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**SYLLABUS OF**

**B. TECH.**

**MECHANICAL ENGINEERING**

**GYAN VIHAR SCHOOL OF**

**ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**EDITION 2022 - 2026**

**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

**Gyan Vihar School of Engineering and Technology**

**Teaching and Examination Scheme**

**B. Tech./Dual Degree I Year (Common to All)**

**CSE/ECE/EE/ME/CE**

**Effective from Academic Session 2022-2026**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CIE** | **ESE** |
| **A** |  | **University Core** |  |  |  |  |  |  |  |
| **1** | PC 101 | Proficiency in Co-curricular Activities | 2 | 0 | 0 | 0 | 0 | 0 | 100 |
| **2** | FD 102 | Foundation Course-I | 1 | 2 | 0 | 0 | 3 | 25 | 75 |
| **3** | EN 105 | Professional Communication I | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| **4** | EN 151 | Professional Communication Lab | 1 | 0 | 0 | 2 | 2 | 60 | 40 |
| **B** |  | **Program Core** |  |  |  |  |  |  |  |
| **5** | **PY 103** | Physics | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| **6** | MA 103 | Mathematics – I | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| **7** | EE 105 | Basic Electrical Engineering | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| **8** | CP 107 | Programming for Problem Solving | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| **9** | CP 153 | Programming for Problem Solving Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| **10** | ME 157 | Engineering Graphics & Design Lab | 2 | 0 | 0 | 3 | 3 | 60 | 40 |
| **11** | PY 152 | Engineering Physics Lab | 1 | 0 | 0 | 3 | 3 | 60 | 40 |
| **C** |  | **University/Open Elective** |  |  |  |  |  |  |  |
|  |  | Students can choose elective from the attached list. |  |  |  |  |  |  |  |
|  |  | **Total** | **25** |  |  |  |  |  |  |

**Year: I Semester: I (Autumn)**

**NOTE: The University Electives are apart from minimum credits required for award of degree.**

**L= Lecture T=Tutorial CIE=Continuous Internal Evaluation**

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

**Members of BoS, EE Convener, BoS Engg.**

**Gyan Vihar School of Engineering and Technology**

**Teaching and Examination Scheme**

**B. Tech./Dual Degree I Year (Common to All)**

**CSE/ECE/EE/ME/CE**

**Effective from Academic Session 2022-2026**

**Year: I Semester: II (Spring)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CIE** | **ESE** |
| **A** |  | **University Core** |  |  |  |  |  |  |  |
| **1** | PC 102 | Proficiency in Co-Curricular Activities | 2 | 0 | 0 | 0 | 0 | 0 | 100 |
| **2** | FD104 | Foundation Course –II | 1 | 1 | 0 | 0 | 3 | 25 | 75 |
| **3** | EM 102 | Employability Skills–I | 1 | 0 | 2 | 0 | 0 | 60 | 40 |
| **4** | EN 106 | Professional Communication II | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| **B** |  | **Program Core** |  |  |  |  |  |  |  |
| **5** | EC 106 | Basic Electronics Engineering | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| **6** | MA 104 | Mathematics – II | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| **7** | ME 102 | Engineering Mechanics | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| **8** | CY 102 | Chemistry | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| **9** | CY 152 | Chemistry lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| **10** | ME 158 | Workshop Manufacturing Practices | 2 | 0 | 0 | 3 | 3 | 60 | 40 |
| **11** | EE 151 | Electrical and Electronics Engineering Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| **C** |  | **University/Open Elective** |  |  |  |  |  |  |  |
|  |  | Students can choose elective from the attached list. |  |  |  |  |  |  |  |
|  |  | **Total** | **23** |  |  |  |  |  |  |

**NOTE: The University Electives are apart from minimum credits required for award of degree.**

**L= Lecture T=Tutorial CIE=Continuous Internal Evaluation**

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

**Members of BoS, EE Convener, BoS Engg.**

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | |
| **Department Of Mechanical Engineering**  **B.Tech Syllabus 3rd Sem Session 2022-2026 (Onwards)**  **to be implemented session 2023 – 2024** | | | | | | | | | |
| 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 | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 2 | EM 201 | Employability Skill-II | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 3 | PC 201 | Proficiency and Co-Curricular Activities – III | 2 | 0 | 0 | 0 | 0 |  | 100 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 4 | ME 201 | Mechanics of Solids | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 5 | ME 251 | Mechanics of Solid Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 6 | ME 203 | Engineering Thermodynamics | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 7 | ME 253 | Industry Oriented Thermal Engineering Laboratory | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 8 | ME 257 | Material Science Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 9 | ME 207 | Applied Material Science | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 10 | MA 205 | Advance Maths | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 11 | ME 211 | Manufacturing Technology | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 12 | ME 259 | Manufacturing Technology Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
|  |  | **PROGRAME ELECTIVE (Select one Theory & One Lab )** |  |  |  |  |  |  |  |
| 13 | ME 216 | Industrial Engineering | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 14 | ME 262 | Industrial Engineering Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 15 | ME 265 | Computer Aided Machine Drawing Lab (AutoCAD Software) | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 16 | ME 215 | Python Programming Language | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 17 | ME 267 | Python Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
|  |  | **UNIVERSITY ELECTIVE** |  |  |  |  |  |  |  |
| 18 | Student can opt from “List of University Elective” | | | | | | | | |
|  |  | TOTAL | 30 | 18 | 4 | 10 |  |  |  |

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | |
| **Department Of Mechanical Engineering**  **B.Tech Syllabus 4th Sem Session 2022-2026 (Onwards)**  **to be implemented session 2023 – 2024** | | | | | | | | | |
| 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-III | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 2 | PC 202 | Proficiency and Co-Curricular Activities – IV | 2 | 0 | 0 | 0 | 0 | 0 | 100 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 3 | ME 218 | Fluid Mechanics & Hydraulic Machines | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 4 | ME 204 | Machine Element Design | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 5 | ME 210 | Internal Combustion Engine | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 6 | ME 220 | Theory of Machines | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 7 | ME 266 | Fluid Mechanics & Hydraulic Machines Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 8 | ME258 | Industry Oriented Internal Combustion Engine Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 9 | ME 264 | Theory of Machines Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 10 | ME 260 | Design/Simulation Lab(Software CREO/CATIA) | 1 | 0 | 0 | 2 | 2 | 60 | 40 |
|  |  | **PROGRAME ELECTIVE (Select Two subject with one lab )** |  |  |  |  |  |  |  |
| 11 | ME212 | Instrumentation & Control | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 12 | ME 250 | Instrumentation & Control Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 13 | ME 214 | Hybrid and Electric Vehicles | 2 | 2 | 0 |  | 3 | 40 | 60 |
| 14 | ME 222 | Digital Electronics | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 15 | ME 268 | Digital Electronics Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
|  |  | **UNIVERSITY ELECTIVE** |  |  |  |  |  |  |  |
| 16 | Student can opt from “List of University Elective” | | | | | | | | |
|  |  | TOTAL | 29 | 16 | 5 | 10 |  |  |  |
| ***Note:- Summer Training: Professional Project Training for 30 days after 4th Semester Exams is compulsory.*** | | | | | | | | | |

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | |
| **Department Of Mechanical Engineering B.Tech Syllabus 5th Sem Session 2022-2026 (Onwards)**  **To be implemented in session 2024 - 2025** | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |
| 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-IV | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 2 | PC 301 | Proficiency and Co-Curricular Activities – V | 2 | 0 | 0 | 0 | 0 | 0 | 100 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 3 | ME 315 | Machining Science and Machine Tools | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 4 | ME 303 | Machine Element Design-II | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 5 | ME 355 | Industry Oriented Production Process Lab | 2 | 0 | 0 | 2 | 2 | 60 | 40 |
| 6 | PT 301 | Industrial Training Seminar I | 1 | 0 | 0 | 2 | 2 |  | 100 |
| 7 | ME 311 | Mechanical Vibration & Noise Engineering | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 8 | ME 357 | Mechanical Vibration Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 9 | ME 306 | Automobile Engineering | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 10 | ME 354 | Automobile lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 11 | ME 304 | Mechatronics | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
|  |  | **PROGRAME ELECTIVE (Select one subject)** |  |  |  |  |  |  |  |
| 12 | ME 309 | Fundamental of Aerodynamics | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 13 | ME 319 | Steam Engineering | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 14 | ME 321 | Data Analytics | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 15 | ME 323 | Principles of Management | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
|  |  | **UNIVERSITY ELECTIVE** |  |  |  |  |  |  |  |
| 16 | Student can opt from “List of University Elective” | | | | | | | | |
|  |  | TOTAL | 29 | 18 | 4 | 08 |  |  |  |

**SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR**

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| **Department Of Mechanical Engineering B.Tech Syllabus 6th Sem Session 2022-2026 (Onwards)**  **To be implemented in session 2024 -2025** | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |
| **S.NO** | **Course Code** | **Course Name** | **Credit** | **Contact Hours** | | | **Exam Hours** | **Weightage (%)** | |
| **L** | **T** | **P** | **CE** | **ESE** |
|  |  | **UNIVERSITY CORE** |  |  |  |  |  |  |  |
| 1 | EM 302 | Employability Skills –V | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 2 | PC 302 | Proficiency and Co-Curricular Activities – VI | 2 | 0 | 0 | 0 | 0 |  | 100 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 3 | ME 302 | Heat & Mass Transfer | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 4 | ME 316 | Finite Element Analysis | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 5 | ME 322 | Turbo Machines | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 6 | ME 320 | Engg. Metrology and Measurement | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 7 | ME 352 | Project Oriented Heat & Mass Transfer Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 8 | ME 366 | Finite Element Analysis Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 9 | PE 302 | Project Stage­I (Minor Project) | 3 | 0 | 0 | 2 | 3 | 60 | 40 |
|  |  | **PROGRAM`E ELECTIVE (Select one Subjects & one Lab)** |  |  |  |  |  |  |  |
| 10 | ME 308 | Gas Dynamics & Propulsion | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 11 | ME 324 | Micro Electro & Mechanical Systems (MEMS) and Microsystems | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 12 | ME 326 | Quality Management | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 13 | ME 368 | Quality Control Lab | 1 | 0 | 0 | 2 | 3 | 40 | 60 |
|  |  | **UNIVERSITY ELECTIVE** |  |  |  |  |  |  |  |
| 14 | Student can opt from “List of University Elective” | | | | | | | | |
|  |  | TOTAL | 26 | 15 | 3 | 8 |  |  |  |
| ***Note:- Industrial training for 45 days after 6th Semester Exams is compulsory.*** | | | | | | | | | |

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | |
| **Department Of Mechanical Engineering B.Tech Syllabus 7th Sem Session 2022-2026 (Onwards)**  **To be implemented in session 2025­2026** | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |
| 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-VI | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 2 | PC 401 | Proficiency and Co-Curricular Activities – VII | 2 | 0 | 0 | 0 | 0 |  | 100 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 3 | ME 401 | Refrigeration & Air-conditioning | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 4 | ME 405 | Operation Research | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 5 | ME 414 | Non-Conventional Machining Methods | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 6 | ME 427 | Additive Manufacturing | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 8 | ME 451 | Refrigeration & Air-Conditioning Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 9 | PT 401 | Practical Training Seminar II | 1 | 0 | 0 | 2 | 3 |  | 100 |
| 10 | PE 401 | Project Stage­II | 3 | 0 | 0 | 2 | 3 | 60 | 40 |
|  |  | **PROGRAME ELECTIVE (Select any Two Subject & Two Lab)** |  |  |  |  |  |  |  |
| 11 | ME 403 | Power Plant Technologies | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 12 | ME 413 | Computational Fluid Dynamics  (use ANSYS CFX/ FLUENT software for tutorials) | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 13 | ME 417 | Engineering Nano Technology | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 14 | ME 419 | Non Destructive Evaluation & Testing | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 15 | ME 429 | Digital Manufacturing | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 16 | ME 425 | Advanced Innovation and  New Product Development | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 17 | MAP 401 | Basic Programmable Logic Controller (PLC )- MAP | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 18 | MAP 451 | Programmable Logic Controller Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 19 | ME 459 | Programming Software Lab (MATLAB) | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
|  |  | **UNIVERSITY ELECTIVE** |  |  |  |  |  |  |  |
| 20 | Student can opt from “List of University Elective” | | | | | | | | |
|  |  | TOTAL | 30 | 17 | 4 | 10 |  |  |  |

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| **SURESH GYAN VIHAR UNIVERSITY, JAGATPURA JAIPUR.** | | | | | | | | | | |
| **Department Of Mechanical Engineering B.Tech Syllabus 8th Sem Session 2022-2026 (Onwards)**  **To be implemented in session 2025­2026** | | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |  |
| S.NO | Course Code | Course Name | Credit | Contact Hours/Week | | | Exam Hours | Weightage (%) | |
| L | T | P | CE | ESE |
|  |  | **UNIVERSITY CORE** |  |  |  |  |  |  |  |
| 1 | EM 402 | Employability Skills-VII | 1 | 1 | 2 | 0 | 3 | 60 | 40 |
| 2 | HS 402 | Intellectual Property Right | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
|  |  | **PROGRAME CORE** |  |  |  |  |  |  |  |
| 3 | ME 424 | Automation in Manufacturing  [CAD, CAM & CIM] | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 4 | ME 462 | CNC Machines and Programming Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 5 | SM 402 | B.Tech seminar | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
|  |  | **PROGRAME ELECTIVE**  **(Select any Two Subjects & one Lab)** |  |  |  |  |  |  |  |
| 6 | ME 409 | Renewable Energy Technology | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 7 | ME 464 | Solar Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 8 | ME 426 | Supply and Operation Management | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 9 | ME 402 | Robotics Engineering | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
|  | ME 428 | AI in Manufacturing | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 10 | ME 412 | Reliability & Maintenance Engg | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 11 | ME 422 | Design & Manufacturing of Plastic Products | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 12 | ME 430 | Microprocessors in Automation | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
|  |  | **UNIVERSITY ELECTIVE** |  |  |  |  |  |  |  |
| 13 |  | Student can opt from “List of University Elective” | | | | | | | | |
|  |  | TOTAL | 16 | 12 | 3 | 6 |  |  |  |

**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** | 6 | 19 | 0 | 0 | **25** |
| **Spring** | 6 | 17 | 0 | 0 | **23** |
| **II** | **Autumn** | 5 | 22 | 3 | 0 | **30** |
| **Spring** | 3 | 21 | 5 | 0 | **29** |
| **III** | **Autumn** | 3 | 23 | 3 | 0 | **29** |
| **Spring** | 3 | 19 | 4 | 0 | **26** |
| **IV** | **Autumn** | 3 | 19 | 8 | 0 | **30** |
| **Spring** | 3 | 6 | 7 | 0 | **16** |
| **Total Credits** | | 32 | 146 | 30 | 0 | **208** |
| **Percentage** | | **15.38%** | **70.19%** | **14.42%** | **0 %** | **100%** |
| **IDEAL Distribution** | | **25%** | **50%** | **15%** | **10%** |  |

**GYAN VIHAR SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**LIST OF COURSES OFFERED**

**(University Core, Program Core & Program Elective)**

**SESSION 2022­2026**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S.NO | Course Code | Course Name | Credit | Contact Hours/Week | | | Exam Hours | Weightage (%) | |
| L | T | P | CE | ESE |
| 1 | PC 101 | Proficiency in Co-curricular Activities | 2 | 0 | 0 | 0 | 0 | 0 | 100 |
| 2 | FD 102 | Foundation Course-I | 1 | 2 | 0 | 0 | 3 | 25 | 75 |
| 3 | EN 105 | Professional Communication I | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 4 | EN 151 | Professional Communication Lab | 1 | 0 | 0 | 2 | 2 | 60 | 40 |
| 5 | **PY 103** | Physics | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 6 | MA 103 | Mathematics – I | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 7 | EE 105 | Basic Electrical Engineering | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 8 | CP 107 | Programming for Problem Solving | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 9 | CP 153 | Programming for Problem Solving Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 10 | ME 157 | Engineering Graphics & Design Lab | 2 | 0 | 0 | 3 | 3 | 60 | 40 |
| 11 | PY 152 | Engineering Physics Lab | 1 | 0 | 0 | 3 | 3 | 60 | 40 |
| 12 | PC 102 | Proficiency in Co-Curricular Activities | 2 | 0 | 0 | 0 | 0 | 0 | 100 |
| 13 | FD104 | Foundation Course –II | 1 | 1 | 0 | 0 | 3 | 25 | 75 |
| 14 | EM 102 | Employability Skills–I | 1 | 0 | 2 | 0 | 0 | 60 | 40 |
| 15 | EN 106 | Professional Communication II | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 16 | EC 106 | Basic Electronics Engineering | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 17 | MA 104 | Mathematics – II | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 18 | ME 102 | Engineering Mechanics | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 19 | CY 102 | Chemistry | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 20 | CY 152 | Chemistry lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 21 | ME 158 | Workshop Manufacturing Practices | 2 | 0 | 0 | 3 | 3 | 60 | 40 |
| 22 | EE 151 | Electrical and Electronics Engineering Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 23 | HS 203 | Economics and Social Sciences | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 24 | EM 201 | Employability Skill-II | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 25 | PC 201 | Proficiency and Co-Curricular Activities – III | 2 | 0 | 0 | 0 | 0 |  | 100 |
| 26 | ME 201 | Mechanics of Solids | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 27 | ME 251 | Mechanics of Solid Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 28 | ME 203 | Engineering Thermodynamics | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 29 | ME 253 | Industry Oriented Thermal Engineering Laboratory | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 30 | ME 257 | Material Science Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 31 | ME 207 | Applied Material Science | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 32 | MA 205 | Advance Maths | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 33 | ME 211 | Manufacturing Technology | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 34 | ME 259 | Manufacturing Technology Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 35 | ME 216 | Industrial Engineering | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 36 | ME 262 | Industrial Engineering Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 37 | \*\*\*\*\*\* | Computer Aided Machine Drawing Lab (AutoCAD Software) | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 38 | \*\*\*\*\*\* | Python Programming Language | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 39 | \*\*\*\*\*\* | Python Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 40 | EM 202 | Employability Skill-III | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 41 | PC 202 | Proficiency and Co-Curricular Activities – IV | 2 | 0 | 0 | 0 | 0 | 0 | 100 |
| 42 | \*\*\*\*\* | Fluid Mechanics & Hydraulic Machines | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 43 | ME 204 | Machine Element Design | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 44 | ME 210 | Internal Combustion Engine | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 45 | \*\*\*\*\* | Theory of Machines | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 46 | \*\*\*\*\* | Fluid Mechanics & Hydraulic Machines Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 47 | ME258 | Industry Oriented Internal Combustion Engine Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 48 | \*\*\*\*\* | Theory of Machines Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 49 | ME 260 | Design/Simulation Lab(Software CREO/CATIA) | 1 | 0 | 0 | 2 | 2 | 60 | 40 |
| 50 | ME212 | Instrumentation & Control | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 51 | ME 250 | Instrumentation & Control Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 52 | ME 214 | Hybrid and Electric Vehicles | 2 | 2 | 0 |  | 3 | 40 | 60 |
| 53 | \*\*\*\*\* | Digital Electronics | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 54 | \*\*\*\*\* | Digital Electronics Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 55 | EM 301 | Employability Skill-IV | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 56 | PC 301 | Proficiency and Co-Curricular Activities – V | 2 | 0 | 0 | 0 | 0 | 0 | 100 |
| 57 | ME 315 | Machining Science and Machine Tools | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 58 | ME 303 | Machine Element Design-II | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 59 | ME 355 | Industry Oriented Production Process Lab | 2 | 0 | 0 | 2 | 2 | 60 | 40 |
| 60 | PT 301 | Industrial Training Seminar I | 1 | 0 | 0 | 2 | 2 |  | 100 |
| 61 | ME 311 | Mechanical Vibration & Noise Engineering | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 62 | ME 357 | Mechanical Vibration Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 63 | ME 306 | Automobile Engineering | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 64 | ME 354 | Automobile lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 65 | ME 304 | Mechatronics | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 66 | ME 309 | Fundamental of Aerodynamics | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 67 | \*\*\*\*\* | Steam Engineering | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 68 | \*\*\*\*\* | Data Analytics | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 69 | \*\*\*\*\* | Principles of Management | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 70 | EM 302 | Employability Skills –V | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 71 | PC 302 | Proficiency and Co-Curricular Activities – VI | 2 | 0 | 0 | 0 | 0 |  | 100 |
| 72 | ME 302 | Heat & Mass Transfer | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 73 | ME 316 | Finite Element Analysis | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 74 | \*\*\*\*\*\* | Turbo Machines | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 75 | ME 320 | Engg. Metrology and Measurement | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 76 | ME 352 | Project Oriented Heat & Mass Transfer Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 77 | \*\*\*\*\*\* | Finite Element Analysis Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 78 | PE 302 | Project Stage­I (Minor Project) | 3 | 0 | 0 | 2 | 3 | 60 | 40 |
| 79 | ME 308 | Gas Dynamics & Propulsion | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 80 | \*\*\*\*\*\* | Micro Electro & Mechanical Systems (MEMS) and Microsystems | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 81 | \*\*\*\*\*\* | Quality Management | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 82 | \*\*\*\*\*\* | Quality Control Lab | 1 | 0 | 0 | 2 | 3 | 40 | 60 |
| 83 | EM 401 | Employability Skills-VI | 1 | 0 | 2 | 0 | 3 | 60 | 40 |
| 84 | PC 401 | Proficiency and Co-Curricular Activities – VII | 2 | 0 | 0 | 0 | 0 |  | 100 |
| 85 | ME 401 | Refrigeration & Air-conditioning | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 86 | ME 405 | Operation Research | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 87 | ME 414 | Non-Conventional Machining Methods | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 88 | \*\*\*\*\*\* | Additive Manufacturing | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 89 | ME 451 | Refrigeration & Air-Conditioning Lab | 2 | 0 | 0 | 2 | 3 | 60 | 40 |
| 90 | PT 401 | Practical Training Seminar II | 1 | 0 | 0 | 2 | 3 |  | 100 |
| 91 | PE 401 | Project Stage­II | 3 | 0 | 0 | 2 | 3 | 60 | 40 |
| 92 | ME 403 | Power Plant Technologies | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 93 | ME 413 | Computational Fluid Dynamics | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 94 | (use ANSYS CFX/ FLUENT software for tutorials) |
| 95 | ME 417 | Engineering Nano Technology | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 96 | ME 419 | Non Destructive Evaluation & Testing | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 97 | \*\*\*\*\* | Digital Manufacturing | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 98 | ME 425 | Advanced Innovation and | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 99 | New Product Development |
| 100 | MAP 401 | Basic Programmable Logic Controller (PLC )- MAP | 3 | 3 | 0 | - | 3 | 40 | 60 |
| 101 | MAP 451 | Programmable Logic Controller Lab | 1 | - | - | 2 | 3 | 60 | 40 |
| 102 | ME 459 | Programming Software Lab (MATLAB) | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 103 | EM 402 | Employability Skills-VII | 1 | 1 | 2 | 0 | 3 | 60 | 40 |
| 104 | HS 402 | Intellectual Property Right | 2 | 2 | 0 | 0 | 3 | 40 | 60 |
| 105 | \*\*\*\*\*\* | Automation in Manufacturing | 4 | 3 | 1 | 0 | 3 | 40 | 60 |
| 106 | [CAD, CAM & CIM] |
| 107 | ME 462 | CNC Machines and Programming Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 108 | SM 402 | B.Tech seminar | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 109 | ME 409 | Renewable Energy Technology | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 110 | ME 464 | Solar Lab | 1 | 0 | 0 | 2 | 3 | 60 | 40 |
| 111 | \*\*\*\*\*\* | Supply and Operation Management | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 112 | ME 402 | Robotics Engineering | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 113 | \*\*\*\*\*\* | AI in Manufacturing | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 114 | ME 412 | Reliability & Maintenance Engg | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 115 | ME 422 | Design & Manufacturing of Plastic Products | 3 | 3 | 0 | 0 | 3 | 40 | 60 |
| 116 | \*\*\*\*\*\* | Microprocessors in Automation | 3 | 3 | 0 | 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.  **Z-Transform:**  Definition, properties and formulae, Convolution theorem, inverse Ztransform, application of Z-transform to difference equation. |  |  |
| **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.  11. To determine Rockwell/ Vickers/Brinell hardness of a given material  12. To perform Impact test on a given material and to determine its resilience.  13. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.  14. To perform Tensile/Compressive/Shear/torsion test on a given material and to determine its various mechanical properties under tensile/compression/Shear/torsional loading | 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.  **Corrosion**:Types of corrosion, Galvanic cell, rusting of Iron, Methods of protection from corrosion. |  |  |
| **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** |
| **Composite Material**: General characteristics, Applications, Introduction to Fibers –glass, carbon, Kevlar 49 fibers. Matrix –Polymeric, Metallic, Ceramic Matrix, Coupling agents and fillers.  Nano Material:  **Mechanical Properties and Testing:** Types of fracture, testing of materials under tension, compression and shear loads – hardness tests (Brinell, and Rockwell) Impact test Izod and charpy, fatigue and creep test.  **Microstructure Testing Machines:** Scanning Electron Microscopy, Energy Dispersive X- Ray, X-Ray diffraction analysis of crystal, X-Ray Photoelectron Spectroscopy (XPS) |  |  |
| **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 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:  **INDUSTRIAL ENGINEERING** | Course Code : ME 216 |
| Semester : **III** | 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 : **III** | 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: Computer Aided Machine Drawing Lab-I (Software AutoCAD) | Course Code: |
| Semester : III | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **1 Credit** |
| Type of course : **Lab Experiment** | Total Contact Hours : **30** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

This guide is designed for new users of AutoCAD. It is recommended that you have a working knowledge of: • Microsoft® Windows® 7, Microsoft® Windows® 8 or Microsoft® Windows® 10.

**Course Objectives:**

The objective of this Lab is to teach students the basic commands and tools necessary for professional 2D drawing, design and drafting using AutoCAD and Student can modeled the drawing even in CAD/CAM software by applying the basic knowledge of machine drawing.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1. Introduction to Compute Aided Machine Drawing software for 2D and 3D Modeling: Basic design concepts, design process, stages in design, flowchart. 2. Introduction to various CAD commands of drafting entities like line, circle, polygon, cylinders; editing commands like move, rotate, mirror, array; solution of projection problems on CAD. 3. To make a given 2-D drawing using CAD software. 4. To perform 3-D modeling. 5. Design of Conic sections: Ellipse, parabola, hyperbola by different methods. 6. Design of machine parts such as external and internal threads, propeller shaft, bearings, springs, gears. 7. Design of Cotter and Knuckle joints. 8. Design of I C Engines parts - piston and connecting rods etc. 9. Editing a drawing using feature modification and Manipulation. 10. Isometric and Orthographic projections. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Reference:**

1. Visvesvaraya Tech. University; A Premier on Computer Aided Engg drawing; VTU Belgaum.
2. Venugopal K.;Engineering Graphics; New Age.
3. Shah MB and Rana BC; Engg.drawing; Pearson Education
4. Narayana and Reddy; Machine Drawing; New age, Delhi.
5. John KC; Text Book Of Machine Drawing; PHI Learning.
6. Bhat, ND; Machine Drawing; Charotar.

**Course outcomes:**

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

1. Use AutoCAD for daily working process. ⎫ Navigate throughout AutoCAD using major navigating tools.
2. Understand the concept and techniques to draw.
3. Create multiple designs using several of tools.
4. Student can modeled this drawing even in CAD/CAM software by applying the basic knowledge of machine drawing.
5. To enhance the ability to work as practicing mechanical engineers in manufacturing Industries and consulting firms.
6. Improving skills to adopt modern methods in mechanical engineering as continuous improvement.

|  |  |
| --- | --- |
| Course Title: Python Lab | Course Code: |
| Semester : III | Core / Elective: PROGRAME Elective |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **1 Credit** |
| Type of course : **Lab Experiment** | Total Contact Hours : **30** |
| Continuous Internal Evaluation : **60 Marks** | SEE : **40 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**List of Python Program**

1. Write a program to find root of quadratic equation

2. Write a program to find and delete repeating number in Given List

3. Write a program to input and print the element sum of user defined matrix

4. Write a program to input and multiply two different matrices

5. Write a program to compute eigen value and vector of a given 3\*3 matrix using NumPy

6. Write a program to find a solution of linear equations in y‐mx+c

7. Write a program to draw line using equation y=mx+c

8. Write the program to determine the intersection point of two line.

9. Draw various types of charts using matplotlib

10. Write a program to perform equations of uniform motion of kinematics :

i. v = u + at0

ii. s = ut + ½(at2)

iii. v2 = u2 – 2as

11. Write a menu driven program to perform following properties of thermodynamics as given

below:

i. First Law of thermodynamics ( U = Q ‐ W), where ΔU is the change in the internal energy. Q

is the heat added to the system, and W is the work done by the system.

ii. Efficiency of Heat Engine = TH – TC / TH where TH & TC is the temperature of HOT and COLD

Reservoirs.

12. Write the menu program to find the to find the out relationship between stress and strain

curve as given below:

i. Young’s Modulus

ii. Shear Modulus

iii. Poisson Ratio

13. Write the program to determine the shear force and bending moment in beams.

14. Write a program to find maxima/minima of functions of two variables and evaluate some real

definite and finite integrals.

15. Write a Program to find out unknown magnitude of TB and TD of unknown tension can be

obtained from two scalar equations of equilibrium i.eEF\_x = 0 and EF\_y =0.

16. Write a program to perform interpolation of equally and unequally spaced data.

17. Write a program to calculate total pressure exerted in ideal fluid as equation is given below:

p+1/2(ρv2) + ρgh =constant

Where P is Pressure, V is Velocity of fluid, ρ is density and h is the height of the container.

18. Write a program to find numerical differentiation using Finite differences Method by

importing NumPy and plot the numerical values using matplotlib libraries of python.

19. Write a program for bresenham’s line drawing algorithm.

20. Write a program for geometric transformation of a given object.

**Course outcomes: The students will be able to**

* Apply conditional statement, loops condition and functions in python program
* Solve mathematical and mechanical problems using python program
* Plot various type of chart using python program
* Analyze the mechanical problem using python program

|  |  |
| --- | --- |
| 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: **THEORY** **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:**

1. TO STUDY ABOUT DEGREE OF FREEDOM,VARIOUS MECHANISM OF DIFFERENT-DIFFERENT MACHINES,GEARS AND GEAR TRAINS
2. Apply the concept of gears to solve the problem in engineering field.
3. Apply the concept of gears trains to solve the problem in engineering field.
4. Apply the concept of gyroscopes to solve the problem in engineering field.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| Units | Course Contents | Hrs. |
| **I** | **BASICS OF MECHANISMS:**  **Introduction to mechanism:** Basic concept of machines, links,  kinematic pair, kinematic chain and mechanism. Inversions of  kinematic chains: four bar chain mechanisms, quick return  mechanisms, inversions of double slider crank mechanisms.  **Velocity and acceleration in mechanism**: Velocity and acceleration polygons, relative velocity and instantaneous centre method | 7 |
| **II** | **Friction devices**: Types and laws of friction. Pivots and collars. Power screws such as lead screw of the lathe.  **Clutches**: Single and multi-plate clutches. Brakes: Band, block and band and block brakes. | 7 |
| **III** | **Gears**: Laws of gearing, gears terminology; tooth form; interference,  undercutting and minimum number of teeth on pinion. Rack and  pinion, Spur, helical, basic introduction of bevel, worm and worm  gears.  **Gear trains:** Simple, compound, reverted and epicyclic gear trains, | 7 |
| **IV** | **Cams**: Type of cams; displacement, velocity and acceleration curves  for different cam followers; consideration of pressure angle and wear.  **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. | 7 |
| **V** | **Balancing**: Balancing of rotating masses in same and different planes, balancing of reciprocating masses, swaying couple, hammer blow and tractive effort. | 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.
5. Apply the concept of gears to solve the problem in engineering field.
6. Apply the concept of gears trains to solve the problem in engineering field.
7. Apply the concept of gyroscopes to solve the problem in engineering field.

|  |  |
| --- | --- |
| 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: Theory of Machines Lab | Course Code : |
| 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 Steering Mechanisms: Davis and Ackerman. 2. Study of quick return mechanism and its practical applications. 3. Study of inversion of Double slider chain: Oldhan Coupling, Scotch Yoke, Elleptical Trammel 4. Study of various cam- follower arrangements. To plot displacement v/s θ curve for cam. 5. Study of various types of dynamometers, Brakes and Clutches. 6. Study of differential gear box. 7. To Verify the relation T=I.W.Wp. for gyroscope. 8. To Perform Experiment On Watt, Porter Governor To Prepare Performance Characteristic Curves. 9. To study various types of gear- Helical, cross helical, worm, bevel gear. 10. Study of sliding mesh , Synchromesh Gear Box, planetary gear box. 11. To plot the pressure curve for journal bearing. 12. To perform wheel balancing. To perform static and dynamic balancing on balancing set up. | 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 analyze velocity and acceleration diagram of various mechanism.

|  |  |
| --- | --- |
| 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:  **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:  **MECHANICS OF SOLID** | Course Code :  **ME 201** |
| Semester : III | 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:  **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:  **Digital electronics** | Course Code: : |
| Semester : IV | 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:**

Boolean theorems, Magnitude Comparator

**Course Objectives:**

To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions

• To introduce the methods for simplifying Boolean expressions

• To outline the formal procedures for the analysis and design of combinational circuits

• and sequential circuits

• To introduce the concept of memories and programmable logic devices.

• To illustrate the concept of synchronous and asynchronous sequential circuits

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | **8** | **20** |
| **UNIT-1** |  |  |
| NUMBER SYSTEMS, BASIC LOGIC GATES & BOOLEAN ALGEBRA: Binary Arithmetic & Radix representation of different numbers. Sign & magnitude representation, complement notation, various codes & arithmetic in different codes & their inter conversion. Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and vica-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion. |  |  |
| **UNITS-2** | **07** | **20** |
| DIGITAL LOGIC GATE CHARACTERISTICS: TTL logic gate characteristics. Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C- MOS & MOSFET. Interfacing logic families to one another. |  |  |
| **UNITS-3** | **07** | **20** |
| MINIMIZATION TECHNIQUES: Minterm, Maxterm, Karnaugh Map, K map upto 4 variables. Simplification of logic functions with K-map, conversion of truth tables in POS and SOP form. Incomplete specified functions. Variable mapping. Quinn-Mc Klusky minimization techniques |  |  |
| **UNIT-4** | **7** | **20** |
| COMBINATIONAL SYSTEMS: Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders. BCD adder. Binary multiplier. Decoder: Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder. Multiplexer, demultiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode switching matrix. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers. |  |  |
| **UNIT 5** | **07** | **20** |
| SEQUENTIAL SYSTEMS: Latches, flip-flops, R-S, D, J-K, Master Slave flip flops. Conversions of flip-flops. Counters: Asynchronous (ripple), synchronous and synchronous decade counter, Modulus counter, skipping state counter, counter design. Ring counter. Counter applications. Registers: buffer register, shift register. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. T.M. Floyd, R.P. Jain-Digital fundamentals, Pearson Education.
2. Morris and Mano - Digital logic and Computer Design, Prentice – Hall of India
3. R.P. JAIN:Modern Digital Electronics 4/e, TMH.
4. Kharate G K : Digital Electronics, Oxford
5. Pedroni -Digital Electronics & Design , ELSEVIER.
6. Balbir Kumar and Shail B.Jain, “Electronic Devices and Circuits” PHI, 2007.
7. Anil K. Maini, “Digital Electronics: Principles and Integrated circuits” Wiley 2008.
8. Anand Kumar, “Switching Theory and Logic Design” Prentice Hall of India, 2008

**Course outcomes:**

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

• Analyze different methods used for simplification of Boolean expressions.

• Design and implement Combinational circuits.

• Design and implement synchronous and asynchronous sequential circuits.

• Write simple HDL codes for the circuits.

|  |  |
| --- | --- |
| Course Title: Digital electronics Lab | Course Code : |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | 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:**

Interfacing of CMOS to TTL, AND/NAND, Schmitt transistor binary circuit

**Course Objectives:**

1. To know the concepts of Combinational circuits.
2. To understand the concepts of flipflops, registers and counters

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **LIST OF EXPERIMENTS** | **20** | **100** |
| **LIST OF EXPERIMENT**  1 To study and perform the following experiments. (a) Operation of digital multiplexer and demultiplexer. (b) Binary to decimal encoder. (c) Characteristics of CMOS integrated circuits.  2 To study and perform experiment- Compound logic functions and various combinational circuits based on AND/NAND and OR/NOR Logic blocks.  3 To study and perform experiment -Digital to analog and analog to digital converters.  4 To study and perform experiment- Various types of counters and shift registers.  5 To study and perform experiment - Interfacing of CMOS to TTL and TTL to CMOS ICs.  6 To study and perform experiment- BCD to binary conversion on digital IC trainer.  7 To study and perform experiment - (a) Astable (b) Monostable (c) Bistable Multivibrators and the frequency variation with different parameters, observe voltage waveforms at different points of transistor.  8 To study and perform experiment -Voltage comparator circuit using IC-710.  9 To study and perform experiment- Schmitt transistor binary circuit.  10 Design 2 bit binary up/down binary counter on bread board. | Two hours for each experiment |  |
| **TOTAL** | **20** | **100** |

**Course outcomes**

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

1. Learn the basics of gates.
2. Construct basic combinational circuits and verify their functionalities
3. Apply the design procedures to design basic sequential circuits
4. To understand the basic digital circuits and to verify their operation

|  |  |
| --- | --- |
| Course Title: Fluid Mechanics & Fluid Machines | Course Code : |
| 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 : 48 |
| Continuous Internal Evaluation : **40 Marks** | SEE : **60 Marks** |
| Programmes: **B.Tech Mechanical Engineering** | |

**Pre-requisites:**

Fluid mechanics, Pascal Law, Engineering mechanics, Rotational mechanics

**Course Objectives:**

To Study About Fluid, Properties of Fluid, Stability of Submerged Bodies, Floting Bodies, Orifice, Nozzles And Wires, Reynolds’s Experiment, Different Loss of Head, Model Similitude, Boundary Layer, Dimensionless Numbers And Their Applications. Different Pressure Measuring Instrument And Their Practical Use and the Rotating Machines Used In Various Power Consuming And Generating Units.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| Units | Course Contents | Hrs. |
| 1 | Introduction of fluid, fluid classifications, luid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitation, compressibility and the bulk modulus, Symbols for Hydraulics energy control units (Pressure, Flow and Direction ), Symbols for Energy conversion units (Actuators) Hydraulic motor, and cylinder, Demonstration of speed and direction changes in Hydraulic Circuit | 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., Lagrangian and Eulerian description of fluid flow, streamlines, stream tubes, pathlines, deformation of fluid elements.  Hydraulic Pumps: Operating principle Hydraulic pumps, principle of External and internal gear pumps, Axial and radial piston pumps , Selection criteria of pumps, Flow rate and pump power , Efficiency, Cylinder mounting, Hydraulic Motors ,Functions of Hydraulic Motors , Characteristics of standard Hydraulic Motors , Selection of Hydraulic motors , Calculations , Efficiency | 7 |
| 3 | Orifice discharging free, co-efficient of contraction, velocity and discharge, coefficient of resistance. Orifices and mouthpieces Nozzles and weires, Reynold’s experiment Darcy’s Weisback equation. Loss of head due to sudden enlargements, bend, pipe fittings, Hydraulic grandient lines, Flow through pipe in series, parallel transmission of power through pipes, pressure control, pressure relief, pressure reducing and pressure sequence valve, Flow Control Valves, Throttle valves, pressure compensator, Meter-in flow control, Meter-out flow control, Check Valves | 7 |
| 4 | Laminar Flow: Simple solution of Navier Stokes equations, Poiseuille flow and coutte flow. Turbulent Flow; Variation of friction factor with Reynold’s number. velocity distribution in smooth pipes, Rough pipes. Dimensional Analysis: Buckingham variables, Model Similitude, Force ratio, Reynolds, Froude’s Mach, Weber and Euler numbers and their applications.  Hydraulic Turbines:  Classification of hydraulic turbines, impact of free jets, major and minor lossesin pipes, transmission power through pipe lines, Design aspects of Pelton turbine- its construction, power and efficiency for ideal case, Design aspects of reaction turbines, construction power and efficiency. | 7 |
| 5 | Description of the boundary layer. Boundary Layer thickness. The Prandtl boundary layer equation. The momentum equation for the boundary layer. The flat plate in uniform free stream with no pressures gradients.  Hydraulic systems: Hydraulic press, Hydraulic accumulator, Hydraulic Intensifier, Hydraulic Ram, Hydraulic lift, Hydraulic coupling, Hydraulic torque convertor Gear pump. | 7 |

**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
6. F. M. White, 1999, Fluid Mechanics, 4th Ed, McGraw-Hill.
7. B. R. Munson, D. F. Young and T. H. Okhiishi, Fundamentals of Fluid Mechanics, 4th Ed, John Wiley, 2002.
8. R. W. Fox and A. T. McDonald, 1998, Introduction to Fluid Mechanics, 5th Ed, John Wiley.
9. S. W. Yuan, 1988, Foundations of Fluid Mechanics, Prentice Hall of India.
10. Pijush Kundu, 2002, Fluid Mechanics, 2nd Ed., Academic Press.
11. Irwing Shames, Mechanics of Fluids, 4th Ed., McGraw Hill.
12. 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. Understand Working principle of fluid machines
2. Understand Working principle of compressors.
3. Understand Working principle of turbines.
4. Use of turbo machines in non-conventional field
5. Understand the Study about the fluid
6. Understand the Study about measuring instrument
7. Pratical Application of Dimensionless Machine.
8. Understand the Study about Boundary Layer:

|  |  |
| --- | --- |
| Course Title: Fluid Mechanics & Fluid Machines Lab | Course Code : |
| Semester : IV | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | 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:**

Fluid mechanics, Hydraulic Turbines

**Course Objectives:**

TO STUDY & PERFORM VARIOUS EXPERIMENTS ON VARIOUS FLUID MECHANICS AND TURBINE 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.  10. To study of Pelton turbine- its construction, power and efficiency  11. To study of Francis turbine- its construction, power and efficiency  12. To study of Keplon turbine- its construction, power and efficiency | 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.
4. Able to understand working of pelton, Francis and Kaplan turbine mechanics

|  |  |
| --- | --- |
| Course Title: **HYBRID AND ELECTRIC VEHICLES** | Course Code : ME |
| Semester : IV | Core / Elective: PROGRAME 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 Prerequisites:** Thermodynamics

**Course Objectives:**

1. To demonstrate and analyze electric vehicle and hybrid electric vehicle configurations.

2. To do mathematical analysis of engine performance parameters.

3. To gain knowledge about electric propulsion systems and energy storage systems of the

Electric and Hybrid Electric Vehicles.

4. Design of Hybrid and electric vehicles.

**Unit-1**

Hybrid Electric vehicles Engine fundamentals, Engine components, Basic engine nomenclature, Engine classification, working of four stroke and two stroke engines, Valve timing diagrams, Port timing diagrams.

**Unit-2**

Conventional Vehicles fundamentals, Vehicle dynamics, Configurations of Electric Vehicles, Performance of Electric Vehicles

**Unit-3**

Traction Motor Characteristics and comparison with engines performance characteristics, Tractive Effort and Transmission Requirement, Vehicle Performance Tractive Effort in Normal Driving and Energy consumption.

**Unit-4**

Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel Hybrid Electric Drive Trains, Torque-Coupling Parallel Hybrid Electric Drive Trains Speed-Coupling Parallel Hybrid Electric Drive Trains Torque-Coupling and Speed Coupling Parallel Hybrid Electric Drive Trains,

**Unit-5**

Introduction to Motors and Energy storage systems used for the hybrid Electric vehicles: DC Motor Drives, Induction Motor Drives, and Permanent Magnetic Brush-Less DC Motor Drives, Switched Reluctance Motor Drives, Batteries and Battery packs

**Text Books:**

1. Iqbal Husain, “Electric and Hybrid Vehicles Design Fundamentals”

**Reference Books:**

1. “Automotive Engines” by Srinivasan, Tata McGraw-Hill Publishing Company Ltd.

2. “Modern Electric, Hybrid Electric and Fuel Cell Vehicles Fundamentals, Theory and Design”

by Mehrdad Ehsani, Yimin Gao,Sebastien E. Gay and Ali Emadi

3. “Hybrid Electrical Vehicle Principles and Application with Practical Perspectives” by Chris MI,

M. Abul and David Wenzhong Gao

4. “Propulsion System for Hybrid Vehicle” 2nd Edition” by John M. Miller

**Course Outcomes:**

The student will be able to –

1. Demonstrate and compare engine fuel supply systems and modern trends in the engines.

3. Demonstrate and analyze electric vehicle configurations

4. Do analysis of engine performance parameters.

5. Demonstrate and analyze hybrid electric vehicle configurations

6. Demonstrate knowledge about electric propulsion systems and energy storage systems of

the Electric and Hybrid Electric Vehicles

|  |  |
| --- | --- |
| 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

|  |  |
| --- | --- |
| 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: 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:  **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 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

|  |  |
| --- | --- |
| Course Title: MECHANICAL VIBRATION & NOISE ENGINEERING | Course Code : ME 311 |
| Semester : V | 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:**

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 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:**

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 Dunkerley’s 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 Excitation 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:  **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)** | |

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| --- | --- | --- | --- |
| **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 |

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| --- | --- |
| Course Title: **MACHINE ELEMENT DESIGN-I** | Course Code : ME 204 |
| Semester : V | 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 : 48 |
| 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** |
| **Basic concepts of machine design,** Design procedure, ergonomic and aesthetic considerations, concurrent engineering  **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, Design of castings, working drawing. DFMA | 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.  **Design of screw fastening**.**:** Pin, cotter, welded, screw and keyed joints | **7** |  |
| UNIT-3: | **7** | **20** |
| **Fatigue Considerations in Design:** Variable load, loading pattern, endurance stresses, Influence of size, surface finish, notch sensitivity and stress concentration.  Goodman line, Soderberg line, Design of machine members subjected to combined, steady and alternating stresses  Design for finite life, Design of Shafts under Variable Stresses, Bolts subjected to variable stresses. |  |  |
| UNIT-4: | **7** | **20** |
| **Design of Shaft**- Design for strength, rigidity. Solid and hollow shafts. Shafts under combined loading -under bending, torsion, both and under axial loading  **Design of Keys**: Sunk keys.  **Couplings**: Design of muff coupling, flanged couplings: rigid and flexible. |  |  |
| 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; complete design of a jig and a fixture.  **Design of belt rope and chain drives** |  |  |
| **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

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| Course Title:  **AUTOMOBILE ENGINEERING** | Course Code : ME 306 |
| 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:**

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:**

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| --- | --- | --- |
| **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

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| Course Title:  **AUTOMOBILE ENGG. LAB** | Course Code : ME 354 |
| 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** | 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

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| --- | --- |
| Course Title: **Mechatronics** | Course Code : ME 304 |
| Semester : **V** | 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

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| --- | --- |
| Course Title: Steam Engineering | Course Code : |
| Semester : V | 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:**

Boilers, Turbines

**Course Objectives:**

1. Understand the various boilers and their performance
2. Develop the concept on flow steam in nozzles and related problems.
3. Give an idea on steam turbines, condensers and gas turbines and their Understand the steam condensers and related problems.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | **8** | **20** |
| **UNIT-1** |  |  |
| Introduction: Objective, scope and outcome of the course, Steam generators: Classification of Boilers, water and fire tube boilers, High pressure boilers, Advantages of high pressure Boilers, Natural and forced circulation boilers, Water wall, Steam drum internal, steam super heaters, Economizers, air preheater, induced, forced and balanced draught boilers, Fluidized bed boilers. |  |  |
| **UNITS-2** | **07** | **20** |
| Definition and type of nozzle and diffuser equation of continuity, sonic velocity, mach no. and stagnation properties, the steady flow energy equation for nozzles, momentum energy equation for flow through steam nozzles nozzle efficiency, effect of friction, nozzle for uniform pressure drop, throat pressure for maximum discharge or chock flow, critical pressure ratio, design of nozzle and diffuser. |  |  |
| **UNITS-3** | **07** | **20** |
| Steam Turbines: Principle and working of steam turbines, type of turbines, compounding for pressure and velocity. Overview anddifference of various type ofturbine, differenttypes of governing of turbines, Impulse turbine: The effect of blade friction on velocity diagram. Force, work and power, Blade or diagram efficiency, Gross stage efficiency, steam speed to blade, speed ratio for optimum performance, turbine performance at various loads. |  |  |
| **UNIT-4** | **7** | **20** |
| Impulse reaction turbine: Velocity diagram and work done, degree of reaction, Parson turbine, blade efficiency, gross stage efficiency comparison of enthalpy drop in various stages, size of blades in impulse reaction turbines for various stages of impulse reaction and impulse turbine, Regenerative Feed Heating Cycles: Introduction, Ideal regenerative feed heating cycle, Regenerative heating cycles and their representation on T-s and h-s Diagram, Representation of actual process on T-s and h-s Diagram Regenerative cycles, types of feed heating arrangements, Optimum feed water temperature and saving in Heat Rate. direct contact and surface heaters. |  |  |
| **UNIT 5** | **07** | **20** |
| Reheating of steam: Practical reheating and Non- reheating cycles, advantage and disadvantages of reheating, reheat regenerative cycle, regenerative water extraction cycles. Process heat and by product power cycle, pass out turbine, Binary vapour cycle. Condensers. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Steam Engineering, By [William Richard King](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=William+Richard+King&search-alias=stripbooks), Publisher : Nabu Press.

# [Steam And Gas Turbines & Power Plant Engineering by Dr.R Yadav, Central Publishing House, Allahabad.](http://una.kenes.com/download/steam-and-gas-turbine-by-r-yadav-pdf-download_pdf)

**Course outcomes:**

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

1. Understand working of boilers including water tube, fire tube and high pressure boilers and determine efficiencies.
2. Analyze the flow of steam through nozzles
3. Evaluate the performance of condensers and steam turbines
4. Evaluate the performance of gas turbines

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| --- | --- |
| Course Title: Data Analytics | Course Code: : |
| Semester : V | 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:**

Machine learning techniques, Big data computing technologies , Multiple Discriminant analysis

**Course Objectives:**

The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | **8** | **20** |
| **UNIT-1** |  |  |
| **Introduction:**Objective, scope, and outcome of the course. Introduction to Multivariate Statistics-Degree of Relationship among Variables-Review of Univariate and Bivariate Statistics-Screening Data, Prior to Analysis-Missing Data, Outliers, Normality, Linearity, and Homoscedasticity. |  |  |
| **UNITS-2** | **07** | **20** |
| **Multiple Regression**– Linear and Nonlinear techniques- Backward Forward-Stepwise- Hierarchical regression-Testing interactions (2way interaction) – Analysis of Variance and Covariance (ANOVA & ANCOVA) – Multivariate Analysis of Variance and Covariance (MANOVA & MANCOVA). |  |  |
| **UNITS-3** | **07** | **20** |
| **Logistic regression**: Regression with binary dependent variable – Simple Discriminant Analysis- Multiple Discriminant analysis Assessing classification accuracy- Conjoint analysis (Full profile method). |  |  |
| **UNIT-4** | **7** | **20** |
| **Principal Component Analysis** -Factor Analysis- Orthogonal and Oblique Rotation-Factor Score Estimation-Multidimensional Scaling- Perceptual Map-Cluster Analysis (Hierarchical Vs Nonhierarchical Clustering). |  |  |
| **UNIT 5** | **07** | **20** |
| **Latent Variable Models an Introduction to Factor**, Path, and Structural Equation Analysis- Time series data analysis (ARIMA model) – Decision tree analysis (CHAID, CART) – Introduction to Big Data Management. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Introduction to Data Analysis Handbook by Migrant & Seasonal Head Start Technical Assistance Center, Springer
2. Data Analytics Made Accessible, by A. Maheshwari

### Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die by E. Siegel

### Data Smart: Using Data Science to Transform Information into Insight, by J. W. Foreman

**Course outcomes:**

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

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.

2. Understand Multiple Regression and Multivariate Analysis of Variance.

3. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics

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| --- | --- |
| Course Title: Principles of Management | Course Code: : |
| Semester : V | 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:**

Management, organization, system, Leadership

**Course Objectives:**

To enable the students to study the evolution of Management, • To study the functions and principles of management. • To learn the application of the principles in an organization. • To enable the effective and barriers communication in the organization • To study the system and process of effective controlling in the organization.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
|  | **8** | **20** |
| **UNIT-1** |  |  |
| Introduction: Objective, scope and outcome of the course, Basic concepts of management: Definition – Need and Scope – Different schools of management thought – Behavioral, Scientific, Systems, and Contingency Contribution of Management Thinkers: Kautilya, Taylor, Fayol, Peter Drucker and C.K. Prahlad. |  |  |
| **UNITS-2** | **07** | **20** |
| Functions of Management: Planning: Essentials of Planning and Managing by Objectives; Strategies, Policies and Planning Premises; Decision making. Organizing The Nature of organizing, Entrepreneuring, and Reengineering; Organizational Structure, Departmentation; Line/staff authority, empowerment, and decentralization; Effective organizing and organization culture; |  |  |
| **UNITS-3** | **07** | **20** |
| Staffing Human resource Management and Selection; Performance Appraisal and Career Strategy; managing change through Manager and Organization Development. |  |  |
| **UNIT-4** | **7** | **20** |
| Leading Human Factors and Motivation; Leadership: Committees, Terms, and Group Decision making; Communication. Controlling The system and process of controlling; Control Techniques and Information Technology; Productivity, Operations Management and Total Quality Management. |  |  |
| **UNIT 5** | **07** | **20** |
| Management practices of: Dhirubhai Ambani, Narayan Murthy, Premji, Ratan Tata, Steve Jobs, Bill Gates. Studying organizational structures of any 10 companies and classifying them into different types of organizations which are studied above and justifying why such structures are chosen by those organizations. Preparing the leadership profiles of any 5 business leaders and studying their leadership qualities. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

2. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition

3. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.

4. Harold Koontz, Heinz Weihrich, ‘Essential of Management’, Tata Mcgraw Hill, 13th edition, 2001.

5. S.Bagad, 'Principles of Management', Techinical Publications, 4th edition, 2013.

6. P.C.Tripathi & P.N.Reddy,’Principles of Management’, Tata Mcgraw Hill, 4th edition, 2008. 7. Thomas S.Bateman & Scott A.Snell,’ Management’, Tata Mcgraw Hill, 5th edition, 2002

**Course outcomes:**

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

1. To understanding of managerial functions like planning, and have same basic knowledge on international aspect of management
2. To understand the planning process in the organization
3. To understand the concept of organization
4. Demonstrate the ability to directing ,leadership and communicate effectively
5. To analysis isolate issues and formulate best control methods.

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| --- | --- |
| Course Title:  **Computer Aided Machine Drawing Lab-II (Software CREO/CATIA/Solidwork)** | Course Code : ME 260 |
| Semester : V | Core / Elective: PROGRAME CORE |
| Teaching Scheme in Hrs (L:T:P) : **0:0:3** | Credits : **01 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

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| 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)** | |

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| **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 |

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| --- | --- |
| 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. |  |  |
| UNITS-2: CONVECTION | 7 | 20 |
| Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external  flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection. |  |  |
| UNITS-3: 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. |  |  |
| UNIT-4: HEAT EXCHANGERS | 07 | 20 |
| **Heat transfer during Change of Phase:** Film condensation and Drop wise condensation. Flow regimes. 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 5: MASS TRANSFER | 7 | 20 |
| **Mass Transfer :** Mass transfer by molecular diffusion- Fick’s law of diffusion- diffusion coefficient Steady state diffusion of gases and liquids through solid- equimolar diffusion, Isothermal evaporation of water through air- simple problems. Convective mass transfer- Evaluation of mass transfer coefficient- empirical relations- simple problems- analogy between heat and mass transfer. |  |  |
| **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:  **MACHINE ELEMENT DESIGN-II** | Course Code : ME303 |
| Semester : **VI** | 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 nonmetal, 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 |
| **Design of springs**- Types of Helical Springs, Terminologies, Stress and Deﬂection Equations, Series and Parallel Connections , Spring Materials, Surge in Spring helical torsional springs, Spiral Springs ,Design of laminated springs, Multi-Leaf Spring , Nipping of Leaf Springs , Shot Peening |  |  |
| UNITS-2 | 7 | 20 |
| **Design of gear teeth**: Lewis and Buckingham equations, wear and dynamic load considerations.  Design and force analysis of spur, helical, bevel and worm gears, Bearing reactions due to gear tooth forces. |  |  |
| UNITS-3 | 7 | 20 |
| **Design of Sliding and Journal Bearing:** Methods of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium.  Selection of anti-friction bearings for different loads and load cycles, Mounting of the bearings, Method of lubrication. | 7 |  |
| UNIT-4 | 7 | 20 |
| **Design of Friction Clutches & Brakes**: Common friction materials, shoe, band, cone and disc brakes their characteristics and design, friction clutches. | 7 |  |
| UNIT 5 | 7 | 20 |
| **Design of I.C. Engine components:**  Piston, Cylinder, Connecting Rod and 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.

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| --- | --- |
| 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

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| --- | --- |
| Course Title: **TURBOMACHINES** | Course Code : \*\*\*\*\*\*\* |
| 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** | SEE : **60 Marks** |
| Programmes: **B.Tech (Mechanical Engineering)** | |

**Pre-requisites:**

Fluid Mechanics, Physics in Secondary Education, Thermodynamics,

**Course Objectives:**

1. Provide students with opportunities to apply basic flow equations;

2. How to compare and chose machines for various operations.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **TURBOMACHINES** | | |
| **UNIT 1: ENERGY TRANSFER IN TURBO MACHINES** | 08 | 20 |
| Application of first and second laws of thermodynamics to turbo machines, moment of momentum equation and Euler turbine equation, principles of impulse and reaction machines, degree of reaction, energy equation for relative velocities, one dimensional analysis only. |  |  |
| **UNIT 2: STEAM TURBINES** | 07 | 20 |
| Impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum U.F Curtis stage, and Rateau stage, include qualitative analysis, effect of blade and nozzle losses on vane efficiency, stage efficiency, analysis for optimum efficiency, mass flow and blade height. Reactions staging: Parson’s stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines, problem of radial equilibrium, free and forced vortex types of flow, flow with constant reaction, governing and performance characteristics of steam turbines. |  |  |
| **UNIT 3: WATER TURBINES** | 07 | 20 |
| Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done, draft tubes, governing of water turbines. Centrifugal Pumps: classification, advantage over reciprocating type, definition of mano-metric head, gross head, static head, vector diagram and work done. Performance and characteristics: Application of dimensional analysis and similarity to water turbines and centrifugal pumps, unit and specific quantities, selection of machines, Hydraulic, volumetric, mechanical and overall efficiencies, Main and operating characteristics of the machines, cavitation. |  |  |
| **UNIT 4 : ROTARY FANS, BLOWERS AND COMPRESSORS** | 07 | 20 |
| Classification based on pressure rise, centrifugal and axial flow machines. Centrifugal Blowers Vane shape, velocity triangle, degree of reactions, slip coefficient, size and speed of machine, vane shape and stresses, efficiency, characteristics, fan laws and characteristics. Centrifugal Compressor – Vector diagrams, work done, temp and pressure ratio, slip factor, work input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser. Axial flow Compressors-Vector diagrams, work done factor, temp and pressure ratio, degree of reaction, Dimensional Analysis, Characteristics, surging, Polytrophic and isentropic efficiencies. |  |  |
| **UNIT 5: POWER TRANSMITTING TURBO MACHINE** | 07 | 20 |
| Application and general theory, their torque ratio, speed ratio, slip and efficiency, velocity diagrams, fluid coupling and Torque converter, characteristics, Positive displacement machines and turbo machines, their distinction. Positive displacement pumps with fixed and variable displacements, Hydrostatic systems hydraulic intensifier, accumulator, press and crane. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Venkanna BK; turbomachinery; PHI

2. Shepherd DG; Turbo machinery

3. Csanady; Turbo machines

4. Bansal R. K; Fluid Mechanics & Fluid Machines;

5. Rogers Cohen & Sarvan Multo Gas Turbine Theory

6. Kearton W. J; Steam Turbine: Theory & Practice

**Course outcomes:**

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

1. Explain basic concepts of turbomachines and visualize dimensional analysis.

2. Describe the working of Pelton, Francis and Kaplan along their performance parameters.

3. Discuss the operation of centrifugal pumps, centrifugal and axial compressors.

4. Associate the effect of cavitation in turbines and pumps.

5. Express the basic cycles and calculations involved in the operation of steam and gas turbines.

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| 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: **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: **FINITE ELEMENT ANALYSIS LAB** | Course Code : \*\*\*\*\* |
| 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.

|  |  |
| --- | --- |
| Course Title:  **MICRO ELECTRO AND MECHANICAL**  **SYSTEMS (MEMS) and MICROSYSTEMS** | Course Code : \*\*\*\*\*\* |
| 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** | SEE : **60 Marks** |
| Programmes: **B.Tech (Mechanical Engineering)** | |

**Pre-requisites:**

Basic electrical engineering, basic electronics, mechanical measurement and control

**Course Objectives:**

* To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
* To educate on the rudiments of Micro fabrication techniques.
* To introduce various sensors and actuators
* To introduce different materials used for MEMS
* To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **MANUFACTURING TECHNOLOGY** | | |
| **UNIT I:** **Introduction: Objective, scope and outcome of the course.** | 08 | 20 |
| Over view of MEMS and Microsystems: Microelectromechanical Systems (MEMS) and Microsystems, Typical MEMS and Microsystem products, Evaluation of Microfabrication, Microsystem and microelectronics, the multidisciplinary nature of microsystem design and manufacture, Microsystems and miniaturization, Application of Microsystems in the automotive industry, applications of Microsystems in other industries. |  |  |
| **UNIT II:** **Working Principles of Microsystems** | 07 | 20 |
| Working Principles of Microsystems: Introduction, Microsensors, Micro actuation, MEMS with Micro actuators, Micro accelerometers, Microfluidics.  Engineering Science for Microsystem Design and Fabrication: Introduction, atomic structure of matter, ions and ionization, molecular theory of matter and intermolecular forces, doping of semiconductors, the diffusion process, plasma physics, electrochemistry, quantum physics. |  |  |
| **UNIT III: Engineering Mechanics for Microsystem design** | 07 | 20 |
| Engineering Mechanics for Microsystem design: Introduction, static bending of thin plates, mechanical vibration, thermomechanics, fracture mechanics, thin-film mechanics, overview of finite element stress analysis.  Thermofluid Engineering and Microsystem design: Introduction, overview of the basics of fluid mechanics in Macro and mesoscales, Basic equations in continuum fluid dynamics, laminar fluid flow in circular conduits, computational fluid dynamics, Incompressible fluid flow in micro conduits, fluid flow in sub micrometer and nanoscale, overview of heat conduction in solids, heat conduction in multilayered thin films, heat conduction in solids in submicrometer scale. |  |  |
| **UNIT IV:** **Scaling laws in Miniaurization** | 07 | 20 |
| Scaling laws in Miniaurization: Introduction to scaling, scaling in geometry, scaling in rigid-body dynamics, scaling in electrostatic forces, scaling in electromagnetic forces, scaling in electricity, scaling in fluid mechanics, scaling in heat transfer.  Materials for MEMS and Microsystems: Introduction, substrate and wafers, active substrate materials, silicon as a substrate material, silicon compounds, silicon piezoresistors, gallium arsenide, quartz, piezoelectric crystals, polymers, packaging materials. |  |  |
| **UNIT V:** **Microsystem Fabrication Processes** | 07 | 20 |
| Microsystem Fabrication Processes: Introduction, Photolithography, Ion implantation, diffusion, oxidation, chemical vapor deposition, physical vapor deposition- sputtering, deposition by epitaxy, etching.  Overview of Micromanufacturing: Introduction, bulk micromanufacturing, surface micromachining, LIGA.  Microsystem Design: Introduction, design consideration, process design, mechanical design, mechanical design using finite element method, design of a silicon die for a micropressure sensor, design of microfluidic network systems, design case: capillary electrophoresis network system. |  |  |
| **TOTAL** | **36** | **100** |
|  |  |  |

**Reference:**

1. Tai Ran Hsu, MEMS and Micro systems Design and Manufacture Tata McGraw Hill, New Delhi, 2002
2. James J.Allen, “Micro Electro Mechanical System Design”, CRC Press Publisher, 2010
3. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, “Micro Sensors MEMS and Smart Devices”, John Wiley and Son LTD,2002
4. Mohamed Gad-el-Hak, editor, The MEMS Handbook, CRC press Baco Raton, 2000
5. Nadim Maluf, An Introduction to Micro Electro Mechanical System Design, Artech House, 2000.
6. Thomas M.Adams and Richard A.Layton, Introduction MEMS, Fabrication and Application, Springer 2012.

**Course outcomes:**

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

* to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
* to understand and analyse, linear and digital electronic circuits.

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| --- | --- |
| Course Title:  **QUALITY MANAGEMENT** | Course Code : \*\*\*\*\*\* |
| 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** | SEE : **60 Marks** |
| Programmes: **B.Tech (Mechanical Engineering)** | |

**Pre-requisites:**

Workshop technology, Production engineering, Secondary school mathematics

**Course Objectives:**

The main objectives of this course are:

1. To introduce the importance of quality in improving competitiveness

2. To develop competency in assessment of Cost of Poor Quality

3. To sensitize students in role of leadership & employee engagements in building

quality culture in organization

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **MANUFACTURING TECHNOLOGY** | | |
| **UNIT I:** **Introduction** | 08 | 20 |
| The meaning of Quality and quality improvement dimensions of quality, history of quality methodology, quality control, Quality of design and quality of conformance, Quality policy and objectives, Economics of quality.  Modeling process quality: Describing variation, frequency distribution, continuous and discrete, probability distributions, pattern of variation, Inferences about process quality: sampling distributions and estimation of process parameters. Analysis of variance. |  |  |
| **UNIT II:** **Statistical Quality Control** | 07 | 20 |
| Statistical Quality Control: Concept of SQC, Chance and assignable causes of variation, statistical basis of control chart, basic principles, choice of control limits, sample size and sampling frequency, analysis of patterns on control charts. The magnificent seven.  Control chart for variables: X-bar and R charts, X-bar and S charts, control chart for individual measurement. Application of variable control charts |  |  |
| **UNIT III: Control chart for attributes** | 07 | 20 |
| Control chart for attributes: control chart for fraction non-conforming P- chart, np-chart, c-chart and u-chart. Demerit systems, choice between attribute and variable control chart. SPC for short production runs. Process capability analysis using histogram and probability plot, capability ratios and concept of six sigma. |  |  |
| **UNIT IV:** **Quality Assurance** | 07 | 20 |
| Quality Assurance: Concept, advantages, field complaints, quality rating, quality audit.  Acceptance Sampling: Fundamental concepts in acceptance sampling, operating characteristics curve. Acceptance sampling plans, single, double and multiple sampling plans, LTPD, AOQL, AOQ.  Introduction to Quality systems like ISO 9000 and ISO 14000 |  |  |
| **UNIT V:** **Reliability and Life Testing** | 07 | 20 |
| Reliability and Life Testing- Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations. Introduction to Availability and Maintainability  Introduction to Taguchi Method of Design of Experiments, Quality loss function. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Fundamentals of Quality Control and Improvement; by Mitra,Amitava; Wiley

2. Total Quality Management by Dale H. Besterfield

3. Quality Planning and Analysis for Enterprise Quality by Juran, J.M.and Gryna, F.M.

4. Total Quality Management: Text with Cases, John S. Oakland,Butterworth - Heinemann

5. Juran’s Quality Handbook (5th Edition); Juran, J.M.; Godfrey, Blanton A; McGraw-Hill

**Course outcomes:**

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

After successful completion of the course, students will be able to

1. Prioritize quality goals based on customer expectations & competition

2. Identify improvement areas based on cost of poor quality

3. Organize for quality and development of quality culture through small group activities

|  |  |
| --- | --- |
| Course Title:  **QUALITY CONTROL LAB** | Course Code : \*\*\*\* |
| 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:**

Manufacturing processes basics, Senior or graduate standing

**Course Objectives:**

1. An understanding of the non-deterministic behaviour of manufacturing systems and other engineering processes. [1, 11]
2. An ability to design control charts and monitor the process behaviour over time. [5, 2]
3. An ability to design and analyze experiments statistically.

**Course Content:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Topic and Contents** | **Hours** | **Marks** |
| **S.No.** | **LIST OF EXPERIMENTS (ANY 10)** | **20** | **100** |
| 1 | Case study on X bar chart and R chart of an industrial process output and process capability analysis of the process. The charts are to be drawn and calculations of process capability analysis to be reported. | Two hours for each experiment |  |
| 2 | p Chart: To verify the Binomial Distribution of the number of defective balls by treating the balls with a red colour to be defective. |
| 3 | p Chart: To plot a p -chart by taking a sample of n=20 and establish control limits |
| 4 | Case study on C-chart of a product and establish control limits. |
| 5 | Operating Characteristics Curve: To plot the operating characteristics curve for single sampling attribute plan for n = 20; c = 1, 2, 3. Designate the red ball as defective. |
| 6 | Operating Characteristics Curve: To compare the actual O.C. curve with theoretical O.C. curve using approximation for the nature of distribution |
| 7 | Distribution Verification:  (a) To verify Normal Distribution using the experimental setup.  (b) To find the distribution of numbered cardboard chips by random drawing  one at a time with replacement. Make 25 subgroups in size 5 and 10 find the type of distribution of sample average in each case. Comment on your observations |
| 8 | To carry out verification of Poisson distribution using experimental set up. |
| 9 | Central Limit Theorem:  (a) To show that a sample means for a normal universe follow a normal distribution  (b) To show that the sample means for a non-normal universe also follow a normal Distribution. |
| 10 | Solve quality control problems using SPC software like STATGRAPHICS/MINITAB/SIGMA XL /SYSTAT/EXCEL etc. |
|  | TOTAL | **20** | **100** |

**Reference:**

Statistical Quality Design and Control by DeVor, Chang and Sutherland

**Course outcomes:**

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

* Apply the concept of SQC in process control.
* Categorize the process in control or out of control using various types of charts

(p, np, C, U charts)

* Identify the sampling plan suitable for the process
* Use optimization concepts in design of reliability.

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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:**

|  |  |  |
| --- | --- | --- |
| **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, psychrometric 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:  **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.

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| --- | --- |
| Course Title: **NON-CONVENTIONAL MACHINING METHODS** | Course Code : ME 414 |
| Semester : VII | Core / Elective: Program 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 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 Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| UNIT-1: |  |  |
| 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 | 20 |
| 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** |

**Reference:**

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 outcomes:**

*After completion of course,*

1. the student shall understand the principle of working, mechanism of metal removal in the various unconventional machining process.
2. The student is able to identify the process parameters, their effect and applications of different processes.

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| --- | --- |
| Course Title:  **ADDITIVE MANUFACTURING** | Course Code : |
| 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:**

Machining and machine tools technology

**Course Objectives:**

1. Develop a comprehensive understanding of fundamental additive manufacturing
2. Cultivate a “design-for-additive manufacturing” skillset for combining computer-aided design (CAD) and computer-aided manufacturing (CAM) methodologies to produce successful 3D prints.
3. Fabricate 3D mechanical objects using a variety of 3D printing technologies on campus. Execute a design project that demonstrates how additive manufacturing technologies can overcome critical limitations of traditional manufacturing processes.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **ADDITIVE MANUFACTURING** | | |
| **UNIT I:** **Overview of Rapid Product Development (RPD):** | 08 | 20 |
| Overview of Rapid Product Development (RPD): Need for the compression in product development, history of RP systems, Definition of RPD; Components of RPD. Rapid Prototyping (RP); Principle of RP; Technologies and their classifications.  Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application |  |  |
|  | | |
| **UNIT II:** **Selective Laser Sintering & Fusion Deposition Modelling** | 07 | 20 |
| Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications. Fusion Deposition Modelling: Principle, Process parameter, Path generation, Applications.  Solid Ground Curing: Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application.  Selection of RP process; Issues in RP; Emerging trends. |  |  |
| **UNIT III: Rapid Tooling & Direct RT processes** | 07 | 20 |
| Rapid Tooling (RT):Introduction to RT, Indirect RT process-Silicon rubber molding, Epoxy tooling, Spray metal tooling and Investment Casting, Cast kirksite, 3Q keltool, etc.  Direct RT processes: Laminated Tooling, Powder Metallurgy based technologies, welding based technologies, Direct pattern making (Quick Cast, Full Mold Casting) |  |  |
|  | | |
| **UNIT IV:** **Reverse Engineering** | 07 | 20 |
| Emerging Trends in RT, Reverse Engineering: Geometric data acquisition, 3D reconstruction, Applications and Case Studies, Engineering applications, Medical applications. |  |  |
| **UNIT V:** **Processing Polyhedral Data** | 07 | 20 |
| Processing Polyhedral Data: Polyhedral B-Rep modeling, STL  format, Defects and repair of STL files,  Introduction to software for RP: Brief overview of Solid view, magics etc. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive manufacturing technologies: rapid prototyping to direct digital manufacturing Springer,

2. Andreas Gebhardt, Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing, Hanser Publishers

3. J.D. Majumdar and I. Manna, Laser-assisted fabrication of materials, Springer Series in Material Science, e-ISBN: 978-3-642- 28359-8.

4. L. Lu, J. Fuh and Y.-S. Wong, Laser-induced materials and processes for rapid prototyping, Kluwer Academic Press, 200 I.

5. Zhiqiang Fan and Frank Liou, Numerical modeling of the additive

manufacturing (AM)

processes of titanium alloy, lnTech, 2012.

**Course outcomes:**

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

1. an ability to design and conduct experiments, as well as to analyze and interpret data
2. an ability to function on multi-disciplinary teams
3. an ability to identify, formulate, and solve engineering problems
4. an understanding of professional and ethical responsibility
5. an ability to communicate effectively
6. a knowledge of contemporary issues
7. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

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| --- | --- |
| 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 absorption refrigeration system.   (Electrolux refrigerator).   1. To determine the C.O.P. of vapour compression cycle. 2. To determine actual and the political C.O.P. of heat pump setup. 3. To study various refrigeration accessories. 4. Three Ton air-conditioner performance test. 5. Energy analysis of parallel and counter flow heat exchanger. 6. Study of Vaporization System. 7. Study of vortex tube refrigeration system. 8. Study of thermoelectric syst 9. 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
4. 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: **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-electric 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

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| --- | --- |
| 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  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

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| --- | --- |
| 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

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| Course Title:  **BASIC PROGRAMMABLE LOGIC CONTROLLER** | Course Code : MAP 401 |
| 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.

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| --- | --- |
| Course Title:  **PROGRAMMABLE LOGIC CONTROLLER LAB** | Course Code : MAP 451 |
| 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: **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 |

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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:  **AUTOMATION IN MANUFACTURING** | Course Code : \*\*\*\*\* |
| 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:**

Workshop technology, Production Engineering, Manufacturing management

**Course Objectives:**

Too know about the Automation and types of Automations in the industries.

1. To understand the different Automated flow lines in the Industries.
2. To perform one or more processing and/or assembly operations on a starting raw
3. material, part, or set of parts.
4. To perform a sequence of automated or mechanized assembly operations Flexible
5. manufacturing system (FMS)—a highly automated machine cell that produces part
6. To know product families often consists of workstations comprising CNC machine
7. tools.

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **AUTOMATION IN MANUFACTURING** | | |
| **UNIT I:** **Introduction** | 08 | 20 |
| Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools, Mechanical Feeding and to changing and machine tool control transfer the automation. |  |  |
|  | | |
| **UNIT II:** **Automated flow lines** | 07 | 20 |
| Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines . |  |  |
| **UNIT III: Assembly system and line balancing** | 07 | 20 |
| Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines. |  |  |
|  | | |
| **UNIT IV:** **Automated material handling** | 07 | 20 |
| Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems. Automated storage systems: Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing. |  |  |
| **UNIT V:** **Fundamentals of Industrial controls** | 07 | 20 |
| Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in manufacturing. Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. M.P.Groover 3e - Automation, Production Systems and Computer Integrated

Manufacturing, PHI,2009.

2. Frank Lamb - Industrial Automation , Mc Graw Hill,2013

3. W. Buekinsham – Automation

**Course outcomes:**

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

1. understand the process of automation and types
2. get exposure to workstation, which refers to the location in the factory where some well-defined task or operation is accomplished by an automated machine.
3. Worker-and-machine combination or a worker using hand tools
4. Understand the Automated Material handling equipment’s and types
5. Get exposure on portable power tools.

|  |  |
| --- | --- |
| Course Title:  **HYBRID AND ELECTRIC VEHICLES** | Course Code : \*\*\*\*\* |
| 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:**

Basic electrical engineering, electrical machines, I.C. Engines, Automobile engineering

**Course Objectives:**

1. To understand upcoming technology of electric and hybrid electric vehicles

2. Analyze different aspects of drive train topologies

3. learn different energy management strategies

4. To understand different communication systems used in electric and Hybrid electric

vehicles

5. Explain the concept of vehicle to grid configurations

**Course Content:**

|  |  |  |
| --- | --- | --- |
| **Topic and Contents** | **Hours** | **Marks** |
| **HYBRID AND ELECTRIC VEHICLES** | | |
| UNIT I: **Introduction to Hybrid Electric Vehicles** | 08 | 20 |
| Introduction to Hybrid Electric Vehicles**:** History of hybrid and electric vehicles, environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.  Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance. |  |  |
|  | | |
| UNIT II: **Hybrid Electric Drive-trains** | 07 | 20 |
| Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.  Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. |  |  |
| UNIT III: **Electric Propulsion unit** | 07 | 20 |
| Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives |  |  |
|  | | |
| UNIT IV: **Energy Storage** | 07 | 20 |
| Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices. |  |  |
| UNIT V: **Sizing the drive system** | 07 | 20 |
| Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology  Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. |  |  |
| **TOTAL** | **36** | **100** |

**Reference:**

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press

**Course outcomes:**

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

1. Impact of conventional vehicles on the society and different types of drive train

topologies

2. Load modelling based on the road profile and braking concepts

3. Different types of motors used in electric and hybrid electric vehicles

4. Different types of energy storage systems

5. The concept vehicle to grid (V2G) and grid to vehicle (G2V).

|  |  |
| --- | --- |
| Course Title:  **CAM LAB** [CNC Machines and Programming 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: **RENEWABLE ENERGY TECHNOLOGY** | Course Code : ME 409 |
| Semester : **VIII** | 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:**

|  |
| --- |
| 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. |

|  |  |  |
| --- | --- | --- |
| **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:  **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)** | |

**Pre-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: **SUPPLY AND OPERATION MANAGEMENT** | Course Code : |
| 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** | |

**Pre requisite:**

Basic Concept of Statistics and Data, Fundamental Knowledge of Mathematics, Understanding of different functional areas of management

**Course objectives:**

1. To provide an introduction to Operations Management and exposure to forecasting methods, namely qualitative & quantitative methods.

2. To Impart knowledge on the Aggregate Planning and Materials Requirement

Planning?

3. To Understand the principles/methods of Scheduling and Sequencing.

4. To Understand the Maintenance Planning and Control and the methods for

reliability improvement?

5. To Impart knowledge on the Modern concepts/ techniques in operations

management and Supply Chain management

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Contents** | **Hours** |
| **I** | Introduction to operations management (OM), the scope of OM; Historical evolution of OM; Trends in business; the management process. Operations Strategy, Competitiveness and Productivity  Demand Forecasting: components of forecasting demand, Approaches to forecasting: forecasts based on judgment and opinion, Time series data. Associative forecasting techniques, Accuracy and control of forecasts, Selection of forecasting technique. | 7 |
| **II** | Product and Service design, Process selection, Process types, Product and process matrix, Process analysis.  Capacity Planning: Defining and measuring capacity, determinants of effective capacity, capacity strategy, steps in capacity planning process, determining capacity requirements, Capacity alternatives, Evaluation of alternatives; Cost-Volume analysis. | 7 |
| **III** | Facility Location: Need for location decisions, factors affecting location, qualitative and quantitative techniques of location. Facilities layout: Product, Process, Fixed position, combination and cellular layouts; line balancing. Material Handling  Planning levels: long range, Intermediate range and Short-range planning, Aggregate planning: Objective, Strategies, and techniques of aggregate planning. Master scheduling; Bill of materials, MRP; inputs processing and outputs, and overview of MRPII, use of MRP to assist in planning capacity requirements, Introduction to ERP | 7 |
| **IV** | Techniques of production control in job shop production, batch production and mass production systems. sequencing: priority rules, sequencing jobs through two work centers, scheduling services  Introduction to Just-in-time (JIT) and Lean Operations: JIT production, JIT scheduling, synchronous production, Lean operations system | 7 |
| **V** | Supply Chain Management (SCM): Need of SCM, Bullwhip effect, Elements of SCM, Logistics steps in creating effective supply chain, Purchasing and supplied management. | 7 |
|  | **Total** | **35** |

**Reference Books:**

1. Mahadevan B., Operations Management, Pearson Education
2. Panneerselvam R., Production and operations Management, Prentice Hall of India. T3
3. Krajewski and Ritzman, Operations Management, Pearson Education
4. Verma A.P., Industrial Engineering, S. K. Kataria & Sons.
5. Adam and Ebert, Production and Operations Management, Prentice Hall of India
6. Chopra and Meindl, Supply Chain Management, Prentice Hall of India
7. Tony Arnold, J.R, Introduction to materials management, Prentice hall inc, N.J,1998.
8. Khanna O.P, Industrial Engineering and Management, DhanPatRai Publications
9. M. Mahajan., Industrial Engineering and Production Management, DhanPatRai & Co

**Learning outcomes:**

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

1. Acquire a sound knowledge on the principles of Operations Management
2. Use forecasting methods, principles/methods of scheduling and Sequencing, methods of maintenance planning and control, concepts/ technique supply chain management for Operations Management
3. Select and use an appropriate principles/methods/ techniques/ modern concepts with reference to given application/situation in the mechanical systems/ project management and finance
4. Develop and implement new ideas/ modern concepts with reference to given application/situation for best manufacturing practices
5. Preparation and ability to engage in independent and lifelong learning in the context of technological change in Operations Management.

|  |  |
| --- | --- |
| 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 –**Origin**,** 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, Notations. |  |  |
| UNITS-2: **Artificial Intelligence, Internet of Things, Swarm Robotics** | 07 | 20 |
| **Artificial Intelligence**-Origin, Alan Turing & his Machines, What is Intelligence, Artificial Intelligence, AI Types &Applications, Machine Learning, Future Prospects.  **Internet of Things-** History, Concept, Application& Future Prospects.  **Swarm Robotics**-Introduction to Coordination of multiple robots as a system, Social Insect Motivation & Inspiration |  |  |
| UNITS-3: **Symbolic Modeling of Robots – Direct Kinematic Model** | 07 | 20 |
| **Coordinate Frames**- Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices  **Symbolic Modeling of Robots** -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, The Future Prospects. |  |  |
| **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.

|  |  |
| --- | --- |
| Course Title: **Reliability and Maintenance Engineering** | 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. |  |  |
| 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: | 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