to pointers and functions; Strings: String I/O, character functions in ctype.h, string functions in string.h. | 7 |
| **III** | Object oriented concepts using C++: Classes: Member functions, Friend functions, Constructors, Access functions, Private member functions, class destructor, static data and function members; Overloading: inline functions, this operator, overloading various types of operators, conversion operators; the String Class; Composition and Inheritance: Hierarchy and types of inheritance, protected class members, private versus protected access, virtual functions and polymorphism, virtual destructors, abstract base classes. | 7 |
| **IV** | Templates and Iterators: function and class templates, container classes, subclass templates, iterator classes; Libraries: standard C++ library, contents of a standard C headers, string streams, file processing: Files and streams classes, text files, binary files, classification of files, the standard template library. | 7 |
| **V** | Data Structures Using C++: Linked lists – Singly linked list, Doubly linked lists, Circularlists, Stacks and Queues priority Queues, Stacks, Queues. | 7 |
|  | **Total** | **35** |

|  |  |
| --- | --- |
| Course Title: OOPS Lab | Course Code : ME 263 |
| Semester : III | Core / Elective: UNIVERSITY  **ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **0:0:2** | Credits : **1 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **30** | **100** |
| |  |  | | --- | --- | | 1. | Write a program to find the greatest between four numbers. | | 2. | Write a program to prepare mark sheet of student using structures. | | 3. | Write a C program to read several different names and addresses, re-arrange the names in alphabetical order and print name in alphabetical order using structures. | | 4. | Write a program to implement concatenation of two strings using pointers. | | 5. | Write a program to search a pattern in a given string. | | GRAPHICS | | | 6. | (a) WAP to draw a line.  (b) WAP to draw a rectangle. | | 7. | (a) To draw random colored circle  (b) To Animate Slider Crank Mechanism. | | 8. | To Animate Quick Return Mechanism. | | 9. | To Animate Cam Follower Mechanism. | | 10. | To Animate Rolling of wheel from inclined plane. | |  |  |
| **TOTAL** | **30** | **100** |

|  |  |
| --- | --- |
| Course Title: **ENERGY STORAGE TECHNOLOGIES** | Course Code : |
| Semester : III | Core / Elective: UNIVERSITY ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Aim:**

This course is intended to build up the necessary background to model and analyze the various types of energy storage systems

**Course Objectives:**

* To develop the ability to understand / analyse the various types of energy storage.
* To study the various applications of energy storage systems

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT I INTRODUCTION** | **5** | **20** |
| Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Applications |  |  |
| **UNIT II THERMAL STORAGE SYSTEM** | **5** | **20** |
| Thermal storage – Types – Modelling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units - Modelling using porous medium approach, Use of Transys |  |  |
| **UNIT III ELECTRICAL ENERGY STORAGE** | **5** | **20** |
| Fundamental concept of batteries – measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide and modern batteries for example (i) zinc-Air (ii) Nickel Hydride, (iii) Lithium Battery |  |  |
| **UNIT IV FUEL CELL** | **5** | **20** |
| Fuel Cell – History of Fuel cell, Principles of Electrochemical storage – Types – Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis – advantage and drawback of each type. |  |  |
| **UNIT V ALTERNATE ENERGY STORAGE TECHNOLOGIES** | **6** | **20** |
| Flywheel , Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications |  |  |
| **TOTAL** | **24** | **100** |

**Reference:**

1. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John

Wiley & Sons 2002

2. Fuel cell systems Explained, James Larminie and Andrew Dicks, Wiley publications, 2003.

3. Electrochemical technologies for energy storage and conversion, Ru-shiliu, Leizhang, Xueliang

sun, Wiley publications, 2012

**Course outcomes:**

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

* Able to anlayse various types of energy storage devices and perform the selection based on techno- economic view point

**Course Code : EM-202 Course Name :** Employability Skills – III

**LTPC :** 0201 **Total Contact Hours** : 25

**COURSE CONTENTS**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Topic** | **Details** | **Contact Hrs** |
| 1 | Communication | Negotiation & Reasoning, Interaction Process, Interpersonal Relationship | 5 |
| 2 | Quantitative | Number System, Ratio & Proportion, Partnership, Percentage, Profit &Loss | 5 |
| 3 | Reasoning, | Analytical Reasoning, Coding & Decoding, Series | 5 |
| 4 | Motivation | Mission, Vision ,Goal, Motivation & Types of Motivation Self Esteem, Winning strategies, | 5 |
| 5 | Preparation, presentation | Self Esteem, Preparation of CV, Writing Application, Placement Mantra | 5 |

|  |  |
| --- | --- |
| Course Title: **Mechanics of Fluids** | Course Code : ME202 |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic of Physics, Basic of Mathematics, Pascal Law

**Course Objectives:**

1. TO STUDY ABOUT FLUID, PROPERTIES OF FLUID,STABILITY OF SUBMERGED BODIES,FLOTING BODIES, ORIFICE,NOZZLES AND WIRES, REYNOLD’S EXPERIMENT, DIFFERENT LOSS OF HEAD, MODEL SIMILITUDE, BOUNDARY LAYER, DIMENSIONLESS NUMBERS AND THEIR APPLICATIONS. DIFFERENT PRESSURE MEASURING INSTRUMENT AND THEIR PRATICAL USE.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| Units | Course Contents | Hrs. |
| 1 | Introduction of fluid, fluid classifications, hypothesis of continuum, Shear stress in a moving fluid, molecular structure of material, fluid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitation, compressibility and the bulk modulus | 7 |
| 2 | Fluid statics: pressure, manometer, hydrostatic forces on submerged on plane surfaces, stability of immersed and floating bodies, fluids in rigid body motion etc.  Fluid kinematics: Lagrangian and Eulerian description of fluid flow, Velocity and Acceleration Fields, Fundamentals of flow visualization, streamlines, stream tubes, pathlines, streaklines and timelines, deformation of fluid elements | 7 |
| 3 | Orifice discharging free, Jet, vena contracts, co-efficient of contraction, velocity and discharge, coefficient of resistance. Orifices and mouthpieces Nozzles and weires. Flow Through Pipes : Reynold’s experiment Darcy’s Weisback equation. Loss of head due to sudden enlargements, contraction, entrance, exit obstruction, bend, pipe fittings. Total and Hydraulic grandient lines, Flow through pipe line. Pipes in series, parallel Transmission of power through pipes. | 7 |
| 4 | Laminar Flow: Simple solution of Navier Stokes equations. Hagen – Poiseuille flow. Plans Poiseuille flow and coutte flow. Turbulent Flow; Variation of friction factor with Reynold’s number. The Prandt Mixing length hypothesis applied to pipe flow, velocity distribution in smooth pipes, Rough pipes. The Universal pipe friction laws, Colebrook. White formula. Dimensional Analysis: Buckingham variables, Model Similitude, Force ratio, Reynolds, Froude’s Mach, Weber and Euler numbers and their applications. Undistorted model distorted model scale effect. | 7 |
| 5 | Boundary Layer: Description of the boundary layer. Boundary Layer thickness boundary layer separation and control. The Prandtl boundary layer equation. Solution for laminar boundary layer. The momentum equation for the boundary layer. The flat plate in uniform free stream with no pressures gradients. Approximate momentum analysis laminar boundary Aerofoils Theory. Flow round a body ; Drag skin friction drag, pressure drag, combined skin friction & pressure drag (Profile drag) wave drag, lift induced drag. Flow past sphere & Cylinder. | 7 |

**Reference:**

F. M. White, 1999, Fluid Mechanics, 4th Ed, McGraw-Hill.

B. R. Munson, D. F. Young and T. H. Okhiishi, Fundamentals of Fluid Mechanics, 4th Ed, John Wiley, 2002.

R. W. Fox and A. T. McDonald, 1998, Introduction to Fluid Mechanics, 5th Ed, John Wiley.

S. W. Yuan, 1988, Foundations of Fluid Mechanics, Prentice Hall of India.

Pijush Kundu, 2002, Fluid Mechanics, 2nd Ed., Academic Press.

Irwing Shames, Mechanics of Fluids, 4th Ed., McGraw Hill.

Batchelor G.K., 2000, An Introduction to Fluid Dynamics,2nd edition, Cambridge University press,

**Course outcomes:**

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

1. Study about the fluid

2. Study about measuring instrument

3. Pratical Application of Dimensionless Machine.

4. Study about Boundary Layer:

|  |  |
| --- | --- |
| Course Title: **MACHINE ELEMENT DESIGN** | Course Code : ME 204 |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Engineering mechanics, Mechanics of solids

**Course Objectives:**

TO STUDY ABOUT BASICS OF DESIGN OF VARIOUS ELEMENTS USED IN MACHINES

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **8** | **20** |
| Materials: Properties and IS coding of various materials, Selection of material from properties and economic aspects. Manufacturing aspects in Design : Selection of manufacturing processes on the basis of design and economy, Influence of rate of production, standard size, Influence of limits, fits tolerances and surface finish. Change in the shape of the designed element to facilitate its production, Design of castings, working drawing. | 08 |  |
| UNIT-2: | **7** | **20** |
| Design for strength: Allowable stresses, detailed discussion on factor of safety (factor of ignorance): Stress concentration. Causes & mitigation. Introduction of various design considerations like strength, stiffness, weight, cost, space etc. Concept of fatigue failures. Design of machine elements subjected to direct stress, Pin, cotter and keyed joints, Design of screw fastening. | **7** |  |
| UNIT-3: | **7** | **20** |
| Design of members in Bending: Beams, levers and laminated springs.  Design of members in torsion : Shafts and shaft couplings. |  |  |
| UNIT-4: | **7** | **20** |
| Design of shafts, brackets under combined stresses, Calculation of transverse & torsional deflections. Screw fasteners subjected to eccentric loading. |  |  |
| UNIT-5: | **7** | **20** |
| **Jigs And Fixtures:-** Introduction, definition and difference; usefulness of jigs and fixtures; design considerations; materials used; principles and methods of location; clamping elements; jig bushes; drilling jigs; fixtures for milling turning, boring and welding; assembly fixtures; indexing devices; economics of jigs and fixtures; complete design of a jig and a fixtures; complete design of a jig and a fixtures. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

Elements of Machine Design, N.C.Pandya & C.S.Shah, Charotar Book Stall, Anand.

Design of Machine Elements; V.B.Bhandari, Tata McGraw Hill Publishing Co. Ltd.

'Mechanical Machine Design; R.C.Bahl & V.K.Goyal, Standard Publishing Distributors, Delhi

'Mechanical Engineering Design; J.E.Shigley,McGraw Hill Book Co.

Machine Design; K.K.Puraja, B.L.Juneja & N.C.Bhandari, Dhanpat Rai & Sons, Delhi

**Course outcomes:**

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

1. Understand the types of design.
2. The ability to formulate and solve some of the physical problems of engineering.
3. Understand the stress and strain.
4. Understands the standards of design

|  |  |
| --- | --- |
| Course Title: **INTERNAL COMBUSTION ENGINE** | Course Code : ME 210 |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

CYCLIC PROCESS AND ITS REQUIREMENT, BASIC PHYSICS, ENGINEERING PHYSICS, ENGINEERING THERMODYNAMICS,ENGINEERING FLUID MECHANICS, KINEMATIC OF MACHINE.

**Course Objectives:**

TO STUDY VARIES CYCLE OF INTERNAL COMBUSTION ENGINE,BASIC DIFFERENCE BETWEEN DEGREE OF FREEDOM,VARIOUS MECHANISM OF DIFFERENT- INTERNAL AND EXTERNAL COMBUSTION ENGINES; CLASSIFICATION OF I.C. ENGINES, KNOCKING. COMPARISON OF KNOCKING IN S.I. AND C.I. ENGINES.STAGES OF COMBUSTION IN C.I. ENGINES;PERFORMANCE PARAMETERS: NECESSITY OF ENGINE COOLING AND LUBRICATING OIL;SUPERCHARGING AND TURBOCHARGING;MODERN DEVELOPMENTS IN IC

**Course Content:**

|  |  |  |
| --- | --- | --- |
| Units | Course Contents | Hrs. |
| 1 | Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines,  Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles;  air standard efficiency, specific work output, specific weight; work ratio;  Mean effective pressure; deviation of actual engine cycle from ideal cycle | 7 |
| 2 | Normal & Abnormal Combustion. Pre-ignition.Detonation. Knocking. Comparison of knocking in S.I. and C.I. Engines.   |  |  | | --- | --- | | Rating of Fuels.  Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; theories of detonation; octane rating of fuels;  S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers |  | | 7 |
| 3 | Gasoline Direct injection, Various Methods for stratification;,Honda CVCC engine.  Types of Hydrocarbon, Gasoline, Diesel specifications,  Alternate Fuels –Properties of CNG, LPG, Alcohol, Bio- Fuel as vehicular Fuels.  **Carburetor:** Properties of air-petrol mixtures, Mixture requirement, S imple carburetor, limitation of simple carburetor, Modern carburetor, Main metering system, Idling system, Economizer system, Acceleration pump and cold starting systemInjection system, Electronic fuel injection, advantage and disadvantage of petrol injection, Multi point Fuel Injection System. | 7 |
| 4 | Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements;  **Ignition System:** Battery and magneto ignition system and their comparative study, Spark plug heat range, Electronic ignition system, Firing order, Ignition timing, Centrifugal and vacuum ignition advance | 7 |
|  | Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems;  properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication,  Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling radiators.;  Lubrication; Cooling; Supercharging and Turbocharging;Modern developments in IC engines | 7 |

**Reference:**

**Course outcomes:**

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

1. Students will be able to know the basics Air Standard Cycles.
2. Apply the various functions in various problems. Also able to short out these problems.
3. Students will be able to know the ic engine parts.
4. Student will be know the modern developments in IC Engines.

|  |  |
| --- | --- |
| Course Title: **KINEMATICS OF MACHINES** | Course Code : |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic Physics, Engineering Physics, Basic of Mathematics

**Course Objectives:**

TO STUDY ABOUT DEGREE OF FREEDOM,VARIOUS MECHANISM OF DIFFERENT-DIFFERENT MACHINES,GEARS AND GEAR TRAINS

**Course Content:**

|  |  |  |
| --- | --- | --- |
| Units | Course Contents | Hrs. |
| **I** | **BASICS OF MECHANISMS:**  Classification of mechanisms , Basic kinematic concepts and definitions , Degree of freedom. Mobility of Mechanism – Kutzbach criterion, Grueblers criterion , Grashof s Law- Kinematic inversions of four-bar chain and slider crank chains , Transmission Angle , Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms. | 7 |
| **II** | **KINEMATICS OF LINKAGE MECHANISMS**  Displacement. velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons , Velocity analysis using instantaneous centres, kinematic analysis of simple mechanisms – Coincident points , Coriolis component of Acceleration , synthesis of mechanism- two and three position synthesis. | 7 |
| **III** | **FRICTION IN MACHINE ELEMENTS**  Surface contacts – Sliding and Rolling friction , Friction drives – Friction in screw threads, Bearings and lubrication, Friction in Journal Bearing and Thrust Bearings, Friction clutches | 7 |
| **IV** | **BRAKES & DYNAMOMETERS**  **Brakes:** Band, block and band & block brakes, braking action, braking system of automobiles.  **Dynamometers:** Absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers braking system of automobiles. | 7 |
| **V** | **KINEMATICS OF CAM MECHANISMS**  Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity. parabolic. simple harmonic and cycloidal motions –Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams. | 7 |

**Reference:**

J. E. Shighley and J.J. Uicker, Theory of Machines and Mechanisms, McGraw Hill, 1995

A. K. Mallik, A. Ghosh, G. Dittrich, Kinematic analysis and synthesis of Mechanisms, CRC, 1994

A. G. Erdman and G. N. Sandor, Mechanism Design, Analysis and Synthesis Volume 1, PHI, Inc., 1997.

J. S. Rao and R. V. Dukkipati, Mechanism and Machine Theory, New Age International, 1992.

S. S. Rattan, Theory of Machines, Tata McGraw Hill,

**Course outcomes:**

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

1. To understand the degree of freedom
2. To analyze different mechanism of various machines.
3. To understand why the smaller pulley made as input.
4. To analyze gear, how the step by step modification was done in gears and at present how many types of gears are available in the market & Need of gear trains.

|  |  |
| --- | --- |
| Course Title: Fluid Mechanics Lab | Course Code : ME 252 |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic Physics, Fluid mechanics

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON VARIOUS FLUID MECHANICS SETUP.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS** | **20** | **100** |
| **LIST OF EXPERIMENT**  1. Determine Metacentric height of a given body.  2. Determine Cd, Cv & Cc for given orifice.  3. Determine flow rate of water by V-notch.  4. Determine velocity of water by pitot tube.  5. Verify Bernoulli’s theorem.  6. Determine flow rate of air by Venturi meter  7. Determine flow rate of air by orifice meter  8. Determine head loss of given length of pipe.  9. Determine flow rate of air by nozzle meter. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

* F. M. White, 1999, Fluid Mechanics, 4th Ed, McGraw-Hill.
* B. R. Munson, D. F. Young and T. H. Okhiishi, Fundamentals of Fluid Mechanics, 4th Ed, John Wiley, 2002.
* R. W. Fox and A. T. McDonald, 1998, Introduction to Fluid Mechanics, 5th Ed, John Wiley.
* S. W. Yuan, 1988, Foundations of Fluid Mechanics, Prentice Hall of India.
* Pijush Kundu, 2002, Fluid Mechanics, 2nd Ed., Academic Press.
* Irwing Shames, Mechanics of Fluids, 4th Ed., McGraw Hill.
* Batchelor G.K., 2000, An Introduction to Fluid Dynamics,2nd edition, Cambridge University press,

**Course outcomes**

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

1. Able to understand meta-centric height of a floating body.
2. Able to determine head loss in pipe flow.
3. Able to understand working of pitot tube, Venturi meter ,and nozzle meter.

|  |  |
| --- | --- |
| Course Title: Industry Oriented Internal Combustion Engine Lab | Course Code : ME 258 |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Internal combustion engine, Engineering thermodynamics, Fluid mechanics

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON VARIOUS ENGINES.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| **LIST OF EXPERIMENT**   1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine. 2. To study the constructional detail & working of two-stroke/ four stroke diesel engine. 3. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus. 4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine. 5. To find the indicated horse power (IHP ) on multi-cylinder petrol engine/diesel engine by Morse Test. 6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp, fhp, vs speed ( ii) volumetric efficiency & indicated specific fuel consumption vs speed. 7. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian’s line method & by motoring method.   8.To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) bhp vs fuel rate, air rate and A/F and (ii) bhp vs mep, mech efficiency & sfc.  9.To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine.  10.To find intensity of smoke from a single cylinder / multi-cylinder diesel engine.  11.To draw the scavenging characteristic curves of single cylinder petrol engine.  12.To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine. | Four hours for each experiment |  |
| **TOTAL** | **40** | **100** |

1. R.P. Sharma and M.L. Mathur, “Internal Combustion Engine”, Dhanpat Rai Publications

2. V. Ganeshan, “Internal Combustion Engine”, Tata McGraw Hill

3. Angli M Course., “Automotive Engines”, CBS Publications

4. Harper, “Fuel Systems Emission Control”, CBS Publications

**Course outcomes:**

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

1. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and
2. Able to understand Working of petrol and diesel engines.
3. To find the indicated horse power (IHP ) on multi-cylinder petrol engine/diesel engine by Morse Test.

|  |  |
| --- | --- |
| Course Title: Design/Simulation Lab(Software CREO/CATIA) | Course Code : ME 260 |
| Semester : IV | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**LIST OF EXPERIMENTS**

Introduction and different features of the CAD Software.

1. 2-D Drafting.
2. 3-D Modeling.
3. 3-D Advanced Modeling.
4. Assembly modeling.
5. Feature Modification and Manipulation
6. Detailing.
7. Sheet Metal Operations.
8. Surface Modeling

|  |  |
| --- | --- |
| Course Title: Kinematics of Machines Lab | Course Code : ME 256 |
| Semester : IV | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

KINEMATICS OF MACHINE,DYNAMICS OF MACHINE,ENGINEERING MECHANICS,BASIC PHYSICS.

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON VARIOUS MECHANSIM.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| **LIST OF EXPERIMENT**  1. To study inversion of four bar chain  2. Coupling Rod  3. Beam Engine  4. Steering Mechanism  (a) Study of quick return mechanism.(Crank and Slotted lever mech.)  (b) To draw velocity and acceleration diagram for Crank and slotted lever mechanism.  5. Study of inversion of Double slider chain  Oldhan Coupling  Scotch Yoke  Elleptical Trammel  6. To plot displacement v/s θ curve for various cams.  7. Study of various cam- follower arrangements.  8. To determine co-efficient of friction.  9. Study of various types of dynamometers, Brakes and Clutches.  10. To determine moment of inertia of the given object using of Trifler suspension.  11. To Verify the relation T=I.W.Wp. for gyroscope. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Course outcomes:**

J. E. Shighley and J.J. Uicker, Theory of Machines and Mechanisms, McGraw Hill, 1995

A. K. Mallik, A. Ghosh, G. Dittrich, Kinematic analysis and synthesis of Mechanisms, CRC, 1994

A. G. Erdman and G. N. Sandor, Mechanism Design, Analysis and Synthesis Volume 1, PHI, Inc., 1997.

J. S. Rao and R. V. Dukkipati, Mechanism and Machine Theory, New Age International, 1992.

S. S. Rattan, Theory of Machines, Tata McGraw Hill,

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

1. Able to understand Mechanism of various machine.
2. Able to understand working principle of dynamometers, Brakes and Clutches.
3. Able to analyse velocity and acceleration diagram of various mechanism.

|  |  |
| --- | --- |
| Course Title:  **Instrumentation & Control** | Course Code : ME 212 |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | System configuration, basic characteristic, calibration, classification and performance characteristics of a instrumentation system, Specification and testing of dynamic response. Strain Measurement : Electric Strain Gauges - Types ; Selection and Installation, Strain gauge circuits; temperature compensation and calibration; Use of Strain Gauges on Rotating Shafts, Load Cells, Mechanical and Optical Strain Gauges. | 7 |
| **II** | Various Mechanical, Electro- Mechanical & Photoelectrical Sensors for sensing of Displacement, Velocity, Acceleration, Torque, Force, Temperature from Low to High Range, flow, level of fluid , pressure, angular speed, voltage, frequency and current. Introduction to Multi-Channel Data-Acquisition System, Measurement Pods, Interface Hardware, Data Analysis Software, Interfacing. | 7 |
| **III** | Concepts and examples of automatic control systems, systems by differential equations, transfer function, block diagram, open and feedback control systems, signal flow graphs & its constructions. Control System components, error sensing devices and servo motors. | 7 |
| **IV** | Control for mechanical systems & processes ; speed control system for steam/gas turbines. A constant tension ;reeling system, Electro-mechanical systems. Thermal systems, Pneumatic systems; Mathematical Models of physical systems, Feedback characteristics of Control Systems. Time response analysis; transient response analysis, time response specifications, steady state-error. | 7 |
| **V** | Concepts of stability, Routh- Hurwiz stability criterion, relative stability. The root locus technique, use of construction rules without any derivation. Frequency response analysis, Polar plots; stability in frequency domain, Bode / Logrithmic plots. Nyquist stability criterion. | 7 |
|  | **Total** | **35** |

**Reference Books:**

1. Mechanical Measurements and Instrumentation, A.K. Sawhney, Puneet Sawhney, Dhanpat Rai
2. Mechanical Measurements, Thomas G. Backwith, N. Lewis Buck, Roy, D., Marangoni, Narosa Publishing House
3. Industrial Instrumentation and Control, S.K.Singh, Tata McGraw Hill
4. Control Systems Engineering; I.J.Nagrath & M.Gopal, Wilay Eastern Limited
5. Automatic Control Engineering; Raxen, McGraw Hill, International Edition

|  |  |
| --- | --- |
| Course Title: Instrumentation & Control Lab | Course Code : ME 250 |
| Semester : IV | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

List of Experiments of I & C Lab

1. Measurement of strain using strain gauges, Load Cell Characteristics.
2. Measurement of displacement using LVDT.
3. Study the Characteristics of LDR, Photodiode, and Photo Transistor.
4. Measurement of electrical parameters using Bridges.
5. Measurement of distance using Ultrasonic sensor.
6. Temperature measurement using Thermocouple.
7. Familiarization with MATLAB control system tool box, Simulink tool box.
8. Determination of Step and Impulse response for first order control systems using MATLAB.
9. Block diagram reduction Technique implementation using MATLAB.
10. Stability analysis of control systems using MATLAB.

|  |  |
| --- | --- |
| Course Title:  **INDUSTRIAL ENGINEERING** | Course Code : ME 216 |
| Semester : **IV** | Core / Elective : **Core** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Pre-requisites:**

Basic math and understand the industry problems.

**Course Objectives:**

* understand how functions within an organisation is managed
* use some standard tools and techniques to solve engineering management problems
* appreciate the interaction between Engineering and Management functions

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| UNIT-1: **EVALUATION OF WORK STUDY** | 8 | 20 |
| Work of F.W. Taylor, Frank and Lillian Gilbreth and others; Productivity definition, Means of increasing productivity work study, Human Factor in the application of work Study. **Motion Study; Definition, aims;** Procedure for method study: selection of jobs; Recording Techniques: Micro motion study: Therbligs; Cychography and Chronocycle graph: Principles of motion economy. design of work place layout: Analysis in the form of a chart; operation chart; flow process chart; flow diagrams; string diagram; Man Machine chart; Two hand chart; Simon chart. | 4  4 |  |
| UNITS-2: **Work Measurement (Time Study):** | 07 | 20 |
| Definition; uses; procedure; time study equipment; performance rating; allowances, number of cycles to be studied. Determination of standard time: Predetermined Motion Time Systems.  **Job Evaluation:** Objective of job evaluation; Methods of Job evaluation; Non-quatative and quantative. | 4  3 |  |
| UNITS-3: **Production Planning and Control:** | 07 | 20 |
| Types of production; function of production planning and control; planning Preplanning, sales forecasting; routing; Scheduling; dispatching and control with other departments.  **Plant Location and Layout:** Selection of site, layout contributing factors. Facilities available from Govt. and autonomous agencies, Material handling system and equipments; layout according to the manufacturing system. Procedure and techniques of layout and line balancing. |  |  |
| UNIT-4: **QUALITY CONTROL** | 7 | 20 |
| Operational and economic definition of quality control, objectives of quality control; Statistical quality control, Process capability studies: Control charts for variable, control charts for average outgoing quality |  |  |
| UNIT 5: **Materials Managements** | 07 | 20 |
| **Materials Managements:** Field and Scope of materials management material planning and Programme. ARC control policy inverter, control Economic lot size, lead time and recorder point, Inventory models (Deterministic only)  **Wages and incentives:** Characteristics of a Good wage for incentive system. Methods of wage payment Concept of wage incentive schemes, financial and non financial Holsely premium plan. Merric's Multiple piece rate system. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Introduction to Study, ILO Publishers.
2. Statistical Quality Control, Grant EL& Leawethwarts R.S., McGraw Hill.
3. Facility Layout& Location, Francis R.C.& White J.A.Prentice Hall.
4. Production and Operations Management, Adam Everett E& Ebert Ronald J.PHI
5. Production and operations management; E.W.S. Buffa and S.Kapoor.

**Course outcomes:**

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

1. understand human factor in the application of work study
2. to draw the operation chart; flow process chart; flow diagrams; string diagram; man machine chart; two hand chart; Simon chart.
3. Integrated system of people, materials, information, equipment, and energy to meet desired needs within realistic constraints (such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability).
4. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

|  |  |
| --- | --- |
| Course Title:  **INDUSTRIAL ENGINEERING LAB** | Course Code : ME 262 |
| Semester : **VI** | Core / Elective : **Core** |
| Teaching Scheme in Hrs (L:T:P) : 0**:0:2** | Credits : **1 Credits** |
| Type of course :  **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Pre-requisites:**

Basics knowledge of industrial engineering

**Course Objectives:**

To study various experiments on industrial engineering.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS** | 20 | 100 |
| 1. Determination of time standard for a given job using stopwatch time- study.  2. Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.  3. Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint.  4. To carry out a work sampling study.  5. To conduct process capability study for a machine in the workshop.  6. To design a sampling scheme based on OC curve.  7. To conduct Shewart's experiments on known population  8. Generation of random numbers for system simulation such as facility planning, job shop scheduling etc.. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1. Production and Operations Management, William Stevenson, Mc Graw Hill Pub
2. Fundamentals of Operations Management, N J Aquilano and Chase, Irwin Pub
3. Production and Operations Management, Heizer Render, Allyn and Bacon Pub
4. Production and Operations Management, Adam Everett E& Ebert Ronald J.PHI
5. Production and operations management; E.W.S. Buffa and S.Kapoor.

**Course outcomes:**

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

1. Determination of time standard for a given job using stopwatch time- study.
2. Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.
3. To carry out a work sampling study.
4. To conduct process capability study for a machine in the workshop.
5. To design a sampling scheme based on OC curve.

|  |  |
| --- | --- |
| Course Title: **ELECTRICAL** **MACHINES** | Course Code :  **EE 214** |
| Semester : **IV** | Core / Elective : **Elective** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **48** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic Electrical Engineering

**Course Objectives:**

1. Help the learner to understand basic principle and operation of energy conversion principle.
2. Understand the principle of operation of transformer.
3. Learn about different type of connection in poly-phase transformer.
4. Understand the basic principle construction, operation rotating machine
5. Make students familiar with the DC electromagnetic conversion devices, their structures and working, such that students can use them easily in the industry afterwards.
6. Understand the basic principle construction, operation performance characteristics of induction machines
7. Understand the basic principle construction, operation performance characteristics of synchronous machines

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| UNIT-1: **Transformer** | 10 | 20 |
| **Single Phase Transformer:** Construction, types, Principle, EMF equation, Ideal Transformer, Equivalent circuits & phasor diagrams, OC and SC tests, Sumpner’s back-to-back test, efficiency. Voltage regulation, parallel operation, autotransformers.  **Three Phase Transformer:** Single unit or bank of single-phase units, poly-phase connections, Open delta and V connections, tertiary winding |  |  |
| UNITS-2: **Basic Concepts of Rotating** **Electrical Machines** | 08 | 20 |
| Basic principles of electromechanical energy conversion. Energy balance. Construction & Principle of AC & DC Machines. Concepts of Armature & Field Winding, Concentrated & Distributed Winding. |  |  |
| UNITS-3: **DC Machines** | 10 | 20 |
| Classifications of DC Machines, EMF equation, Back EMF, types, production of torque, armature reaction and inter-poles, characteristics of shunt, series and compound Machine, DC motor starting. Speed Control of DC Motor: Armature voltage and field current control methods, Ward Leonard method. Braking, losses and efficiency. |  |  |
| UNIT-4: **Induction Motor** | 10 | 20 |
| Types: squirrel cage and slip ring induction motor, basic principles, induction motor as a transformer. Equivalent circuits, torque equation, torque-slip curves, no load and block rotor tests, Effect of rotor resistance. Cogging, Crawling. Methods of starting and speed control of squirrel cage and slip ring motor, cascade connection.  **Single-Phase Induction Motor:** Revolving field theory, starting methods, equivalent circuits. |  |  |
| UNIT 5: **Synchronous Machine** | 10 | 20 |
| **Synchronous Motor:** Excitation systems, Equation of induced emf, theory of cylindrical rotor and salient pole machines, two reactance theory, phasor diagrams, power developed, synchronization, parallel operation, hunting and its prevention, types.  **Synchronous Generator:** V-curves, starting methods, performance calculations, applications, synchronous condenser, synchronous induction motor. |  |  |
| **TOTAL** | **48** | **100** |

**Reference:**

1. P.S.Bimbhra, Electrical Machinery, 2000, Khanna publishers New Delhi.

1. J.Nagrath and D.P.Kothari, Electrical Machines 2000, TATA MCGRAW HILL Publication New Delhi.

2. GopalK.Dubey, Fundamental of Electrical Drives, 2001 Narosa Publishing House, New Delhi

3. Fitzrald,Kingsley and Umans Electrical Machines 2000, TATA MCGRAW HILL Publication New Delhi.

4. Advance Electrical Technologies by H.Cotton

5. Alexander S. Langsdorf, “Theory of Alternating current Machinery” Second Edition, TATA McGRAW-HILL, 1983.

**Course outcomes:**

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

1. Explain principles of electromechanical energy conversion
2. Armature reaction, commutation
3. parallel operation of generators
4. Speed Control of DC Motor: Armature voltage and field current control methods
5. Voltage regulation, effect of frequency, parallel operation of transformers
6. Use various types of DC electrical machines in the industry
7. Understand principle, construction, laying of armature and field windings, types, generation of EMF, methods of starting, steady state and transient behaviour of induction motors.
8. Understand steady state and transient behaviour, synchronization and parallel operation of synchronous machines.
9. Understand principle, construction, methods of starting of synchronous motors, steady state and transient behaviour and application of synchronous motor, its operation with variable load operation with variable excitation, performance evaluation.
10. Work on AC rotating electrical machines in industry, and will also be able to test them.

|  |  |
| --- | --- |
| Course Title: **ELECTRICAL** **MACHINES LAB** | Course Code : EE 264 |
| Semester : IV | Core / Elective : Elective |
| Teaching Scheme in Hrs (L:T:P) : **0:0:2** | Credits : **1 Credits** |
| Type of course : **Experiment + File** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |
|  | |

**Pre-requisites:**

EE 214: Electrical Machines.

**Course Objectives:**

1. Help the learner to understand basic principles, operation and design of electrical drives.
2. Understand the connection of voltmeter, ammeter and wattmeter and use of tacho-generator
3. Understand practical use of starters and speed control methods
4. Understand losses occurring at various stages
5. Impart learning about various speed control methods for DC & AC electrical machines.
6. Learn about various tests done on transformers to obtain their parameters.

**Course Content:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S. No.** | **Topic and Contents** | | **Hours** | **Marks** |
|  | Speed control of D.C. shunt motor by (a) Field current control method and plot the curve for speed vs field current. (b) Armature voltage control method and plot the curve for speed vs armature voltage. | | 2 |  |
|  | Speed control of a D.C. Motor by Ward Leonard method and to plot the curve for speed vs applied armature voltage. | | 2 |  |
|  | To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency. | 2 | |  |
|  | To perform back-to-back test on two identical 1-phase transformers and find their efficiency and parameters of the equivalent circuit. | | 2 |  |
|  | To perform parallel operation of two 1-phase transformers and determine their load sharing. | | 2 |  |
|  | To perform the load test on single phase D.C. generator. | | 2 |  |
|  | To plot the O.C.C. and S.C.C. of an alternator and to determine its regulation by synchronous impedance method. | | 2 |  |
|  | To synchronize an alternator across the infinite bus (RSEB) and summarize the effects of variation of excitation on load sharing | | 2 |  |
|  | To plot the V-curve for a synchronous motor for different values of loads | | 2 |  |
|  | To perform the load test on a 3-phase induction motor and determine its performance characteristics (a) Speed vs load curve (b) pf vs load curve (c) Efficiency vs load curve (d) Speed vs torque curve | | 2 |  |
|  | **TOTAL** | | **20** |  |

**Reference:**

1. Electrical and Electronics measurements and measuring instruments. A.K.SAWHNEY – Dhanpat Rai and Sons
2. Electrical measurements and measuring instruments by Rajendra Prasad - Khanna Publishers
3. A course in Electronics and Electrical measurements and instrumentation by J.B.GUPTA - Kataria Publications
4. Electrical measurements and measuring instruments by Rajendra Prasad – Khanna Publishers

**Course outcomes:**

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

1. Student will be able to measure the AC and DC electrical quantities(voltage, current and energy)
2. Measurement of power loss in motors and find efficiency
3. Determine the parameters of its equivalent circuit its voltage regulation and efficiency of machines
4. Determine the load, speed and current characteristics
5. Perform parallel operation of transformers and DC machines
6. Work on basic transformers and DC electrical machines, and obtain their parameters and do their speed control.
7. Find out the parameters of an alternator using O.C.C., S.C.C. and V-curve.
8. Calculate the parameters of a three-phase induction motor through no-load and blocked-rotor tests, and determine its various characteristics.

**Course Objectives:**

1. To understand the starting, speed control and braking of AC rotating electrical machines.
2. To develop an ability to find heating and cooling characteristics of electric motors.
3. To learn the various tests done on transformers to find out its parameters.
4. To learn the various tests done to find out the parameters of an AC rotating electrical machine.

|  |  |
| --- | --- |
| Course Title: **Electro Hydraulics** | Course Code : MCEH (T) |
| Semester : IV | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Content:**

Basic Principles of Electro-Hydraulics

Basics : Electric current, voltage, resistance and power

Basic electric circuits : series and parallel

Measurement of current and voltage

Electro-hydraulic valves

Solenoids

Classifications of solenoids

Function and operating principle of a relay

Relay as a logical switch

Relay Logic Diagram : control and main circuit

Symbols of most important switching elements (NO an NC)

Signal storage concept

Electrical interlocking concept

Momentary-contact limit switches

Categories of limit switches

Pressure switches

Graphical symbols to DIN electrical engineering and electronics

|  |  |
| --- | --- |
| Course Title: **Electro Hydraulics Lab** | Course Code : MCEH (L) |
| Semester : IV | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

Exp-1 : Extending a cylinder by operating a push button

Exp-2: Signal storage by electrical self-locking, setting and resetting using a momentary-contact switch

Exp-3 : Mechanical locking by means of momentary- contact switch contacts

Exp-4: Electrical locking by means of contactor contacts

Exp-5 : Signal storage by means of contactor contacts

Exp-6: Rapid advance circuit

Exp-7: Pressure-dependent reversing

Exp-8: Pressure switches and proximity switches

Exp-9: Advance control with time-dependent intermediate stop

Exp-10: Pressure-dependent sequence control

Exp-11: Sequencing Hydraulic actuators

|  |  |
| --- | --- |
| Course Title: **Swachh Bharat Abhiyan Syllabus** | Course Code : |
| Semester : IV | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| Introduction to Health, Hygiene, and Sanitation ; The Need for Health, Hygiene, and Sanitation Education ; Related International projects on Health and Hygiene; Overview of the Swachh Bharat ; Qualities of Healthy Living. |  |  |
| **UNIT-2:** | **4** | **20** |
| Hygiene - Understanding of Hygiene; Desired Definition of Hygiene; The Hygiene Practices of the different categories of family in India; Role of Family, Institutions and Corporations and government in Developing Hygiene consciousness. |  |  |
| **UNIT-3:** | **5** | **20** |
| Sanitation ; Understanding the importance of sanitation; The facilities developed for sanitation; Means adopted to promote the use of Sanitation Facilities; Sanitation Facilities provided by government under Swachh Bharat Abhiyaan. |  |  |
| **UNIT-4** | **5** | **20** |
| Water Storage Methods; Water Contamination ; Prevention of Water Contamination ; The Health Risks, especially due to Water Borne Diseases; Water Purification ; Importance of Safe water use; Government’s role and actions taken for awareness generation for consumption of pure water and preventing contamination of Water. |  |  |
| **UNIT-5** | **4** | **20** |
| Waste Management – Introduction, importance and need; Action Plans for Healthy Living introduced under Swachh Bharat Abhiyaan; Means adopted for Waste Management under Swachh Bharat Abhiyaan. |  |  |
| **TOTAL** | **24** | **100** |

|  |  |
| --- | --- |
| Course Title:  **Hydraulic Machinery** | Course Code : ME 317 |
| Semester : V | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Engineering mechanics, Rotational mechanics, Fluid mechanics

**Course Objectives:**

TO STUDY ABOUT THE ROTATING MACHINES USED IN VARIOUS POWER CONSUMING AND GENERATING UNITS

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **8** | **20** |
| Graphical Symbols and Circuit Diagrams ISO 1219, Symbols for energy supply and processing unit ( Power Pack ) ,Symbols for Hydraulics energy control units (Pressure, Flow and Direction ),  Symbols for Energy conversion units (Actuators) ,Symbols for accessories, Demonstration of Hydraulics circuits ,Hydraulic circuit with manual & solenoid DCV a cylinder ,Hydraulic motor, and cylinder, Demonstration of speed and direction changes in Hydraulic Circuit |  |  |
| **UNIT-2:** | **07** | **20** |
| Hydraulic Pumps ,Functions and Operating principle Hydraulic pumps ,Differentiate b/w positive and non– positive displacement pumps ,Characteristics of standard Hydraulic pumps ,  Construction and Operating principle following pumps ;  i. External and internal gear pumps  i . Vane pumps  iii. Axial piston pumps  iv. Radial piston pumps  Selection criteria of pumps, Flow rate and pump power ,  Efficiency, Hydraulic Cylinder , Operating Principle , Course curriculum , Components of a Hydraulic cylinder , Functions of Hydraulic cylinder , Design and operation , Types of cylinder  Types of design  i. Tie rod cylinders  ii. Mill type cylinders  Technical specification ,End positioning cushioning ,Cylinder mounting, Hydraulic Motors ,Functions of Hydraulic Motors  Characteristics of standard Hydraulic Motors , Selection of Hydraulic motors , Calculations , Efficiency |  |  |
| **UNIT-3:** | **07** | **20** |
| Pressure Control Valves, Pressure relief valve, pilot operated, pressure reducing valve , Pressure sequence valve, Directional Control Valve , Poppet Valves ,Types of spool valves  Flow Control Valves, Throttle valves, pressure compensator, Meter-in flow control, Meter-out flow control, Check Valves , Filtration Technology ,Causes of contamination. |  |  |
| **UNIT-4:** | **07** | **20** |
| **Hydraulic Turbines:**  Classification of hydraulic turbines, impact of free jets, major and minor lossesin pipes, siphon, transmission power through pipe lines., specific speed and unit quantities. Design aspects of  Pelton turbine- its construction, power and efficiency for ideal case, characteristic curves. Design aspects of reaction turbines, construction & setting, draft tube theory, characteristic curves, cavitations. |  |  |
| **UNIT-5:** | **07** | **20** |
| **Hydraulic systems:** Hydraulic press, Hydraulic accumulator, Hydraulic Intensifier, Hydraulic Ram, Hydraulic lift, Hydraulic coupling, Hydraulic torque convertor Gear pump. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Engineering Fluid Mechanics K.L.Kumar, Eurasia Publishing House (P) Ltd.
2. Fluid Mechanics & Machine, F.M.White, John Wiley & Sons
3. Fluid Mechnaics & Machine, A.K. Jain
4. Fluid Mechanics, V.L.Streeper, McGraw Hill
5. Fluid Machanics with Applications. S.K.Gupta V.Gupta, New Age Publications

**Course outcomes:**

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

1. Working principle of fluid machines
2. Working principle of compressors.
3. Working principle of turbines.
4. Use of turbo machines in non-conventional field

|  |  |
| --- | --- |
| Course Title: **DYNAMICS OF MACHINES** | Course Code : **ME 307** |
| Semester : **V** | Core / Elective : **Program Core** |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.TECH MECHANICAL ENGINEERING** | |

**Pre-requisites:**

ENGINEERING MECHANICS, WORKSHOP LAB

**Course Objectives:**

1. Apply the concept of governors and their applications to solve the problem in engineering field.
2. Apply the concept of inertia force analysis to solve the problem in engineering field.
3. Apply the concept of gears to solve the problem in engineering field.
4. Apply the concept of gears trains to solve the problem in engineering field.
5. Apply the concept of gyroscopes to solve the problem in engineering field.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | **Governors:** Watt, Porter, Proell, Hartnell and spring controlled governors, governor effort, power, stability, inertia effects. | 7 |
| **II** | **Gyroscopes:** Effect of Gyroscopic Couple on an Aeroplane and Naval Ship, Stability of a Four Wheel drive Moving in a Curved Path.Stability of a Two Wheel Vehicle Taking a Turn.  **Inertia force analysis:** inertia force, piston thrust and forces on connecting rod, turning moment diagram, flywheel. | 7 |
| **III** | **Gears:** Law of gearing, terminology, tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with gear or rack, interference and undercutting, bevel, helical and spiral gears. | 7 |
| **IV** | **Gear trains:** Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio, gear boxes- sliding and constant mesh for automobiles. | 7 |
| **V** | **Balancing:** Balancing of rotating masses, balancing of reciprocating masses single cylinder engine, multi-cylinder inline engines, V-engines, concept of direct and reverse cranks, partial balancing of locomotives, IC engines, V engines and balancing machines. | 7 |

**Reference:**

1. The Theory of Machines, Thoman Beaven, CBS publishers & Distributors, Delhi
2. Theory of Mechanisms and Machines; Jagdish lal, Metropolitian Book Co. Ltd, New Delhi
3. Theory of Machines; P.L. Ballaney, Khanna Publishers, Delhi

**Course outcomes:**

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

1. Apply the concept of governors and their applications to solve the problem in engineering field.
2. Apply the concept of inertia force analysis to solve the problem in engineering field.
3. Apply the concept of gears to solve the problem in engineering field.
4. Apply the concept of gears trains to solve the problem in engineering field.
5. Apply the concept of gyroscopes to solve the problem in engineering field.

|  |  |
| --- | --- |
| Course Title: Machining Science and Machine | Course Code : ME 315 |
| Semester : V | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Casting,Welding and forming Process

**Course Objectives:**

* To develop the machinery product by various machines.
* To study and calculations of machinery operations
* To develop the Design, implement and refine products, services, processes and systems taking in consideration that constraints and particularities of the related communities
* These objectives facilitate a method to achieve Program Outcomes [1, 2, 3, 4, 5, 7]

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **7** | **20** |
| **MATERIALS AND GEOMETRY OF CUTTING TOOLS:** Introduction, Desirable Properties of Tool Materials, Characteristics of Cutting Tool Materials, Cutting tool geometry, Chip flow direction, Tool angles specification systems, Cutting parameters and Tool geometry, Index able inserts, chip breakers, Tools of unusual geometry. |  |  |
| UNIT-2: | **7** | **20** |
| **MECHANICS OF METAL CUTTING:** Merchant's circle diagram- determination of cutting and thrust forces; Coefficient of friction; shear plane angle, Velocity and force relationship, shear stress and strain and strain rate in orthogonal cutting, stress distribution along rake face, theories of Lee and Shaffer’s, Oxley’s, etc. Cutting force measuring techniques i.e dynamometer. |  |  |
| UNIT-3: | **08** | **20** |
| **THERMAL ASPECTS IN MACHINING AND CUTTING FLUID:** Regions of heat generation; Heat In the Primary Shear Zone, Heat at the Tool/work Interface, Heat Flow at the Tool Clearance Face, Average shear plane temperature; Average chip-tool interface temperature; method of tool temperature measurement, temperature distribution in tool, Cutting Fluid: Types and composition of cutting fluids, selection of cutting fluid. |  |  |
| UNIT-4: | **07** | **20** |
| **TOOL WEAR, TOOL LIFE AND MACHINABILITY:** Tool wear mechanisms, Types of tool damage during cutting, Wear and chipping characteristics of different tool materials, Tool wear equations, tool failure criteria, Tool life equations, Effect of process parameters on Tool life, Tool life testing, Machinability, Surface finish and surface integrity. |  |  |
| UNIT-5: | **07** | **20** |
| **Machine Tools:** types and classification; NC, CNC etc., static, dynamic and thermal consideration in machine tools. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

* 1. Manufacturing Science, Ghosh, A. and Mallik, A.K., Affiliated East West Press
  2. Modern Machining Processes, P.C.Pandey, H.S.Shah, TMH
  3. Machine Tool Design: N.K.Mehta, Tata McGraw Hill
  4. Production Engineering Sciences by P.C.Pandey & C.K.Singh, Standard Publishers & Distributors Delhi
  5. Production Engineering by P.C.Sharma, S.Chand & Co.Pvt, Ltd., New Delhi.
  6. Fundamentals of tool design: F.W.Willson, Astme

**Course outcomes:**

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

1. Study design of single point cutting tool
2. Study design of multi point cutting tool

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| --- | --- |
| Course Title:  **MACHINE DESIGN** | Course Code : ME303 |
| Semester : **V** | Core / Elective : **Core** |
| Teaching Scheme in Hrs (L:T:P) : 3**:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Pre-requisites:**

Properties of metal and non metal, strength of materials

**Course Objectives:**

1. Develop an ability to apply knowledge of mathematics, science, and engineering
2. To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
3. To develop an ability to identify, formulate, and solve engineering problems.
4. To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| UNIT-1 | 8 | 20 |
| Mechanical Properties of Metals. Principal Stresses and Principal Planes. Determination of Principal Stresses for a Member Subjected to Bi-axial Stress. Application of Principal Stresses in Designing Machine Members. Combined Steady and Variable Stresses. Gerber Method for Combination of Stresses. Goodman Method for Combination of Stresses. Soderberg Method for Combination of Stresses. |  |  |
| UNITS-2 | 7 | 20 |
| **Mechanical Drives**: Selection of transmission, helical, bevel and worm gears, belt and chain drives. |  |  |
| UNITS-3 | 7 | 20 |
| **Friction Clutches & Brakes**: Common friction materials, shoe, band, cone and disc brakes their characteristics and design, friction clutches. | 7 |  |
| UNIT-4 | 7 | 20 |
| **Bearings and Lubrication:** Types of sliding bearing, materials, type of lubrication, design of sliding bearing, selection and application of rolling bearing, seals. | 7 |  |
| UNIT 5 | 7 | 20 |
| **Hoisting Elements**; Wire ropes, hooks, pulley  **Engine parts**: Piston, connecting rod crank shaft | 7 |  |
| **TOTAL** | **36** | **100** |
|  |  |  |

**Reference:**

**Text Books:**

1. Maleeve Hartman and O.P.Grover, “Machine Design”, CBS Publication & Publishers

2. V.B. Bhandari, “Machine Design”, Tata McGraw Hill

3. P.C. Sharma and D.K Aggarwal., “Machine Design”, S.K. Kataria & Sons.

**Reference Book:**

1. Mahadevan, “Design Data Book”, CBS Publishers & Distributors

2. I.E. Shigley & C.R. Mischke, "Mechanical Engineering Design”, Tata McGraw Hill

**Course outcomes:**

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

1. Be able to analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts
2. Demonstrate knowledge on basic machine elements used in machine design; design machine elements to withstand the loads and deformations for a given application, while considering additional specifications.
3. Be able to approach a design problem successfully, taking decisions when there is not a unique answer
4. Be proficient in the use of software for analysis and design.

|  |  |
| --- | --- |
| Course Title: Dynamics of Machine Lab | Course Code : ME 351 |
| Semester : V | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:2** | Credits : **1 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

KINEMATICS AND DYNAMICS, KINEMATICS AND DYNAMICS LAB

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON DYNAMICS OF MACHINE LAB EQUIPMENTS

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. To study inversion of four bar chain  2. Coupling Rod  3. Beam Engine  4. Steering Mechanism  (a) Study of quick return mechanism.(Crank and Slotted lever mech.)  (b) To draw velocity and acceleration diagram for Crank and slotted lever mechanism.  5. Study of inversion of Double slider chain  Oldhan Coupling, Scotch Yoke  Elleptical Trammel  6. To plot displacement v/s θ curve for various cams.  7. Study of various cam- follower arrangements.  8. To determine co-efficient of friction.  9. Study of various types of dynamometers, Brakes and Clutches.  10. To determine moment of inertia of the given object using of Trifler suspension.  11. To Verify the relation T=I.W.Wp. for gyroscope. | TWO hours for each experiment |  |
| **TOTAL** | **20** | **100** |
|  |  |  |

**Reference:**

1. The Theory of Machines, Thoman Beaven, CBS publishers & Distributors, Delhi
2. Theory of Mechanisms and Machines; Jagdish lal, Metropolitian Book Co. Ltd, New Delhi
3. Theory of Machines; P.L. Ballaney, Khanna Publishers, Delhi

**Course outcomes:**

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

1. Students will become familiar with kinematics and different motions of machines.
2. Students get to know the automotive vehicle mechanism.
3. Students will be able understand the brake and dynamometers construction and their working.
4. Students will be able to understand the concept of cams and gyroscopes.

|  |  |
| --- | --- |
| Course Title: INDUSTRY ORIENTED PRODUCTION PROCESS LAB | Course Code : ME 355 |
| Semester : V | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **30** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Mechanical workshop, Casting, Welding and Forming.

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS BY USING VARIOUS MACHINES AND TOOL.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **30** | **100** |
| 1. To study of single point cutting tool geometry & to grind the tool to the given tool geometry. Write importance of various angles and to prepare a capacity chart of the Tool & cutter grinder. 2. Prepare a hexagonal/octagonal nut using indexing head on milling m/c and to cut bsw/ metrix internal threads on lathe (to meet with job). 3. To prepare the capacity chart for a lathe machine. 4. To cut multi-start square/metric thread. 5. To cut external metric threads & to mesh it with the nut (drg). 6. Prepare the process chart for the job. 7. To perpare the job by eccetric turning on lathe machine drawing. 8. To study shaper machine & its mechanism and calculate its quick return ratio. 9. To prepare a job on shaper from given mild Steel rod drawing   10. To study the effect of rake angle on chip thickness ratio and the shear angle in orthogonal machining.  11. Using drill dynamometer measure the torque and thrust force in drilling and to plot the characteristics, torque, force & power v/s speed & feeds.  12. To measure effective diameter of a screw thread by three wire method.  13. To perform alignment test on a centre lathe  14. To calibrate pneumatic comparator and measure taper of a given work peice. | Three hours for each experiment |  |
| **TOTAL** | **30** | **100** |

**Reference:**

1. James S Campbell, Principles of Manufacturing Materials and Processes, Tata McGraw Hill, 1995.

2. F.C. Flemmings, Solidification processing, Tata McGraw Hill, 1982

3. M J Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw Hill, 1987.

3. G E Linnert, Welding Metallurgy, AWS, 1994.

4. P C Pandey and C K Singh, Production Engineering Sciences, Standard Publishers Ltd. 1980.

**Course outcomes:**

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

1. To provide various angles on single point cutting tool by using grinding machine.
2. Able to perform various operation on different different machine.
3. To make various threads on workpiece and also calculate pitch and angle.

|  |  |
| --- | --- |
| Course Title: **Hydraulic Machines Lab** | Course Code : ME 363 |
| Semester : V | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **30** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. Impact of jet on vanes 2. Study of Hydraulic RAM. 3. Performance test on Pelton wheel turbine 4. Performance test on Francis turbine. 5. Performance characteristics of a single stage / multi-stage centrifugal pump. 6. Performance characteristics of a reciprocating pump. 7. Single-rod cylinder, pressure intensification 8. Single-rod cylinder, flow 9. Hydraulic motor 10. 4/3 directional valve 11. Check valve 12. Check valve, pilot operated 13. Throttle valve, adjustable 14. Throttle check valve 15. Flow control valve 16. Pressure relief valve, 17. direct operated 18. Pressure relief valve, 19. Pressure reducing valve 20. Pressure switch 21. Hydraulic accumulator 22. Regenerative circuit 23. Rapid speed/creep speed control | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

|  |  |
| --- | --- |
| Course Title:  **FUNDAMENTALS OF AERODYNAMICS** | Course Code : **ME 309** |
| Semester : **V** | Core / Elective **ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : 3**:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engg.** | |

**Pre-requisites:**

Basics in thermodynamics, fluid mechanics , basic mathematics

**Course Objectives:**

1. To study the various concepts of of Aerodynamic forces and moments
2. To apply the concepts of blade theory and isentropic flow
3. Measurement and analysis of shock wave relation.
4. Able to understand the different tables related to shock, steam etc.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | | |
| UNIT-1: **Basic aerodynamics** | 08 | 20 |
| Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient.  centre of pressure of an aerofoil, nomenclature of aerofoil, angle of attack, circulation and lift over an-aerofoil, Kutta condition, Kelvin's circulation theorem. |  |  |
| 08 | | |
| UNITS-2: blade Theory | 07 | 20 |
| Symmetrical and non-symmetrical aerofoil. Energy transfer in terms of lift and drag.  Cascade nomenclature, turbine cascade nomenclature, cascade lift and drag coefficient. |  |  |
| UNITS-3: Isentropic flow | 07 | 20 |
| Velocity of sound; Mach angle; Mach number, steady isentropic flow through ducts; use of isentropic tables; condition for maximum discharge.  Choked flow; flow through convergent and convergent-divergent nozzle, supersaturated flow in nozzle. |  |  |
|  | | |
| UNIT-4: Adiabatic flow & flow with heat transfer | 07 | 20 |
| Adiabatic flow; Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow .  Rayleigh line; use of tables; change in entropy; effect of change in stagnation temperature. |  |  |
| UNIT 5: Normal shock | 07 | 20 |
| Plane stationary normal shock; Ranking-Hugoniot relations; increase in entropy; Prandtl's relations; change in stagnation pressure across the shock. |  |  |
|  | 07 |  |
| **TOTAL** | **36** | **100** |

**Reference:** 1.Compressible Flow by S.M.Yahya

2.Gas Dynamics, R.K.Prohit

3.Fundamentals Of Aerodynamics by Anderson

4.Basic concept of fluid mechanics by R.K.Bansal

**Course outcomes:**

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

1.Study of Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient, centre of pressure of an airfoil

2.Student will be able to understand blade theory and isentropic flow concepts

3.Measurement and analysis of shock wave relation.

4. Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow .

5.Student will be able to understand the different propulsion systems.

**Reference Books:**

1. Compressible Flow by S.M.Yahya
2. Gas Dynamics, R.K.Prohit
3. Fundamentals Of Aerodynamics by Anderson
4. Basic concept of fluid mechanics by R.K.Bansal

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| --- | --- |
| Course Title: MECHANICAL VIBRATION & NOISE ENGINEERING | Course Code : ME 311 |
| Semester : V | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Mathematics-I & II, DOM-I, Numerical Methods.

**Course Objectives:**

TO STUDY ABOUT THE HINDERED VIBERATION IN MACHINE TO GET BALANCED

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **8** | **20** |
| Sound level and subjective response to sound; Frequency dependent human response to sound, Sound pressure dependent human response.  Decibel scale; Decibel addition, subtraction and averaging. Relationship among sound power, sound intensity and sound pressure level. Sound spectra. Octave band analysis. Loudness.  Noise: Effects, Ratings and Regulations; Non-auditory effects of noise on people, Auditory Effects of noise, Noise standards and limits in India.  Major sources of the noise; Industrial noise sources. Industrial noise control-strategies; Noise control at the source, Noise control along the path, Acoustic barriers, Noise control at the receiver. | 02  02  02  02 |  |
| UNIT-2: | **7** | **20** |
| Scope of vibration, important terminology and classification, Degrees of freedom, Harmonic motion; vectorial representation, complex number representation, addition.  Derivation of equation of motion for one dimensional longitudinal, transverse and torsional vibrations without damping using Newton’s second law, D’ Alembert’s principle and Principle of conservation of energy. Compound pendulum and centre of percussion.  Damped vibrations of single degree of freedom systems. Viscous damping; under damped, critically damped and over damped systems, Logarithmic decrement. Vibration characteristics of Coulomb damped and Hysteretic damped systems. | 02  02  03 |  |
| UNIT-3: | **07** | **20** |
| Forced vibrations of single degree of freedom systems. Forced vibration with constant harmonic excitation. Steady state and transient parts. Frequency response curves and phase angle plot.  Forced vibration due to excitation of support. Vibration Isolation and transmissibility; Force transmissibility, Motion transmissibility. Forced vibration with rotating and reciprocating unbalance. Materials used in vibration isolation. | 03  04 |  |
| UNIT-4: | **07** | **20** |
| System with two degrees of freedom; principle mode of vibration, Mode shapes.  Undamped forced vibrations of two degrees of freedom system with harmonic excitation. Vibration Absorber;  Undamped dynamic vibration absorber and centrifugal pendulum absorber. Many degrees of freedom systems: exact analysis. | 02  02  03 |  |
| UNIT-5: | **07** | **20** |
| Many degrees of freedom systems: approximate methods; Rayleigh’s, Dunkerley’s, Stodola’s and Holzer’s methods.  Vibrations of continuous systems; Transverse vibration of a string, Longitudinal vibration of a bar, Torsional vibration of a shaft. | 03  04 |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Mechanical Vibrations; G.K.Grover, Nemi Chand & Bros., Roorkee
2. Vibration Theory & Applications; W.T.Thomson
3. Vibration & Noise for Engineers; K.K.Purja, Dhanpat Rai & Sons, Delhi
4. Theory & Problems of Mechanical Vibrations; W.W.Seto, Schaum's Outline Series, McGraw Hill International Editions
5. Mechanical Vibrations, Den Hartog
6. Vibration Problems in Engineering, Timshenko

**Course outcomes:**

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

1. Study of Scope of vibration, important terminology and classification, Degrees of freedom, Harmonic motion; vectorial representation
2. Detailed study of Forced vibrations of single degree of freedom systems. Forced vibration with constant harmonic excitation.
3. Sound level and subjective response to sound; Frequency dependent human response to sound.

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| --- | --- |
| Semester : V | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Mechanical Vibration & Noise Vibration , Mathematics-I & II, DOM-I, Numerical Methods.

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON VIBRATING EQUIPMENTS

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. To verify relation T=2 √L/g for a simple pendulum. 2. To determine radius of gyration of compound pendulum. 3. To determine the radius of gyration of given bar by using bifilar suspension. 4. To determine natural frequency of Spring mass System. 5. Equivalent spring mass system 6. To determine natural frequency of free torsional vibrations of single rotor system (a) Horizontal rotor (b) Vertical rotor. 7. To verify the Dunkerleys rule. 8. Study of free damped torsional vibration to performing the experiment to find out damping co-efficient. 9. To conduct experiment on trifilar suspension   10. Vibration of beams concept of more than one degree of freedom Excrtation using eccentric mass.  11. Critical speed of shafts.  12. Study of vibration measuring instruments. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1. Mechanical Vibrations; G.K.Grover, Nemi Chand & Bros., Roorkee
2. Vibration Theory & Applications; W.T.Thomson
3. Vibration & Noise for Engineers; K.K.Purja, Dhanpat Rai & Sons, Delhi
4. Theory & Problems of Mechanical Vibrations; W.W.Seto, Schaum's Outline Series, McGraw Hill International Editions
5. Mechanical Vibrations, Den Hartog
6. Vibration Problems in Engineering, Timshenko

**Course outcomes:**

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

1. To determine, Degrees of freedom, Harmonic motion of various vibrating equipments
2. Able to understand about the natural frequency.
3. Calculate damped undamped vibrations of machinery

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| Course Title: Proportional Hydraulics | Course Code : MCPH |
| Semester : V | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Fluid mechanics

**Course Objectives:**

Understand various laws governing fluid flow, Select appropriate hydraulic fluid for given application, Select appropriate hydraulic pipe for given application, pumping theory,

Select and use various hydraulic accessories with its location on hydraulic system.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **7** | **20** |
| **Fundamentals of Hydraulics.**  Power transmission modes and comparison, Fluid power – history, concept and definition, Application of hydraulic and pneumatic in fluid power, Hydrostatic and hydrodynamic-concept and definitions, Laws governing fluid flow:  i. Pascal’s law. ii. Continuity equation. iii. Bernoulli’s theorem, Hydraulic systems –applications, advantages and limitations. |  |  |
| **UNIT-2:** | **07** | **20** |
| **Hydraulic Elements-I.**  Basic hydraulic system, Hydraulic pipes – Types, standards, designation and specifications, pressure ratings, applications, selection criteria, Pumping theory & classification.  General assembly sketch, main parts, working principle, working, applications and comparison of following pumps: i. External, Internal gear pumps & Ge-rotor.(Generator rotor).Selection criteria of pumps. Hydraulic Actuators - classification, construction, working and applications. |  |  |
| **UNIT-3:** | **07** | **20** |
| **Hydraulic Elements-II.**  Classification of Hydraulic control valves. Types, construction, working and applications of: i. Pressure control valves.  ii. Directional control valves. iii. Flow control valves.  iv. Proportional control valve (Proportional pressure relief valve, Proportional pressure reducing valve, Proportional direction valve).  v. Servo control valves. (Mechanical hydraulic servo valve, Electro hydraulic servo valve, Single stage, two stage Flapper type, Jet pipe type). Comparison of proportional and servo control valves. Selection of control valves. Hydraulic Accessories: types, construction, working and applications of: i. Strainers and filters.  ii. Seals (static and dynamic). iii. Hydraulic reservoirs.  iv. Hydraulic accumulators. v. Manifold. vi. Heat exchangers.  vii. Oil level and pressure indicator. |  |  |
| **UNIT-4** | **07** | **20** |
| **Hydraulic Circuit Design.**  ISO symbols used in hydraulic circuits. Circuit diagram, components, working and application of following hydraulic circuits: i. Control of single acting cylinder. ii. Control of double acting cylinder. iii. Pump unloading circuit. iv. Intensifier Circuit.  Automatic Cylinder Reciprocation circuit. Sequencing circuits. Meter-in and Meter-out circuit. Two hand safety control. Emergency cut-off control. |  |  |
| **UNIT-5** | **07** | **20** |
| **Hydraulic Devices.**  Hydraulic Devices – Concept and applications. Construction, working principle, major elements, performance variables and applications of following devices: i. Automotive hydraulic brake.  ii. Industrial Fork lift. iii. Hydraulic jack. iv. Hydraulic press.  v. Automotive power steering.vi. Hydraulic lift. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

* Majumdar, S.R. , Oil Hydraulic Systems , Tata Mcgraw-Hill Publication, 3/e, 2013
* Srinivasan, R. ,, Hydraulic and Pneumatic Controls , Vijay Nicole Imprints Private Limited, 2/e, 2008
* Jagadeesha, T. , Fluid Power Generation, Transmission and Control, Universities Press (India) Private Limited, 1/e, 2014

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| --- | --- |
| Course Title: **Statistics for Decision Making** | Course Code : |
| Semester : V | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic of Mathematics, Advance Maths

**Course Objectives:**

The course provides an overview of management science / operations research with select applications / case studies from management systems and interdisciplinary areas.

In the beginning statistics for Statistics for Statistics for Decision Making is briefly discussed by reviewing the basics of probability and statistics leading to its applications in Quantitative methods.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| **A overview to quantitative methods and probability:**  An analytical  scientific approach to Problem solving, An analytical  scientific approach to Problem solving modeling process for Managerial Decision Making, Statistics for Management: Measures of Central Tendency & Dispersion  ,  Probability concepts, Bayes Theorem & Applications, Probability Distributions- Binomial, Poisson , Normal & Exponential |  |  |
| **UNIT-2:** | **4** | **20** |
| **Collection and analysis of data**  Sampling & Sampling Distributions,  Testing of Hypothesis ( z-,t-,Chi square, f- test),  Correlation, Regression & Multivariate Analysis |  |  |
| **UNIT-3:** | **06** | **20** |
| **Decision making and quantitative techniques**  Forecasting methods & Time Series Analysis, Decision Analysis: Decision Trees& Utility Theory, Decision Making under uncertainty, Decision Making  under risk,  Decision Making under conflict ( Game Theory) |  |  |
| **UNIT-4** | **04** | **20** |
| **Multi-criteria Decision making tools**  Multi-criteria Decision making, Linear Goal Programming  Scoring Models, Fuzzy outranking, AHP (Analytic Hierarchy Process} concepts & applications, ANP ( Analytic Network Process) an Introduction |  |  |
| UNIT-5: | **04** | **20** |
| **Inventory and queuing management**  Inventory models ( static, dynamic, probabilistic & stochastic)  Waiting Line / Queuing models  steady state operation( M/M/1),  Simulation concepts & applications for inventory & Queuing situation, Network models; shortest route, maximal flow problem |  |  |
| **TOTAL** | **24** | **100** |

**Reference:**

1. Barry Render, RalphM StairJr, Michael E Hanna, 2005, Quantitative analysis for management, Pearson Education
2. Frederic S.Hillier, Gerald J.Liberman,2005 Introduction to Operations Research,Â  Tata McGraw-Hill
3. Gupta M.P. and R.B. Khanna, 2004, Quantitative Techniques for Decision Making, Prentice Hall of India
4. Natarajan,A.M, Balasuramani.P,Tamilarasi, A2009 Operations Research, Pearson Education

5. Srinivasan.G, 2007, Operations Research, Eastern Economy Edition PHI

|  |  |
| --- | --- |
| Course Title: **Global Engineering** | Course Code : |
| Semester : V | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| Role of energy in economic development and social transformation: Energy & GDP, GNP and its dynamics. Discovery of various energy sources: Energy Sources and Overall Energy demand and availability, Energy Consumption in various sectors and its changing pattern, Exponential increase in energy consumption and Projected future demands. |  |  |
| **UNIT-2:** | **4** | **20** |
| Energy Resources: Coal, Oil, Natural Gas, Nuclear Power and Hydroelectricity, Solar and Other Renewable etc. Depletion of energy sources and impact exponential rise in energy consumption on economies of countries and on international relations. Energy Security: Chemical and Nuclear: Non Proliferation, Energy Security, Energy Consumption and its impact on environmental climatic change. |  |  |
| **UNIT-3:** | **06** | **20** |
| A Systems Approach to Human Development- Par - Concepts and models of development - Development challenges in the developed and developing world - The Millennium and Sustainable Development Goals - Integrating a systems approach to the MDGs and SDGs - Models of Global Change: IF Future trend “what if” models - Scenario planning models at different scales 5. The Water-Energy-Land-Food Nexus - The Water of Ayole case study - Analyzing the components of a case study - Modeling a case study. |  |  |
| **UNIT-4** | **04** | **20** |
| A Systems Approach to Human Development- Modeling population dynamics - System archetypes. Systems Approach to Management of Development Projects -Stages of project management - Role of non-technical issues in all stages of project management - The non-technical dimensions of engineering innovation. Who benefits? - Right projects, done right, and for the right reasons. Who decides and participates? - Collecting and analyzing data for systems modeling - Defining issues and their dynamic hypotheses - Social network analysis and GIS - Methods of decision making, importance of perspective (Zoom) - Capacity, vulnerability, and risk analysis - Developing an implementation plan - Failure and the engineering mindset – |  |  |
| UNIT-5: | **04** | **20** |
| The ethical dimensions of failure - Deciding when faced with uncertainty and complexity - Biases and cross-cultural communication. Sustainability and Sustainable Development - Definitions - Integrating sustainability in engineering projects 9. Systems Approach to Community Resilience and Security- Importance of context and scale - Capacity and vulnerability Critical infrastructure - Response to hazards, adverse events, and human migrations. Group Decision Making Dynamics- The different dimensions of leadership - Teamwork - Dealing with conflict (internal and external) - Case studies. |  |  |
| **TOTAL** | **24** | **100** |

|  |  |
| --- | --- |
| Course Title: **Green Car Technology and Maintenance** | Course Code : |
| Semester : V | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Objectives:**

Upon completion of this course, students will

• Address smart energy and green infrastructure.

• Demonstrate safe behavior and practice in laboratory environment.

• Understand the history, global and environmental and economic impact of green technology.

• Identify technological system that will function with renewable energy resources

• Apply math and science to find solutions to address non renewable energy challenges.

• Apply the engg and design processes to solve problems

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1: Introduction to various green technologies** | **6** | **20** |
| * Solar Photovoltaic * Solar Thermal * Sustainable Lighting * Renewable Energy |  |  |
| **UNIT-2:** **Green technology resources** | **4** | **20** |
| * Green components of car body, efficiency calculation, * Energy Efficient different * Alternative Fuels, |  |  |
| **UNIT-3:** **Green technology and maintenance** | **06** | **20** |
| * Hybrid Vehicle Technology * Low-emission Vehicle Technology * Environmental and Industrial Laboratory Testing – Chemical Technology |  |  |
| **UNIT-4: Design and maintenance** | **04** | **20** |
| Principles of vehicle dynamic, necessity of gears and clutch, correlation between braking, wheel load and recovery of energy. Calculation simple properties of a car. |  |  |
| **UNIT-5: Environmental consideration of green technology** | **04** | **20** |
| Natural Resources and Environmentalism,  Pollution and its Effects, Sustainable and Unsustainable Energy; Fossil Fuels, The Greenhouse Effect and Climate Change, Efficiency and Alternative Energy |  |  |
| **TOTAL** | **24** | **100** |

**Learning outcomes:-**

* Able to understand the detailed concept of green technology
* Should be able to use various technological advancements and available green resources.
* Able to understand various maintenance procedure for green technology.
* Understanding the effect of green technology on environment

|  |  |
| --- | --- |
| Course Title: **Waste to Energy** | Course Code : |
| Semester : V | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

* **Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors |  |  |
| **UNIT-2:** | **4** | **20** |
| Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications. |  |  |
| **UNIT-3:** | **06** | **20** |
| Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation. |  |  |
| **UNIT-4** | **04** | **20** |
| Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors. |  |  |
| UNIT-5: | **04** | **20** |
| Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India. |  |  |
| **TOTAL** | **24** | **100** |

**Reference:**

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I &

II, Tata McGraw Hill Publishing Co. Ltd., 1983.

3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley &

Sons, 1996. Edition PHI

|  |  |
| --- | --- |
| Course Title:  **EMPLOYABILITY SKILL** | Course Code :  **EM-302** |
| Semester : **VI** | Core / Elective : **Program** **Core** |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.Tech (Mechanical Engineering)** | |

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Topic** | **Details** | **Contact Hours** |
| 1 | Group Discussions & PI | Objective and Managing GD/PI, GD/PI-Technical/Mkt/HR/IT/Gen round, Factual, Argumentative, Opinion, Abstract GDs, Practice, Mock, Recorded PI/GD. | 10 |
| 2 | Industry | Importance of SIP & Networking, Workplace Competency, Value and Ethics, Problem Solving & Decision Making, Resume Writing/ Sample Resumes, , Business Sectoral Information | 6 |
| 3 | General Awareness | News paper reading & interpretation, Quiz, Current topics, Small Talks, Discussions, Speak Smart, Current affairs, Current Political Issues/Topics | 6 |
| 4 | Preparation Presentation | Role play Presentation skills & Preparation | 3 |

|  |  |
| --- | --- |
| Course Title: **HEAT AND MASS TRANSFER** | Course Code : ME 302 |
| Semester : **VI** | Core / Elective : **Program** **Core** |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.Tech (Mechanical Engineering)** | |

**Pre-requisites:**

ENGINEERING THERMODYNAMICS, INDUSTRY ORIENTED THERMAL ENGINEERING LABORATORY

**Course Objectives:**

1. Understand the basic concept of laws of heat transfer
2. Analyze the laws of heat transfer in different heat exchangers of different shapes.
3. Have detailed understanding of natural and forced convection.
4. Have an understanding of thermal radiation.
5. Understand basic principles of mass transfer.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| UNIT-1: CONDUCTION | 8 | 20 |
| **Conduction:** One dimensional steady state conduction. Simple convection. Overall heat transfer coefficient. Simple cases of Heat Transfer through, homogenous and composite plane walls,cylinders and spheres with constant and variable thermal conductivity. Critical thickness of insulation. Heat transfer from Fins of uniform cross section.  **Convection:** Concept of Hydrodynamic and Thermal boundary layers. Application of Dimensional analysis to Free and Forced convection. Important Dimensions- less numbers. |  |  |
| UNITS-2: THERMAL RADIATION | 7 | 20 |
| **Thermal Radiation:** Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces. |  |  |
| UNITS-3: HEAT EXCHANGERS | 7 | 20 |
| **Heat transfer during Change of Phase:** Film condensation and Drop wise condensation. Flowregimes. Heat transfer coefficient for Film Condensation. Boiling: Classification. Boiling regimes. Heat transfer correlations in boiling.  **Heat exchangers:** Types of Heat exchangers. LMTD and NTU methods exchangers Design.Simple calculations. |  |  |
|  | | |
| UNIT-4: HEAT TRANSFER ENHANCEMENT TECHNIQUES | 07 | 20 |
| **Heat transfer enhancement techniques**, special heat transfer processes like transpiration and film cooling, ablative cooling; Mass transfer: molecular diffusion, Fick's law, equimolar counter diffusion, molecular diffusion in a stationary gas, analogy between heat and mass transfer |  |  |
| UNIT 5: INTRODUCTION TO MASS TRANSFER | 7 | 20 |
| **Introduction to Mass Transfer:** Mass and mole concentrations. molecular diffusion, eddy, diffusion from an evaporation fluid surface. Mass transfer in laminar and turbulent convections. Raynold's analogy. Combined heat and mass transfer the wet and dry build thermometer |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. F.P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 4e, John Wiley and Sons. 1996.
2. J.P. Holman, Heat Transfer, 8e, McGraw Hill, 1997.
3. M.N. Ozisik, Heat Transfer - A basic approach, McGraw Hill, 1985.
4. Bejan, Convection Heat Transfer, 2e, Interscience, 1994.

**Course outcomes:**

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

1. Understand the basic concept of laws of heat transfer
2. Analyze the laws of heat transfer in different heat exchangers of different shapes.
3. Have detailed understanding of natural and forced convection.
4. Have an understanding of thermal radiation.
5. Understand basic principles of mass transfer.

|  |  |
| --- | --- |
| Course Title:  **AUTOMOBILE ENGINEERING** | Course Code : ME 306 |
| Semester : VI | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Kinematics of machines, Internal combustion engines, Material science

**Course Objectives:**

1. To study about the old and latest mechanisms used in automobiles

2. Describe how the steering and the suspension systems operate.

3. The anatomy of the automobile in general.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | **Power Plant**: Selection of power plant for automotive vehicle, requirements of vehicle. Characteristics of various power plants (Petrol engines, Diesel engines, CNG LPG engine, Gas Turbines constructional details of C.I. and S.I. engines, crank shafts, connecting rods, pistons, piston pins, piston rings, valves mechanisms, manifolds, air cleaners, mufflers, radiators and oil filters.  **Frame & Body:** Layout of chassis, types of chassis frames and bodies, their constructional features and materials. | 7 |
| **II** | Transmission Systems : Transmission requirements, general arrangement of clutch, gear box and rear axle transmission, general arrangement of rear engines and vehicles with live axles. General arrangement of Dead axle and axle-less transmission, De-Dion drive, arrangement of front engine and front wheel drives, four wheel drive transmission.  **Clutches**: Principle of friction clutch, single and multiplate clutches, centrifugal clutch. Friction materials. Bonding materials. Fluid fly wheel clutch. | 7 |
| **III** | Transmission : Description and working of manually operated gearboxes like sliding mesh, constant mesh, synchromesh. Hydraulic torque converter and its construction working and performance. Semi-automatic transmission (Wilson Gear Box). Analysis of differentials, live axles, construction and working. Requirement of overdrive.  **Steering System** : Steering geometry, Ackermann steering, Center point steering, Power steering. | 7 |
| **IV** | **Suspension** : Independent suspension; Perpendicular arm type, Parallel arm type. Dead axle suspension. Live axle suspension, air suspension, shock absorbers.  **Wheels, Tyres and Brakes** : Wheel and tyre requirements, tyre dynamics, mechanical and hydraulic brakes, shoe arrangements and analysis, disc brakes, braking effectiveness relationship for 4 wheel drive. | 7 |
| **V** | **Automotive Air Conditioning**: Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis.  **Automotive Safety**: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System) etc. | 7 |
|  | **Total** | **35** |

**Reference:**

1. Automobile Engineering, R.K.Sharma
2. Automobile Engineering, Kirpal Singh, Vol. 1 & 2
3. Automotive Chassis and Body, P.L.Kohli, Vol.1 & 2
4. Vehicle Engine and Technology, Heisler, ELBS
5. Jain &Asthana, “Automobile Engineering”, Tata McGraw-Hill, New Delhi, 2002.

**Course outcomes:**

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

1. Selection of power plant for automotive vehicle, requirements of vehicle. Characteristics of various power plants
2. Transmission requirements, general arrangement of clutch, gear box and rear axle transmission
3. Understanding Principle of friction clutch, single and multiplate clutches, centrifugal clutch. Friction materials
4. Study of various types of Wheels, Tyres and Brakes
5. Identify the different parts of the automobile

|  |  |
| --- | --- |
| Course Title:  **Finite Element Analysis** | Course Code : ME 316 |
| Semester : VI | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Mathematics-I & II, DOM-I, Mechanics of solids. KOM, Engineering Drawing, Machine Drawing, Numerical Methods.

**Course Objectives:**

To introduce the concepts of Mathematical Modeling of Engineering Problems.

To appreciate the use of FEM to a range of Engineering Problems

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | Stress strain and deformation relations, plane - stress, planes strain, Principles of minimum Potential Energy, principle of virtual work. | 7 |
| **II** | Stiffness method for steady state problems of discrete systems (Bar, trusses, one dimensional heat transfer system) Element stiffness matrix, Assembly of elements, global stiffness matrix and its properties, Node numbering, Displacement and force Boundary conditions, Transformations matrix, Gauss elimination method | 7 |
| **III** | Displacement - Based FEM for solid mechanics;Derivation of finite element equilibrium equations, Langrangian elements (I-D & 2-D elements); CST, rectangle, aspect ratio shape functions, lumping of loads, computability and convergence requirements. Stress calculations Isopohmetric Derivation of Stiffness matrices, bar and plane bilinear elements, Seredipity elements, natural coordinates, numerical integration, Co-continuity p and h refinement | 8 |
| **IV** | Variational Method: Variational Approach for known functional of field problems. Weighted Reidual Methods: Point collection, subdomain collocation, methods of least square, Galerkin. Application of these methods to one dimensional boundary value problems; Structures, fluid mechanics and heat transfer. | 7 |
| **V** | Finite Elements in Dynamics and Vibrations: Introduction, Dynamic Equations, Mass and Damping Matrics, Mass Matrics, Consistent and Diagonal, Damping, Natural frequencies and Mode Shapes. | 7 |
|  | **Total** | **36** |

**Reference:**

1. Introduction to Finite Elements in Engineering, Tirupathi R. Chandrapatla and Ashok D. Belagundu, Prentice Hall of India. Ltd.
2. Comcept and Applications of Finite Element Analysis, Robert D. Cook. David S. Malkus. Michaiel E. Palesha, John Wiley & Sons.
3. Finite Element Procedures, Klaus Jurgan Bathe, Prentice Hall of India, New Delhi

|  |  |
| --- | --- |
| Course Title: Project Oriented Heat & Mass Transfer Lab | Course Code : ME 352 |
| Semester : VI | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | ESE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

ENGINEERING THERMODYNAMICS, INDUSTRY ORIENTED THERMAL ENGINEERING LABORATORY

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON HEAT AND MASS TRANSFER EQUIPMENTS

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. To find emissivity of a grey body relative to a given block body.  2. Perform parallel flow heat exchanger.  3. Perform counter flow heat exchanger.  4. To find out the Stefan Boltzmen constant.  5. To perform experiment on pin fin test rig in forced convection by neglecting radiation losses & to calculate. Convective heat transfer coefficient. (Experimentally & empirical correlation), Efficiency, Effectiveness, Comparison of experimental & theoretical temperature profile.  6. Repeat the same exercise by considering radiation losses  7. To find convectively heat transfer coefficient of a given cylinder in vertical position by neglecting radiation losses by assuring, constant surface temperature, constant heat flux & compare with experimental heat transfer coefficient by neglecting radiation losses.  8.Perform the experiment No.5 by using cylinder in horizontal position.  9. To find convectively heat transfer coefficient of a given cylinder in vertical position by neglecting radiation losses by assuring, constant surface temperature, constant heat flux & compare with experimental heat transfer coefficient by considering radiation losses.  10. To perform experiment on pin fin test rig in forced convection by considering radiation losses & to calculate. Convective heat transfer coefficient. (Experimentally & empirical correlation), Efficiency, Effectiveness, Comparison of experimental & theoretical temperature profile. | TWO hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1. F.P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 4e, John Wiley and Sons. 1996.
2. J.P. Holman, Heat Transfer, 8e, McGraw Hill, 1997.
3. M.N. Ozisik, Heat Transfer - A basic approach, McGraw Hill, 1985.
4. Bejan, Convection Heat Transfer, 2e, Interscience, 1994.

**Course outcomes:**

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

1. Understand the basic concept of laws of heat transfer
2. Analyze the laws of heat transfer in different heat exchangers of different shapes.
3. Have detailed understanding of natural and forced convection.
4. Have an understanding of thermal radiation.
5. Understand basic principles of mass transfer.

|  |  |
| --- | --- |
| Course Title:  **AUTOMOBILE ENGG. LAB** | Course Code : ME 354 |
| Semester : VI | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:2** | Credits : **1 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | ESE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

IC Engine lab

**Course Objectives:**

TO STUDY THE PARTS OF AN AUTOMOBILE

To understand function and linkages of each part

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. Disassembling and assembling of multi-cylinder petrol engines and study of their parts. 2. Disassembling and assembling of multi-cylinder diesel engines and study of their parts   3. To disassemble and assemble a 2-stroke petrol engine.  4. To disassemble and assemble a 4-stroke motor cycle engine and study of various engine parts.  5. Load test on a single cylinder 4-stroke diesel engine using a rope brake dynamometer and calculate volumetric and thermal efficiency and draw a heat balance-sheet.  6. Study of carburetors and disassembling and assembling of their parts.  7. Study MPFI system and disassembling and assembling of their parts.  8. To calculate valve timing of a multi-cylinder petrol engine and valve tappets adjustment.  9. Disassemble all the parts of a fuel injection pump and its parts study.  10. To disassemble the governor and study its various parts.  11. To study constant mesh gearbox. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1.Automobile Engineering, R.K.Sharma

2.Automobile Engineering, Kirpal Singh, Vol. 1 & 2

3.Automotive Chassis and Body, P.L.Kohli, Vol.1 & 2

4.Vehicle Engine and Technology, Heisler, ELBS

**Course outcomes:**

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

* Disassembly of various parts.
* Assembly of various automobile parts
* Study of various automobile mechanisms

|  |  |
| --- | --- |
| Course Title: Software Lab (Solidwork/ANSYS) | Course Code : ME 362 |
| Semester : VI | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | ESE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Engineering Mechanics, Strength of Materials, KOM, DOM, Numerical Methods.

**Course Objectives:**

**Simulation Technology**

Systems & Multi Physics

Electromagnetics

Fluid Dynamics

Structural Mechanics

**Workflow Technology**

Geometry Interfaces

High-performance Computing

Simulation Process & Data Management

Our courses will make use of ANSYS Fluent, ANSYS HFSS, ANSYS Mechanical and ANSYS RedHawk and other ANSYS products.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. STUDY OF BASICS IN ANSYS 2. STRESS  ANALYSIS OF A PLATE WITH CIRCULAR HOLE 3. STRESS ANALYSIS OF  RECTANGULAR L BRACKET 4. STRESS ANALYSIS OF BEAM 5. MODE FREQUENCY ANALYSIS OF BEAM 6. STRESS ANALYSIS OF AN AXI - SYMMETRIC COMPONENT 7. HARMONOC ANALYSIS OF A 2D COMPONENT 8. THERMAL STRESS ANALYSIS OF A 2D COMPONENT 9. CONDUCTIVE HEAT TRANSFER ANALYSIS OF A 2D COMPONENT 10. CONVECTIVE HEAT TRANSFER ANALYSIS OF A 2D COMPONENT 11. INTRODUCTION TO MAT LAB | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

# The Finite Element Method for Mechanics of Solids with ANSYS Applications By Ellis H. Dill

1. Bathe, K.J., "Finite Element Procedures",
2. Crisfield, M.A., "Non-linear Finite Element Analysis of Solids and Structures", Vol. 1, 1991 and Vol. 2, 1997
3. Wriggers, P., "Computational Contact Mechanics, 2nd ed, 2006

**Course outcomes:**

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

1. You will be know how to simulate and validate the performance of products of all manufacturing sectors including automotive, power electronic products, electronic equipment, electromechanical devices, and electrical systems.
2. You will know how to simulate every structural aspect, including linear static analysis, of a single part of a complex assembly with hundreds of components interacting through contacts or relative motions.
3. You will know how to perform fluid flow analysis to know the impact of fluid flows on your product while manufacturing and when used by customers in real world applications.
4. With your mastery in simulation, you will contribute not only to success of products but also cost management, product integrity, designing smart products, and reduced time-to-market.

|  |  |
| --- | --- |
| Course Title:  **GAS DYNAMICS AND PROPULSION** | Course Code : **ME 308** |
| Semester : **VI** | Core / Elective :**PROGRAM** **ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engg.** | |

**Pre-requisites:**

Basics in aerodynamics ,propulsion system, thermodynamics

**Course Objectives:**

1. To study the various concepts of of Aerodynamic forces and moments
2. To apply the concepts of blade theory and isentropic flow
3. Measurement and analysis of shock wave relation.
4. Able to understand the different tables related to shock, steam etc.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | | |
| UNIT-1: **Revision of fundamentals** | 08 | 20 |
| Thermodynamics of compressible flow – wave motion in compressible medium, Mach number and cone, properties. Steady one-dimensional compressible flow through variable area ducts.  Effects of heating and friction in duct flow, Rayleigh and Fanno lines. Flows with normal shocks. Oblique shocks and reflection. Expansion waves. Prandtl- Meyer flow. Flow over bodies. Measurements and applications. |  |  |
|  | | |
| UNITS-2: **Compressors** | 07 | 20 |
| **Centrifugal Compressors:** Principal of operation; work done and pressure rise; slip diffuser. Design criterion; compressibility effects; non-dimensional quatities used for plotting compressor characteristics surging, choking and rotating stall gas Turbine  **Axial Fow Compressors:** Basic constructional features; turbine v/s compressor blades; elementary theory; degree of reaction; vortex theory, simple design calculations; introduction to blade design; cascade test; compressibility effects; operating characteristics; |  |  |
| UNITS-3: **Nozzles** | 07 | 20 |
| Application of Nozzles. Types of Nozzles. Converging and converging-diverging nozzles and diffusers.Expansion of steam through a Nozzle.  Effect of friction. Critical pressure ratio. Areas at Throat & Exit for maximum discharge conditions. Performance at Off- design conditions. |  |  |
|  | | |
| UNIT-4: **Jet Propulsion:** | 07 | 20 |
| Aircraft propulsion- types of jet engines-energy flow through jet engines, study of turbojet engine components-diffuser, compressor, combustion chamber, turbine and exhaust systems.  performance of turbo jet engines-thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engines, ram jet and pulse jet engines. |  |  |
| UNIT 5: **Rocket propulsion** | 07 | 20 |
| basics, solid and liquid propelled engines, parametric studies,construction features, single and multi-stage rockets. Thrust chamber and nozzle models. Studies of in-use engines. Environmental aspects**.** |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. J.P. Holman; “Heat Transfers” McGraw Hill, USA

2. Mills; “Heat Transfers”, C.B.S Publications.

3. Kearton; “Steam Turbine”, C.B.S Publications

4. Arora DomkundwaR, “A Course in heat & Mass Transfer”,

**Course outcomes:**

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

1.Study of Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient, centre of pressure of an airfoil

2.Student will be able to understand blade theory and isentropic flow concepts

3.Measurement and analysis of shock wave relation.

4. Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow .

5.Student will be able to understand the different propulsion systems.

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| --- | --- |
| Course Title: **Mechatronics** | Course Code : ME 304 |
| Semester : **VI** | Core / Elective :**Program Elective** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.Tech Mechanical Enginnering** | |

**Pre-requisites:**

Electronics Engineering, Electrical Machines, Control Theory and application.

**Course Objectives:**

1. Apply the basic mathematical skills needed to solve routine engineering problems.
2. To demonstrate knowledge of electrical circuits and logic design
3. Demonstrate knowledge of statics, dynamics and solid mechanics relevant to Mechatronics.
4. Apply and design mechatronic components and systems field.
5. To select the appropriate mechatronic device for a given application

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **MECHATRONICS** | | |
| UNIT-1: Introduction about Mechatronics | 07 | 20 |
| Introduction about Mechatronics, scope of Mechatronics, application, process control automation and N/c Machines.  **Hydraulic And Pneumatic Actuation Systems:** Overview: Pressure Control Valves, Cylinders, Direction Control Valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing |  |  |
| UNITS-2: **Electrical Actuation Systems** | 07 | 20 |
| **Electrical Actuation Systems:** Switching Devices, Mechanical Switches **–** SPST, SPDT, DPDT, Debouncing keypads; Relays, Solid State Switches, Diodes, Thyristors, Transistors, Solenoid, Types Devices: Solenoid Operated Hydraulic and Pneumatic Vlaves, Electro-Pneumatic equencing Problems. Control of DC Motors, Permanent Magnet DC Motors, Control of DCMotors, Bush less Permanent Magnet DC Motors, AC Motors, Stepper Motors, Stepper Motor Controls, Servo Motors. |  |  |
| UNITS-3: **Sensors and transducers and application** | 08 | 20 |
| **Sensors and transducers and application:** Performance Terminology, Static and Dynamic Characteristics, Displacement, Position and Proximity Sensors, Potentiometer Sensors, Strain Gauge Element, LVDT, Optical Encoders, Pneumatic Sensors, Hall Effect Sensors,Tachogenerators, Strain Gauge Load Cell, Thermostats, Photo Darlington. Interfacing Sensors in Mechantronic System as – Temperature Switch Circuit, Float Systems |  |  |
| UNIT-4: **Interfacing controllers, Data Acquisition and Control System** | 07 | 20 |
| **Interfacing controllers:** Interfacing, Buffers, Darlington Pair, I/O Ports, Interface Requirements, Handshaking, Serial and Parallel Port Interfacing, Peripheral Interface, Adapters.  **Data Acquisition and Control System -** Introduction, Quantitizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, transfer function, transient response & frequency response & frequency response, stability criteria. |  |  |
| UNIT 5: **Design of Mechatronic systems** | 07 | 20 |
| **Design of Mechatronic systems -** Introduction, Automatic front and book and cutting in steel rolling mill, lift control system, CNC lathe, temperature control of a heat treatment furnace, EOT crane control panel, Grey grain separators, electrode arm control in electric arc furnace.. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Mechatronics Engineering, Tomkinson, D. and Horne, J., McGraw Hill, 1996
2. Mechatronics, Bolton, W., Longman, 1995
3. Mechatronics, HMT Hand Book, 1998
4. Understanding Electro-Mechanical Engineering, Kamm, L.J., IEEE Press, New York, 2000
5. Nitaigour Premchand Mahalik, Mechatronics, Tata Mcgraw-Hill
6. J.P. Holman, Mechanical Measurements,McGraw-Hill
7. T.K.Kundra, P.N.Rao And N.K.Tewari,Numerical Control and Computer AidManufacturing,Tata McGraw-Hill,

**Course outcomes:**

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

1. Mechatronics, scope of Mechatronics, application, process control automation and N/c Machines.
2. Student will be able to know the concept of Hydraulic And Pneumatic Actuation Systems
3. Student will be able to understand Sensors and transducers and application .
4. Design of Mechatronic systems

|  |  |
| --- | --- |
| Course Title:  **Engineering Metrology and Measurement** | Course Code : ME 320 |
| Semester : **VI** | Core / Elective :Program Elective |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Pre-requisites:**

Basics physics and physical instrument.

**Course Objectives:**

* To provide to the students an understanding and appreciation of the science of Measurement.
* To expose the students to various mechanical and electrical engineering measuring devices, and understand the different degree of accuracy obtained from different types of instruments.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| UNIT-1 | 8 | 20 |
| **Principles of measurement**: Definition of Metrology, difference between precision andaccuracy. Sources of errors: Controllable and Random Errors, Effects of Environment and Temperature, Effects of support, alignment errors, application of Least Square principles, errors in measurement of a quality which is function of other variables.  **Length Standards:** Line standards, end standards and wavelength standards, transfer from line standards to end standards. Numerical based on line standards. Slip gauges – its use and care, methods of building different heights using different sets of slip gauges.  **Limits, fits and tolerances**: Various definitions, IS919-1963, different types of fits and methods to provide these fits. Numerical to calculate the limits, fits and tolerances as per IS 919- 1963. ISO system of limits and fits; Gauges and its types, limit gauges – plug and ring gauges. Gauge Design – Taylor’s Principle, wear allowance on gauges. Different methods of giving tolerances on gauges, Numericals.. | 2  2  4 |  |
| UNITS-2 | 07 | 20 |
| **Comparators:** Mechanical Comparators: Johanson Mikrokator and Signma Mechanical Comparator. Mechanical – optical comparator. Principles of Electrical and electronic comparators. Pneumatic comparators – advantages, systems of Penumatic gauging:- Flow type and back pressure type, Principle of working of back pressure gauges, different type of sensitivities and overall magnification, Solex Penumatic gauges and differential comparators. Numericals based on pneumatic comparators.  **Angular Measurement**: Sine Bar – different types of sine bars, use of sine bars in conjuction with slip gauges, precautions and calibration of sine bars. Use of angle gauges, spirit level, errors in use of sine bars. Numericals. Principle and working of Micro-optic autocollimator. Circular Division: dividing head and circular tables, circular division by precision Polygons. Caliper Principle, Calibration of polygons. Numerical based on circular division. | 4  3 |  |
| UNITS-3 | 07 | 20 |
| **Straightness and flatness**: Definition of Straightness and Flatness error. Numericals based on determination of straightness error of straight edge with the help of spirit level and auto collimator. Numericals based on determination of flatness error of a surface plate with the help of spirit level or auto collimator.  **Machine Tool Alignment**: Machine tool tests and alignment tests on lathe. Alignment tests on milling machine. Alignment tests on a radial drilling machine. | 4  3 |  |
| UNIT-4 | 7 | 20 |
| **Screw Thread Measurement** :Errors in threads, Measurement of elements of screw threads –major dia, minor dia, pitch, flank angle and effective diameter (Two and three wire methods).Effect of errors in pitch and flank angles and its mathematical derivation. Numericals.  **Gear Measurement**: Measurement of tooth thickness – Gear tooth vernier caliper, Constant chord method, base tangent method and derivation of mathematical formulae for each method.Test plug method for checking pitch diameter and tooth spacing. Measurement of Gear Pitch,Parkinson Gear Tester, Numericals. | 4  3 |  |
| UNIT 5 | 07 | 20 |
| **Interferometry:** Principle of measurement, Interferometry applied to flatness testing, surface contour tests, opticalflats, testing of parallelism of a surface with the help of optical flat. Quantitative estimate of error in parallelism, Flatness Interferometer NPL-Gauge length interferometer for checking the error in slip gauges. Numericals based on Interferometry.  **Surface texture**: Introduction, different types of irregularities, standard measures for assessment and measurement of surface finish | 5  2 |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. J.F.W. Galyer, C.R.Shotbolt, ***Metrology for Engineers***, 5th Edition, ELBS Edition, 1993.
2. I .C. Gupta, ***A Textbook of Engineering Metrology***, 4th Edition, Dhanpat Rai Publications, 1994.
3. Bentley, J.P,  ***Principles of Measurement Systems***, 3rd Edition, Longmans Publishing, 1995.

**Course outcomes:**

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

1. To be familiar with the different instruments that is available for linear, angular, roundness and roughness measurements.
2. To be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc.)
3. TO determination of straightness error of straight edge with the help of spirit level and auto collimator
4. to understand different types of irregularities, standard measures for assessment and measurement of surface finish.
5. to understand machine tool tests and alignment tests on lathe.

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| --- | --- |
| Course Title: **Metrology Lab** | Course Code : ME 364 |
| Semester : **III** | Core / Elective : **Program** **Core** |
| Teaching Scheme in Hrs (L:T:P) : 0**:0:2** | Credits : **1 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech (Mechanical Engineering)** | |

**Course Objectives:**

* To provide to the students an understanding and appreciation of the science of Measurement.
* To expose the students to various mechanical and electrical engineering measuring devices, and understand the different degree of accuracy obtained from different types of instruments.

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| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. Study the working of simple measuring instruments- Vernier calipers, micrometer.  2. Measurement of effective diameter of a screw thread using 3 wire method.  3. Measurement of angle using sinebar & slip gauges. Study of limit gauges.  4. Study & angular measurement using level protector. 5. Adjustment of spark plug gap using feeler gauges.  6. Study of dial indicator & its constructional details.  7. Use of dial indicator to check a shape run use.  8. Use of dial indicator and V Block to check the circularity and plot the polar Graph.  9. Study and understanding of limits, fits & tolerances.  10. Study of Measurement of surface roughness  11. Measurement of gear elements using profile projector | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1. J.F.W. Galyer, C.R.Shotbolt, ***Metrology for Engineers***, 5th Edition, ELBS Edition, 1993.
2. I .C. Gupta, ***A Textbook of Engineering Metrology***, 4th Edition, Dhanpat Rai Publications, 1994.
3. Bentley, J.P,  ***Principles of Measurement Systems***, 3rd Edition, Longmans Publishing, 1995.

**Course outcomes:**

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

1. To be familiar with the different instruments that is available for linear, angular, roundness and roughness measurements.
2. To be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc.)
3. TO determination of straightness error of straight edge with the help of spirit level and auto collimator
4. to understand different types of irregularities, standard measures for assessment and measurement of surface finish.
5. to understand machine tool tests and alignment tests on lathe.

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| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | Errors and significant digits, Roots of algebraic equations Bisection method, secant method,Graff’s root- squaring method,Finite differences, Symbolic  relations, differences and factorial notation of a polynomial, data smoothing, interpolation and extrapolation,  **Numerical Techniques:** The solution of linear and non-linear equations: Direct Iteration method, Regula-Falsi method, Newton – Raphson method.  Solution of system of simultaneous equations by Gauss elimination, Gauss-Jacobi and Gauss-Seidal methods.  **Finite differences**: Forward, backward and Central differences. | 7 |
| **II** | **Interpolation and Numerical Calculus:** Newton’s interpolation for equi spaced values. Divided differences and  Interpolation formula in terms of divided differences.  Stirling’s central difference interpolation formula,  Lagrange’s  Interpolation formula for unequi-spaced values. Inverse interpolation by  Lagrange and iterative methods. | 7 |
| **III** | Numerical differentiation, Numerical Integration: - Trapezoidal, Simpson’s rule and Gaussian integration (only formula applications) Differential equations and their solutions. Numerical methods for ordinary differential equations (Picard method, Taylor series method, Euler’s method, Ranga Kutta Method, Predictor- corrector method, Adams- Bashforth method).Numerical solution of  boundary value problems by finite difference and shooting methods. | 7 |
| **IV** | Sampling theory: Introduction: Moments, Moment generating functions, Skewness, Kurtosis, Correlation and Regression, Normal sampling distributions; Binomial distribution, Poisson distribution, Normal distribution; Sampling distribution of the means; sampling distribution of the differences of the means; sampling distributions of proportions. | 7 |
| **V** | **Computer Programming**:  Writing programmes in C++ for solving numerical problems.  For example, Programme for solving algebraic and transcendental equations by Newton-Rapson Method, solving simultaneous equations by Gauss-Seidal method.  Programme for Interpolation by Lagrange’s method.  Programme for estimating the value an integral by Simpson’s rule.  Programme for solving differential equation by Runge-Kutta method, etc. | 7 |

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| Course Title:  Numerical Analysis & Programming | Course Code : ME 310 |
| Semester : **VI** | Core / Elective :University Elective |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Numerical Methods by Sukhendu Dey and Shishir Gupta,**

**Reference Books:**

1. **B.v.ramana.,** mcgraw hill
2. **B.ram, peerson publication**

**E.krizing, willy publication**

**Course objectives:-**

**1.** To apply numerical methods to obtain approximate solutions to mathematical problems.

**2.** To describe the concept of Numerical differentiation, Numerical Integration.

3.To describe various sampling techniques.

**Course Learning Outcomes:**

1. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
2. Apply numerical methods to obtain approximate solutions to mathematical problems.
3. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
4. Analyze and evaluate the accuracy of common numerical methods.
5. Implement numerical methods in Mat lab.
6. Write efficient, well-documented Mat lab code and present numerical results in an informative way.

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| Course Title:  **Programming Lab­NMAS** | Course Code : ME 356 |
| Semester : **VI** | Core / Elective : **University Elective** |
| Teaching Scheme in Hrs (L:T:P) : 0**:0:2** | Credits : **1 Credits** |
| Type of course :  **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | ESE : **40 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

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| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1.To study of basic matrix operations  2.Programme for solving algebraic and transcendental equations by Newton-Rapson Method  3. Solving simultaneous equations by Gauss-Seidal method  4. Programme for Interpolation by Lagrange’s method  5. Programme for estimating the value an integral by Simpson’s rul  6. Programme for solving differential equation by Runge-Kutta method, etc.  7.Programme for solving Newton’s interpolation for equi spaced values  8. Programme for solving Picard method,  9. Programme for solving Taylor series method  10. Programme for solving Gauss-Jacobi and Gauss-Seidal methods. | **2 hrs for each experiment** |  |
| **TOTAL** | **20** | **100** |

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| Course Title:  **Sensoric** | Course Code : MAS (T) |
| Semester : **VI** | Core / Elective : **University Elective** |
| Teaching Scheme in Hrs (L:T:P) : 0**:0:2** | Credits : **3Credits** |
| Type of course :  **UNIVERSITY ELECTIVE** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | ESE : **40 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Course objectives**

1. To develop practical knowledge of different sensors.
2. To study the behavior of different sensors.

**Course Learning Outcomes:**

1. Students will able to develop practical knowledge of different sensors.
2. Students will able to understand the behavior of different sensors.

**Reference Books**

Hand book of modern sensors by JACOB FRADEN

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1** | 8 | 20 |
| **Introduction to Sensorics**  Its Knowledge and scope of employability What is Sensorics ? Different sensor types Classification of sensors Types of proximity sensors Contact type Non contact type Advantages of Sensors Role of sensors in control system/circuit | 08 |  |
| **UNITS-2** | 07 | 20 |
| **Inductive Sensors** Fundamental Principles Basic Construction Reduction Factor Sensing Range Installation Types of inductive sensor Applications **Capacitive Sensors** 0.75 Fundamental Principles Sensor construction Sensitivity Reduction factor Application. |  |  |
| **UNITS-3** | 07 | 20 |
| **Ultrasonic Sensors** Fundamental Principles Propagation of sound waves in air Generation of ultrasonic waves Electrostatic converter Methods of Operation Direct detection with a transceiver Direct detection with a two-head system Retroreflective operation Through beam detection with two sensor heads Applications |  |  |
| **UNIT-4** | 7 | 20 |
| **Photoelectric Sensors** Fundamental Principles Methods of Operation Direct detection Retroreflex detection Through beam detection with two sensor heads Applications |  |  |
| UNIT 5 | 07 | 20 |
| Magnetic Sensors 0.5 Fundamental Principles Principle of Operation Applications |  |  |
| **TOTAL** | **36** | **100** |

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| --- | --- |
| Course Title:  **Sensoric lab** | Course Code : MAS (L) |
| Semester : **VI** | Core / Elective : **University Elective** |
| Teaching Scheme in Hrs (L:T:P) : 0**:0:2** | Credits : **1Credits** |
| Type of course :  **UNIVERSITY ELECTIVE** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | ESE : **40 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Course objectives**

1. To develop practical knowledge of different sensors.

2. To study the behavior of different sensors.

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| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1.To study Behaviour of inductive sensor  2. To study Behaviour of the capacitive sensor  3. To study Behaviour of magnetic sensors  4. To study Behaviour of the direct detection sensor  5. To study Behaviour of through beam sensors  6. To study Behaviour of the reflex photoelectric sensor  7. To study Behaviour of an ultrasonic sensor  8. To study Switching frequency of the inductive sensor  9. To study Switching frequency of the capacitive sensor  10. To study Switching frequency of the direct detection sensors | **2 hrs for each experiment** |  |
| **TOTAL** | **20** | **100** |

**Course Learning Outcomes:**

1. Students will able to develop practical knowledge of different sensors.

2. Students will able to understand the behavior of different sensors.

**Reference Books**

Hand book of modern sensors by JACOB FRADEN

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| Course Title: Engineering Sustainability Analysis & design. | Course Code : |
| Semester : VI | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| **Environment and Development**  Challenges and efforts, Sustaining life support systems, land degradation water management, urbanization and industrialization, conservation of bio-deversity. Agenda, Declaration at earth summit, Dunkel draft, a forestation, sustainable mechanism, clean development mechanism.  **Air and Water Pollution**  Environmental pollutants, kinds of pollution, Acid rains, measurement of air quality, control of air pollution, sources of water pollution, Ground water pollution marine pollution, Heavy metal pollution, measurement of water quality, wet land conservation. |  |  |
| **UNIT-2:** | **4** | **20** |
| **Environmental monitoring and Impact Assessment**  Different methods of environmental monitoring, impact assessment and strategic management. Application to residential buildings, industrial complexes, and other sectors.  **Environmental Law** Challenges in implementing environment law, Indian environmental law and national policy. |  |  |
| **UNIT-3:** | **06** | **20** |
| Systems analysis approaches – life cycle analysis, simulation models, risk based models, Measures of sustainability, indicators and different types societal change, sustainable developments.  **Industrial Energy Usage**: Lifecycle analysis and design for sustainability – Different types of industries, Issues on sustainable engineering. |  |  |
| **UNIT-4** | **04** | **20** |
| Sustainable design, industrial ecology, multiple life cycle design, principles of design, green engineering, cradle to cradle design, The Natural Step, biomimicry, design for reuse, dematerialization, modularization, design for flexibility, design for disassembly, design for inverse manufacturing, design for the environment, etc |  |  |
| UNIT-5: | **04** | **20** |
| Sustainable building design, critique of BREEAM, LEED, Gold Globe, Green Star & Green Guide for Health Care design approaches, integrated project development. Hydrological cycle of buildings and opportunities for water efficiency. Active and passive design strategies for energy conservation, and performance modeling. Materials, waste reduction and healthy buildings |  |  |
| **TOTAL** | **24** | **100** |

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| --- | --- |
| Course Title: **Fuel Cell Technology** | Course Code : |
| Semester : VI | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Objectives:**

* To present a problem oriented in depth knowledge of fuel cell technology.
* To address the underlying concepts, methods and application of fuel cell technology.
* To expose the student to various fuel cells and it performance based on the requirements in industries

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1: INTRODUCTION TO FUEL CELLS** | **6** | **20** |
| Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells |  |  |
| **UNIT-2:** **FUEL CELLS FOR AUTOMOTIVE APPLICATIONS** | **4** | **20** |
| Fuel cells for automotive applications – technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market. |  |  |
| **UNIT-3:** **FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE** | **06** | **20** |
| Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates. |  |  |
| **UNIT-4: FUELING** | **04** | **20** |
| Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass |  |  |
| UNIT-5: FUEL CYCLE ANALYSIS | **04** | **20** |
| Introduction to fuel cycle analysis – application to fuel cell and other competing technologies like battery powered vehicles, SI engine fueled by natural gas and hydrogen and hybrid electric vehicle. |  |  |
| **TOTAL** | **24** | **100** |

**Students Learning Outcomes**

· The student can identify different areas of fuel cell technology.

· Can find the applications of all the areas in day to day life.

**Reference:**

1. Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1-

86058 4233, 2004.

2. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN

0-8493-0877-1-2003.

|  |  |
| --- | --- |
| Course Title: **Green Building and Infrastructure** | Course Code : |
| Semester : VI | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| Environmental implications of buildings energy, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transporation Energy for Building Materials; Maintenance Energy for Buildings. |  |  |
| **UNIT-2:** | **4** | **20** |
| Implications of Building Technologies Embodied Energy of Buildings: Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings. |  |  |
| **UNIT-3:** | **06** | **20** |
| Comforts in Building: Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations. |  |  |
| **UNIT-4** | **04** | **20** |
| Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. Solar Heating & Cooling System: Liquid based solar heating system; Natural, forced and gravity flow, mathematical modeling, Vapour absorption refrigeration cycle; Water, ammonia & lithium bromide-water absorption refrigeration systems; Solar operated refrigeration systems; Solar desiccant cooling. |  |  |
| UNIT-5: | **04** | **20** |
| Green Composites for buildings: Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment. |  |  |
| **TOTAL** | **24** | **100** |

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| --- | --- |
| Course Title: **Project Design, Evaluation Management & Innovation** | Course Code : |
| Semester : VI | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

* Analyzing the problem and developing a requirement specification
* Designing a system or experiment (including any measurements) to meet the requirements
* Constructing or implementing the designed system or experiment
* Testing or validating the constructed or implemented system
* valuating the results of the project

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| Course Title: **REFRIGERATION AND AIR - CONDITIONING** | Course Code : ME 401 |
| Semester : **VII** | Core / Elective : Program **Core** |
| Teaching Scheme in Hrs (L:T:P) : 3**:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Enginnering** | |

**Pre-requisites:**

Properties of materials.,Basic law’s of thermodynamics ,Heat and Mass Transfer

**Course Objectives:**

1. The students will have a thorough understanding Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.
2. Student will be able to distinguish the properties and parameters Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System
3. Psychometric properties, psychometric relations, psychometric charts, psychometric processes, cooling coils, By-pass factor and air washer.
4. Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system.

**Course Content:**

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| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **REFRIGERATION AND AIR - CONDITIONING** | | |
| UNIT-1: **Refrigeration System** | 08 | 20 |
| **Introduction -** Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle. **Vapour Compression Refrigeration System -** Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions, liquid vapour heat exchangers, actual refrigeration cycle. **Multiple Evaporator and compressor system -** Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system. |  |  |
| UNITS-2: **Gas cycle Refrigeration** | 07 | 20 |
| **Gas cycle Refrigeration -** Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative heat exchanger. **Air cycle for air craft -** Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle. |  |  |
| UNITS-3: **Vapour Absorption System** | 07 | 20 |
| **Vapour Absorption System -** Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System. **Refrigerants -** Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants. **Refrigeration Equipments -** Compressor, condenser, evaporator, expansion devices – types & working. |  |  |
| UNIT-4: **Other Refrigeration System** | 07 | 20 |
| **Other Refrigeration System:** Principle and applications of steam jet refrigeration system, Performance; vortex tube refrigeration, thermoelectric refrigeration systems. **Psychrometry-** Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor and air washers. **Human Comfort -** Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart. |  |  |
| UNIT 5: **Cooling load calculations** | 07 | 20 |
| **Cooling load calculations -** Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system. **Distribution and Duct systems:** Distribution of air in conditioned space et location, return and exhaust grills. Duct materials and sizing, design of Supply and return air ducts. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. **Re** Refrigeration and Air Conditioning, C.P.Gupta
2. Refrigeration and Air Conditioning, Ballarey
3. Refrigeration and Air Conditioning, C.P.Arora

Modern Air Conditioning-Practice, Narman E.Harris, Tata McGraw Hill

**Course outcomes:**

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

1. Student will be able to distinguish the properties and parameters Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System
2. Psychometric properties, psychometric relations, psychometric charts, psychometric processes, cooling coils, By-pass factor and air washer.
3. Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system.

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| Course Title: **Renewable Energy Technology** | Course Code : ME 409 |
| Semester : **VII** | Core / Elective : Program **Core** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Enginnering** | |

**Pre-requisites:**

Nil

**Course Objectives:**

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| The objective of the course are: |
| 1. The course intends to provide an overview of the principles, basics and application of electronic materials. |
| 1. To provide the basic skills required to understand, develop, and design various engineering applications involving magnetic fields |
| 1. To introduce the concepts and techniques seeking understanding of semiconductor material structures and to measure and characterize materials properties. 2. To help in predicting and evaluating the performance of materials as structural or functional elements including mechanical, electrical, optical, magnetic, thermal, and chemical properties in engineering systems with respect to conductor and superconductors |
| 1. The main objective of this course is to obtain physical and chemical phenomena underlying the electronic properties of solids from macroscopic to nano properties of engineering materials. |

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| **Units** | **Course Contents** | **Hours** |
| **I** | **FUNDAMENTALS OF ENERGY** Introduction to Energy-Energy consumption and standard of living-classification of energy resources-consumption trend of primary energy resources-importance of renewable energy sources-energy chain-common forms of energy-advantages and disadvantages of conventional energy sources-salient features of nonconventional energy sources-environmental aspects of energy-energy for sustainable development-energy density of various fuels-availability of resources and future trends. Energy scenario in India – Overall production and consumption-Availability of primary energy resources: Conventional, Non-Conventional-Estimated potential and achievement-Growth of energy sector and its planning in india – Energy conservation: Meaning and importance. | 7 |
| **II** | **SOLAR ENERGY** Introduction – Solar radiation at the earth's surface-Solar Radiation measurements-Estimation of average solar Radiation. Solar energy collectors- Classifications-Flat plate collectors-Concentrating collectors-Comparison. Solar water heaters-Solar industrial heating system – Solar Refrigeration and Air-Conditioning Systems-Solar cookers-Solar furnaces- Solar greenhouse-Solar Distillation-Solar pond Electric power plant-Distributed Collector- Solar thermal Electric power plant. Principles of photovoltaic conversion of solar energy – types of solar cells – solar Photo Voltaic applications. | 7 |
| **III** | **WIND ENERGY** Introduction-Basic principles of wind energy conversion: Nature of the wind, power in the wind, forces on the blades and wind energy conversion-wind data and energy estimation-site selection-classification of wind energy conversion systems-Advantages and Disadvantages-Types of wind machines-Horizontal axis machine-Vertical axis machine-Generating system-Energy Storage– Application of wind energy-Safety and environmental aspects. | 7 |
| **IV** | **BIO – ENERGY** Introduction – photo synthesis – usable forms of bio mass, their composition and fuel properties-Biomass resources – Biomass conversion technologies – Urban waste to energy conversion – Biomass gasification – biomass liquification – biomass to ethanol production – Biogas production from waste Biomass – types of bio gas plants - applications – Bio diesel production – Biomass energy programme in india. | 7 |
| **V** | **OCEAN AND GEOTHERMAL ENERGY** Ocean energy resources – principle's of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation – Energy utilisation – basic principle of tidal power – components and operations of tidal power plant – Energy and Power forms of waves – Wave energy conversion devices. Geothermal Energy – Geothermal Sources – Prime movers for Geothermal energy conversion – Advantages and Disadvantages – Applications – Material selection for geothermal power plants – Geo thermal exploration – Operational and Environmental problems – Prospects of geothermal energy in india. | 7 |
|  | **Total** | **35** |

**Text Books:**

1. Non Conventional Energy Sources - G.D. Rai – Khanna Publishers, New Delhi,1999.
2. Non Conventional Energy Sources and Utilisation - R.K. Rajput - S.Chand & Company Ltd., 2012.
3. Renewable Energy Sources - Twidell, J.W. and Weir, A. - EFN Spon Ltd., 1986.
4. "Non-Conventional Energy Resources - B.H.Khan - Tata Mc Graw Hill, 2nd Edn, 2009

**Course outcomes:**

*On successful completion of the course:*

Students in this program learn how environmental forces such as the wind and sun are used to reduce consumption of fossil fuels and other limited natural resources. Associate's degree programs teach everything from the electrical construction of photovoltaic systems to the mechanical workings of wave-driven turbines.

Students interested in renewable energy technology learn how to perform cost-to-benefit analyses, evaluate potential locations for system installations and repair existing systems.

|  |  |
| --- | --- |
| Course Title:  **OPERATION RESEARCH** | Course Code : ME 405 |
| Semester : **VII** | Core / Elective : **Core** |
| Teaching Scheme in Hrs (L:T:P) : 3**:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Pre-requisites:**

Basics math and understand problem of industry

**Course Objectives:**

This course aims to introduce students to use quantities methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| UNIT-1 | 7 | 20 |
| **Linear Programming-** Introduction & Scope, Problem formulation, Linear Programming: LP formulation, graphical method, simplex method, duality and Sensitivity analysis. |  |  |
| UNITS-2 | 7 | 20 |
| Transportation Model, Assignment Model, Sequencing problems, Network Flow, constrained optimisation and Lagrange multipliers. **Dynamic Programming-** Multistage decision problems & solution, Principle of optimality |  |  |
| UNITS-3 | 7 | 20 |
| **Decision theory-**Decision under various conditions. **Game Theory-**Minimax & maximum strategies. Application of linear programming. **Integer Programming-** Cutting Plane method and Branch & Bound method |  |  |
| UNIT-4 | 8 | 20 |
| **Deterministic and Stochastic inventory models-** Single & multi period models with continuous & discrete demands, Service level & reorder Policy. **Replacement Models:** Capital Equipment replacement with time, group replacement of tems subjected to total failure, Industrial staff problem, replacement problems under warranty condition. |  |  |
| UNIT 5 | 7 | 20 |
| **Simulations-** Need of simulation, advantages and disadvantages of simulation method of simulation. Generation of Random numbers, Generation of normal Random numbers, Generation of random numbers with any given distribution. Use of random numbers for system simulation, Application of simulation for solving queueing Inventory Maintenance, Scheduling and other industrial problems. Simulation V/S mathematical modeling, Monte Carlo simulation, simulation language ARENA, Example & cases. **Queing models-** Introduction Model types, M.M. 1 & M/M/S system cost consideration. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Introduction of Operations Research, Hiller F.S. & Liberman G.J.CBS Publishers
2. Operations Research, Taha H.A., McMillan Publishing Company
3. Foundation of Optimization, Heightler, C.S. & Philips D.T. Prentice Hall

**Course outcomes:**

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

1. Be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.
2. Be able to build and solve Transportation Models and Assignment Models.
3. Be able to design new simple models, like: CPM, PERT to improve decision –making and develop critical thinking and objective analysis of decision problems.
4. Be able to build and solve Queuing Models and simulation.

|  |  |
| --- | --- |
| Course Title:  **REFRIGERATION AND AIR CONDITIONING LAB** | Course Code : ME 451 |
| Semester : VII | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic thermodynamics law’s, Systems’ process, Heat transfer modes.

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON REFRIGRATION & AIR-CONDITIONING SYSTEM.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. Study of a vapour absorbtion refrigeration system. (Electrolux refrigerator). 2. To determine the C.O.P. of vapour compression cycle. 3. To determine actual and the political C.O.P. of heat pump setup. 4. To study various refrigeration accessories. 5. Three Ton air-conditioner performance test. 6. Energy analysis of parallel and counter flow heat exchanger. 7. Study of Vaporization System. 8. Study of vortex tube refrigeration system. 9. Study of thermoelectric syst   Study of steam jet refrigeration system. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1. Refrigeration and Air Conditioning, C.P.Gupta
2. Refrigeration and Air Conditioning, Ballarey
3. Refrigeration and Air Conditioning, C.P.Arora

Modern Air Conditioning-Practice, Narman E.Harris, Tata McGraw Hill

**Course outcomes:**

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

1. The students will have a thorough understanding Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.
2. Student will be able to distinguish the properties and parameters Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System
3. Psychometric properties, psychometric relations, psychometric charts, psychometric processes, cooling coils, By-pass factor and air washer.
4. Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system.

|  |  |
| --- | --- |
| Course Title: Programing Software Lab(MATLAB) | Course Code : ME 459 |
| Semester : VII | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**List of Experiments:**

|  |  |
| --- | --- |
| S. No. | Experiment |
|  | Arithmetic Operators and all formats of variables. |
|  | Array and Matrix (access and operations). |
|  | Creates graphs and plots in 2-Dimensions (2D) |
|  | Creates graphs and plots in 3-Dimensions (3D) |
|  | Start working with m-file. (Multiple programs for practice). |
|  | Multiple programs for practice based on Mechanics/Mechanical branch subjects |
|  | Solving programs based on Symbolic Mathematics (like algebra, calculus, etc.) |
|  | Solving programs based on Symbolic Mathematics (like differential, integrals etc.) |
|  | Simulink tool |
|  | Multiple programs for creating block diagrams of a problem, practice based on Mechanics/Mechanical branch subjects |

|  |  |
| --- | --- |
| Course Title : **Power Plant Technologies** | Course Code : ME 403 |
| Semester : VII | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Fluid Engineering, Turbo Machinery.

**Course Objectives:**

* To introduce the concepts and phenomenon of different sources of Power Generation.
* To give an idea about the fundamental concepts of electrical power distribution, both AC & DC.
* To familiarize the students with the Tariff methods for electrical energy consumption in the prospect of optimum utilization of electrical energy.
* To impart the knowledge of different turbines used in the generating stations with the analytical methods.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **07** | **20** |
| **Introduction:** Introduction to generation of electrical power, Sources of energy, comparative merits, types of power plants. Review of growth of power & development of different types of power plants in India, future possibilities. Review of Steam power plant and gas power plant. | 07 |  |
| UNIT-2: | **07** | **20** |
| Diesel Power Plants: General layout; elements of diesel power plants; field of use; systems of diesel power plant; comparison with steam power plants (advantages and disadvantages). combined gas and steam power plants; Advantage of combined cycle, Introduction to integrated coal gasification combined cycle power plants | **07** |  |
| UNIT-3: | **07** | **20** |
| Nuclear Power Plants: Elementary concept of physics of generation of nuclear energy, Nuclear materials and waste disposal; nuclear fuels, fuel cycles, coolants, moderating and reflecting materials; cladding materials, shielding materials; Disposal of nuclear waste; General components of nuclear reactor, different types of nuclear reactors, Their construction and working; Location of nuclear power plants; Comparison of nuclear plants with thermal plants. Enrichment; safety and control. Fast breeder reactors and power plants | 07 |  |
| UNIT-4: | **07** | **20** |
| Hydro-elecrtic power Plant: Classification and applications of Hydro-electric plant; Measurement of stream flow; capacity calculation of hydro-power, The hydro plant and its auxiliaries; automatic and remove control of hydro-systems. MHD geothermal, tidal & wind power plants. | 07 |  |
| UNIT-5: | **07** | **20** |
| Power Plant Economics: Load curves; different terms and definitions; cost of electrical energy; Selection of type of generation; Performance and operating characteristics of power plants; load division combined operation of power plants; load division between stations. Different systems of tariff. | 07 |  |
| **TOTAL** | **35** | **100** |

**Reference:**

1. 1 Power Plant Technology, M.M.El-Wakil, McGraw Hill Book Company
2. A Course in power Plant Engineering, Arora and Domkunwar Dhanpat Rai and Co.(P) Ltd.
3. Power Plant Engineering, Black and Veatch, CBS publication.

**Course outcomes:**

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

1. To study about generation of electrical power
2. To study various types of power plant
3. Understand to calculate the power consumption
4. Study various parts of plant

|  |  |
| --- | --- |
| Course Title: **COMPUTATIONAL FLUID DYNAMICS** | Course Code : ME 413 |
| Semester : VII | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Automobile Engineering** | |

**Pre-requisites:**

Fluid Engineering, Design of machine element, CAD. Knowledge of a scientific programming language.

**Course Objectives:**

To study about basis of fluid, basis of conservation of law & analyize the fluid flow.

To introduce the student to widely used techniques in the numerical solution of fluid equations, issues that arise in the solution of such equations, and modern trends in CFD.

Emphasis will be on ‘learning by doing’, as students will work on programming projects for assignments.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| Review of basic fluid mechanics and the governing (Navier-Stokes) equations. Types of partial differential equations- hyperbolic, parabolic and elliptic. Traditional solution methods- method of characteristics, separation of variables, Greens function method. |  |  |
| UNIT-2: | **07** | **20** |
| Preliminary computational techniques: Discretisation, converting derivatives to discrete algebraic expressions, spatial derivatives, time derivatives.  Approximation of derivatives, Taylor series expansion, general techniques. Accuracy of discretisation process-higher order vs lower order formulae. |  |  |
| UNIT-3: | **08** | **20** |
| Finite difference method: conceptual implementation, application to transient heat conduction problem.Convergence, consistency and stability of FD equation. |  |  |
| UNIT-4: | **07** | **20** |
| Weighted residual methods: General formulation, Introduction to Finite Volume method.  Finite Volume method: Equations with first derivatives and second derivatives. FV method applied to Laplace’s equation. |  |  |
| UNIT-5: | **08** | **20** |
| Finite Element method: Linear interpolation, quadratic interpolation, two dimensional interpolations.  Application to heat transfer problems. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Computational Fluid Dynamics: The Basics with [Applications](http://www.indiastudychannel.com/resources/37094-Syllabus-University-Pune-M-E-Chemical-Engg-Semester-I-Computational-Fluid-Dynamics.aspx), John D.Anderson, McGraw Hill, 1995.  
2. Computational Flow Moeling for Chemical Reactor Engineering, V. V. Ranade, Process Engineering Science, Volume 5, 2001.  
3. Fundamentals of Grid Generation, Patrick Knupp and Stanly Steinberg, CRC Press,1994.  
4. Turbulence Modelling for CFD, D.C. Wilcox 1993,

5. Computational Methods for Fluid Dynamics, J.H. Ferziger & M. Peric, 3rd Edition.

6. Computational Techniques for Fluid Dynamics 1, C.A.J. Fletcher, 2nd Edition.

7 Computational techniques for Fluid Dynamics 2, C.A.J. Fletcher, 2nd Edition.

**Course outcomes:**

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

1. To solve partial differential equations.
2. To converting derivatives to discrete algebraic expressions, spatial derivatives & time derivatives
3. To analyze stability of FD equation.
4. Implementation of FEM to various realistic problems.

|  |  |
| --- | --- |
| Course Title:  **Engineering Nano Technology** | Course Code : ME 417 |
| Semester : **VII** | Core / Elective :Program Elective |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical engineering** | |

**Pre-requisition:**

It is assumed that you have a background in basic University-level theoretical physics and chemistry .

**Course Objectives:**

* You will have broad knowledge in your chosen discipline, with deep knowledge in its core concepts.
* You will have knowledge in at least one discipline other than your primary discipline and some understanding of interdisciplinary linkages.
* You will demonstrate well-developed problem solving skills, applying your knowledge and using your ability to think analytically and creatively.
* You will develop a capacity for independent and self-directed work.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | | |
| UNIT-1: | 8 | 20 |
| Nanoscale Cutting:- Introduction, Material representation and  microstructure, Atomic interaction;  Nonomachining:- Introduction, Nanometric machining, Theoretical  basis of machining;  Meso-micromcahining:- Introduction, size effects in micromachining,  mechanism for large plastic flow, origin of the size effect, Mesomachining  processes.  Product quality in micromachining, Burr formation in micromachining  operations. |  |  |
| UNITS-2: | 7 | 20 |
| Microturning:- Characteristic features and applications, Microturning  tools and tooling systems, Machine tools for microturning  **Microdrilling:** Characteristic features and applications, Microdrills and  tooling systems, Machine tools for microdrilling  Micromilling:- Characteristic features and applications, Micromills and  tooling systems, Machine tools for micromilling,  Micro machining high aspect ratio microstructures, micromolding,  micromolding processes, micromolding tools, micromold design,  micromolding applications, limitations of micromolding. |  |  |
| UNITS-3: | 7 | 20 |
| **Microgrinding and Ultra-precision Processes:** Introduction, Micro  and nanogrinding, Nanogrinding apparatus, Nanogrinding procedures,  Nanogrinding tools, Preparation of nanogrinding wheels, Bonding  systems, Vitrified bonding  **Non-Conventional Processes:** Laser Micromachining:- Introduction,  Fundamentals of lasers, Stimulated emission, Types of lasers, Laser  microfabrication, Nanosecond pulse microfabrication, Shielding gas,  Effects of nanosecond pulsed microfabrication, Picosecond pulse  microfabrication, Femtosecond pulse microfabrication, Laser  nanofabrication. |  |  |
|  | | |
| UNIT-4: | 07 | 20 |
| **Diamond Tools in Micromachining:** Introduction, Diamond  technology, Hot Filament CVD (HFCVD), Preparation of substrate,  Selection of substrate material, Pre-treatment of substrate, Modified  HFCVD process.  Deposition on complex substrates, Diamond deposition on metallic  (molybdenum) wire, Deposition on WC-Co microtools, Diamond  deposition on tungsten carbide, (WC-Co) microtool, Performance of  diamond-coated microtool |  |  |
| UNIT 5: | 7 | 20 |
| **Evaluation of Subsurface Damage in Nano and Micromachining:**  Introduction, Destructive evaluation technologies, Cross-sectional  microscopy, Preferential etching, Angle lapping/angle polishing, X-ray  diffraction, Micro-Raman spectroscopy.  **Applications of Nano and Micromachining in Industry:** Introduction,  Typical machining methods, Diamond turning, Shaper/planner  machining, Applications in optical manufacturing, Aspheric lens,  Fresnel lens, Microstructured components, Semiconductor wafer  production. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

Cao G., “Nanostructures and Nanomaterials: Synthesis, Properties and Applications”, Imperial College Press, 2004.

T.Pradeep, “A Text Book of Nanoscience and Nanotechnology”, Tata McGraw Hill, New Delhi, 2012.

Sam Zhang, “Materials Characterization Techniques”, CRC Press, 2008.

**Course outcomes:**

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

1. Describe the basic science behind the properties of materials at the nanometre scale, and the principles behind advanced experimental and computational techniques for studying nanomaterials.
2. Communicate clearly, precisely and effectively using conventional scientific language and mathematical notation.
3. Systematically solve scientific problems related specifically to nanotechnological materials using conventional scientific and mathematical notation

|  |  |
| --- | --- |
| Course Title:  **Non Destructive Evaluation & Testing** | Course Code : ME 419 |
| Semester : **VII** | Core / Elective :Program Elective |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical engineering** | |

**Pre-requisites:** The student should have basic knowledge of the following. ·

Basic Mathematics. · Basic Physics · Fundamentals of Materials Science and Engineering.

**Course Objectives**: NDT techniques are used for locating flaws as well as for characterizing material properties. Flaws within the materials can play havocs and may cause planes to crash, reactors to fail, trains to derail, pipelines to burst and alike. However if we d techniques, all these catastrophic failures can be avoided. Use of NDT techniques results in better confidence in the materia lower value of factor of safety. Understanding the basic principles of various NDT techn various applications of NDT techniques, limitations of NDT techniques, codes, standards and specifications related to non techniques etc. would be taught to the students and thus the students would have proper skills and would be equipped with proper competencies to locate a flaw in various materials, products

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | | |
| UNIT-1: | 8 | 20 |
| **Introduction**: An Overview, Factors influencing the Reliability of NDE,  Defects in materials, Defects in composites. NDT methods used for  evaluation of materials and composites.  **Visual Inspection:** Basic Principle and Applications.  **Liquid Penetrant Testing:** Principle, Procedure and Test Parameters,  Materials, Limitations and Applications. |  |  |
| UNIT-2: | 7 | 20 |
| **Radiographic Inspection:** Principles of X – ray radiography,  equipment, Absorption, Scattering, X-ray film processing, General  radiographic procedures, Reading and Interpretation of Radiographs,  Industrial radiographic practice, Limitations and Applications, Welding defects detection. Gamma ray radiography |  |  |
| UNIT-3: | 7 | 20 |
| **Ultrasonic Testing:** Principle of wave propagation, Ultrasonic  equipment, Variables affecting an ultrasound test, Basic methods:  Pulse Echo and Through Transmission, Types of scanning.  **Applications of UT:** Testing of products, Welding Inspection, Tube  Inspection, Thickness Measurement, Elastic Constant Determination,  Ultrasonic testing of composites. |  |  |
|  | | |
| UNIT-4: | 07 | 20 |
| **Magnetic Particle Inspection:** Methods of generating magnetic field,  Demagnetization of materials, Magnetic particle test: Principle, Test  Equipment and Procedure, Interpretation and evaluation.  **Introduction to Accostic Emission Testing and Thermography.** |  |  |
| UNIT 5: | 7 | 20 |
| **Eddy Current Testing:** Principle of eddy current, Factors affecting  eddy currents, Test system and test arrangement, Standardization and **5**  calibration, Application and effectiveness.  Comparison and Selection of NDT Methods, Codes and Standards |  |  |
| **TOTAL** | **36** | **100** |

**Reference Books:**

1. Nondestructive Testing Techniques, Ravi Prakash, New Age International Publishers,

2012.

2. Practical Non-destructive Testing, Baldev Raj, T. Jayakumar and M. Thavasimuthu Woodhead Publishing, 2002.

3. Non-destructive Evaluation - A tool in Design, Manufacturing and Service by D.E. Bray and R. K. Stanley, Revised Edition CRC Press, 1996.

4. NDT Handbooks Vol 1-17, ASNT Press, OH, USA. 3. Nondestructive Testing, “Warren J. McGonnagle”, McGraw-Hill, 1961.

**Course outcomes:**

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

1. Ability to apply scientific and technical knowledge to the field of non-destructive testing.

2. Ability to use the relevant non-destructive testing methods for various engineering practice. 3. Ability to recognize and achieve high levels of professionalism in their work.

3. Recognition of the need and ability to engage in lifelong learning, thought process and development

|  |  |
| --- | --- |
| Course Title: **Advanced Innovation and**  **New Product Development** | Course Code : |
| Semester : **VII** | Core / Elective : **Elective** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | ESE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Pre-requisites:**

Design, strength of materials and method of management in earlier semesters.

**Course Objectives:**

This course aims at introducing the students to the basic concepts of engineering design and product development with focus on the front end processes. At the end of this course the student is expected to demonstrate an understanding of the overview of all the product development processes and knowledge of concept generation and selection tools.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| UNIT-1: **NEW PRODUCT DEVELOPMENT PROCESS** | 8 | 20 |
| Importance of new product for growth of enterprise. Definition of product and new product. Responsibility for new product development. Demands on product development team. Classification of products from new product development. Point of view- Need based/Market pull products, Tech. push, Platform based, Process based and customized products. New product development process and organization. Generic product development process for Market Pull Products. Modification of this process for other types of products. |  |  |
| UNITS-2: **NEED ANALYSIS** | 07 | 20 |
| Establishing economic existence of need, Need Identification and Analysis, Engineering Statement of Problem, Establishing Target Specification. |  |  |
| UNITS-3: **CONCEPT GENERATION AND SELECTION** | 07 | 20 |
| Concept generation- a creative process, Creativity, Road Elects to creative thinking- Fear of criticism and Psychological set. Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process. Concept feasibility and Concept Selection, Establishing Engineering Specification of Products. |  |  |
| UNIT-4: **PRELIMINARY & DETAILED DESIGN**. | 7 | 20 |
| Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility. Detailed design of subsystems, component design, Preparation of assembly drawings. Review of product design from point of view of Manufacturing, Ergonomics and aesthetics |  |  |
| UNIT 5: **MANAGEMENT OF NEW PRODUCT** | 07 | 20 |
| New Product Management’s Challenges – Maintaining focus, Promotion of Right Culture, Management of Creativity, Top Management attention. Design Team Staffing and Organization. Setting key mile stone, Identification of Risk Areas, Project Execution and Evaluation Product Launch Strategies. Project Planning – Project Task matrix, estimation of time & resources, project scheduling. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Product Design and Manufacturing, Chital AK and Gupta RC,PHI
2. Product Design and Manufacturing, Ulrich Ktand Eppinger SD McGraw Hill
3. Product Design and Manufacturing, Lind beck JR, Prentice Hall.
4. Engineering Design Method, Cross, Nigel, John Wiley & Sons.
5. Design for Strength & Production; C.Ritz and F. Koenigsbenger.

**Course outcomes:**

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

1. Understand the integration of customer requirements in product design
2. Apply structural approach to concept generation, selection and testing
3. Understand various aspects of design such as industrial design, design for manufacture , economic analysis and product architecture
4. to understand the top management work
5. to understand the customer need
6. to understand identification of risk areas, project execution and evaluation of product

|  |  |
| --- | --- |
| Course Title:  Basic Programmable Logic Controller | Course Code : MAP (T) |
| Semester : VII | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **2:2:0** | Credits : **2 Credits** |
| Type of course : **Theory** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic Knowledge of pneumatic controlled system, hydrullics and fluid mechanics

**Course Objectives:**

To provide knowledge levels needed for PLC programming and operating.

To make the students how devices to which PLC input and output modules are connected

To train the students to create ladder diagrams from process control descriptions.

To make the students understand various types of PLC registers

Apply PLC Timers and Counters for the control of industrial processes

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | Overview of Automation System.What is Automation?  Different devices used in Automation. Role of PLC in automation system.  Scope of Automation field in present and future. Comparison between Automated and Manual Operated Systems. Overview of Switchgears  What is a Relay and its applications? Introduction to Switching devices like Contactors, Solenoids, MCB’s etc. Symbolic representation of different electrical & electronic components in wiring diagram. | 7 |
| **II** | Different types of Signals. Digital Signal. Analog Signal. Overview of Limit Switches, Proximity Switches & Reed switches. Introduction to PLC.  Comparison of PLC & PC What is a PLC? How does a PLC work? Applications of PLC  Block Diagram of PLC. Processing cycle of PLC. Different types of PLC’s available in the market | 7 |
| **III** | Programmable Logic Controller. Specifications of PLC. Onboard/Inline/Remote IO’s  Memory Allocation in PLC. What is Scan time of PLC? I/O handling capacity of different PLC. Internal Structure of PLC. Hardware Details of the PLC. Wiring and Connection Techniques. Safety Measures for handling the PLC. Network Settings/Communication Settings | 7 |
| **IV** | Introduction to PLC Software. Overview of Software/Software at a glance  Hardware Configuration. Communication Settings for PLC. PLC Programming. Building simple logic in PLC (AND/OR/NOT)  Online & Offline Change. Overview of different types of Data types in PLC programming. Standard format for addressing the variables. Standard Time formats  Rules for Declaration of Variable names.Working with Digital Signals/IO’s  Relay Logic. Introduction to Timer/Counters/Triggers/FlipFlops  Exercises based on Timers, Counters, Flip Flops & Triggers. Usage of Mathematical Operators, Comparators, Conversion. Operators, Multiplexers & Logical Gates in the PLC Program | 7 |
| **V** | Exercises based on the above operators. Compilation & Downloading the program to PLC. Trouble Shooting the PLC programming errors. Local & Global Variables  Declaration in Tabular Format. Display of Address and Comments in Logic.  Jump & Return Command. Commands like Run, Stop, Reset, Reset Original, Breakpoint etc. Different Methods to take the PLC Program Backup (Source Code  Download/Upload, Archive/Restore & Export/Import) Library Management  Target Settings. Running the PLC program in Simulation Mode | 7 |
|  | **Total** | **35** |

**Reference:**

1. Programmable Logic Controllers — Principle and Applications by John W Webb and Ronald A Reiss Filth edition, PHI 2. Programmable Logic Controllers — Programming Method and Applications by JR Hackworth and ED Hackworth — Jr- Pearson, 2004.

**Course outcomes:**

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

To provide the knowledge about understand various types of PLC registers

Able to create ladder diagrams from process control descriptions.

Ability to apply PLC timers and counters for the control of industrial processes

Able to use different types PLC functions, Data Handling Function.

Able to develop a ―coil and contact‖ control system to operate a basic robot and analog PLC operations.

|  |  |
| --- | --- |
| Course Title:  Programmable Logic Controller Lab | Course Code : MAP (L) |
| Semester : VII | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:1** | Credits : **2 Credits** |
| Type of course : **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic Knowledge of pneumatic controlled system, hydrullics and fluid mechanics

**Course Objectives:**

To provide knowledge levels needed for PLC programming and operating.

To make the students how devices to which PLC input and output modules are connected

To train the students to create ladder diagrams from process control descriptions.

To make the students understand various types of PLC registers

Apply PLC Timers and Counters for the control of industrial processes

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| PROJECT 1: TANK FILLING DEVICE SIMULATOR 1  PROJECT 2: SUPERVISE EQUIPMENT 1  PROJECT 3: PUMP CONTROL 1  PROJECT 4: SELECTIVE BAND SWITCH 1  PROJECT 5: GATE CONTROL SYSTEM 1  PROJECT 9: FURNACE DOOR CONTROL 1  PROJECT 10: REACTION VESSEL 1  PROJECT 13: CLEANING SYSTEM 1  PROJECT 16: CHANGING FLOOR 1  PLC Interfacing with Hydraulics and Pneumatics | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1. Programmable Logic Controllers — Principle and Applications by John W Webb and Ronald A Reiss Filth edition, PHI 2. Programmable Logic Controllers — Programming Method and Applications by JR Hackworth and ED Hackworth — Jr- Pearson, 2004.

**Course outcomes:**

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

Ability to gain knowledge on Programmable Logic Controllers

Will understand different types of Devices to which PLC input and output modules are connected

To provide the knowledge about understand various types of PLC registers

Able to create ladder diagrams from process control descriptions.

Ability to apply PLC timers and counters for the control of industrial processes 6 Able to use different types PLC functions, Data Handling Function.

|  |  |
| --- | --- |
| Course Title:  **DISASTER MANAGEMENT** | Course Code : ME 421 |
| Semester : **VII** | Core / Elective :University Elective |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical engineering** | |

**Course Content:**

|  |
| --- |
| **Topic and Contents** |
| UNIT-1: |
| Introduction to Disasters: Concepts and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks) |
| UNIT-2: |
| Disasters: Classification Causes, Impacts (including social, economic, political, environmental, health, psychosocial, etc.), Differential impacts- in terms of caste, class, gender, age, location, disability, Global trends in disasters! Urban disasters, pandemics, complex emergencies, Climate change |
| UNIT-3: |
| Approaches to Disaster Risk reduction: Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural non-structural ensures roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders. |
| UNIT-4: |
| Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources. |
| UNIT-5 |
| Disaster Risk Management in India Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programs and legislation) |
| UNIT-6 |
| The project /fieldwork is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located. |

**Suggested Reading list**

1. Alexander David, Introduction in 'Confronting Catastrophe', Oxford University Press, 2000
2. Andharia J. Vulnerability in Disaster Discourse, JTCDM, Tata Institute of Social Sciences Working Paper no. 8, 2008
3. Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples' Vulnerability and Disasters, Routledge.
4. Coppola P Damon, 2007. Introduction to International Disaster Management,
5. Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
6. Cuny, F. 1983. Development and Disasters, Oxford University Press.
7. Govt. of India: Disaster Management Act 2005, Government of India, New Delhi.
8. Government of India, 2009. National Disaster Management Policy,
9. Gupta Anil K, Sreeja S. Nair. 2011 Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi , Indian Journal of Social Work 2002.Special Issue on Psychosocial Aspects of Disasters, Volume 63, Issue 2, April.
10. Kapur, Anu & others, 2005: Disasters in India Studies of grim reality, Rawat Publishers, Jaipur

|  |  |
| --- | --- |
| Course Title:  **Principles & Practices of Management** | Course Code : ME 423 |
| Semester : VII | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **2 Credits** |
| Type of course : **Theory** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

This introductory course is designed for undergraduate students with no or limited background in management.

**Course Objectives:**

Discuss and communicate the management evolution and how it will affect future managers.

Observe and evaluate the influence of historical forces on the current practice of management.

Identify and evaluate social responsibility and ethical issues involved in business situations and logically articulate own position on such issues.

Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment.

Practice the process of management's four functions: planning, organizing, leading, and controlling.

Identify and properly use vocabularies within the field of management to articulate one's own position on a specific management issue and communicate effectively with varied audiences.

Evaluate leadership styles to anticipate the consequences of each leadership style. 8. Gather and analyze both qualitative and quantitative information to isolate issues and formulate best control methods.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | Definition, nature, importance, evolution of management thoughts – pre & post scientific era, contributions made by Taylor, Fayol, Gilbreth,  Elton Mayo, McGregor, Maslow –covering Time & Motion Study, Hawthrone Experiments; Is management a science or art? Functions of | 7 |
| **II** | Why Management process starts with planning, steps in planning, planning premises, types of planning, barriers to effective planning,  operational plan, strategic planning, Mckinsey’s 7’s Approach, SWOT analysis, Controlling- concept, Planning- control relationship, process of control, human response to control, dimensions | 7 |
| **III** | Decision Making & Organizing (4 hours)  Nature, process of decision making, decision making under Certainty and Uncertainty, decision-tree, group-aided decision, brain-storming.  Organizing – concept, nature and process of organizing, authority and responsibility, delegation and empowerment, centralization and decentralization, concept of departmentation. | 7 |
| **IV** | Staffing & Motivation Concept, Manpower planning, Job design, recruitment & selection, training and development, performance appraisal, motivation, motivators and satisfaction, motivating towards organizing objectives, morale building. | 7 |
| **V** | Leadership & Communication. Defining leadership and its role, should managers lead, leadership style, leadership development, Leadership behavior. Communication- Process, Bridging gap-using tools of communication, electronic media in Communication | 7 |
|  | **Total** | **35** |

**Reference:**

Stephen P. Robbins & Mary Coulter, Management, 12th Edition. (A customized version is available at the HKU bookstore).

**Course outcomes:**

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

Demonstrate critical thinking when presented with managerial problems and express their views and opinions on managerial issues in an articulate way.

Understand the major internal features of a business system and the environment in which it operates.

Identify and explain the importance of the management process and identify some of the key skills required for the contemporary management practice.

Conduct topic and case analysis to apply theoretical concepts.

Prepare and present structured presentations and reports.

|  |  |
| --- | --- |
| Course Title: **Bio Robotics** | Course Code : |
| Semester : VII | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1: Elements of robots -- joints, links, actuators, and sensors** | **5** | **20** |
| Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision. |  |  |
| **UNIT-2:** **Kinematics of serial robots / Kinematics of parallel robots** | **5** | **20** |
| Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator. |  |  |
| **UNIT-3:** **Dynamics of serial and parallel robots** | **5** | **20** |
| Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation (direct and inverse) of dynamic equations of motion, Examples of a planar 2R and four-bar mechanism, Recursive dynamics, Commercially available multi-body simulation software (ADAMS) and Computer algebra software Maple. |  |  |
| **UNIT-4:** **Motion planning and control** | **5** | **20** |
| Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators. |  |  |
| UNIT-5: | **04** | **20** |
| Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE’s). |  |  |
| **TOTAL** | **24** | **100** |

|  |  |
| --- | --- |
| Course Title: Principles & Practices of Management | Course Code : |
| Semester : VII | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Basic concepts of Product design and integrated product development

**Course Objectives:**

This course will provide an insight into the application of cloud computing in manufacturing enabling high level integration of product development phases. It gives an idea about different tools and methodologies used for cloud based product management.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **4** | **20** |
| cloud based manufacturing systems- Introduction to cloud computing – definition- architecture of cloud manufacturing-resource requirements – service oriented manufacturing environment – IaaS, SaaS, PaaS, interoperability of systems, cloud based systems and interoperability – virtual service layer |  |  |
| **UNIT-2:** | **6** | **20** |
| Distributed service – definition – application of manufacturing ,assembly processes and management of products for recycling of e-waste – customizable decision making model. Development of cloud community for small and medium industries integrating OEMs and suppliers, out sourcing machining process – Cloud based manufacturing of parts, Vendor selection and supply chain management in cloud environment |  |  |
| **UNIT-3:** | **05** | **20** |
| Factors affecting cloud technology adoption and implementation – Benefits of cloud, Barriors and approaches of cloud adoption, various perspectives of users, developers and market teams, Data as a service, Business process as a service. |  |  |
| **UNIT-4** | **05** | **20** |
| Sustainable manufacturing system, product design, manufacturing – Needs of sustainability - adaption of sustainability factors in product development- manufacturing requirement, strategy, domain for production paradigm, Re use, Recycle, Remanufacture for sustainability- Lifecycle sustainable information management- |  |  |
| **UNIT-5:** | **04** | **20** |
| Cloud based integrated systems for design and manufacturing – collaborative cloud based systems - visualization information sharing – Designing by service for collaborative product development – Real time work in progress management- modeling for operational information exchange network |  |  |
| **TOTAL** | **24** | **100** |

**Course Outcome**

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

* Understand the concept of cloud based distributed environment for collaborative

manufacturing.

* to apply the cloud concepts in a sustainable and global product development

**Reference:**

1. Weidong Li , Jorn Mehnen, ‘Cloud Manufacturing Distributed computing technologies for

global and sustainable manufacturing , Springer New York

2. Stark, J., Product Lifecycle Management - 21st Century Paradigm for Product Realization,

|  |  |
| --- | --- |
| Course Title: **DIGITAL MANUFACTURING** | Course Code : |
| Semester : VII | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Objectives:**

1. To give Overview of digital manufacturing processes
2. To aware students about Fundamentals of geometric representations for digital manufacturing

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| Overview of digital manufacturing processes what makes manufacturing process “digital” .The 10 disruptive principles of digital manufacturing processes. Additive Manufacturing processes – Engineering polymers, metals, ceramics Stereo lithography Selective Laser Sintering Fused Deposition Modeling Poly jet LENS Layered object manufacturing. Additive Manufacturing processes – Advanced materials Electronic Materials Bio printing Food Printing |  |  |
| **UNIT-2:** | **4** | **20** |
| Material properties, Mechanical properties of printed materials, Post processing, Empirical and data-driven models. |  |  |
| **UNIT-3:** | **5** | **20** |
| CNC Mill Lathe 2D Cutting Laser Cutting, Plasma Cutting Water jet Programmable Assembly Digital Assembly Digital Bending |  |  |
| **UNIT-4** | **5** | **20** |
| Fundamentals of geometric representations for digital manufacturing Solid representations Boundary representations Function representations Vowel representations Algorithmic design for digital manufacturing Parametric Models.Vibrational Geometry |  |  |
| UNIT-5: | **4** | **20** |
| Generative models Topology optimization Machine Control. Gantry positioning approaches STL/AMF Slicing, Broader impacts Safety, Liability and intellectual property Environmental impact On-demand fabrication models and mass customization. |  |  |
| **TOTAL** | **24** | **100** |

**Course Outcome**

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

1. Student will learn about digital manufacturing processes

2. Students will get knowledge about Fundamentals of geometric representations for digital manufacturing

**Reference:**

1. “Fundamentals of Digital Manufacturing Science” By Zhou, Zude, Xie, Sheng, Chen, Dejun

2. “Additive Manufacturing Technologies” by Ian Gibson, David Rosen, Brent Stucker

|  |  |
| --- | --- |
| Course Title: **Smart cities and Automation** | Course Code : |
| Semester : VII | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Objectives:**

1. To provide the student with basic skills useful in identifying the concepts of automated machines and equipment.

2. To describe the terms and phrases associated with industrial automation.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| Introduction Smart Cities, Smart Mobility benefits Reducing cars and car movements freeing up parking space Reducing exhaust emissions and energy consumption reducing the number of incidents, accidents, Injuries and casualties. |  |  |
| **UNIT-2:** | **4** | **20** |
| Introduction Architecture of Industrial Automation Systems Measurement Systems Characteristics Data Acquisition Systems, Introduction to Automatic Control: Control PID Control Tuning Feed forward Control Ratio Control Time Delay Systems and Inverse Response Systems. |  |  |
| **UNIT-3:** | **5** | **20** |
| Special Control Structures: Introduction to Sequence Control, PLC, RLL. Sequence Control. Scan Cycle, Simple RLL Programs, Sequence Control. More RLL Elements, RLL Syntax, A Structured Design Approach to Sequence Control, PLC Hardware Environment. |  |  |
| **UNIT-4** | **5** | **20** |
| Flow Control Valves, Hydraulic Control Systems – I, Hydraulic Control Systems - II Industrial Hydraulic Circuit Pneumatic Control Systems - I Pneumatic Systems - II Energy Savings with Variable Speed Drives |  |  |
| UNIT-5: | **4** | **20** |
| The Field bus Network - I Higher Level Automation Systems |  |  |
| **TOTAL** | **24** | **100** |

**Course Outcome**

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

1. Explain the General function of Industrial Automation.

2. Identify Safety in Industrial Automation.

3. Identify Practical Programmable Logic Controller Applications

**Reference:**

1. Industrial Instrumentation, Control and Automation,S. Mukhopadhyay,S.Sen and A.K. Deb, Jaico Publishing House.

|  |  |
| --- | --- |
| Course Title: **Energy Auditing and energy conservation in Thermal system** | Course Code : |
| Semester : VII | Core / Elective: **UNIVERSITY ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : **2:1:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **UNIT-1:** | **6** | **20** |
| Basic of thermodynamics and heat transfer: Review of laws of thermodynamics; Energy and entropy balances, Equilibrium criteria; Chemical potential; Fugacity; Activity; Raoult's Law; Conservation of Energy; Heat Capacity Energy analysis: Concept of energy; Energy analysis for mixing and separation process of fluids, open and closed systems; Energy analysis of power plant cycles and Refrigeration cycle; Energy-economic analysis. |  |  |
| **UNIT-2:** | **4** | **20** |
| Energy sectors, departments and ministries of India: Power sector and Ministry of Power; Coal sector and Ministry of Coal; Oil & gas sector and Ministry of Petroleum and Natural Gas; Renewable Energy sector and Ministry of New and Renewable Energy; Nuclear sector and Department of Atomic Energy.  Energy policies and plans: Integrated energy policy, 2008; National policy on bio-fuels; Strategic plan for new and renewable energy sector for the period of 2011-2017; 5 year plans and their impacts on energy sector; National action plan for climate change. |  |  |
| **UNIT-3:** | **5** | **20** |
| Energy management: Energy management in organizations; Energy efficiency and energy conservation; Environmental impacts, including greenhouse gas emissions, of Energy; Legal and other requirements applicable to the energy management. Energy monitoring, measurement and analysis: Energy performance indicators; Energy monitoring devices and instruments; Energy monitoring, measurement and analysis. |  |  |
| **UNIT-4** | **5** | **20** |
| Energy analysis: Energy review; Development of energy baseline and energy plans. Energy management systems: Management systems approach for energy management in organizations; Energy management systems and requirements of ISO 50001; Development, implementation, maintenance and improvement of energy management systems. |  |  |
| **UNIT-5:** | **4** | **20** |
| Auditing and certification of energy management systems: ISO 19011 and internal and second party auditing of energy management systems; ISO 17021 and third party auditing and management system certification/registration. Case study: Energy management system auditing case study. |  |  |
| **TOTAL** | **24** | **100** |

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| --- | --- |
| Course Title: INTELLECTUAL PROPERTY RIGHT | Course Code : HS 402 |
| Semester : **VIII** | Core / Elective :**University** **Core** |
| Teaching Scheme in Hrs (L:T:P) : 2**:0:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Pre-requisites:**

NONE

**Course Objectives:**

Basics of Intellectual property right

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| UNIT-1 | 5 | 20 |
| OVERVIEW OF INTELLECTUAL PROPERTY  introduction and the need for intellectual property right (IPR)  IPR in India – Genesis and Development  IPR in abroad  Some important examples of IPR |  |  |
| UNITS-2 | 5 | 20 |
| PATENTS  Macro economic impact of the patent system  Patent and kind of inventions protected by a patent  Patent document  How to protect your inventions?  Granting of patent  Rights of a patent  How extensive is patent protection?  Why protect inventions by patents? |  |  |
| UNITS-3 | 5 | 20 |
| Searching a patent  Drafting of a patent  Filing of a patent  The different layers of the international patent system  (national, regional and international options)  Utility models  Differences between a utility model and a patent? |  |  |
| UNIT-4 | 5 | 20 |
| **COPYRIGHT**  **What is copyright?**  What is covered by copyright?  How long does copyright last?  Why protect copyright?  RELATED RIGHTS  What are related rights?  Distinction between related rights and copyright?  Rights covered by copyright? |  |  |
| UNIT 5 | 4 | 20 |
| **TRADEMARKS**  What is a trademark?  Rights of trademark?  What kind of signs can be used as trademarks?  types of trademark  function does a trademark perform  How is a trademark protected?  How is a trademark registered? |  |  |
| **TOTAL** | **24** | **100** |

**Course outcomes:**

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

Basics of IPR policy

|  |  |
| --- | --- |
| Course Title: Computer Aided Mechanical Design | Course Code : ME 406 |
| Semester : VIII | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **4 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Mathematics-I & II, DOM-I, Numerical Methods.

**Course Objectives:**

* Train engineers to become professionally certified in the computer-aided mechanical engineering field without formally pursuing a graduate degree.
* provide a set of integrated courses on the fundamentals of finite element analysis and CAD/CAM, and
* enable students completing the certificate program to understand the theoretical foundations of modeling and analysis of various mechanical components and to conduct performance analysis

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | Overview of Computer Graphics, Picture representation, Coordinate Systems, Output Graphcis Display devices. Raster Scan Graphics : DDA for line generation and Bresenham’s algorithm for line and circle generation. | 8 |
| **II** | Wire frame models, Parametric representation of curves, Plane curves : line, circle, ellipse, parabola and hyperbola. Space curves : Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves. | 7 |
| **III** | Surface models and entities Parametric representation of Hermite Bicubic surfaces, Bezier surfaces and B-spline surfaces. Solid Models and entities, Solid Representation : B-rep. and CSG.Comparison between three types of models**.** | 7 |
| **IV** | Two and three dimensional transformation of Geometric models: Translation, Scaling Reflection, Rotation and Shearing. Homogeneous Representation, Combined Transformation. Projection of Geometric models: Parallel and Perspective Projection. | 7 |
| **V** | Clipping : Point clipping, Line clipping, Cohen- Sutherland algorithm etc. Viewing Transformation, Hidden Line and surface Removal : Techniques and Algorithms. | 7 |
|  | **Total** | **36** |

**Reference:**

1. Mathematical Elements for Computer Graphics, Rogers and Admas.
2. CAD/CAM Theory and Practice, Zied Ibrahim, Tata McGraw Hill.
3. Computer Graphics (Schaum Series), Plastock and Kalley.

**Course outcomes:**

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

1. They will be able to understand Overview of Computer Graphics, Picture representation, Coordinate Systems, Output Graphcis Display devices. Raster Scan Graphics .
2. They will be able to understand Wire frame models, Parametric representation of curves, Plane curves : line, circle, ellipse, parabola and hyperbola. Space curves : Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves.
3. They will be able to understand Two and three dimensional transformation of Geometric models: Translation, Scaling Reflection, Rotation and Shearing. Homogeneous Representation, Combined Transformation. Projection of Geometric models: Parallel and Perspective Projection.

|  |
| --- |
| **Composition of Educational Components:** |

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom’s taxonomy) such as:

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Educational Component** | **Weightage (%)** |
| 1 | Remembering and Understanding | 35 |
| 2 | Applying the knowledge acquired from the course | 25 |
| 3 | Analysis and Evaluation | 40 |

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| --- | --- |
| Course Title: CNC Machines & Programming | Course Code : ME 404 |
| Semester : VIII | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **3:1:0** | Credits : **4 Credits** |
| Type of course : **Theory** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Computer Aided Designing, Mathematics-I, Engineering Mechanics

**Course Objectives:**

* The main objective is to obtain products at a much lower manufacturing cost, compared to the one resulted from conventional applications.
* CNC applications, by their complexity, allow the obtaining of much more reduced manufacturing times, compared to the conventional ones.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | Introduction: Overview of manufacturing processes, types of manufacturing systems, the product cycle, computer’s role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Basic components of NC systems, NC Procedure, NC coordinate system and machine motions, applications and economics of NC. | 8 |
| **II** | Part programming- manual and computer assisted such as APT Language. Computer Controls In NC Systems: Problems with conventional NC computer numerical control, Direct numerical control, combined CNC/ DNC systems, adaptive control machining system computer process interfacing, New development and latest trends. | 7 |
| **III** | Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data system, computer generated time standards. Group Technology: Introduction, part families, part classification and coding, coding system and machining cells. | 7 |
| **IV** | Computer Aided Production Management Systems: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control. Computer Aided Quality Control: Computer in quality control, contact inspection methods, Non contact inspection methods, optical and non optical computer aided testing. Computer Aided Material Handling: Computer control on material handling, conveying, picking. Ware house control, computerized material handling for automated inspection and assembly. | 7 |
| **V** | Computer Integrated Manufacturing Systems: Introduction, types special manufacturing systems, flexible manufacturing systems (FMS). Collaborative Engineering**:** Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing. | 7 |
|  | **Total** | **36** |

**Reference:**

1. Automation, Production Systems and Computer Integrated Manufacturing by M.P.Grover, PHI
2. Principal of computer integrated manufacturing by S.Kant Vajpayee.
3. Numerical control and computer aided Manufacturing; Kundra, Rao & Tiwari, TMH.

**Course outcomes:**

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

1. Understand Overview of manufacturing processes, types of manufacturing systems, the product cycle, computer’s role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Basic components of NC systems, NC Procedure, NC coordinate system and machine motions, applications and economics of NC.
2. To understand how Part programming- manual and computer assisted such as APT Language. Computer Controls In NC Systems: Problems with conventional NC computer numerical control.
3. Understanding of special manufacturing systems, flexible manufacturing systems (FMS). Collaborative Engineering: Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprise.

|  |  |
| --- | --- |
| Course Title: Non-Conventional Machining Methods | Course Code : ME 414 |
| Semester : VIII | Core / Elective: Programe Elective |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Theory** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | | |
|  | | |
| UNIT-1: | 8 | 20 |
| Introduction and classification of advanced machining process,  consideration in process selection, difference between traditional and non-traditional process, Hybrid process.  **Abrasive finishing processes**: AFM, MAF (for Plain and cylindrical surfaces). | 8 |  |
| UNIT-2: | 7 | 20 |
| **Mechanical advanced machining process**: Introduction, Mechanics of metal removal, process principle, Advantages, disadvantages and applications of AJM,USM,WJC. | 7 |  |
| UNIT-3: | 7 | 20 |
| **Thermo electric advanced machining process**: Introduction,  Principle, process parameters,advantages, disadvantages and  applications about EDM, EDG, LBM, PAM, EBM | 7 |  |
|  | | |
| UNIT-4: | 07 | 20 |
| **Electrochemical and chemical advanced machining process**: ECM, ECG, ESD, Chemical machining, Anode shape prediction and tool design for ECM process. Tool (cathode) design for ECM Process. | 7 |  |
| UNIT 5: | 7 | 20 |
| Intorduction to Micro and nanomachining, Nanoscale Cutting,  Diamond Tools in Micromachining, Conventional Processes:  Microturning, Microdrilling and Micromilling, Microgrinding,  Non-Conventional Processes: Laser Micromachining, Evaluation of Subsurface Damage in Nano and Micromachining, Applications of Nano and Micromachining in Industry. | 7 |  |
| **TOTAL** | **36** | **100** |

**Course Objectives:**

* The course aims in identifying the classification of unconventional machining processes.
* To understand the principle, mechanism of metal removal of various unconventional

machining processes.

* To study the various process parameters and their effect on the component machined on various unconventional machining processes.
* To understand the applications of different processes.

**Course outcomes:**

After completion of course, the student shall understand the principle of working, mechanism of

metal removal in the various unconventional machining process. The student is able to identify

the process parameters, their effect and applications of different processes.

**References:**

**1.** Sukhatme S.P. and J.K.Nayak, Solar Energy - Principles of Thermal Collection and Storage, Tata McGraw Hill, New Delhi, 2008.

**2.** Khan B.H., Non-Conventional Energy Resources,Tata McGraw Hill, New Delhi, 2006.

**3.** J.A. Duffie and W.A. Beckman, Solar Energy - Thermal Processes, John Wiley, 2001.

|  |  |
| --- | --- |
| Course Title:  **Operation Management** | Course Code : ME 418 |
| Semester : **VIII** | Core / Elective : **ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical engineering** | |

**Course objectives:**

One of the most critical areas for success in any business enterprise is how Production and Operations are managed. In the ‘Productions and Operations Management’ course an attempt will be made to integrate the courses studied by the students like statistics, economics, finance, organizational behaviour and strategy into a consolidated production and operation related decisions

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | **Operations Management:** An Overview - Systems concepts in Operations Management, Objectives in Operations Management, Operations management Decisions, Productivity concepts and measurement, Types of Production Systems. Aggregate planning and master scheduling Objectives of Aggregate planning Methods, Master Scheduling, Objectives, Master Scheduling Methods. | 7 |
| **II** | **Forecasting Demand:** Forecasting Objectives and uses, Qualities & Quantities methods of Forecasting, Opinion and Judgmental Methods Time Series Methods, Exponential Smoothing, Regression and Correlation Methods, Time Series Analysis, Application and Control of Forecasts. Capacity Planning: Capacity Strategy, aspects of Capacity Planning, Determination of Capacity Requirement, Types of capacity, Evaluation of Alternative plant size, Traditional Economic Analysis, Cost-Volume Profit Analysis. | 7 |
| **III** | Materials Management: Scope of Materials Management, Purchase system and procedure, purpose of Inventories, Classification of inventory, factors effecting inventory, inventory models, probabilistic models, inventory systems classification, selective inventory control, stores management, standardization codification and variety reduction. Material and Capacity Requirements Planning Overview, MRP and CRP, MRP Underlying concepts, system parameters, MRP Logic, CRP Activities. | 7 |
| **IV** | Scheduling and controlling Production Activities: Introduction, PAC Objectives and Date Requirements. Scheduling Strategy and Guidelines., Scheduling Methodology, Priority Control, Capacity Control | 7 |
| **V** | Just in Time (JIT) in manufacturing planning & control. Major-elements, Characteristics of Just in Time System pre-requisite for JIT manufacturing, Elements of Manufacturing, Eliminating Waste, Enforced, Problem Solving and Continuous Improvements, Benefits of JIT Purchasing, The Kanban System JIT implementation in Industries. Bottleneck scheduling and theory of constraints. Issues in choosing manufacturing technologies and strategies: product life cycle, standardization, simplification, diversification, value analysis. | 7 |
|  | **Total** | **35** |

**Reference Books:**

1. Production and Operations Management, Adam Everett E.& Elbert Ronald J., PHI
2. production & Operation Management; S.N.Charry, TMH
3. Manufacturing planning and control systems; Berry W.L.Whybark D.C. Vollman T.E.galgotia Publication Pvt. Ltd.
4. Operations Management: Theory and Problems Monk J.G. McGraw Hill.

**Learning outcomes:**

After completing the course the participants shall develop an understanding on how to create a production entity with focus on -

* Production Base.
* Financial (Cost) Performance.
* Technical and Operational capabilities.
* Human Capabilities.

|  |  |
| --- | --- |
| Course Title:  **CAM LAB** | Course Code : ME 462 |
| Semester : **VIII** | Core / Elective : **Core** |
| Teaching Scheme in Hrs (L:T:P) : 0**:0:2** | Credits : **1 Credits** |
| Type of course :  **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Pre-requisites:**

CAD and CAM theory

**Course Objectives:**

To know basics of cad and cam software

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS** | 20 | 100 |
| 1. To prepare part programming for plain turning operation. 2. To prepare part programming for turning operation in absolute mode. 3. To prepare part program in inch mode for plain turning operation. 4. To prepare part program for taper turning operation. 5. To prepare part program for turning operations using turning cycle. 6. To prepare part program for threading operation. 7. To prepare part program for slot milling operation. 8. To prepare part program for gear cutting operation. 9. To prepare part program for gear cutting using mill cycle. 10. To prepare part program for drilling operation. 11. To prepare part program for multiple drilling operation in Z-axis. 12. To prepare part program for multiple drilling in X-axis. 13. To prepare part program for multiple drilling in X and Z axis using drilling cycle. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1. Mikell P. Grover, “Automation, Production Systems and Computer-Integrated Manufacturing”, Pearson Education, New Delhi.
2. P. Radhakrishnan and S. Subramanyan “CAD/CAM/CIM” Willey Eastern Limited, New Delhi.
3. Michael Fitzpatrick, “Machining and CNC Technology”, Tata McGraw Hill.
4. Mikell P. Grover and Enory W. Zimmers Jr. “CAD/CAM”, Pearson Education, New Delhi.
5. Steve Krar, Arthar Gill “CNC Technology and Programming”, McGraw Hill Pub. Company, New Delhi.
6. P.N. Rao N.K. Tewari et al “CAM” Tata Mc Graw Hill Pub. New Delhi.
7. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi
8. Zeid Ibrahim, “CAD/CAM Theory and Practices”, McGraw Hill International Edition.

**Course outcomes:**

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

1. Preparation of cad model
2. Preparation of cam model

|  |  |
| --- | --- |
| Course Title:  **SOLAR LAB** | Course Code : ME 464 |
| Semester : **VIII** | Core / Elective : **Core** |
| Teaching Scheme in Hrs (L:T:P) : 0**:0:2** | Credits : **1 Credits** |
| Type of course :  **Lab Experiment** | Total Contact Hours : **20** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**-requisites:**

Theory of solar energy

**Course Objectives:**

• To produce an ultimate practical knowledge on various gadgets of solar systems and trying with assorted parameters

• To analyze of analyzing the numerical results from experimentation

• To generate consciousness on routine usages of solar energy gadgets/ industrial utilities

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS** | 20 | 100 |
| 1. Solar Radiation Measurements 2. Flat Plate Solar Water Heater 3. Flat Plate Solar Air Heater 4. IV. Flat Plate Collector with Reflector 5. Parabolic Trough Collector 6. Evacuated Tube Collector 7. Solar Cookers 8. Thermal Storage System | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Course outcomes:**

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

The student will be able to understand • The working principle behind the existing collector systems practically. • The domestic and industrial purposes and usages of solar gadgets available. • The various radiation measuring instruments and storages related to solar thermal studies.

|  |  |
| --- | --- |
| Course Title:  **ROBOTICS ENGINEERING** | Course Code : ME-402 |
| Semester : **VIII** | Core / Elective :Program Elective |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical engineering** | |

**Pre-requisites:**

Basics of Electronics Engineering, Electrical Machines, Control Theory and application. Mechatronics System.

**Course Objectives:**

1. To gain introductory knowledge of systems, and how the functional units connect to each other.
2. Understand importance of robotics in today and future goods production
3. To read drawings related to mechanics, electronics and pneumatics.
4. An ability to understand the Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices.
5. Principles of robot programming and handle with typical robot •
6. working of mobile robots.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **INDUSTRIAL ROBOTICS** | | |
| UNIT-1: **Introduction to Robotics** | 07 | 20 |
| **Introduction to Robotics -** Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Programming Robots, The Future Prospects, Notations. |  |  |
| UNITS-2: **Coordinate Frames, Mapping and Transforms** | 07 | 20 |
| **Coordinate Frames, Mapping and Transforms -** Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices |  |  |
| UNITS-3: **Symbolic Modeling of Robots – Direct Kinematic Model** | 07 | 20 |
| **Symbolic Modeling of Robots – Direct Kinematic Model -** Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator, Denavit – Hartenberg Notation, Kinematic Relationship between Adjacent Links, Manipulator Transformation Matrix. Introduction to Inverse Kinematic model |  |  |
| UNIT-4: **Robotic Sensors and Vision** | 07 | 20 |
| **Robotic Sensors and Vision -** The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Robotic vision, Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition. |  |  |
| UNIT 5: **Robot Applications** | 08 | 20 |
| **Robot Applications -** Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications. |  |  |
| **TOTAL** | **48** | **100** |

**Reference:**

1. Introduction to Robotics by John J. Craig,Pearson Education
2. Robotics by K.S.Fu,R.C.Gonzalez and C.S.G.Lee,McGraw-Hill
3. Robotic Engineering by Richard D.Klafter,Thomas A.Chmielewski and Michel Negin

**Course outcomes:**

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

1. An ability to understand the fundamental concept robotics.
2. An ability to know the concepts about Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots.
3. An ability to understand the Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices.

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| --- | --- |
| Course Title: Reliability and Maintenance | Course Code : ME 412 |
| Semester : VIII | Core / Elective: PROGRAME ELECTIVE |
| Teaching Scheme in Hrs (L:T:P) : **3:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Operation Management, Production Management,

**Course Objectives:**

TO STUDY ABOUT THE PRODUCTION AND MANAGEMENT ENGINEERING

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | **Introduction:** Maintenance Objectives and Functions; Maintenance Organization and Administration of Maintenance Systems. Need of planned maintenance. Maintenance policies; Breakdown, time based maintenance: Block replacement, age replacement and periodic replacement policy. Corrective and preventive maintenance. Maintenance planning, Scheduled maintenance. Cost of maintenance versus Cost of equipment and production delays. | 8 |
| **II** | **Predictive maintenance.** Equipment wear records, standards. Equipment used in predictive maintenance. Computerized maintenance, Total Productive Maintenance. Methods of condition monitoring, Non-destructive testing, Liquid Penetrate, Magnetic particles, Ultrasonic testing, and Vibration analysis. Oil analysis, Radiographic testing. | 7 |
| **III** | **Reliability**: Definition, failure data analysis, Mean failure rate, mean time to failure (MTTF),mean time between failures (MTBF) , hazard rate, Bathtub curve.  **Inspection**: Inspection intervals, Inspection reports, card history system, guarantee period etc. | 7 |
| **IV** | **System reliability**: Series, parallel and mixed configuration; Simple problems. Reliability improvement: Techniques, use of Pareto analysis-Design for reliability, redundancy unit and stand by redundancy, Optimization of reliability. | 7 |
| **V** | **Spare Parts Management:** Spare parts, features and categorization of spares, cost considerations, Techniques of cost reduction; Selective controls used in spare parts control; ABC analysis, FSN, XYZ, VED and other approaches. Inventory control of spares. | 7 |
|  | **Total** | **36** |

**Reference:**

1. **Reliability of Machines by D.Reshetov, A.Ivanov, V.Fadeev**
2. **Engineering Diagnostics by I.A.Birger**
3. Production Technology by R.K.Jain
4. Production and operation management by Adam and Evert ,Tata McGraw Hill.

**Course outcomes:**

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

1. Study of Scope of Production Management, important terminology and classification, Maintenance.
2. Detailed study of Management.

|  |  |
| --- | --- |
| Course Title:  **Design & Manufacturing of Plastic Products** | Course Code : **ME 422** |
| Semester : **VIII** | Core / Elective: **PROG ELECTIVE** |
| Teaching Scheme in Hrs (L:T:P) : 3**:0:0** | Credits : **3 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **36** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engg.** | |

**Course Objectives:**

1. To provide the students with overall knowledge on the manufacturing of plastic materials, their properties, applications, processing, product design, mold design, testing & quality control, and recycling through theory as well as practical training.
2. To make the students competent to take up the challenging positions in Plastics material manufacturing industries, compounding industries, processing machinery manufacturing industries through offering specialized elective subjects and industry exposure.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | | |
| UNIT-1: | 08 | 20 |
| Plastics Materials: An Overview, Classification, Thermoplastics,  Thermosets, Crystalline, Amorphous, and Liquid, Crystalline Polymers,  Copolymers, Alloys, Elastomers, Additives, Reinforcements, and Fillers, Physical Properties and Terminology.  Mechanical Properties, Thermal Properties, Electrical Properties,  Environmental Considerations. |  |  |
| 08 | | |
| UNITS-2: | 07 | 20 |
| **Design Considerations for Injection-Molded Parts**: Injection Molding Process, Design Strategy, Efficient and Functional Design, Material Selection,  Nominal Wall Thickness, Normal Ranges of Wall Thickness, Structural Requirements of the Nominal Wall, Insulation Characteristics of the Nominal Wall, Impact Response of the  Nominal Wall, Draft, Structural Reinforcement, Ribs, Other Geometric Reinforcement, Bosses, Coring, Fillets and Radii, Undercuts |  |  |
| UNITS-3: | 07 | 20 |
| Polymer processing techniques such as extrusion, compression and transfer moulding.  Injection moulding, blow moulding, thermoforming, rotational  moulding, calendaring. |  |  |
|  | | |
| UNIT-4: | 07 | 20 |
| Assembly: General Types of Assembly Systems, Molded-In Assembly Systems, Snap-Fit Assembly, Molded-In Threads, Press-Fits, Chemical Bonding Systems, Solvent Welding, Adhesive Bonding, Thermal Welding Methods.  Spin Welding, Radio Frequency (RF) Welding, Electromagnetic or Induction Welding, Assembly with Fasteners, Bolted Assembly, Threaded Metal Inserts, Self-Tapping Screws, Riveted Assembly, Sheet Metal Nuts, Specialty Plastic Fasteners |  |  |
| UNIT 5: Solar Refrigeration | 07 | 20 |
| Machining of Plastics: Drilling and Reaming,Thread Tapping, Sawing, Milling, Turning, Grinding.  Finishing and Decorating of Plastics: Painting, Vacuum Metallizing and Sputter Plating, Electroplating, Flame Spraying/Arc Spraying, Hot Stamping |  |  |
|  |  |  |
| **TOTAL** | **36** | **100** |

**Course Outcomes:**

1. This program could provide well trained professionals for the plastics and allied industries to meet the well trained manpower requirements.
2. The program will help the graduates to take up responsibilities in production, testing, design and marketing in the plastics industries and contribute for the growth of industry.
3. The graduates will get hands on experience in various aspects of plastics technology viz. plastic materials manufacturing, properties, applications, processing, product design, mold design, testing & quality control, and recycling.

**References:**

1. Hand Book of Plastics Materials & Technology - By Rubin, Irwin, J.
2. Text Book of Polymer Science-By Billmeyer, F.W.
3. Plastics Materials Hand Book - By Athalye, A.S

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| --- | --- |
| Course Title: **Total Quality Management** | Course Code : ME-424 |
| Semester : **VIII** | Core / Elective :**University** **Elective** |
| Teaching Scheme in Hrs (L:T:P) : 2**:0:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Course Objectives:**

1. To learn the basic concepts of quality and quality from organizational point of view.
2. To learn the concept of total quality management from western and Japanese approach.
3. To learn the internal politics, quality culture, education and training of the organization.
4. To be aware of international/national Quality awards.

**Syllabus** **Contents :**

Definition, History, Framework and Benefits of TQM, Characteristic and roles of a successful quality leader, Voice of customer and retention of customer, Employee involvement, teamwork, performance appraisal and rewards, Juran Trilogy, PDSA, Kaizen, Six-sigma, Selection, certification and rating of suppliers, Quality costs, Malcolm Baldrige National Quality Award, benchmarking, Spider chart and comparison with competitors products, ISO 9000+ certifications, quality audits, Quality Management Systems, ISO14000+ certifications, Environmental Management System, Voice of customer, house of quality, Quality Function Deployment, Rationale and methods Quality by Design, Methodology and documentation, Failure Mode and Effect Analysis, Liability laws and defense, Products Liability, Affinity diagram, interrelations digraph, tree and matrix diagrams, Management Tools, Charts and techniques for statistical process control, Statistical Process Control

**Course Outcome:**

1. Students should be able to Quality environment of the organization.
2. Student should be able to know the TQM approach for manufacturing/service organization in length.
3. Student should be able to know various Quality terms like Tolerance and Variability, PDCA cycle, Crosby’s 10 points and Deming’s 14 Points**.**
4. Student should be able to know international/national Quality awards

**Reference Books**

1. Besterfield, Dale H., Total Quality Management, Pearson Education, 3rd Revised Edition, 2011.

2. Sharma D.D., Total Quality Management, Principles, Implementation & Cases, Sultan Chand & Sons, New Delhi, 2000

3. James R. Evans, Total Quality Management, Organization, and Strategy, Thomson, 4th Ed., 2007.

4. Besterfield, D.H., Quality Control, Pearson, 7th Ed., 2004.

|  |  |
| --- | --- |
| Course Title: **Human Resource Management** | Course Code : ME 426 |
| Semester : **VIII** | Core / Elective :**University** **Elective** |
| Teaching Scheme in Hrs (L:T:P) : 2**:0:0** | Credits : **2 Credits** |
| Type of course : **Lecture + Assignments** | Total Contact Hours : **24** |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.TECH (MECHANICAL ENGINEERING)** | |

**Course Objectives:**

Students are introduced to the management of an organization's workforce through the design and implementation of effective human resources policies and procedures. Current Canadian issues and practices are examined. Topics include the need for human resources management and its growing professionalism; human resource planning including job design and analysis; recruitment and selection; compensation; employee development; workplace health and safety; and employee relations.

**Syllabus** **Contents :**

Introduction: Introduction to Human Resource Management and its definition, functions of HumanResource Management & its relation to other managerial functions. Nature, Scope and Importanceof Human Resource Management in Industry, Role & position of Personnel function in theorganization.

Procurement and Placement: Need for Human Resource Planning; Process of Human Resource

Planning; Methods of Recruitment; Psychological tests and interviewing; Meaning and Importanceof Placement and Induction, Employment Exchanges (Compulsory Notification of vacancies) Act1959, The Contract Labour (Regulation & Abolition) Act 1970.

Training & Development: Difference between training and Development; Principles of Training;

Employee Development; Promotion-Merit v/s seniority Performance Appraisal, Career Development & Planning.

Job analysis & Design: Job Analysis: Job Description & Job Description, Job Specification.

Job Satisfaction: Job satisfaction and its importance; Motivation, Factors affecting motivation,

introduction to Motivation Theory; Workers ' Participation, Quality of work life.

The Compensation Function: Basic concepts in wage administration, company’s wage policy,

Job Evaluation, Issues in wage administration, Bonus & Incentives, Payment of Wages Act-1936, Minimum Wages Act-1961

Integration: Human Relations and Industrial Relations; Difference between Human Relations and

Industrial Relations, Factors required for good Human Relation Policy in Industry; Employee

Employer relationship Causes and Effects of Industrial disputes; Employees Grievances & their

Redressal, Administration of Discipline, Communication in organization, Absenteeism, Labour

Turnover, Changing face of the Indian work force and their environment, Importance of collective Bargaining; Role of trader unions in maintaining cordial Industrial Relations.

Maintenance: Fringe & retirement terminal benefits, administration of welfare amenities, Meaning and Importance of Employee Safety, Accidents-Causes & their Prevention, Safety Previsions under the Factories Act 1948; Welfare of Employees and its Importance, Social security, Family Pension Scheme, ESI act 1948, Workmen’s Gratuity Act 1972, Future challenges for Human Resource Management.

**Course Outcomes:**

1. Develop the knowledge, skills and concepts needed to resolve actual human resource management problems or issues.
2. Manage the employment relationship, which is a shared responsibility between employers, management, human resources specialists, and employees. Investigate how HRM is responding to current business trends, opportunities, and challenges.
3. Identify the human resources needs of an organization or department.
4. Conduct a job analysis and produce a job description from the job analysis.
5. Evaluate the procedures and practices used for recruiting and selecting suitable employees.
6. Assess training requirements and design a successful orientation and training program.
7. Discuss workplace health and safety programs and the roles of the employer and the employee in enforcing health and safety policies and procedures.

**Recommended Text Books:**

1. T.N.Chhabra- Human Resource Management (Dhanpat Rai & Co.)

**Recommended Reference Books:**

1. Lowin B. Flippo - Principles of personnel Management (Mc Graw-Hill)

2. R.C. Saxena - Labour Problems and social welfare (K.Math & Co.)

3. A Minappa and M. S. Saiyada - Personnel Management (Tata Mc. Graw-Hill)

4. C.B. Mamoria - Personnel Management (Himalaya Publishing House, Bombay)

5. T.N. Bhagotiwal - Economics of Labour and Industrial Relations (Sahitya Bhawan

Agra)

**Innovation and Entrepreneurship (ME 428)**

Contacts: 2L

Credits- 2

**Course Obectives:**

The emerging concept of self-reliance at individual and national level - has significant impact on current developing economy. Future social expectations towards engineering professionals would be certainly as job creators and not as purely job seekers. Upgraded technological and changing economic environment has opened up wide horizons of business areas-including in service sectors too. This course deals with the key concern areas of self-employment and entrepreneurship development. This course is directed to help students to develop and shape their creativity and to understand peripheral influencing aspects. The content will certainly help students to think in a direction to establish a new enterprise using fundamental knowledge.

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | | |
| UNIT-1: **Introduction to self-employment and entrepreneurship development** | 8 | 20 |
| Introduction of self-employment: Concept and need in present Indian job market context, Characteristics of self-employment areas for mechanical engineering field, Broader ways to identify self-employment areas in mechanical engineering.  Creativity- concept, examples related to applications in mechanical engineering, ways to develop.  Innovativeness- concept, examples related to applications in mechanical engineering, ways to develop.  Entrepreneurship development: Concept and need, Scope in local and global market, Qualities of entrepreneur and Characteristics of Diploma holder as a self-employer like developing networking and personal contacts, communication skills, transferable work skills, positive work skills, conflict resolution, professional dress, workplace legal issues, work ethic, etc.  Concept and importance of productivity, quality, cost consciousness and customers’ satisfaction.  Types of enterprise- Sole partnership, Partnership firm, Joint stock company, Co-operative society. |  | 20 |
| UNITS-2: **Entrepreneurial support agencies** | | |
| Definition – Micro, small and medium industries, Registration process of an enterprise with Government agencies,  Name, type and role of state and national level support agencies for: Sources of information, Financial assistance, Technical assistance, Training.  Current state & national level promotional schemes for establishment of new enterprise | 7 | 20 |
| UNITS-3: **Project set up planning** | 7 | 20 |
| Product (Physical and service both-having mechanical features) selection:  Concept and importance, Product selection , Effect of competitive or similar types of products on product selection , Product development stages.  Process Selection: Concept and importance, Factors affecting process selection, Technology life cycle , Productivity-concept & importance,  Flexibility.  Process Conversion- Capacity Planning : Concept, Importance, Basic method to assess / estimate capacity.  Selection of location and layouts: Concept, Factors affecting selection of location, Objectives and types of plant layout, Factors affecting plant layout. |  | 20 |
| UNIT-4: **Project proposal planning** | 7 | 20 |
| 7-M resources, Marketing- definition, need for enterprise, 4Ps channels (product, price, place and promotion), Market survey-concept, need and methods,  Managing finance: Terminology used in financial management, Concept of financial statement and types (balance sheet, profit & loss statement and funds flow statement).  Project report preparation for mechanical feature based product:  Meaning of project planning and report, Feasibility study, Details required for preparing project plan, Project cost estimation, Cost, Volume and Profit (CVP) analysis, Preliminary project report (PPR) and detailed project report (DPR). |  | 20 |
| UNIT 5: **Enterprise and risk management.** | 7 | 20 |
| Concept of risk in the context of enterprise / project , Uncertainty and certainty of project elements, Decision making under risk, Methods of risk management, Strength, Weakness, Opportunity and Threat (SWOT) analysis |  |  |
| **TOTAL** | **36** | **100** |

**Course Outcomes:**

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

* 1. Identify entrepreneurial quality.
  2. Develop the ability to select potential areas for self-employment.
  3. Select appropriate agency / ies for technical and financial support.
  4. Prepare project setup planning and project report.
  5. Explain SWOT analysis and strategies to achieve goals.
  6. Identify risk factors of project and their remedial measures.

**Paper: Consumer Affairs**

**(For Undergraduate courses in any discipline as an elective)**

#### Duration: 3 hrs. Max Marks: 100 Total Lectures: 24

**Objective**: This paper seeks to familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights. It also provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards. The student should be able to comprehend the business firms’ interface with consumers and the consumer related regulatory and business environment.

#### Unit 1: Conceptual Framework 5 Lectures

**Consumer and Markets**: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology.

**Experiencing and Voicing Dissatisfaction**: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

**Unit 2: The Consumer Protection Law in India 5 Lectures**

**Objectives and Basic Concepts**: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, restrictive trade practice.

**Organizational set-up under the Consumer Protection Act**: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

**Unit 3: Grievance Redressal Mechanism under the Indian Consumer Protection Law 5 Lectures**

Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

**Leading Cases decided under Consumer Protection law by Supreme Court/National Commission**: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

#### Unit 4: Role of Industry Regulators in Consumer Protection 5 lectures

1. Banking: RBI and Banking Ombudsman
2. Insurance: IRDA and Insurance Ombudsman
3. Telecommunication: TRAI
4. Food Products: FSSAI
5. Electricity Supply: Electricity Regulatory Commission
6. Real Estate Regulatory Authority

#### Unit 5: Contemporary Issues in Consumer Affairs 4 Lectures

**Consumer Movement in India:** Evolution of Consumer Movement in India, Formation of

consumer organizations and their role in consumer protection, Misleading Advertisements and

sustainable consumption, National Consumer Helpline, Comparative Product testing,

Sustainable consumption and energy ratings.

**Quality and Standardization**: Voluntary and Mandatory standards; Role of BIS, Indian

Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International

Standards: ISO an Overview

**Suggested Readings**:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) *Consumer*

*Affairs,* Universities Press.

2. Choudhary, Ram Naresh Prasad (2005). *Consumer Protection Law Provisions and*

*Procedure,* Deep and Deep Publications Pvt Ltd.

3. G. Ganesan and M. Sumathy. (2012). *Globalisation and Consumerism: Issues*

*and Challenges*, Regal Publications

4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues

and Concerns, IIPA, New Delhi

5. Rajyalaxmi Rao (2012), *Consumer is King,* Universal Law Publishing Company

6. Girimaji, Pushpa (2002). *Consumer Right for Everyone* Penguin Books.

7. E-books :- www.consumereducation.in

8. Empowering Consumers e-book,

9. ebook, www.consumeraffairs.nic.in

10. *The Consumer Protection Act, 1986 and its later versions.* [www.bis.org](http://www.bis.org)

**Articles**

1. Misra Suresh, (Aug 2017) “Is the Indian Consumer Protected? One India One

People.

2. Raman Mittal, Sonkar Sumit and Parineet Kaur (2016) Regulating Unfair Trade

Practices: An Analysis of the Past and Present Indian Legislative Models, Journal of

Consumer Policy.

3. Chakravarthy, S. (2014). MRTP Act metamorphoses into Competition Act. CUTS

Institute for Regulation and Competition position paper. Available online at

www.cuts-international.org/doc01.doc.

4. Kapoor Sheetal (2013) “Banking and the Consumer” Akademos (ISSN 2231-0584)

5. Bhatt K. N., Misra Suresh and Chadah Sapna (2010). Consumer, Consumerism and

Consumer Protection, Abhijeet Publications.

6. Kapoor Sheetal (2010) “Advertising-An Essential Part of Consumer’s Life-Its Legal

and Ethical Aspects”, Consumer Protection and Trade Practices Journal*,* October

2010.

7. Verma, D.P.S. (2002). Regulating Misleading Advertisements, Legal Provisions and

Institutional Framework. Vikalpa. Vol. 26. No. 2. pp. 51-57.