

**COURSE STRUCTURE & SYLLABUS**

for

**B.Tech Four Year Degree Course**

**(A-20- III & IV year)**

in

**MECHANICAL ENGINEERING**

**(ME)**

(Applicable for the batches admitted from 2020-2021)

###### SREENIDHI INSTITUTE OF SCIENCE AND TECHNOLOGY

**(An Autonomous Institution approved by UGC and affiliated to JNTUH)**

(Accredited by NAAC with ‘A’ Grade and Accredited by NBA of AICTE)

Yamnampet, Ghatkesar, Malkajigiri Medchal District -501 301

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|  |  |  | **A20-Course Structure for B. Tech(Mech)-I Year – I semester  (1st Semester)** | | | | | |  |  |
| **Sl.No** | **AICTE Categery** | **Dept Course** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | BS | S&H | 8HC06 | Applied Physics | 3 | 1 | 0 | 4 | 30 | 70 |
| 2 | BS | S&H | 8HC09 | Calculus and Matrix Methods (CMM) | 2 | 1 | 0 | 3 | 30 | 70 |
| 3 | ES | ME | 8BC02 | Engineering Graphics | 1 | 0 | 4 | 3 | 30 | 70 |
| 4 | ES | IT | 8FC01 | Problem Solving using C | 3 | 0 | 0 | 3 | 30 | 70 |
| 5 | PC | ME | 8B103 | Engineering Mechanics | 2 | 0 | 0 | 2 | 30 | 70 |
| 6 | HS&MS | S&H | 8HC02 | Written Communication Skills | 1 | 0 | 0 | 1 | 30 | 70 |
| 7 | BS | S&H | 8HC65 | Applied Physics Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 8 | HS&MS | S&H | 8HC62 | Written Communication Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 9 | ES | IT | 8FC61 | Problem Solving using C Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 10 | Proj,Sem, interns, viva | ME | 8B191 | Comprehensive test and Viva-voce-I  ( 2 Mids-Test (20M) and vivA (10M)and End Semester Test (50M) and Viva(20M) = 70) | 1 | 0 | 0 | 1 | 30 | 70 |
| 11 | Proj,Sem, interns, viva | ME | 8B185 | Technical Seminar I | 0 | 0 | 2 | 1 | 100 |  |
| 12 | MC | S&H | 8HC18 | Orientation Course | 1 | 0 | 0 | 0 | Marks and  Grade will be given at the end of I year II semester | |
|  |  |  |  | **Total** | **14** | **2** | **12** | **21** | **400** | **700** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  |  | |  | | | **A20-Course Structure for B. Tech.(Mech.)-I Year – II semester (2nd Semester)** | | | | | | | | | | |  |  | |  | |
| **Sl.No** | **AICTE Categery** | | **Dept Course** | | | **Course code** | | **Name of the Course** | | | **L** | | **T** | **P/D** | | | **C** | **Max. Marks** | | | |
|  |  | |  | | |  | |  | | |  | |  |  | | |  | **CIE** | | **SEE** | |
| 1 | BS | | S&H | | | 8HC04 | | Engineering Chemistry | | | 3 | | 1 | 0 | | | 4 | 30 | | 70 | |
| 2 | BS | | S&H | | | 8HC12 | | Differential Equations & Integral Calculus (DEIC) | | | 2 | | 1 | 0 | | | 3 | 30 | | 70 | |
| 3 | BS | | S&H | | | 8HC08 | | Introductory Mathematics, Analysis  and Reasoning (IMAR) | | | 2 | | 1 | 0 | | | 3 | 30 | | 70 | |
| 4 | ES | | CSE | | | 8EC01 | | Data Structure and C++ | | | 3 | | 0 | 0 | | | 3 | 30 | | 70 | |
| 5 | HS&MS | | S&H | | | 8HC01 | | Oral Communication Skills | | | 1 | | 0 | 0 | | | 1 | 30 | | 70 | |
| 6 | ES | | ME | | | 8BC01 | | Workshop/ Manufacturing processes (Theory) | | | 1 | | 0 | 0 | | | 1 | 30 | | 70 | |
| 7 | PC | | ME | | | 8B205 | | Mechanics of solids | | | 2 | | 0 | 0 | | | 2 | 30 | | 70 | |
| 8 | ES | | ME | | | 8BC61 | | Workshop/ Manufacturing processes Lab | | | 0 | | 0 | 2 | | | 1 | 30 | | 70 | |
| 9 | HS&MS | | S&H | | | 8HC61 | | Oral Communication Lab | | | 0 | | 0 | 2 | | | 1 | 30 | | 70 | |
| 10 | BS | | S&H | | | 8HC64 | | Engineering Chemistry Lab | | | 0 | | 0 | 2 | | | 1 | 30 | | 70 | |
| 11 | ES | | CSE | | | 8EC61 | | Data Structure (C and C++) Lab | | | 0 | | 0 | 2 | | | 1 | 30 | | 70 | |
| 12 | PC | | ME | | | 8B262 | | Advanced Engineering Graphics & CAD | | | 0 | | 0 | 2 | | | 1 | 30 | | 70 | |
| 13 | Proj,Sem, interns, viva | | ME | | | 8B292 | | Comprehensive test and Viva-voce-II  ( 2 Mids-Test (20M) and vivA (10M)and End Semester Test (50M) and Viva(20M) = 70) | | | 1 | | 0 | 0 | | | 1 | 30 | | 70 | |
| 14 | Proj,Sem, interns, viva | | ME | | | 8B286 | | Technical Seminar II | | | 0 | | 0 | 2 | | | 1 | 100 | |  | |
| 15 | MC | | S&H | | | 8HC18 | | Orientation Course | | | 2 | | 0 | 0 | | | 0 | 30 | | 70 | |
|  |  | |  | | |  | |  | | |  | |  |  | | |  | Grade Evaluation | | | |
|  |  | |  | | |  | | **Total** | | | **17** | | **3** | **12** | | | **24** | **520** | | **980** | |
|  | |  | |  | **A20- Course Structure for B. Tech.(Mech)-II Year – I semester (3rd Semester)** | | | | | | | | | |  |  | | |  | |
| **Sl.No** | | **AICTE Categery** | | **Dept Course** | **Course code** | | **Name of the Course** | | **L** | **T** | | **P/D** | | | **C** | **Max. Marks** | | | | |
|  | |  | |  |  | |  | |  |  | |  | | |  | **CIE** | | | **SEE** | |
| 1 | | BS | | S&H | 8HC15 | | Complex Analysis, Probability And Statistics | | 2 | 1 | | 0 | | | 3 | 30 | | | 70 | |
| 2 | | ES | | IT | 8FC21 | | Python programming and Algorithms | | 2 | 1 | | 0 | | | 3 | 30 | | | 70 | |
| 3 | | HS&MS | | S&H | 8HC05 | | Environmental Science and Ecology | | 2 | 0 | | 0 | | | 2 | 30 | | | 70 | |
| 4 | | HS&MS | | MBA | 8ZC01 | | Economics, Accountancy and Management Science | | 2 | 0 | | 0 | | | 2 | 30 | | | 70 | |
| 5 | | PC | | ME | 8B306 | | Thermodynamics | | 2 | 1 | | 0 | | | 3 | 30 | | | 70 | |
| 6 | | PC | | ME | 8B307 | | Materials Science and Metallurgy | | 2 | 0 | | 0 | | | 2 | 30 | | | 70 | |
| 7 | | PC | | ME | 8B308 | | Machine Drawing and Computer aided Drawing Practice | | 1 | 0 | | 2 | | | 2 | 30 | | | 70 | |
| 8 | | PC | | ME | 8B363 | | Metallurgy Lab & Mechanics of Solids Lab | | 0 | 0 | | 2 | | | 1 | 30 | | | 70 | |
| 9 | | PC | | ME | 8B364 | | Fuels and Lubricants Lab | | 0 | 0 | | 2 | | | 1 | 30 | | | 70 | |
| 10 | | Proj,Sem, interns, viva | | ME | 8B393 | | Comprehensive test and Viva-voce-III  ( 2 Mids-Test (20M) and vivA (10M)and End Semester Test (50M) andViva(20M) = 70) | | 1 | 0 | | 0 | | | 1 | 30 | | | 70 | |
| 11 | | Proj,Sem, interns, viva | | ME | 8B387 | | Technical Seminar III | | 0 | 0 | | 2 | | | 1 | 100 | | |  | |
|  | |  | |  |  | | **Total** | | **14** | **3** | | **8** | | | **21** | **400** | | | **700** | |

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|  |  |  | **A20- Course Structure for B. Tech.(Mech) -II Year – II Semester( 4th Semester)** | | | | |  |  |  |
| **Sl.No** | **AICTE Categery** | **Dept Course** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | ES | EEE | 8AC48 | Elements of Electrical & Electronics Engineering | 3 | 0 | 0 | 3 | 30 | 70 |
| 2 | ES | CSE | 8EC41 | Java Programming | 2 | 1 | 0 | 3 | 30 | 70 |
| 3 | HS&MS | S&H | 8HC17 | Universal Human Values | 2 | 1 | 0 | 3 | 30 | 70 |
| 4 | PC | ME | 8B409 | Manufacturing Processes | 3 | 0 | 0 | 3 | 30 | 70 |
| 5 | PC | ME | 8B410 | Kinematics of Machinery | 2 | 1 | 0 | 3 | 30 | 70 |
| 6 | PC | ME | 8B411 | Fluid Mechanics and Hydraulic Machinery | 2 | 0 | 0 | 2 | 30 | 70 |
| 7 | HS&MS | S&H | 8HC03 | Soft Skills | 1 | 0 | 0 | 1 | 30 | 70 |
| 8 | HS&MS | S&H | 8HC63 | Soft Skills Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 9 | ES | EEE | 8AC95 | Electrical & Electronics Engineering lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 10 | PC | ME | 8B465 | Manufacturing Processes Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 11 | PC | ME | 8B466 | Fluid Mechanics and Hydraulic Machinery Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 12 | CVV | ME | 8B494 | Comprehensive test and Viva-voce-IV | 1 | 0 | 0 | 1 | 30 | 70 |
| 13 | TS | ME | 8B488 | Technical Seminar IV | 0 | 0 | 2 | 1 | 100 |  |
| 14 | Proj,Sem, interns, viva | ME |  | Summer Industry Internship-I  **(Internal Evaluation only in III Year - I Sem (2 Internal Reviews (30 M) and External Evaluation (70M) )** | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | **Total** | **16** | **3** | **10** | **24** | **460** | **840** |

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|  |  |  | **A20-Course Structure for B. Tech.(Mech.)-III Year – I Semester (5th Semester)** | | | | |  | | |
| **S.No** | **AICTE Category** | **Dept Course** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  |  |  | **CIE** | **SEE** |
|  |  |  |  |  |  |  |  |  |  |  |
| 1 | MC | ME | 8FC24 | Cyber Security (Grade Award) | 2 | 0 | 0 | 0 | 30 | 70 |
| 2 | PC | ME | 8B512 | Applied Thermodynamics-I | 2 | 1 | 0 | 3 | 30 | 70 |
| 3 | PC | ME | 8B513 | Dynamics of Machinery | 2 | 1 | 0 | 3 | 30 | 70 |
| 4 | PC | ME | 8B514 | Metal Cutting and Machine Tools | 3 | 0 | 0 | 3 | 30 | 70 |
| 5 | PC | ME | 8B515 | Design of Machine Members -I | 2 | 1 | 0 | 3 | 30 | 70 |
| 6 | PE | ME |  | Professional Elective-I | 3 | 0 | 0 | 3 | 30 | 70 |
| 7 | OE | OTHER |  | Open Elective-I | 2 | 0 | 0 | 2 | 30 | 70 |
| 8 | PC | ME | 8B568 | Applied Thermodynamics Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 9 | PC | ME | 8B569 | Machine Tools Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 10 | PC | ME | 8B570 | KOM & DOM Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 11 | Intern | ME | 8B567 | Summer Industry Internship-I (Internal Evaluation only) | 0 | 0 | 0 | 1 | 30 | 70 |
|  |  |  |  | **Total** | **16** | **3** | **6** | **21** | **330** | **770** |

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|  |  |  | **A20-Course Structure for B. Tech.(Mech.)-III Year – II Semester (6th Semester)** | | | | |  | | |
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| **S.No** | **AICTE Category** | **Dept Course** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  |  |  | **CIE** | **SEE** |
|  |  |  |  |  |  |  |  |  |  |  |
| 1 | MC | ME | 8EC75 | Artificial Intelligence(Grade Award) | 2 | 0 | 0 | 0 | 30 | 70 |
| 2 | PC | ME | 8B620 | Applied Thermodynamics-II | 2 | 1 | 0 | 3 | 30 | 70 |
| 3 | PC | ME | 8B621 | CAD/CAM | 3 | 0 | 0 | 3 | 30 | 70 |
| 4 | PC | ME | 8B622 | Design of Machine Members -II | 2 | 1 | 0 | 3 | 30 | 70 |
| 5 | PC | ME | 8B623 | Heat Transfer | 2 | 1 | 0 | 3 | 30 | 70 |
| 6 | PE | ME |  | **Professional Elective-II** | 3 | 0 | 0 | 3 | 30 | 70 |
| 7 | **OE** | OTHER |  | **Open Elective-II** | 2 | 0 | 0 | 2 | 30 | 70 |
| 8 | PC | ME | 8B671 | CAD/CAM Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 9 | PC | ME | 8B672 | Heat Transfer Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 10 | PC | ME | 8B673 | Group Project | 0 | 0 | **2** | 1 | 30 | 70 |
| 11 | PC | ME | 8B695 | Comprehensive Viva-voce-II | 0 | 1 | 0 | 1 | 30 | 70 |
| 12 | PC | ME |  | Summer Industry Internship-II (Internal Evaluation only in IV Year - I Sem (2 Internal Reviews (30 M) and External Evaluation (70M)) | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **Total** | **16** | **4** | **6** | **21** | **330** | **770** |

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|  |  |  | **A20-Course Structure for B. Tech.(Mech.) -IV Year – I Semester (7th Semester)** | | | | |  |  |  |
| **S.No** | **AICTE Categery** | **Dept Course** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | PC | ME | 8B728 | Additive Manufacturing Processes | 3 | 0 | 0 | 3 | 30 | 70 |
| 2 | PC | ME | 8B729 | Robotics | 3 | 0 | 0 | 3 | 30 | 70 |
| 3 | PC | ME | 8B730 | Finite Element Methods | 2 | 1 | 0 | 3 | 30 | 70 |
| 4 | PC | ME | 8B731 | Metrology and Instrumentation | 3 | 0 | 0 | 3 | 30 | 70 |
| 5 | PE | ME |  | **Professional Elective-III** | 3 | 0 | 0 | 3 | 30 | 70 |
| 6 | PE | ME |  | **Professional Elective-IV** | 3 | 0 | 0 | 3 | 30 | 70 |
| 7 | PC | ME | 8B774 | M&I Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 8 | PC | ME | 8B775 | CAE Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 9 | **PC** | ME | 8B776 | Production Drawing Practice Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 10 | Proj, Sem, | ME | 8B768 | Summer Industry Internship-II | --- | --- | --- | 1 | 30 | 70 |
| interns, viva | (Internal Evaluation only) |
|  |  |  |  | **Total** | **17** | **1** | **6** | **22** | **300** | **700** |

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|  |  |  | **A20-Course Structure for B. Tech.(Mech.) -IV Year – II Semester (8th Semester)** | | | | |  |  |  |
| **S.No** | **AICTE Categery** | **Dept Course** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | PE-V | ME |  | **Professional Elective –V** | 3 | 0 | 0 | 3 | 30 | 70 |
| 2 | OE | OTHER |  | **Open Elective-III** | 2 | 0 | 0 | 2 | 30 | 70 |
| 3 | Sem, interns, viva | ME | 8B877 | **Major Project** | - | - | 10 | 5 | 30 | 70 |
|  |  |  |  | **Total** | **5** | **0** | **10** | **10** | **90** | **210** |

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| **Professional Elective Streams** |  | **Professional Electives (PE)** | | | | | | | | |
| **Course  Code** | **PE– I** | **Course  Code** | **PE – II** | **Course  Code** | **PE – III** | **Course  Code** | **PE – IV** | **Course  Code** | **PE – V** |
| **(3-1)** | **(3-2)** | **(4-1)** | **(4-1)** | **(4-2)** |
| **Design &IE** | **8B516** | Fluid Power System(FPS) | **8B624** | Mechanical Vibrations(MV) | **8B731** | MEMS | **8B735** | Industrial Management(IM) | **8B839** | Composites |
| **Thermal** | **8B517** | Power Plant Engineering(PPE) | **8B625** | RAC(Refrigeration & Air Conditioning) | **8B732** | Renewable Energy Sources(RES) | **8B736** | Computational Fluid Dynamics(CFD) | **8B840** | Jet Propulsion & Rocket Engineering (JPRE) |
| **Manufacturing** | **8B518** | Operation Research((OR) | **8B626** | Unconventional Machining(UM) | **8B733** | Production Planning and Control(PPC) | **8B737** | Automation in Manufacturing(AIM) | **8B841** | Mechatronics |
| **Automobile  Engineering** | **8B519** | Automotive Chassis | **8B627** | Automotive Engines | **8B734** | Automotive Electrical & Electronics | **8B738** | Vehicle Dynamics | **8B842** | Alternate Fuels |

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| **Open Elective Streams** |  | **Open Elective (OE)** | | | | |
| **Course  Code** | **OE– I** | **Course  Code** | **OE – II** | **Course  Code** | **OE – III** |
|  | **(3-1)** | **(3-2)** | **(4-2)** |
| **Entrepreneurship Stream** | **8ZC22** | Basics of Entrepreneurship | **8ZC23** | Advanced Entrepreneurship | **8ZC24** | Product and Services |
| **Social Sciences Stream** | **8ZC25** | Basics of Indian Economy | **8ZC26** | Basics of Polity | **8ZC27** | Indian History, Culture and Geography |
| **Innovation and Design Thinking Stream** | **8ZC08** | Design literacy and Design Thinking | **8ZC09** | Co-Creation and Product Design | **8ZC10** | Entrepreneurship & Business Design |
| **Finance Stream** | **8ZC05** | Banking Operations, Insurance and Risk Management | **8ZC19** | Entrepreneurship Project Management and Structured Finance | **8ZC15** | Financial Institutions, Markets and Services |
| **ECE** | **8CC56** | Fundamental of Digital Circuits and Microprocessors | **8DC43** | Introduction to VLSI Design | **8DC44** | Internet of things( IOT) |
| **CSE** | **8EC74** | Database systems Concepts | **8EC76** | Operating Systems Concepts | **8EC77** | Computer Networks |
| **EEE** | **8AC46** | Control System Engineering | **8AC36** | Special Machines | **8AC44** | Fundamentals of Measurements and Instrumentation |

**VISION**

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| **To emerge as a renowned centre in Mechanical Engineering by following the best practices in teaching, learning and research.** |

**MISSION OF THE MECHANICAL ENGINEERING DEPARTMENT**

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| **M1** | **To Provide good academic environment for pursuing high quality undergraduate, Post graduate and Doctoral programs in mechanical engineering to prepare our graduates for outstanding successful professional career.** |
| **M2** | **To become a continuous learning center by providing service to the practicing engineers from industry , academia and professional technical societies through the Industry -Institute interaction activities.** |
| **M3** | **To ensure that our students be trained in interpersonal & communication skills, team work, professional ethics, IPR, practical industry training by providing campus training programs related to both placement and co-extra curricula activities.** |
| **M4** | **To Conduct and proliferate high quality research work to the students for their lifelong learning in developing quality solutions to society problems.** |

**B.Tech.(Mechanical Engineering) Program Educational Objectives**

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| **PEO1** | **Preparation & Learning Environment: To prepare graduates with the strong fundamentals in basic science and engineering by providing an effective academic learning environment to excel in postgraduate programs and professional career.** |
| **PEO2** | **Core Competence: To provide graduates with a solid foundation in the core mechanical engineering fundamentals that are required to solve engineering problems and also pursue higher studies or to succeed in the industry profession.** |
| **PEO3** | **Breadth: To train graduates with multi-disciplinary engineering knowledge so as to comprehend, analyze, design, and create novel products and solutions for the real life problems.** |
| **PEO4** | **Professionalism: To inculcate ethical attitude, communication skills, teamwork skills, life-long learning skills, and multidisciplinary approach in graduates to succeed in the professional career and society at large.** |

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

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| **PO1** | **ENGINEERING KNOWLEDGE: Graduate can apply the knowledge of the fundamentals of mathematics, science and engineering for solutions of the problems.** |
| **PO2** | **PROBLEM ANALYSIS: Graduate can identify, formulate and solve problems in the key areas of Design, Production and Thermal Engineering.** |
| **PO3** | **DESIGN / DEVELOPMENT OF SOLUTIONS: Graduate can design, analyze and conduct experiments, and interpret the data in the areas of Mechanical Engineering.** |
| **PO4** | **CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS: Graduate can conduct investigations and solve problems using research based knowledge and methods to arrive at logical conclusions.** |
| **PO5** | **MODERN TOOLS USAGE: Graduate can use the skills of IT tools, software and modern engineering equipment for analyzing the problems in Mechanical Engineering.** |
| **PO6** | **THE ENGINEER AND SOCIETY: Graduate can demonstrate the impact of engineering solutions on the society problems related to health, safety, legal, and social issues.** |
| **PO7** | **ENVIRONMENT AND SUSTAINABILITY: Graduate can demonstrate the impact of professional engineering solutions in environmental context and respond effectively to the needs of sustainable development.** |
| **PO8** | **PROFESSIONAL ETHICS: Graduate can implement the principles of ethics & human values in the professional responsibilities.** |
| **PO9** | **INDIVIDUAL AND TEAM WORK: Graduate able to work effectively as an individual , a team member and a leader in multidisciplinary settings.** |
| **PO10** | **COMMUNICATION: Graduate able to write critique samples (abstract, executive summary, project report), and make effective presentations among the engineering community and society at large.** |
| **PO11** | **PROJECT MANAGEMENT AND FINANCE: Graduate can demonstrate the knowledge of project management & finance, and handle various projects in both own discipline and multidisciplinary environments.** |
| **PO12** | **LIFE-LONG LEARNING: Graduate recognizes the need of self-learning skills and utilize them in lifelong learning.** |

**B.Tech.(Mechanical Engineering) Program Specific Outcomes**

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| --- | --- |
| **PSO1** | **Graduate can apply the concepts of basic Mechanical Engineering courses for choosing professional career in Mechanical Engineering and allied disciplines.** |
| **PSO2** | **Graduate can design and analyze the technological problems and solutions specific to Thermal, Manufacturing and Product Design areas using conceptual, simulation and practical tools.** |
| **PSO3** | **Graduate can adapt emerging Mechanical and IT based Technologies to develop innovative solutions to varied problems, enabling graduate for lifelong learning that leads to successful career in industry / R&D / academics.** |

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**Cyber Security**

**(Mandatory Course)**

**Code: 8FC24**

**L T P/D C**

**2 0 0 0**

**Prerequisite : Nil**

**Course Objectives:**

* To familiarize with network security, network security threats, security services, and countermeasures.
* To be aware of computer security and Internet security.
* To study the defensive techniques against these attacks.
* To familiarize with cyber forensics.
* To be aware of cyber crime related to mobile and laptop etc.
* To acquire knowledge relating to Cyberspace laws and Cyber crimes.
* To understand ethical laws of computer for different countries, Offences under the Cyberspace and Internet in India.

**Course Outcomes:**

**At the end of this course the student will be able to**

1. The students will be able to understand cyber-attacks, types of cybercrimes.
2. Realize the importance of cyber security and various forms of cyber attacks and countermeasures.
3. Get familiar of cyber forensics.
4. Get familiar with obscenity and pornography in cyber space and understand the violation of Right of privacy on Internet.
5. Cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.
6. Elucidate the various chapters of the IT Act 2008, power of Central and State Government to make rules under IT Act 2008.

**UNIT-I: Introduction to cyber Security**

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc.,

**UNIT-II: Cyber Forensics:**

Introduction to cyber forensic, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

**UNIT-III: Cybercrime: Mobile and Wireless Devices:**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops and desktop.

**UNIT-IV: Cyber Security: Organizational Implications:**

Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

**Cybercrime and Cyber terrorism:** Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

**UNIT-V: Privacy Issues:**

Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

**UNIT-VI: Cyberspace and the Law &Miscellaneous provisions of IT Act.**

Introduction to Cyber Security Regulations, International Law. The INDIAN Cyberspace, National Cyber Security Policy. Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threats.

Other offences under the Information Technology Act in India, The role of Electronic Evidence and miscellaneous provisions of the IT Act.2008.

**Cybercrime: Examples and Mini-Cases**

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

**TEXT BOOKS:**

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley

1. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

**REFERENCE BOOKS:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

3. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)”, 2ndEdition, O’ Reilly Media, 2006.

4. Wenbo Mao, “Modern Cryptography – Theory and Practice”, Pearson Education, New Delhi, 2006.

5. Cyberspace and Cybersecurity, George Kostopoulos, Auerbach Publications, 2012.

6. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes, Second Edition, Albert Marcella, Jr., Doug Menendez, Auerbach Publications, 2007.

7. Cyber Laws and IT Protection, Harish Chander, PHI, 2013

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**APPLIED THERMODYNAMICS-I**

**Code: 8B512**

**L T P/D C**

**2 1 --- 3**

**Pre-requisite:** Thermodynamics

**Course Objective:**

To understand the working principles of 2-stroke and 4-stroke cycles, combustion processes of S.I and C.I Engines, working principles of compressors*.*

**Course Outcomes:**

After studying this course, the students will be able to:

1. *Compare the air standard, actual and the fuel-air cycles of Internal Combustion Engines.*
2. *Classify IC Engines, understand the working principles of 2-stroke and 4-stroke cycles, draw valve and port timing diagrams and explain different engine subsystems.*
3. *Understand the combustion process in S.I and C.I Engines, the phenomenon of knocking, factors affecting knocking, and different types of combustion chambers for S.I and C.I Engines,*
4. *Understand the performance parameters, methods of measurement of brake and friction power and Draw the heat balance diagram.*
5. *Understand the working principles of Roots blower, vaned blower, reciprocating compressor-single stage and multi-stage compression with inter cooling.*
6. *Understand the working principles of centrifugal and axial compressors and draw the velocity diagram and calculate the Compressor Power input and efficiency.*

**UNIT – I**

**Ideal cycles and Actual Cycles and their Analysis:** Introduction, Air Standard cycles -otto cycle, diesel cycle and dual cycle , problems on ideal cycles and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down - Loss due to Gas exchange process, Volumetric Efficiency, Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines

**I.C. Engines :**Classification - Working principles, Valve and Port Timing Diagrams, Engine systems – Fuel Carburetor, Fuel Injection System, Multipoint fuel Injection, Ignition, Cooling and Lubrication. *Applications: These topics will give broader view of working of IC engines.*

**UNIT – II**

**Combustion in S.I. Engines :**Normal Combustion and Abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of ) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types. *Applications: These concepts are useful for achieving deeper knowledge about normal and abnormal combustion in SI and CI engines.*

**Combustion in C.I. Engines :**Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

**UNIT – III**

**Testing and Performance :**Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart. *Applications: These topics will tell in greater detail about the performance evaluation of IC engines.*

**UNIT –IV**

**Compressors** – Classification –positive displacement and roto-dynamic machinery – power absorbing machines, fan such as blower and compressor – reciprocating and rotary types.

**Reciprocating:** Principles of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, stage compression, under cooling, saving of work, minimum work condition for stage compression. *Applications: These topics will discuss on the design and applications of reciprocating air compressors.*

**UNIT V**

**Centrifugal Compressors:**  Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape- losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power input calculations.

**Axial Flow Compressors:** Mechanical details and principle of operation – velocity triangles and energy transfer per stage, degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency. *Applications: This unit will bring in differences between reciprocating and rotary compressors. Theses compressors are employed in land based power plants and aircraft engines.*

**UNIT VI**

**REFRIGERATION AND AIR CONDITIONING:**  
Refrigerants - Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide – water systems (Description only) . Air conditioning system - Processes, Types and Working Principles. - Concept of RSHF, GSHF, ESHF

**TEXT BOOKS:**

1. I.C. Engines / V. GANESAN- TMH

2. Thermal Engineering / Rajput / Lakshmi Publications.

**REFERENCES:**

1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.

2. Thermodynamics & Heat Engines / B. Yadav/ Central Book Depot.,Allahabad

3. I.C. Engines / Heywood /McGraw Hill.

4. IC Engines/ Ramalingam/ Scitech publishers

5. “A Treatise on Turbo Machines”,G.Gopalakrishnan, &D.Prithviraj, Scitech

Publications (India) Pvt. Limited (2002.)

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**DYNAMICS OF MACHINERY**

**Code: 8B513**

**L T P/D C**

2 **1 -- 3**

**Pre-requisite:** Kinematics of Machinery

**Course Objectives**

*The main objective of this course is intended to cover the field of engineering theory, analysis, design and practice that is generally described as dynamics of machinery.*

**Course Outcomes**

*After completing the subject, students will be able to*

* *Understand the phenomenon of friction and in developing different applications like, brakes, clutches and dynamometers etc. [CO1]*
* *Understand the effect of precession motion on the stability of moving vehicles. [CO2]*
* *Understand and development of speed controlling devices like flywheel. [CO3]*
* *Understand how to control speed in engines or turbines by governors. [CO4]*
* *Understand how to balance different systems, machines and engines. [CO5]*
* *Understand how to do analysis of different vibrating systems. [CO6]*

**UNIT – I: FRICTION, CLUTCHES, BRAKES & DYNOMOMETERS:**

**FRICTION**: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis : lubricated surfaces, boundary friction, film lubrication.

**CLUTCHES:** Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

**BRAKES AND DYNAMOMETERS:** Simple block brakes, internal expanding brake, band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of operations.

**UNIT – II**

**GYROSCOPIC AND PRECESSIONAL MOTION:**

Static and dynamic force analysis of planar mechanisms.

Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

**UNIT –III**

**TURNING MOMENT DIAGRAM AND FLY WHEELS:**

Dynamics of Reciprocating Parts,Turning moment – Inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – Fly wheels and their design.

**UNIT-IV**

**GOVERNERS:**

Watt, Porter and Proell governors. Spring loaded governors – Hartnell and hartung with auxiliary springs. Sensitiveness, isochronism and hunting. Quality and stability of governors.

**UNIT – V**

**BALANCING:**

**Balancing of rotating masses:** Single plane and multiple mass systems – Multi mass in different parallel planes.

**Balancing of Reciprocating Masses:** Primary, Secondary, and higher balancing of reciprocating masses.Analytical and graphical methods. Unbalanced forces and couples – examination of “V” multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing – Hammer blow,Swaying couple, variation of tractive efforts. Field balancing.

**UNIT – VI**

**VIBRATION:** Introduction, Definitions, Types of vibrations, Natural frequency,Free longitudinal vibrations, Spring –rotor systems. Equation of motion , Energy methods, Free & forced damped vibrations, Vibration Isolation & Transmissibility, Transverse vibrations Whirling of shafts, critical speeds, Dunkerleys method .Torsional vibrations, two and three rotor systems. Multi rotor system – Amplitude ratios

**TEXT BOOKS:**

1. Theory of machines and mechanisms-vicker, Shigley

2. Theory of Machines / S.S Rattan/ McGraw Hill Publ.

**REFERENCES:**

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**METAL CUTTING & MACHINE TOOLS**

**Code: 8B514**

**L T P/D C**

**3 -- --- 3**

**Pre-requisites:** Manufacture Processes

**Course Objectives:**

To teach students the fundamental concepts of Additive Manufacturing, techniques involved and their advantages and limitations and various applications of these technologies in relevant fields such as mechanical, Bio-medical, Aerospace, electronics etc.

**Course Outcomes:**

After completing the subject, students will be able to:•Understand the basic metal cutting process and parameters, Forces in metal cutting ,various chips, tool materials, basic relations in metal cutting [CO1]•Understand the thermal aspects of metal cutting, tool wear, tool life, various cuttingtool materials and economic analysis of machining [CO2]•Understand the principle and working of lathe, shaping, planning, slotting machinesand Drilling machines and estimate the machining time [CO3]•Understand the principle and working of Milling machine and Broaching machine[CO4]•Understand the principle and working of Grinding machine, Lapping and Honingmachine [CO5]•Understand the principle of Jigs & Fixtures and the principles of advancedmachining processes[CO6]

**UNIT – I**

Metal cutting theory – Elements of cutting process, cutting speeds, feed, depth of cut, Geometry of single point tool and angles, Orthogonal and Oblique machining, Mechanism of Chip formation-shear angle relation, types of chips, Velocity relationship, chip breakers-types, Mechanics of orthogonal cutting –Merchant’s Force diagram-derivations of forces, stress and strain in chip, Work done in cutting, Horsepower calculation, Popular metal cutting theories-Ernst & merchant and Lee &Shaffler - Problems

**UNIT – II** Sources of heat in metal cutting, Failure of cutting tool and Tool wear, Tool life-Taylor’s Equation- Problems, Factors effecting tool life, Cutting Fluids-Functions, qualities, types, Machinability, Machinability index, Cutting tool materials-properties and types, Economics of machining – Tool life for minimum cost and maximum production – Problems

**UNIT – III**

Lathe – Principle of working, types of lathe, Parts of Lathe, specification of lathe, Lathe operations, Taper turning & thread turning-estimation of machining time

Shaping - Principal parts, Principles of working – Quick return mechanisms, operations performed, machining time calculations. Planing and slotting machines –Principle of working, operations performed and comparison wrt shaper

Drilling – type of drilling machines, parts of radial drilling machines, various hole making operations –Elements & angles of twist drill – estimation of Machining time

**UNIT – IV**

Milling machine – Principle of working, Milling methods–Up & Down Milling, Various Milling operations, Geometry of End milling cutter, Indexing heads, Indexing Methods: direct, plain, differential and angular indexing Problems – estimation of Machining time in milling.

Broaching -Types-Classification-Broach elements-Advantages-Limitations.

**UNIT –V**

Grinding machine – cutting action – classification of grinding machines – cylindrical and surface grinding machine –Different types of abrasives and bonds, symbolic representation of bonds, grit, grade and structure, method of Specifying grinding wheel and selection of a grinding wheel, Loading and glazing of grinding wheels, Truing and Dressing the grinding wheels, Lapping, Honing and burnishing – principle, methods and applications

**UNIT - VI**

Jigs and fixtures- Differences, Need, Elements of Jigs & Fixtures, Main Principles of location and clamping: 3-2-1 location principle – Types of Locating and clamping devices, Types of Jigs and Fixtures.

Unconventional Machining: Principles of working and applications of USM, AJM, EDM, ECM, LBM and EBM.

**TEXT BOOKS:**

1. A course in Workshop Technology Vol II (Machine tools) – B.S.RaghuVamshi – DhanpatRai& Co.

2. Production Technology by R.K. Jain and S.C. Gupta.

**REFERENCES:**

1. Manufacturing Science, AmithabhaGhosh and Mallik, Affiliated East West Press

Production Engineeing / P.C.Sharma / S.Chand& Co

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**DESIGN OF MACHINE MEMBERS – I**

**Code: 8B515**

**L T P/D C**

**3 1 --- 4**

**Course Objectives:**

1. Students will learn the mechanical design process / philosophy, the need for and use of standards as part of the same, the selection of materials for mechanical design.
2. Students will learn to design mechanical components subjected to static and variable loading, apply related theories of failure to design based on strength and rigidity; and apply the concepts thereof to design of various fundamental mechanical components.

**Course Outcomes:**

*After completing the subject, students will be able to:*

* Use different theories of failure for designing machine members subjected to steady loads and fatigue loads.[CO1]
* Use different criteria of failure for designing machine members subjected to fatigue loads.[CO2]
* Develop ability to analyze, design and select shafts, keys, couplings, cotter and knuckle joints.[CO3]
* Able to analyze and design the helical coiled and leaf springs.[CO4]
* Identify the applications where Temporary (threaded and bolted) joint and permanent (riveted ) joints are used for various applications - with attention  to design requirements.[CO5]
* able to design and analyze various Welded joints [CO6]

**UNIT I: Introduction:**

Basic design process and requirements of machine design, use of standards in design, design synthesis; Engineering materials, stress-strain diagrams, mechanical properties of engineering materials; Materials selection techniques. Design for Tolerances of manufacturing.

**Design against static loading:**

Stresses due to axial loads, bending moment, torsional moment and eccentric axial loading, factor of safety, principal stresses, theories of elastic failure; Design of shafts under combined loading , Design of shafts carrying pulleys, gears etc.., Design for strength and rigidity, concept of stiffness in tension / compression, bending and torsion

**UNIT II: Design against Fluctuating Loads:**

Stress concentration & its factors, fluctuating stresses, fatigue failure, endurance limit, Soderberg, Goodman, Modified-Goodman and Gerber criterion, Fatigue design under combined stresses. Design for finite and infinite life. Shaft design against fluctuating and shock loads.

**UNIT III: Design of Keys, Couplings and Joints:**

Types of keys, Design of saddle, sunk, feather, Woodruff and Kennedy keys.

Design of couplings – Muff and Split Couplings, Flange, Flexible and Marine type of couplings.

Design of cotter joint and knuckle joint

**UNIT IV: Design of springs:**

Types of springs, terminology of helical spring, stress and deflection equations, spring materials, helical spring design against static and fluctuating loads, concentric springs, surge in springs.

Design of Leaf springs, Materials for Springs.

**UNIT V: Design of Joints -I:**

**Design of Threaded joints:** Design of bolts and nuts, locking devices, bolt of uniform strength, design of gasket joints, design of power screws and screw jack Bolted joint design with static loads and fluctuating loads, eccentrically loaded bolted joints. Design of Nuts

**Design of Riveted joints:** Types riveted joints, failures of riveted joints, design of lap and butt riveted joints, Eccentric loading of riveted joints.

**UNIT VI: Design of Joints - II:**

**Welded joints:** Types of welded joints, strength of butt and fillet joints, axially loaded symmetrical and unsymmetrical welded joints, bending moment and tensional moment, welded joints subjected to eccentric and variable loading.

**TEXTBOOKS:**

1. **Design of Machine Elements** – Third Edition / V.B.Bhandari / Tata McGraw-Hill Pub.
2. **Mechanical Engineering Design** / J.E.Shigley, C.R.Mischke / Tata McGraw-Hill Pub.
3. Materials Selection in Mechanical Design / Michael F. Ashby
4. Mechanical Design Handbook/PSG

**REFERENCE BOOKS:**

**Fundamentals of Machine Elements** / Bernard Hamrock, Steven Schmid, Bo Jacobson / Tata McGraw Hill

1. A Text of Machine Design – R S Khurmi
2. Design of machine Elements -Kulakarni

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**FLUID POWER SYSTEMS**

(Professional Elective Course – I)

**Code: 8B516**

**L T P/D C**

**3 -- --- 3**

**Pre-requisites:** Fluid Mechanics and Hydraulics Machinery

**Course Objectives:**After doing this, student should be able to

Understand the Properties of fluids, Fluids for hydraulic systems, governing laws. distribution of fluid power,

Design and analysis of typical hydraulic circuits.

Know accessories used in fluid power system, Filtration systems and maintenance of system.

**Course Outcomes:**

Co1: Understand the types of Fluid Power Systems

Co2: Understandthegain knowledge of Hydraulic System

Co3: Demonstrate varies control valves of Fluid Power Systems

Co4:Demonstrate Fluid Power Circuits

Co5: Understand the pneumatic Systems

Co6: Understandthe typical Hydro-pneumatic Circuits for Industrial Applications

**UNIT-I:**

Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations. ISO symbols, energy

losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors.Pump and motor analysis.Performance curves and parameters.

**UNIT-II:**

Hydraulic actuators, types and constructional details, lever systems, control elements – direction, pressure and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and Design.

**UNIT-III:**

Proportional control valves and servo valves. Nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities). Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits,Synchronization circuits, and accumulator sizing.

**UNIT-IV:**

Intensifier circuits Meter-in, Meter-out and Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system, Filtration systems and maintenance of system.

**UNIT-V:**Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems. Development of single and multiple actuator circuits. Valves for logic functions; Time delay valve; Exhaust and supply air throttling;

**UNIT-VI:**

Examples of typical circuits using Displacement – Time and Travel-Step diagrams. Will-dependent control, Traveldependent control and Time-dependent control, combined control, Program Control, Electro-pneumatic control and air-hydraulic control, Ladder diagrams. Applications in Assembly, Feeding, Metalworking, materials handling and plastics working.

**Textbooks:**

1. Fundamentals of Fluid Power Control by John Watton, 1stEd. Cambridge University Press, 2009 Prerequisit

2. Fluid Power Control by Blackburn J. F.,G.Reethof, and J. L.Shearer, New York: Technology Press of M. I.T.and Wiley.

3. Fluid Power with applications by Anthony Esposito, Pearson Education.

**Reference Books:**

1. Hydraulic operation and control of Machine tools by Ian Mencal, Ronald Press.

2. Hydraulic and Pneumatic power for production by Sterwart, Industrial Press.

3. Fundamentals of Pneumatics/electropeumatics by Hasebrink J.P., and Kobler R., FESTO Didactic publication

No. 7301,Esslingen Germany, 1979.

4. Pneumatic Control-An introduction to the principles by Werner Deppert and Kurt Stoll, Vogel-Verlag.

5. The analysis and Design of Pneumatic Systems by Blaine W.Andersen, John Wiley

6. Oil Hydraulic Power and its Industrial Applications by Ernst, W., New York: McGraw Hill.

7. Design of Hydraulic Control Systems by Lewis E.E., and H.Stern, New York: McGraw Hill.

8. Electro hydraulic Servomechanism by Morse A. C., New York: McGraw Hill.

9. Fluid Power Control systems by Pippenger, J.J., and R.M.Koff, New York: McGraw Hill.

10. Fluid Power Control Systems by Fitch, Jr. E.C., New York: McGraw Hill.

11. Hydraulic and Pneumatic Control of Machine Tools by Khaimovitch,

12. Fluid Power Systems: modeling, simulation and microcomputer control by John Watton, Prentice Hall

International.

13. Hydraulic control systems by Herbert E. Merritt, John Wiley and Sons Inc

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**POWER PLANT ENGINEERING**

(Professional Elective Course**- I)**

**Code: 8B517**

**L T P/D C**

**3 -- --- 3**

**Pre-requisites :Thermodynamics and Fluid Mechanics**

**Course Objectives:**

The goal of this course is to become prepared for professional engineering design of conventional and alternative power-generation plants. The learning objectives include

1. Analysis and preliminary design of the major systems of conventional fossil-fuel steam-cycle power plants.

2. A working knowledge of the basic design principles of nuclear, gas turbine, combined cycle, hydro, wind,

geothermal, solar, and alternate power plants.

3. Awareness of the economic, environmental, and regulatory issues related to power generation.

**Course Outcomes:**

Co1: Acquire the basics of sources of Energy and combustion processes

Co2: Evaluate the details of Internal combustion engine Plants

Co3: Demonstrate hydro Electric Power Plant

Co4: Realize the significance of Non Conventional Energy plants

Co5: Understand the working o nuclear power plant

Co6: Explain the economics and environmental issues of various power plants

**UNIT – I:**

Introduction to the Sources of Energy – Resources and Development of Power in India.**Steam Power Plant :** Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

**Combustion Process:** Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader

stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system,cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

**UNIT – II:**

**Internal Combustion Engine Plant:**

DIESEL POWER PLANT: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel

supply system, air starting equipment, lubrication and cooling system – super charging. **Gas Turbine Plant:**

Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison. **Direct Energy Conversion:** Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

**UNIT – III:**

**Hydro Electric Power Plant:** Water power – Hydrological cycle / flow measurement – drainage area

characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

**Hydro Projects And Plants:** Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

**UNIT – IV:**

**Power From Non-Conventional Sources:** Utilization of Solar- Collectors- Principle of Working, Wind Energy – types –HAWT, VAWT -Tidal Energy.

**UNIT – V:**

**NUCLEAR POWER STATION:** Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor

operation.**Types of Reactors:** Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast

Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

**UNIT – VI:**

**Power Plant Economics And Environmental Considerations**: Capital cost, investment of fixed charges,

operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of

connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises.Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution

control.

**TEXT BOOKS:**

1. Power Plant Engineering by P.C.Sharma, S.K.Kataria Pub

2. A Course in Power Plant Engineering by Arora and S. Domkundar

**REFERENCE BOOKS:**

1. A Text Book of Power Plant Engineering by Rajput, Laxmi Publications

2. Power plant Engineering by Ramalingam, Scietech Publishers

3. Power Plant Engineering by P.K.Nag, II Edition, TMH.

4. An Introduction to Power Plant Technology bby G.D. Rai.

5. Power plant Engineering by Elanchezhian, I.K. International Pub

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**OPERATIONS RESEARCH**

(Professional Elective Course-1**)**

**Code: 8B518**

**L T P/D C**

**3 -- --- 3**

**Prerequisites:** None

**Course Objectives:**

Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.

**Course Outcome:**

CO1: Learns various OR methods and modeling of Job allocation with Linear program

CO2: Analyze the transportation and Assignment models

CO3: Lear sequencing and Replacement models

CO4: Understand theory of gaming and inventory model

CO5: Demonstrate various waiting models and their limitations

CO6: Understand the basics of dynamic programming

**UNIT – I:**

Development – Definition– Characteristics and Phases – Types of models – Operations Research models –

applications.

**ALLOCATION:** Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

**UNIT – II:**

**TRANSPORTATION PROBLEM:** Formulation – Optimal solution, unbalanced transportation problem –

Degeneracy.

**Assignment problem:** Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

**UNIT – III:**

**SEQUENCING:** Introduction – Flow **–**Shop sequencing – n jobs through two machines – n jobs through three

machines – Job shop sequencing – two jobs through ‘m’ machines

**REPLACEMENT:** Introduction – Replacement of items that deteriorate with time – when money value is not

counted and counted – Replacement of items that fail completely- Group Replacement.

**UNIT – IV:**

**THEORY OF GAMES:** Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

**INVENTORY:** Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

**UNIT – V:**

**WAITING LINES:** Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

**UNIT-VI:**

**DYNAMIC PROGRAMMING :**Introduction – Terminology- Bellman’s Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

**TEXT BOOKS:**

1. Operation Research by J.K.Sharma, MacMilan.

2. Operations Research by ACS Kumar, Yesdee

**REFERENCE BOOKS:**

1. Operations Research: Methods and Problems by Maurice Saseini, ArhurYaspan and Lawrence Friedman

2. Operations Research by A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi, Pearson Education.

3. Operations Research by Wagner, PHI Publications.

4. Introduction to O.Rby Hillier &Libermann, TMH.

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**AUTOMOTIVE CHASSIS**

(Professional Elective Course-1**)**

**Code: 8B519**

**L T P/D C**

**3 -- --- 3**

**Pre-requisites**

**COURSE OBJECTIVES:**

* • To illustrate the vehicle lay-out and body types
* • To provide the working of transmission systems
* • To learn the basic functionality of final drive, steering and suspension systems
* • To present the construction and working of brake and wheel and tyre assembly

**COURSE OUTCOMES:** After completion of the course, the student should be able to

**CO-1:** Understand the vehicle lay-out and body types

**CO-2:** Comprehend the working of Clutch and gearing system

**CO-3:** Acquire the knowledge of Automatic transmission

**CO-4:** Comprehend the working of driveline system

**CO-5:** learn principles and types of steering and suspension system

CO-6: Demonstrate the construction and working of brake, wheel and tyre assembly

**UNIT – I:**

**Frame and Body:** Classification of automobiles, layout of chassis and sub systems and their role, types of chassis - light, medium and heavy duty vehicle chassis. Role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

**UNIT – II:**

**Clutch and Gear Box:** Types of clutch - single plate clutch, coil spring type and diaphragm spring type, multiple plate clutch, centrifugal clutch and clutch trouble diagnosis. Need for gearbox, types of gear box - sliding mesh, constant mesh and synchromesh, overdrives, transfer case, gear shifting mechanisms and transmission trouble diagnosis.

**UNIT – III:**

**Automatic Transmission:** Need for fluid coupling and torque converters, epicyclical gearbox, automatic transmission – automatic manual transmission, continuously variable transmission and fully automatic transmission, control mechanisms and limitations.

**UNIT – IV:**

**Drive Line and Final Drive:** Propeller shaft drive, torque reaction and drive thrust, Hotchkiss drive, torque tube drive and universal joints. Front axle and its types, stub axle and its types, rear axle and its types. Need for differential, working, non-slip differentials, differential lock and drive line and final drive trouble diagnosis.

**UNIT – V:**

**Steering System:** Principle of steering, Ackerman’s and Davis steering mechanisms, steering layout, types of steering gearbox, types of front axle and stub axle, steering geometry. Purpose, working and types of power steering.

**Suspension System:** Types of suspension - rigid axle suspension and independent suspension, types of suspension spring - leaf spring, coil spring, torsion bar spring, air spring, rubber spring and hydro elastic spring. Role and types of shock absorber, construction and working. Steering and suspension trouble diagnosis.

**UNIT – VI:**

**Brake System:** Stopping distance, time and braking efficiency, effect of weight transfer, braking torque, classification of brakes, drum and disc brakes, construction and working of mechanical, hydraulic, pneumatic, power-assisted brakes and servo brakes. Drum brake and disc brake trouble diagnosis.

**Tyres and Wheels:** Types and construction of wheel, tyre requirements, bias ply and radial ply tyres, tubeless tyres, wheel balancing and tyre rotation.

**TEXTBOOKS:**

1. Advanced Vehicle Technology, by Heinz Heisler, 2nd Edition, Butterworth Heinemann Publishers, 2002

2. Automotive Mechanics, by Giri N K, Khanna Publications, 2008

**REFERENCES:**

1. The Motor Vehicle, by Garrett T K, Newton K. and Steeds W., 13th Edition Butterworth Heinemann Publishers, 2001

2. Automotive Mechanics, by William Crouse and Donald Anglin, 10th Edition, McGraw- Hill Publication, 2010

3. Automotive Mechanics, by Srinivasan S, 2nd Edition, McGraw-Hill Publishing Company Ltd., 2003

4. Automotive Chassis, by Heldt P M, Chilton & Co., 1996

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**BASICS OF ENTREPRENEURSHIP (WADHWANI MODEL)**

(Open Elective-1**)**

**Code: 8ZC22**

**L T P/D C**

**2 0 0 2**

**Course Objective:** The objective of the course is to make students understand the nature of Entrepreneurship, and its importance to business to the engineering students, which will allow them to get the required intuition and interest in starting their own start-up’s

**Course Outcomes:**

1. The students’ will acquire basic knowledge on Skills of Entrepreneurship.
2. The students’ will understand the techniques of selecting the customers through the process of customer segmentation and Targeting
3. Business Models and their validity are understood by the students’.
4. The basic cost structure, Revenue Streams and the pricing strategies are understood by the students’.
5. The students’ will acquire knowledge about the project management and its techniques.
6. The students’ get exposure on marketing strategies and business regulations for the Start up.

**Unit – I: Introduction to Entrepreneurship & Self Discovery: -** Define Entrepreneurship, Entrepreneurship as a Career option, Find your Flow, Stock of Your Means, Characteristics, Qualities and Skills of Entrepreneurship, Effectuation, Principles of Effectuation, Life as an Entrepreneur, Stories of Successful Entrepreneurs.

**Unit – II: Opportunity & Customer Analysis: -** Identify your Entrepreneurial Style, Methods of finding and understanding Customer Problems, Run Problem Interview, Process of Design Thinking, Identify Potential Problems worth Solving, Customer Segmentation, Niche Marketing and Targeting, Craft your Values Proportions, Customer-driven Innovation.

**Unit – III: Business Model & Validation: -** Introduction to Business Models, Lean approach to Business Model Canvas, Blue and Red Ocean Strategies, the Problem-Solution Fit, Build your Solution Demo, Solution Interview Method, Identify Minimum Viable Product (MVP), Product-Market fit test.

**Unit – IV: Economics & Financial Analysis: -** Revenue Analysis, Identify different Revenue Streams and Costs Analysis – Startup Cost, Fixed Cost and Variable Cost, Break Even Analysis, Profit Analysis, Introduction to Pricing, different Pricing Strategies, Sources of Finance, Bootstrapping and Initial Financing, Practice pitching to Investors and Corporate.

**Unit – V: Team Building & Project Management: -** Leadership Styles, Shared Leadership Model, Team Building in Venture, Roles and Responsibilities of team in venture, Explore collaboration tools and techniques, Brainstorming, Introduction to Project Management, Project Life Cycle, Create a Project Plan.

**Unit – VI: Marketing & Business Regulations: -** Positioning, Positioning Strategies, Branding, Branding Strategies, Selecting and Measuring Channels , Customer Acquisition, Selling Process, Selling Skills, Sales Plans. Business regulations – List of Required Registrations, Compliance Check List, Business Structures and Legal Entities.

**References:**

* Robert D Hisrich, Michael P Peters, Dean A Shepherd, Entrepreneurship, Sixth Edition, New Delhi, 2006.
* Thomas W. Zimmerer, Norman M. Scarborough, Essentials of Entrepreneurship And Small Business Management, Fourth Edition, Pearson, New Delhi, 2006
* Alfred E. Osborne, Entrepreneur’s Toolkit, Harvard Business Essentials, HBS Press, USA, 2005.
* MadhurimaLall, ShikhaSahai, Entrepreneurship, Excel Books, First Edition, New Delhi, 2006.
* S.S. Khanka, Entrepreneurial Development, S. Chand and Company Limited, New Delhi, 2007.
* H. Nandan, Fundamentals of Entrepreneurship, Prentice Hall of India, First Edition, New Delhi, 2007.

• S.R. Bhowmik, M. Bhowmik, Entrepreneurship-A tool for Economic Growth   And A   
 key to Business Success, New Age International Publishers, First Edition,  (formerly   
 Wiley Eastern Limited), New Delhi, 2007.

* *https://www.wfglobal.org/*
* [*https://www.learnwise.org/#/IN/en/home/login*](https://www.learnwise.org/#/IN/en/home/login)*,*

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**BASICS OF INDIAN ECONOMY**

(Open Elective-1**)**

**Code: 8ZC25**

**L T P/D C**

**2 0 0 2**

**Course objectives:** To provide basic knowledge relating to the Indian Economy thus making the students aware of the current aspects taking place in the Indian and world economy.

**Course Outcomes**:

1. Gain knowledge relating to Economics, various sectors and its growth
2. Will gain knowledge relating to various concepts of National income and related aggregates
3. Students will learn about Indian Industrial policy and benefits of LPG to India
4. Comprehend knowledge relating to Fiscal policy & Taxation system in India
5. Learn about inflation & business cycles.
6. Know about the BoP and its influence on economy.

**Unit 1:Introduction to Economics**:

Definition, Economics and economy, back ground of economy, sectors of the economy, types of economy, growth of economy, primary moving force of Economic growth in India, mixed economy.

**Unit 2: National Income and related aggregates**

Aggregates related to National Income: Gross National Product (GNP), Net National Product (NNP), Gross and Net Domestic Product (GDP and NDP) - at market price, at factor cost; National Disposable Income (gross and net), Private Income, Personal Income and Personal Disposable Income; Real and Nominal GDP.

**Unit 3: Industrial policy & Liberalization of Economy**

Industrial policy in India, its objectives, Review of Industrial policies up to 1986, Industrial policy 1991 - causes of its implementation, benefits of Liberalization, privatization & Globalization to the Indian economy.

**Unit 4: Fiscal policy & Taxation system**

Fiscal policy- Definition, objectives, importance, setbacks, recent fiscal policy of India, Reforms to strengthen the fiscal policy in India. Taxation system in India, methods of taxation, a good tax system, VAT, GST, Reforms in taxation.

**Unit 5: Inflation & Business Cycles**: Inflation – Definition, types, effects of inflation on various segments of the population and sectors of the economy, measures to control inflation, Business cycles: Introduction, Depression, Recovery, Boom, and Recession.

**Unit 6: Balance of Payments**

Balance of payments account - meaning and components; balance of payments deficit-meaning. Foreign exchange rate - meaning of fixed and flexible rates and managed floating. Determination of exchange rate in a free market

References:.

* Indian Economy, Datt& Mahajan, 70th Edition, Sultan Chand publishers.
* Indian Economy, Misra&Puri, 33rd Edition, Himalaya publishing house.
* Latest Budget document by Ministry of Finance
* Latest Economic survey
* 12th Five year plan
* News articles in The Hindu, The Business Line

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**DESIGN LITERACY AND DESIGN THINKING**

(Open Elective-1**)**

**Code: 8ZC08**

**L T P/D C**

**2 0 0 2**

**Course Objective:** The objective of the course is to make students understand the fundamental concepts of design thinking, and to familiarize with product design process and to motivate the students to ideate new products and services.

**Course Outcomes:**

1. The students gain the knowledge on the inputs required for design thinking and also gain familiarity on concepts related to design thinking.
2. The students learn the techniques of idea generation
3. The students gain knowledge on different phases of design thinking
4. The students realize the product design process.
5. The students gain familiarity on design thinking for service design.
6. The students gain knowledge on variouscases related to design thinking.

**Unit – I: Design Thinking –** Introduction to Design thinking, Principles of design thinking, Benefits of design thinking, Applications of Design thinking, Social Innovation, Impact of Design thinking, Design thinking tools and techniques. Innovation and Design thinking.

**Unit – II: Idea Generation**: New Idea generation methods - Principles of Idea Generation, Techniques, Creativity thinking techniques and tools, types of creative thinking, select ideas from ideation methods.

**Unit – III: Design Thinking Foundations:**The Design Double Diamond: Discover-Define-Develop-Deliver, User-centric design approaches: Importance of user-centricity for design, Empathisation, Empathy Maps, Data collection from users and for users, Data Validation Responsible Innovation and Ethical Design:

**Unit – IV: Product Design Process**: Identification of opportunities, Problem Statement, Product planning, Characteristics of Successful product Development, New product development process, Stanford design thinking iterative model

**Unit – V:Design Thinking for Service Design:** Attributes of a good service design, service design tools – blueprint, customer journey mapping Identifying the user needs in a service-driven economy; Process Flows and Customer Experience considerations for designing and improving services; 5 Why‟s; Service Delivery Pathways

**Unit – VI: Case Studies on Design thinking:** Case 1: Arcturus IV by John E.Arnold, Case – 2: How can we make AI to make things better for humans. Case – 3: User Centered Helmet Design by Prof. B.K. Chakravarthy- Part 1 and Part 2; Case – 4: Challenges of Reaching a Million Users by Prof. Chetan Solanki and Prof Jayendran V.

**Text Books:**

1. Brown, T. (2008). Design thinking. *Harvard business review*, *86*(6), 84.
2. “Innovation by Design", Gerald H. (Gus) Gaynor, AMACOM {American Management Association), NYC, 2002
3. Ansell, C., &Torfing, J. (2014). Collaboration and design: new tools for public innovation. In *Public innovation through collaboration and design* (pp. 19-36). Routledge.
4. Lewrick, M., & Link, P. (2015). Design thinking tools: Early insights accelerate marketers’success. *Marketing Review St. Gallen*, *32*(1), 40-51.

**References Books:**

1. Mæhlum, A. R. (2017). *Extending the TILES Toolkit-from Ideation to Prototyping* (Master's thesis, NTNU).
2. Norman, D. (2013). *The design of everyday things: Revised and expanded edition*. Basic books.
3. Design Thinking – A primer,Prof: Dr. BalaRamadurai, Indian Institute of Technology, Madras.

**Websites:**

1. [www.smashingmagazine](http://www.smashingmagazine) **.com**
2. **www.ID**

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**BANKING OPERATIONS, INSURANCE AND RISK MANAGEMENT**

(Open Elective-1**)**

**Code: 8ZC05**

**L T P/D C**

**2 0 0 2**

**Course Objectives:**To make the students understand the concepts and principles of Indian Banking Business, Insurance Business and Capital market business products and services, which facilitate them to understand the nature of market.

**Course Outcomes:**

1. Describe the new dimensions and products served by the banking system in INDIA.
2. Explain the credit control system and create awareness on NPA’s
3. Apply the knowledge of Insurance concepts in real life scenarios
4. Recognize the importance of regulatory and legal frame work of IRDA
5. Identify the risk management process and methods.
6. Calculate the diversity of risk and return

**UNIT I**

**INTRODUCTION TO BANKING BUSINESS:** Introduction to financial services - History of banking business in India, Structure of Indian banking system: Types of accounts, advances and deposits in a bank. KYC norms, New Dimensions and products- E-Banking: Mobile-Banking, Net Banking, Digital Banking, Negotiable Instruments: Cheque system.

**UNIT II**

**BANKING SYSTEMS AND ITS REGULATION: Banking Systems:** Branch Banking, Unit Banking, Correspondent Banking, Group Banking, Deposit Banking, Mixed Banking and Investment Banking - Banking Sector Reforms with special reference to Prudential Norms, Capital Adequacy Norms, Classification of Assets and NPA’s, Functions of RBI, Role of RBI in regulating Indian Banking. Banking Ombudsman scheme.

**UNIT III**

**INTRODUCTION TO INSURANCE:** Introduction to insurance, Need and importance of Insurance, principles of Insurance, characteristics of insurance contract, branches of insurance and types of insurance: Life insurance and its products, General Insurance and its variants.

**UNIT IV**

**INSURANCE BUSINESS ENVIRONMENT:** Procedure for issuing an insurance policy –Nomination - Surrender Value - Policy Loans – Assignment - Revivals and Claim Settlement; Insurance as a tax mitigation tool, Role of IRDA in Insurance Regulation.

**UNIT V**

**FINANCIAL MARKETS AND RISK MANAGEMENT:** Introduction to Financial Markets: Money Market – Capital market; Introduction to Risk Management, meaning and classification of risks, Risk management process, Risk Management Approaches and Techniques.

**UNIT VI**

**DERIVATIVES AS A RISK MANAGEMENT TOOL:** Introduction to Financial Derivatives, Advantages of Derivatives - types of Derivative Contracts - Forwards, Futures, Options and Swaps - Differences among Forwards, Futures and Option Contracts.

**References:**

* Varshney, P.N., Banking Law and Practice, Sultan Chand & Sons, New Delhi.
* General Principles of Insurance Harding and Evantly
* Mark S. Dorfman: Risk Management and Insurance, Pearson, 2009.
* Scott E. Harringam Gregory R. Nichanus: Risk Management & Insurance, TMH, 2009.
* Geroge E. Rejda: Principles of risk Management & Insurance, 9/e, pearson Education. 2009.
* G. Koteshwar: Risk Management Insurance and Derivatives, Himalaya, 2008.

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**Fundamental of Digital Circuits and Microprocessors**

(Open Elective-1**)**

**Code: 8CC56**

**L T P/D C**

**2 0 0 2**

***Course objectives***: To develop the skills for understanding the design of digital circuits, learn programming skills for 8086 Microprocessor and interfacing peripherals to it.

***Course outcomes****:*

1. *To understand number systems and apply the rules of Boolean algebra to simplify Boolean expressions using theorems and K-maps.*
2. *To design combinational circuits such as full adders, multiplexers, decoders, encoders. Code converters etc.*
3. *To design basic memory units (latches and flip-flops) and sequential circuits*
4. *To understand Architecture of 8086 and analyzing in single mode and in multi processor mode.*
5. *To understand instructions of 8086 and to write Assembly Language Programs*
6. *To interface I/0 devices with 8086.*

**UNIT – I**

**Number System and Boolean Algebra:** Binary, decimal, octal, hexa decimal, weighted and un-weighted codes. Axiomatic definition of Boolean algebra, Binary operators, postulates of and theorems. Boolean addition, subtraction, 1’s complement, 2’s complement. Switching functions, Canonical forms and Standard forms, Simplification of switching functions using theorems. K-map representation, simplification of logic functions using K-map.

**UNIT - II**

**Combinational Logic Design:** Single output and multiple output combinational logic circuit design, Binary adders/subtractors, Encoder, Decoder, Multiplexer, Demultiplexer, Parity bit generator, Code-converters.

**UNIT - III**

**Sequential circuits:** Classification of sequential circuits, the clocked SR flip flop, J- K, T and D-types flip flops, triggering mechanism of flip-flops, flip-flop conversion, introduction to counters and registers

**UNIT - IV**

**Architecture of 8086 Microprocessor:** Memory segmentation, BIU and E.U General Purpose registers, 8086 flag register and function of 8086 Flags, Pin diagram of 8086-Minimum mode and maximum mode of operation.

**UNIT – V**

**Instruction set of 8086:** Addressing modes of 8086, Assembly directives, Simple programs. Assembly language programs: involving logical, Branch & Call instructions, sorting.

**UNIT - VI**

**Interfacing with 8086:** Interfacing with RAM, ROM, 8255 PPI – Interfacing with key board, ADC and DAC Stepper Motor.

**Text Books:**

1. Morris Mano-,Digital design –PHI, 2nd Edition.
2. ZviKohavi and Niraj K Jha -Switching & Finite Automata theory – Cambridge, 3rd Edition.
3. Microprocessors and interfacing – Douglas V. Hall, TMH, 2nd Edition, 1999.
4. Advanced microprocessor & Peripherals - A.K.Ray & K.M.Bhurchandi, TMH, 2000.

**References:**

1. Fletcher -An Engineering Approach to Digital Design – PHI.
2. Fundamentals of Logic Design, Roth, Kenny, Seventh Edition, Cengage Learning
3. R.P.Jain-Switching Theory and Logic Design- TMH Edition,2003.
4. CVS Rao -Switching Theory and Logic Design –Pearson Education, 2005
5. Micro computer systems, The 8086/8088 Family Architecture, Programming and Design – Y.Liu and G.A. Gibson, PHI, 2nd Edition.

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**DATABASE SYSTEMS CONCEPTS**

(Open Elective-1**)**

**Code: 8EC74**

**L T P/D C**

**2 0 0 2**

**Course Objective:**

To understand the different issues involved in the design and implementation of a database system. Study the physical and logical database designs, database modeling, relational, hierarchical, and network models and to understand and use data manipulation language to query, update, and manage a database. Develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency and design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

**Course Outcomes:**

1. Students will learn basics of databases and understand the architecture of database management systems.
2. Students will learn about good database design techniques and database theoriesbehind.
3. Understand conceptual database designs, and functional dependencies and normalization.
4. Students will understand the Mathematical foundation for relationaldatabases.
5. Student will be able to understand concept of Constraints, Views and will be able to create dynamicdatabases.
6. Learn transaction management, concurrencycontrols.

UNIT – I

Introduction to databases and transactions what is database system, purpose of database system, view of data, relational databases, database architecture, transaction management

UNIT- II

Data models the importance of data models, basic building blocks, business rules, the evolution of data models, degrees of data abstraction.

UNIT-III

Database design, ER-diagram and unified modeling language database design and ER model: Overview, ER-model, constraints, ER-diagrams, ERD issues, weak entity sets, Codd’s rules, relational schemas, introduction to UML relational database model: Logical view of data, keys, integrity rules. Relational database design: Features of good relational database design, atomic domain and normalization (1nf, 2nf, 3nf, BCNF).

UNIT- IV

Relational algebra and calculus relational algebra: Introduction, selection and projection, set operations, renaming, joins, division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, domain relational calculus, calculus vs algebra, computational capabilities.

UNIT- V

Constraints, views and SQL what is constraints, types of constrains, integrity constraints, views: Introduction to views, data independence, security, updates on views, comparison between tables and views SQL: Data definition, aggregate function, null values, nested sub queries, joined relations.

UNIT-VI

Transaction management and concurrency control transaction management: Acid properties, serializability and concurrency control, lock based concurrency control (2pl, deadlocks), time stamping methods, optimistic methods, database recovery management.

**TEXT BOOKS:**

A SILBERSCHATZ, H KORTH, S SUDARSHAN, “DATABASE SYSTEM AND CONCEPTS”, FIFTH EDITION MCGRAW-HILL, ROB, CORONEL, “DATABASE SYSTEMS”, SEVENTH EDITION, CENGAGELEARNING.

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**Control System Engineering**

(Open Elective-1**)**

**Code: 8AC46**

**L T P/D C**

**2 0 0 2**

**Course Objective:** Course Objective is to Study the principles of system modeling, system analysis and feedback control and use them to design and evaluate feedback control systems with desired performance;

**Course Outcomes:**

Students able to understand

1. Learn basic concepts of control systems.
2. Study about time response analysis.
3. Learn basic concepts of stability and root locus method.
4. Study about frequency response analysis.
5. Learn basic concepts stability analysis in frequency domain.
6. Learn fundamentals of state space analysis.

**UNIT – I INTRODUCTION:**

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions – Translational and Rotational mechanical systems

**Transfer function representation:**

Transfer Function of Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using Mason’s gain formula.

**UNIT-II TIME RESPONSE ANALYSIS:**

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems, PID controllers.

**UNIT – III STABILITY ANALYSIS IN S-DOMAIN:**

The concept of stability – Routh’s stability criterion – qualitative stability and conditional stability – limitations of Routh’s stability.

**Root Locus Technique:** The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

**UNIT – IV FREQUENCY RESPONSE ANALYSIS:**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

**UNIT – V STABILITY ANALYSIS IN FREQUENCY DOMAIN:**

Polar Plots-Nyquist Plots-Stability Analysis.

**CLASSICAL CONTROL DESIGN TECHNIQUES:** Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain.

**UNIT – VI STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS:**

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties.

**TEXT BOOKS:**

1. Automatic Control Systems 8th edition –B. C. Kuo 2003– John wiley and sons.

2. Control Systems Engineering – I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.

**REFERENCES:**

1. Modern Control Engineering – Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

2. Control Systems – N.K.Sinha, New Age International (P) Limited Publishers, 3rd Edition, 1998.

3. Control Systems Engg. – NISE 3rd Edition – John wiley.

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**APPLIED THERMODYNAMICS LAB**

**Code: 8B568**

**L T P/D C**

**-- -- 2 1**

**Pre-requisites: ATD-I and ATD-II Theory.**

**Course Objectives:**

To integrate the concepts, laws and methodologies from the first course in thermodynamics into the analysis of cyclic process.to apply the thermodynamic concepts into various thermal application like I.C Engines, Steam turbines, compressors and Refrigeration and Air Conditioning systems.

**Course Objectives:**

*After completing the subject, students will be able to conduct:*

1. Performance test on air compressor will make the student to analyze the performance of the compressor**(CO1)**
2. Disassembly and assembly of I.C engine and Valve timing diagram will make the student understand the internal components and their functionality and study of boilers**(CO2)**
3. Heat balance test and performance of four stroke single cylinder diesel engine and will make the student understand have the energy supplied to the engine **(CO3)**
4. Vapour compression Refrigeration system and Air conditioning system will make the student understand the components and working of a refrigeration cycle**(CO4)**
5. computerized IC engine and variable compression ratio engine performance will make the student understand have the energy supplied to the engine in distributed in a cycle.**(CO5)**
6. Performance of four stroke petrol engine and Morse test will make the student understand have the energy supplied to the engine**.(CO6)**

**LIST OF EXPERIMENTS**

**Note:** Minimum of 10 experiments to be performed

1. Two stage reciprocating compressor: performance test
2. Valve timing diagram of four stroke single cylinder diesel engine
3. Disassembly and assembly of diesel engine
4. Performance test on diesel engine
5. Performance test on four stroke petrol engine
6. Heat balance test on diesel engine
7. Morse test on four cylinder four stroke petrol engine
8. Determination of COP of Vapour compression refrigerator
9. Determination of psychometric properties of Air conditioning equipment
10. Computer based single cylinder diesel engine eddy current dynamometer

**LIST OF EQUIPMENT**

1. Cut Section of Four Stroke Diesel Engine
2. Four Stroke Single Cylinder Diesel Engine Dis-Assembly and Assembly
3. Four Stroke Multi Cylinder Petrol Engine
4. Four Stroke Single Cylinder Diesel Engine
5. Four Stroke Single Cylinder Petrol Engine
6. Single Acting two Stage Reciprocating Air Compressor
7. Single cylinder Diesel Engine Test Rig
8. Refrigeration tutor, 1/3 HP Capacity
9. Air Conditioner Trainer - Duct type
10. Variable compression ratio Diesel Engine

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**MACHINE TOOLS LAB**

**Code: 8B569**

**L T P/D C**

**-- -- 2 1**

**Pre-requisites: Machine Tools Theory.**

**Course Objectives:**

This course gives students the opportunity to obtain skills in machine shop operations under the supervision of qualified machine shop personnel. They also understand the safety aspects of handling machines and work effectively with others and conduct themselves ethically and responsibly in a machine shop context

**Course Outcomes:**

After completing the Laboratory, students will be able to:

After completing the Laboratory, students will be able to:  
**CO-1:**Make simple products using lathe and covering various machining operations as per drawing  
**CO-2:** Produce jobs as per drawing using shaper, PlanerandSlotter machines  
**CO-3:**Understand the principle and working of Drilling machine and conduct various machining  
operations as per drawing  
**CO-4:**Work on Tool & Cutter Grinding, Milling machine and conduct various machining operations as perdrawing  
**CO-5:**Perform surface grinding operation and conduct alignment test on lathe and drilling machines

**List of Experiments**

1. Introduction to General purpose machine tools - Lathe, Drilling machine, Milling machine, Shaper and Grinding machines
2. Study and usage of measuring and inspection tools used in Machine tool laboratory: – Verniercaliper, micrometers, height gauge, V-block, surface plate, Bore gauges, Pitch gauges, straight edges, dial gauge, plug and ring gauges, slip gauges, tool maker’s microscope.
3. Lathe Operations-I: Facing, Plain turning, Step turning, Taper turning and Chamfering
4. Lathe Operations-II: Thread cutting, Grooving and Knurling
5. Drilling Operations-I: Drilling, Boring, Reaming
6. Drilling Operations-II: Counter boring, Counter sinking and Tapping
7. Shaping Operations: Machining of V-Block
8. Milling Operations
9. Surface Grinding Operations
10. Tool and Cutter Grinder: Grinding of Tool angles of single point cutting tool
11. Machine tool alignment test on Lathe
12. Machine tool alignment test on Drilling machine

**LIST OF EQUIPMENT**

1. Lathe machines
2. Surface Grinding Machine
3. Tool & Cutter Grinding Machine
4. Bench Grinding Machine
5. Shaping Machine
6. Slotting machine
7. Vertical Milling Machine
8. Radial Drilling machine
9. Spirit level
10. Mandrel
11. Height Gauge

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**Kinematics & Dynamics of Machines Lab**

**Code: 8B570**

**L T P/D C**

**--- --- 2 1**

**Pre-requisites: Kinematics & Dynamics of Machines Theory.**

**Course Objective:**

To expose practical knowledge in kinematics and dynamics of planar mechanism and vibrations.

**Course Outcomes: -**

*After completing the Laboratory, students will be able to:*

1. Understand the concept of vibrations, able to calculate the acceleration due to gravity and stiffness of the spring.
2. Understand concept of radius of gyration
3. Draw the displacement diagram of cam and follower and study the characteristics of governor
4. Understand the torsional vibrations
5. Understand the gyroscopic effects and balancing of rotating masses
6. Understand the pressure distribution in a journal bearing and critical speeds of shafts.

**List of Experiments**

1. Evaluate the acceleration due to gravity with the help of simple pendulum
2. Calculate the radius of gyration of the given bar treating that as a compound pendulum
3. Draw the displacement diagram for the Cam and Follower
4. Find the modulus of rigidity for the given shaft
5. Verity the gyroscopic couple using motorized gyroscope
6. Study the pressure distribution of a Journal Bearing
7. Identify the stiffness of the given spring
8. Obtain the radius of gyration of a given bar using the Bifilar Suspension
9. Create the characteristic curves for the Hartnell Governor
10. Measure the modulus of rigidity of the given shaft
11. Examine the different fundamental frequencies of the given shaft
12. Estimate the required balancing mass using a rotating balancing

**List of Equipment**

1. Vibration Lab for experiments and vibrations, in modular form.
2. Universal governor apparatus.
3. Cam analyzer apparatus
4. Static and dynamic balancing apparatus
5. Whirling of shaft apparatus with stroboscope
6. Motorized gyroscope
7. Journal bearing
8. Digital stroboscope

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**ARTIFICIAL INTELLIGENCE**

**(Mandatory Course)**

**Code: 8EC75**

**L T P/D C**

**2 0 0 0**

**Pre-requisites:** Cyber Security

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**Course objective:**

To train the students to understand the significance of AI, different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning.

**COUR****SE OUTCOMES:**

**At the end of this course the student will be able to**

1. Understand the concepts of state space representation and calculate time and space complexities of exhaustive search and heuristic search together.
2. Apply AI techniques to solve problems of advanced searching techniques.
3. Distinguish different knowledge representation techniques.
4. Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
5. Analyze different learning techniques and decision trees.
6. Use techniques to represent domain knowledge of the expert systems.

## UNIT-I

**Introduction:**AIproblems,AgentsandEnvironments, Structure ofAgents,ProblemSolvingAgents**BasicSearchStrategies**:ProblemSpaces,UninformedSearch(Breadth-First,Depth-FirstSearch,Depth-firstwithIterativeDeepening),HeuristicSearch(HillClimbing,GenericBest-First,A\*).

## UNIT-II

**AdvancedSearch**:ConstraintSatisfaction (Backtracking,LocalSearch), ConstructingSearchTrees,StochasticSearch,A\* SearchImplementation,MinimaxSearch,Alpha-BetaPruning.

## UNIT–III

**KnowledgeRepresentationandReasoning**:PropositionalLogic,First-OrderLogic,ForwardChaining andBackwardChaining,IntroductiontoProbabilisticReasoning,BayesTheorem, KnowledgeRepresentationIssues,OtherKnowledgeRepresentationSchemes.

## UNIT-IV

**ReasoningUnderUncertainty**:Basicprobability,ActingUnderUncertainty,Bayes’Rule,Representing KnowledgeinanUncertainDomain, Bayesian Networks, Non-monotonicReasoning.

## UNIT-V

**Learning:**WhatIsLearning? RoteLearning, LearningbyTakingAdvice, LearninginProblemSolving,LearningfromExamples,Winston’sLearningProgram,Decision Trees.

## UNIT–VI

**ExpertSystems:**RepresentingandUsingDomainKnowledge,Shell,Explanation,KnowledgeAcquisition.

## TEXTBOOK:

* + 1. Russell,S.andNorvig,P,ArtificialIntelligence:AModernApproach,ThirdEdition,Prentice-Hall,2010.

## REFERENCEBOOKS:

1. ArtificialIntelligence,ElaineRich,KevinKnight,ShivasankarB. Nair,TheMcGrawHillpublications,ThirdEdition, 2009.
2. GeorgeF.Luger,ArtificialIntelligence:StructuresandStrategiesforComplexProblemSolving,Pearson Education,6thed.,2009.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**APPLIED THERMODYNAMICS – II**

**Code: 8B620**

**L T P/D C**

**2 1 --- 3**

**Pre-requisites:** TD and ATD-I

**Course Objectives:**

*The main objective of the course is to offer the students fundamental knowledge of Rankin cycles,*

*Working of different boilers, working principle of different types of Turbines & Rocket engines.*

**Course Outcomes**

*After completing the subject, students will be able to:*

* *Understand steam power plants and the Rankine cycle on p-v, T-S and h-s diagrams*
* *Understand the working principles and basic design parameters of different types boilers.*
* *Understand the function of steam nozzle, Wilson line*
* *Understand the difference between impulse and reaction turbines, draw velocity diagrams and understand the Principle of operation of reaction turbine, features of Parsons reaction turbine and to draw the velocity diagrams for the same*
* *Understand the working principles of different condensers and understand the gas turbine power plants*
* *Understand the working principle of jet propulsion and rocket engines*

**UNIT – I**

**Basic Concepts:** Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temp0erature of Heat addition, Methods to improve cycle performance – Regeneration & reheating

**UNIT – II**

**Boilers :** Classification – Working principles – with sketches including H.P.Boilers –Working principles, Boiler horse power, equivalent evaporation, Draught, classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney

**UNIT – III**

**Steam Nozzles :** Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit-Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

**UNIT -IV**

**Steam Turbines:** Classification – Impulse turbine; Mechanical details – Velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency.

De-Laval Turbine - its features. Methods to reduce rotor speed-Velocity compounding and pressure compounding, Velocity and Pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine.

**Reaction Turbine:** Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson’s reaction turbine – condition for maximum efficiency.

**UNIT – V**

**Steam Condensers** : Requirements of steam condensing plant – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement.

**Gas Turbines :** Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits, Brief concepts about compressors, combustion chambers and turbines of Gas Turbine Plant.

**UNIT – VI**

**Jet Propulsion :** Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

**Rockets:** Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

**TEXT BOOKS:**

1. Thermal Engineering / R.K. Rajput / Lakshmi Publications

2. Gas Turbines – V.Ganesan /TMH

3.Refrigeration And Air Conditioning by Arora and Domkundwar-Dhanpat Rai & Co

**REFERENCES:**

1. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot

2. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman

3. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**CAD/CAM**

**Code: 8B621**

**L T P/D C**

**3 0 -- 3**

**Pre-requisites: None**

**Course objectives:**

To provide an overview of how computers are being used in design, development of manufacturing plans and

manufacture. To understand the need for integration of CAD and CAM

**Course Outcomes:**

1.To apply geometric transformation techniques in CAD.

2.Develop mathematical models to represent curves and surfaces and model engineering components using solid modelling techniques.

3.Develop programs for CNC to manufacture industrial components.

4. Learn group technologies concepts

5. Demonstrate the FMS and computer quality control

6. Address CIM and computer Aided manufacturing Resources Plans

**UNIT – I:**

Fundamentals of CAD,CAM, Automation , design process, Application of computers for design, Benefits of CAD,Computer configuration for CAD applications, Computer peripherals for CAD,Design workstation, Graphic terminal, CAD software- definition of system software and application software ,CAD database and structure.

**Geometric Modeling:** 3-D wire frame modeling, wire frame entities and their definitions, Interpolation and

approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting

techniques, and definitions of cubic spline, Bezier, and B-spline.

**UNIT-II:**

**Surface modeling:** Algebraic and geometric form, Parametric space of surface, Blending functions,parametrization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface,Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

**Solid Modelling:** Definition of cell composition and spatial occupancy enumeration, Sweep representation,

Constructive solid geometry, Boundary representations.

**UNIT – III:**

**NC Control Production Systems:** Numerical control, Elements of NC system, NC part programming: Methods of NC part programming, manual part programming, Computer assisted part programming, Post Processor,Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

**UNIT – IV:**

**Group Technology:** Part families, Parts classification and coding. Production flow analysis, Machine cell design.**Computer aided process planning:** Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

**UNIT – V:**

**Flexible manufacturing system**: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

**Computer aided quality control**: Automated inspection- Off-line, On-line, contact, Non-contact; Coordinate

measuring machines, Machine vision.

**UNIT – VI:**

**Computer Integrated Manufacturing:** CIM system, Benefits of CIM, Evaluation of CIM, Applications.

**Computer aided manufacturing resource planning:** Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterpris9e resource planning, Capacity requirements planning

**TEXT BOOKS:**

1. CAD/CAM Principles and Applications by P.N.Rao, TMH

2. CAD/CAM Concepts and Applications by Alavala, PHI

**REFERENCE BOOKS:**

1. CAD/CAM by Groover M.P., Pearson education

2. CAD/CAM Theory and Practice,/ Ibrahim Zeid,TMH

3. CAD/CAM/CIMbyRadhakrishnan and Subramanian, New Age

4. Principles of Computer Aided Design and Manufacturing by FaridAmirouche, Pearson

**5.** Computer Numerical Control Concepts and programming by Warren S Seames, Thomson.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**DESIGN OF MACHINE MEMBERS-II**

**Code: 8B622**

**L T P/D C**

**2 1 -- 3**

**Course Objectives:**

1. Students will understand the concepts associated with design of bearings, engine parts, gears, and cylindrical pressure vessels.
2. Students will understand the significance and apply statistical methods to design simple machine members.

**Course Outcomes:**

A student achieving a passing grade in this course will be able to:

* Design bearings and select appropriate bearings using bearing catalogs.[CO1]
* design parts of internal combustion engine[CO2]
* derive design expression for spur and bevel gears [CO3]
* design helical and worm gears [CO4]
* gain skills to design various pressure vessels.[CO5]
* Learn the application of statistical mathematics for machine design subject.[CO6]

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P01** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 |  | 2 |  |  |  |  |  |  |  |  | 3 | 3 | 1 |
| **CO2** | 3 | 3 |  | 2 |  |  |  |  |  |  |  |  | 3 | 3 | 1 |
| **CO3** | 3 | 3 |  | 2 |  |  |  |  |  |  |  |  | 3 | 3 | 1 |
| **CO4** | 3 | 3 |  | 2 |  |  |  |  |  |  |  |  | 3 | 3 | 1 |
| **CO5** | 3 | 3 |  | 2 |  |  |  |  |  |  |  |  | 3 | 3 | 1 |
| **CO6** | 3 | 3 |  | 2 |  |  |  |  |  |  |  |  | 3 | 3 | 1 |

**UNIT I: Design of Bearings:**

**Sliding Contact Bearings:** Classification of bearings, Design Hydrodynamic bearimgs.basic modes of lubrication, Petroff’s equation, McKee equation, bearing design, selection of parameters, Design of Hydrostatic bearings. Selection bearing materials and lubricating oil

**Rolling contact bearings:**

Types of rolling contact bearings, Design of ball and roller bearings. static load carrying capacity, dynamic load carrying capacity, equivalent bearing load, load-life relationship, load factors, bearing reliability ,selection of bearing from manufactories catalogues.

**UNIT II: Design of I.C. Engine parts:**

Introduction of I.C.Engine**,** Design of Cylinder, piston, Piston rings, Piston pin, connecting rod & its ends and crank shaft. Material selection.

**UNIT III: Design of Gears-I**

**Spur Gears:** Classification of gears, gear terminology, undercutting, gear tooth failures; Force analysis; Strength analysis: bending strength (Lewis equation), beam and wear strength of gear tooth, checking for dynamic (Buckingham equation) and wear considerations; design procedure for spur gears (estimation of module, centre distance, face width etc).

**Beval Gears:** Classification, Terminology, Design calculations, Force Analysis.

**UNIT IV: Design of gears-II**

**Helical Gears**: Introduction, terms of helical gears, formative no.of teath, proportion of helical gears, Design equations of helical gears. design procedure for helical gears (estimation of module, centre distance, face width etc).

**Worm Gears:** Terminology, Design of Worm and gear, Heat Dessipation calculations, Effeceincy of worm gear. Force analysis.

**UNIT V: Design of Cylinders and Pressure Vessels:**

Thin and thick cylinders under internal and external pressures; Design of cylinders: Lame’s equation, Clavarino’s and Birnie’s equations, Barlow’s equation. Compound cylinders; thin spherical vessels; Design of end closures of thick and thin cylinder.

**UNIT VI: Statistical Considerations in Design:**

Frequency distribution, frequency curves, measures of central tendency and dispersion, probability distribution, Normal curve, design and natural tolerances; Probabilistic aspects of variations in geometry of machine elements, material properties, external loading and initial / boundary conditions, probabilistic approach to design, reliability. Introduction to failure analysis and design of simple machine elements when uncertainities modeled with mean and standard deviations.

**TEXTBOOKS:**

1. **Design of Machine Elements** – Third Edition / V.B.Bhandari / Tata McGraw-Hill Pub.
2. **Mechanical Engineering Design** / J.E.Shigley, C.R.Mischke / Tata McGraw-Hill Pub.

**REFERENCE BOOKS:**

1. **Fundamentals of Machine Elements** / Bernard Hamrock, Steven Schmid, Bo Jacobson / Tata McGraw Hill
2. Probabilistic Mechanical Design / Edward B. Haugen
3. A Text Book of Machine Design -Kurmi

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**HEAT TRANSFER**

**Code: 8B623**

**L T P/D C**

**2 1 -- 3**

**Pre-requisites :FluidMechanics and Thermodynamics**

**COURSE OBJECTIVE:**

To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment in process industries.

**COURSE OUTCOMES**:

After completing the subject, students will be able:

1. To demonstrate basic knowledge of heat transfer by understanding: differences between conduction, convection and radiation; Students shall be able to formulate basic differential equations for heat transfer; Students must able to understand the importance of thermal conductivity of materials.
2. To deal with problems like conduction through walls and composite walls; critical radius of insulation; heat transfer in fins; Transient heat transfer.
3. To Calculate of heat transfer coefficient; overall heat transfer coefficient; log-mean temperature differences.
4. To differentiate forced and natural convection problems correlations; and demonstrate the use of Biot, Nusselt, Reynolds, Grashof, Rayleigh and Prandtl numbers; basic radiative heat transfer, basic principles of mass transfer.
5. To make the students capable of employing the heat transfer principles during phase change processes in heat exchangers; To bring in confidence to apply the principles in industrial appliances and machinery like Power Plants, Heat Exchangers, coolers etc
6. To understand basic principles of radiation heat transfer and radiation heat exchange between surfaces.

**UNIT – I**

**Introduction:** Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.

**Conduction Heat Transfer:** Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

**UNIT – II**

Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions.

**One Dimensional Steady State Conduction Heat Transfer:** Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation

**One Dimensional Steady State Conduction Heat Transfer:** Variable Thermal conductivity – systems with heat sources or Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.

**One Dimensional Transient Conduction Heat Transfer :**Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems- Concept of Functional Body

**UNIT – III**

**Convective Heat Transfer :** Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.

**Forced convection: External Flows:** Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders.

**UNIT – 1V**

**Internal Flows:** Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

**Free Convection:** Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and pipes.

**UNIT V**

**Heat Transfer with Phase Change: Boiling:** – Pool boiling – Regimes Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

**Condensation:** Film wise and drop wise condensation –Nusselt’s Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

**Heat Exchangers:**

Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

**UNIT VI**

**Radiation Heat Transfer:**

Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

**TEXT BOOKS:**

1. Fundamentals of Engg. Heat and Mass Transfer / R.C.SACHDEVA / New Age International

**REFERENCE BOOKS:**

1. Heat Transfer / HOLMAN/TMH
2. Fundamentals Of Engineering Heat And MassTransfer - R. C. Sachdeva/ New Age
3. Heat Transfer – P.K.Nag/ TMH
4. Heat and Mass Transfer – R.K. Rajput – S.Chand& Company Ltd.
5. Heat and Mass Transfer-Kondandaraman

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**MECHANICAL VIBRATIONS**

(Professional Elective Course**-II)**

**Code: 8B624**

**L T P/D C**

**3 0 -- 3**

**Pre-requisites:** Dynamics of Machines

**Course objectives:** Understand various levels of vibrations and remedies for each of them.

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

1.Understand the causes and effects of vibration in mechanical systems & single degree freedom vibrations.

2. learn methods to implement on SDF Vibrations

3.Develop schematic models for physical systems and formulate governing equations of motion for two degree freedom system

4.Understand the role of multi degree in mechanical systems

5. Analyze and design continuous vibration system

6.Analyze rotating and reciprocating systems and compute critical speeds.

**UNIT- I:**

**Single degree of Freedom systems - I:** Undamped and damped free vibrations, viscous damping,coulomb

damping, forced vibrations, Response to excitation, rotating unbalance and support excitation, vibration isolation and transmissibility.

**UNIT- II:**

**Single degree of Freedom systems - II:** Response to Non Periodic Excitations: unit impulse, unit step and unit Ramp functions, response to arbitrary excitations, The Convolution Integral, shock spectrum,System response by the Laplace Transformation method.

**UNIT- III:**

**Two degree freedom systems:** Principal modes- undamped, damped free and forced vibrations, undamped

vibrationabsorbers.Vibration measuring instruments: Vibrometers**:**velocity meters & accelerometers.

**UNIT- IV:**

**Multi degree freedom systems:** Matrix formulation, stiffness and flexibility influence coefficients, Eigen value problem, normal modes and their properties, Free and forced vibration by Modal analysis, Method of matrix inversion, Torsional vibrations of multi- rotor systems and geared systems, Discrete- Time systems.

**UNIT-V:**

**Continuous system:** Free vibration of strings – longitudinal oscillations of bars- traverse vibrations of beams-

Torsional vibrations of shafts.

**UNIT-VI:**

**Critical speeds of shafts**: Critical speeds without and with damping, secondary critical speed.

**Numerical Methods:** Rayliegh'sstodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods.

**TEXT BOOKS:**

1. Elements of Vibration Analysis by Meirovitch, TMH, 2001

2. Mechanical Vibrations and sound engineering by A.G.Ambekar, PHI

**REFERENCE BOOKS:**

1. Mechanical Vibrations by SS Rao, Pearson, 2009, Ed 4,

2. Mechanical Vibration by RaoV.Dukkipati& J Srinivas, PHI, 2010.

3. Mechanical Vibratins by V. Ram Murthy.

4. Vibration problems in Engineering by S.P. Timoshenko.

5. Mechanical Vibrations by Seto, Schaum'sOutilines, McGraw Hill

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**REFRIGERATION & AIR CONDITIONING**

(Professional Elective Course**-II)**

**Code: 8B625**

**L T P/D C**

**3 0 -- 3**

**Pre-requisite**: Thermodynamics

**Course Objective**: To apply the principles of Thermodynamics to analyse different types of refrigeration and air conditioning systems and to understand the functionality of the major components.

**Course Outcomes**: At the end of the course, the student should be able to

CO1: Understand the Principle and applications of Air Refrigeration system

CO2: Demonstrate working of vapour compression Refrigeration System

CO3: Understand the various components of Refrigeration system

CO4: Illustrate the vapour Absorption system

CO5: Learn Principle and methods of basic Air conditioning system

CO6: Gain knowledge Air conditioning Equipments

**UNIT – I:**

**Introduction to Refrigeration:** - Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical

Refrigeration – Types of Ideal cycle of refrigeration.

Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system – Refrigeration needs of Air crafts- Air systems – Actual Air refrigeration system – Refrigeration needs of Air crafts – Application of Air Refrigeration, Justification – Types of systems – Problems.

**UNIT – II:**

Vapour compression refrigeration – working principle and essential components of the plant – Simple Vapour

compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – Problems.

**UNIT III:**

**System Components:** Compressors – General classification – comparison – Advantages and Disadvantages.

Condensers – classification – Working Principles

Evaporators – classification – Working Principles

Expansion devices – Types – Working Principles

Refrigerants – Desirable properties – common refrigerants used – Nomenclature – OzoneDepletion – Global

Warming – Azeotropes and Zeotropes

**UNIT IV:**

Vapor Absorption System – Calculation of max COP – description and working of NH3 – water system – Li – Brsystem. Principle of operation Three Fluid absorption system, salient features.

Steam Jet Refrigeration System – Working Principle and Basic Components

Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

**UNIT – V:**

**Introduction to Air Conditioning:**

Psychometric Properties & Processes – Sensible and latent heat loads – Characterization – Need for Ventilation,Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP.

Concept of human comfort and effective temperature –Comfort Air conditioning – Industrial air conditioning and Requirements – Air conditioning Load Calculations.

**UNIT-VI:**

Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification,

filters, grills and registers, deodorants, fans and blowers.

Heat Pump – Heat sources – different heat pump circuits – Applications.

**TEXT BOOKS:**

1. A Course in Refrigeration and Air conditioning by SC Arora&Domkundwar, Dhanpatrai

2. Refrigeration and Air Conditioning by CP Arora, TMH.

3. Refrigeration and Air Conditioning by Manohar Prasad, New Age

**REFERENCE BOOKS:**

1. Principles of Refrigeration by Dossat, Pearson Education

2. Basic Refrigeration and Air-ConditioningbyAnanthanarayanan, TMH

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**UNCONVENTIONAL MACHINING PROCESSES**

(Professional Elective Course-II**)**

**Code: 8B626**

**L T P/D C**

**3 0 -- 3**

**Prerequisites:** Theory of metal cutting, machine tools

**Course Objectives:**

To understand the need for the development of UnConventional machining processes.

To know various methods of material removal processes.

To know the principles and applications of Non-Conventional machining processes.

**Course Outcomes:**

1. Student will identify the problem faced in traditional metal cutting and come to an understanding of theneed for the

development of Unconventional machining processes.

2. Gain the knowledge of basic mechanism of various Unconventional machine processes namely UM and AJM related

equipment, variables, advantages, limitations, applications.Given a set of physical, electrical and other parameters.

Student can identify a suitable Unconventionalmachining process.

3. Understand the learn various Thermal material Removing processes

4. Understand the Acquire Knowledge in chemical Remaining processes

5. Understand the demonstrate working of chemical material remaining process

6. Understand the significance of micro machine

**UNIT–I:**

**INTRODUCTION:** Need for non-conventional machining processes, Classification of non -conventional

machining processes, considerations in process selection, materials, general characteristics and applications of nonconventional machining processes, Historical development.

**UNIT–II:**

**MECHANICAL MATERIAL REMOVAL PROCESSES:** Ultrasonic machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining – basic principles, components, process variables, advantages and disadvantages, applications.

**UNIT–III:**

**THERMAL MATERIAL REMOVAL PROCESSES:** Electro Discharge Machining, Wire EDM, Laser Beam Machining, Electron Beam Machining, Ion Beam Machining - basic principles, components, process variables,advantages, limitations and applications.

**UNIT–IV:**

**CHEMICAL MATERIAL REMOVAL PROCESSES:** Electro Chemical Machining, Electro Chemical

Grinding, Electro Chemical Honing, and Electro Chemical Deburring - basic principles, components, process

variables, advantages, limitations and applications.

**UNIT-V:**

**MICRO MACHINING:** Bulk micromachining, surface micromachining and LIGA process – General description, basic principles, components, process variables, advantages and disadvantages, applications.

**UNIT VI:**

**ADVANCED NANO FINISHING PROCESSES**: Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations

**TEXT BOOKS:**

1. Advanced machining processesby VK Jain, Allied publishers.

2. Non Traditional Manufacturing Processes by Gary F Benedict, CRC Press.

**REFERENCE BOOKS:**

1. MEMS & Microsystems – Design and Manufacture by Tai-Ran Hsu, Tata McGraw Hill

2. Modern Machining Process by Pandey P.C. and Shah H.S., TMH

3. New Technology by Bhattacharya A the Institution of Engineers, India 1984.

4. Non-Traditional Machining by P.K.Mishra, New Age.

5. Micro Machining of Engineering Materials Edited by J.McGeough, CRC Press.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**AUTOMOTIVE ENGINES**

(Professional Elective Course-II**)**

**Code: 8B627**

**L T P/D C**

**3 0 -- 3**

**COURSE PRE-REQUISITES:** Physics and chemistry

**COURSE OBJECTIVES:**

* • To present the constructional details and combustion in automotive engines
* • To learn the principle and functions of an automotive engine sub-systems
* • To know engine measurements and performance characteristics
* • To provide the concepts and working of unconventional engines

**COURSE OUTCOMES:** After completion of the course, the student should be able to

**CO-1:** Understand the constructional details and combustion in automotive engines

**CO-2:** Describe the principle and functions of an automotive fuel engine systems

**CO-3:** Understand the role of senses and Activations inAutomotives

**CO-4:** Analyze engine measurements and performance characteristics for Engines with cooling and vibration

**CO-5:** Discuss the concepts and working of charging

**CO-6:** learns types and working of unconventional Engines

**UNIT – I:**

**Engine:** Classification, principle, construction and working of four stoke and two stroke SI and CI engines. Theoretical and actual indicator, valve and port timing diagrams, stages of combustion in SI and CI engines, abnormal combustion and combustion chambers.

**UNIT – II:**

**Fuel System:** Air fuel ratio requirements, principle and working of carburetor, multi- point fuel injection and gasoline direct injection. Diesel fuel injection pump, types of nozzles and common rail direct injection.

**UNIT – III:**

**Engine Sensors and Actuators:** Role of engine management system, sensors – engine speed, mass air flow, manifold absolute pressure, throttle position, knock, temperature, exhaust oxygen level and accelerometers, actuators - solenoids, relays, piezoelectric force generators and stepper motors and engine mapping.

**UNIT – IV:**

**Cooling and Lubrication:** Necessity of cooling, air-cooling, water cooling - thermosyphon and pump cooling, radiator, pump, thermostat, antifreeze solution and radiator fan. Mist, splash and forced lubrication, oil filters and oil pumps.

**UNIT – V:**

**Engine Performance and Supercharging:** Engine power, measurement of friction power, engine efficiencies, performance characteristics and heat balance.

Supercharging - mechanical supercharging, turbocharging, types of superchargers and methods of supercharging.

**UNIT – VI:**

**Unconventional Engines:** Stiriling engine - Working Principle, two piston engine, control system, fuel requirement, emissions, merits and demerits. Wankel engine - Construction and working, performance, emissions, merits and demerits.Variable compression ratio engine - Necessity, theoretical analysis, different methods.HCCI engine – principle and Strategies for Mixture Preparation, and stratified charge engine – methods of charge stratification.

**TEXT BOOKS:**

1. “Internal Combustion Engine Fundamentals”, by John B Heywood, 2nd Edition, McGraw-Hill Education, 2018

2. “Internal Combustion Engines”, by Mathur ML and Sharma RP, DhanpatRai Publications, New Delhi, 2014

**REFERENCES:**

1. “Internal Combustion Engines”, by Ganesan V, 4th Edition, Tata McGraw Hill, New Delhi, 2017

2. Advanced Vehicle Technology, by Heinz Heisler, Butterworth Heinemann Publishers, 2002

3. Introduction to Internal Combustion Engines, by Richard Stone, SAE Publications,1999

4. Internal Combustion Engine, by Willard W Pulkrabek, Prentice Hall Publication, 1997

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Advanced Entrepreneurship**

(Open Elective-II**)**

**Code: 8ZC23**

**L T P/D C**

**2 0 -- 2**

**Course Objective:** The course is designed to impart the necessary managerial skills and tactics required for an emerging Entrepreneur for the Engineering students to enhance their prospects as an Entrepreneur.

**Course Outcomes:**

* The Students’ gain knowledge on the stages of Startup and the turbulence environment it undergoes and the stages related to growth of the Startup.
* The Students are exposed to the various business models and critically evaluating the effectiveness of the business models and products
* The students understand the method of business traction, create roles and build their A- team
* The students understand the various channels of revenue building and exploration of new revenue avenues.
* The students understand the need of sales planning and people plan and also financial modeling
* The students are exposed to the legal implications affecting the company’s prospects and identifying right mentors and advisors to support startups

**Unit – I: Fundamentals of Entrepreneurship & Refining Business Model and Product:**

Fundamentals and key concepts of entrepreneurship, refining the business model, products and services, pivoting, types of business models, business model evolution, generating new business models, analyzing the business model, adding new customer segment, product manager, significance and role of product manager.

**Unit – II: Business Planning & Exploring Revenue:**

Business plan, sales plan, hiring sale team, people plan, financial planning, financial forecasting, create a procurement plan, negotiating role play, understanding primary revenue sources, exploring customer lifecycle for growth customers, exploring and identify secondary sources of revenue,

**Unit- III: Funding the Growth & Building the A-Team:**

Overview of funding, funding options for an entrepreneur, explore the right funding options, create funding plan, pitch deck, introduction to building A-Team, pitching to attract the talent, setting your team, defining roles, hiring the A-Team members.

**Unit- IV: Brand and Channel Strategy & Leveraging Technologies:**

Introduction to branding, drawn the venture’s golden circle, positioning and positioning statements, creating brand name, logo, social media handle, Identify right channels, leaping ahead with technology, digital marketing for startups, plan a social media campaign, digital collaboration, store documents online, other technology platforms, make tech plan, platform wish list.

**Unit V: Measuring Progress and Legal Matters:**

Metrics for customer acquisition (CAC, CLV, and ARPU), metrics for customer retention and satisfaction, find CAC, CLV and ARPU, key financial metrics, communicate metrics, new revenue stream through key financial metrics, re-forecasting of financial plan, identify professional help for legal and compliance requirements, searching of trademark and brand name and company name.

**Unit –VI: Seeking Support and Final Project:**

Mentors help to create successful startups, identify mentors and advisors, importance of mentors and advisors, scout the board of directors, overview on final project, capstone project presentation, contents of capstone project.

**Books Recommended:**

* Entrepreneurship Rajeev Roy “” oxford ,2012
* Entrepreneurship Development Khanka, ,S.Chand 2012

**References:**

* Small Scale industries and Entrepreneurship Vasanth Desai “Himalya publishing 2012
* Robert Hisrich et al “enterpreneruship TMH 2012
* Entrepreneurship Development Khanka, ,S.Chand 2012
* Entrepreneurship Development B.Janikairam and M Rizwana
* e-source: - [www.learnwise.org](http://www.learnwise.org)

**Social Science Stream**

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**BASICS OF POLITY**

(Open Elective-II**)**

**Code: 8ZC26**

**L T P/D C**

**2 0 0 2**

**Course Objectives:**

To provide basic knowledge relating to the Indian Polity , thus making the students appreciate the current aspects related to polity .

**Course Outcomes:**

1. Gain knowledge relating to the Indian Constitution and the Preamble to the Constitution.
2. Gain knowledge relating to the fundamental rights and duties of the Indian citizens and the directive principles of state policy.
3. Students will learn about the federal structure and judiciary of India.

**Unit 1: Introduction to Salient Features of Constitution**

Significance of the Constitution, Distinction between Written and Unwritten Constitution, Composition of the Constituent Assembly and the role and objectives of the Drafting Committee, Main features and the nature of the Constitution of India. Preamble to the Constitution and its relevance; Basic principles of Preamble and their reflection in the constitutional provisions.

**Unit 2: Fundamental Rights, Duties and Directive Principles of State Policy**

Fundamental Rights and Duties of Citizens- Importance of Rights and Duties, Dignity of an individual, Safeguards against deprivation of life and personal liberty; Writs for the protection of Fundamental Rights; Meaning of Directive Principles of State Policy, Classification of the Directive Principles, Role of Directive Principles, Role of Directive Principles in the establishment of economic and social democracy.

**Unit 3: Government and Judiciary**

Legislative, financial and judicial powers of the President; Appointment of Prime Minister and constitution of Council of Ministers; Powers and functions of Prime Minister; Individual and collective responsibility; Powers and discretionary powers of the Governor; Appointment of the Chief Minister, Formation of the Council of Ministers; Powers and jurisdiction of the Supreme Court and High Courts of India.

**References**

* Indian Polity - M. Laxmikanth, 5th Edition, McGraw Hill Education, Chennai
* Environment And Ecology A Complete Guide for Civil Services Preliminary and Main Examinations – R. Rajgopalan, 2017, Oakbridge Publishing Pvt. Limited.
* Introduction to Constitution of India – Dr. Durga Das Basu, 22nd Edition, 2015, LexisNexis
* Our Constitution – Subhash C Kashyap, 5th Edition, 2015, National Book Trust, India

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**CO-CREATION AND PRODUCT DESIGN**

(Open Elective-II**)**

**Code: 8ZC09**

**L T P/D C**

**2 0 0 2**

**Course Objective:** The objective of the course is to make students understand the fundamental concepts of design thinking, and to familiarize with product design process and to motivate the students to ideate new products and services.

**Course Outcomes:**

1. The students gain the knowledge on the inputs required for human centric design thinking the students learn the techniques of idea generation.
2. The students gain knowledge on exploring the different phases of Ideation process.
3. The students grasp the awareness on emerging technologies and understand 3d printing in manufacturing.
4. The students gain familiarity on development of prototypes.
5. The students understand reverse engineering methods in product development.
6. The students have access to information on IPR, and patent application.

**Unit – I: Human Centered Design:** Understanding user and Customer perspectives, Identify insights and opportunities, Interviewing, User Experience design.Frame your design challenge**.**

Empathy tools and techniques.

**Unit – II: Ideation Process:** Articulation of Problem Statement, Visualizing Ideas, Communicating ideas and compelling story telling, Brainstorming, Divergent thinking in exploring solutions, 3- box thinking, 3-box framework and Box-3 ideation.

**Unit – III: Emerging Technologies and Design:** Emerging technologies, utilization and growth, Automation through Industry 4.0, IOT for Network and Intelligent world, efficient and effective manufacturing aided by Robotics, Custom manufacturing by Additive / 3D printing, Augmented reality for product and process.

**Unit – IV: Prototyping**: Introduction to Prototype, types of prototype, prototyping strategies, Design consideration in the five stages of the product life cycle. Prototype building by different engineering disciplines. Testing Solution and taking the solution to the users. Create a pitch for your design.

**Unit – V:Reverse engineering in product development:** Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials,importance of ergonomics in product development, environmental considerations in design, and safety considerations in design.

**Unit – VI: Intellectual Property Rights:** Introduction to IPR, Patents – Types of Patents, elements of patentability, Patents registration Procedure, Patent office and Appellate Board, Rights and Duties of Patentee, Restoration of Lapsed patents.

**Text Book(s)**

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, “Exploring Engineering: An Introduction to Engineering and Design”, 4th edition, Elsevier, 2016.
2. David Ralzman, “History of Modern Design”, 2nd edition, Laurence King Publishing Ltd., 2010 3. An AVA Book, “Design Thinking”, AVA Publishing, 2010.
3. Ingle, B. R. (2013). *Design thinking for entrepreneurs and small businesses: Putting the power of design to work*. Apress.
4. Norman, D. A. (2016). *Living with complexity*. MIT press.
5. Chapman, J. (2017). *Routledge handbook of sustainable product design*. Taylor & Francis.
6. Nithyananda, K.V. (2019), IPR, protection and Management, India, Cengage learning India.

**Reference Books:**

1. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, “Engineering Design: A Systematic Approach”, 3rd edition, Springer, 2007. 2. Tom Kelley, Jonathan Littman, “Ten Faces in Innovation”, Currency Books, 2006.
2. Kumar, V. (2012). *101 design methods: A structured approach for driving innovation in your organization*. John Wiley & Sons.
3. Chapman, J. (2012). *Designers Visionaries and Other Stories: A Collection of Sustainable Design Essays*. Taylor & Francis.
4. Garrett, J. J. (2010). *The elements of user experience: user-centered design for the web and beyond*. Pearson Education.
5. Neeraj, P. &Khusdeep, D (2014), IPR, India, IN: PHI Learning.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**ENTREPRENEURSHIP, PROJECT MANAGEMENT AND STRUCTURED FINANCE**

(Open Elective-II**)**

**Code: 8ZC19**

**L T P/D C**

**2 0 0 2**

**Course Objective:**The objective of the course is to make students understand the nature of Entrepreneurship, its importance and to create an awareness regarding the systematic planning and implementation of projects; highlight the components of structured finance and establish a framework of CMBS with respect to Servicing Agreements

**Course Outcomes:**

1. Students will understand the nature of Entrepreneurship andits importance
2. Will gain knowledge regarding project, its life cycle and organization
3. Will gain knowledge relating to project formulation and implementation
4. Comprehend the components of structured finance
5. Establish a framework of CMBS
6. Students will gain knowledge relating to the CRE Servicing

**UNIT I**

**CONCEPTS OF ENTREPRENEURSHIP:**Definition of Entrepreneurship, Evolution of Entrepreneurship, Classification of Entrepreneurs**,** Characteristics of Entrepreneur**,** Selection of Product and the means required for starting an enterprise, Financing and Financial incentives available, Success rate of entrepreneurs – a case study.

**UNIT-II**

**BASICS OF PROJECT MANAGEMENT:** Concept and characteristics of a project - types of projects - Objectives of project management - Project Organizational structure - Project life cycle - Challenges and problems of project management - Qualities & functions of a project manager.

**UNIT III**

**PROJECT FORMULATION AND IMPLEMENTATION:** Generation of Project Ideas; Monitoring the environment; Preliminary Screening of Projects; Feasibility study; Project Selection. Detailed Project Report: Market, Technical, Financial and Economic aspects.Pre-requisites for Successful Project Implementation; Control of in-progress Projects (Gantt chart, PERT, CPM); Project Risk Management Process, Post-audit; Abandonment Analysis

**UNIT-IV**

**INTRODUCTION TO STRUCTURED FINANCE**: Term Loans, Bonds/Debentures, Types of debentures, Issue of debt instruments. Structured Finance: Evolution, Securitization process, characteristics, and structured finance products (ABS, CDO, MBS, CDS)

**UNIT-V**

**COMMERCIAL MORTAGAGE LOAN BASICS**: Definition and characteristics of CMBS, CMBS Vs other Mortgage Backed Securities, CMBS three level perspective: property level, loan level, bond level; Life cycle of commercial real estate loans – Loan cycle, Key players in loan cycle; Property types and characteristics, property performance.

**UNIT-V1**

**BASICS OF CRE SERVICING:** Introduction to servicing, Role of the Servicer, Servicing approaches, Influence of technology, Ethics in commercial servicing, Servicing – sources of income, Overview of servicing agreements, Pooling & Servicing agreement, Sub servicing agreement.

**References:**

* H. Nandan, Fundamentals of Entrepreneurship, Prentice Hall of India, First Edition, New Delhi, 2007.
* Jeffrey K. Pinto “Project Management”, 2nd edition, Pearson
* DhandapaniAlagiri “Structured Finance – Concepts & Perspectives”, ICFAI University press.
* Projects by Prasanna Chandra, McGraw-Hill Publishing Co. Ltd
* Project Management: Systems approach to Planning Scheduling and Controlling, H. Kerzner.
* The Complete Real Estate Documents by Mazyar M. Hedayat, John J. Oleary
* The Fundamentals of Listing and Selling Commercial Real Estate - By Keim K. Loren (Author)

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**INTORDUCTION TO VLSI DESIGN**

(Open Elective-II**)**

**Code: 8DC43**

**L T P/D C**

**2 0 0 2**

***Course Objectives:*** *The student will learn about the*

1. *IC fabrication process of various technologies and to understand the electrical properties of MOS transistor.*
2. *Various Layers and layouts for a different technology design rules and how scaling impacts its performance.*
3. *Design of various combinational and sequential circuits using MOS transistors and about CMOS testing.*

***Course Outcomes:*** *After completing the course, student shall be able to*

* + 1. *Design and verify basic logic gates*
    2. *Draw layouts for a digital circuit for a specified technology and verify design rules and validate them.*
    3. *Design schematics for the digital sub systems.*

**UNIT I**

**INTRODUCTION TO MOS AND IC FABRICATION TECHNOLOGY**:

MOS, PMOS, NMOS, CMOS & BiCMOS, VLSI Design Flow, Oxidation, Lithography, Diffusion, Ion Implantation, Metallization, Encapsulation, Probe testing, Integrated Resistors and Capacitors

**Application** – CMOS IC Manufacturing

**UNIT II**

**BASIC ELECTRICAL PROPERTIES:** Basic Electrical Properties of MOS and BiCMOS Circuits: V-I characteristics, Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of Merit (ωo), Zpu/Zpd, Latch-Up in CMOS

**INVERTERS**: NMOS Inverter, Various Pull-Ups, CMOS Inverter Analysis & Design, Bi-CMOS Inverters

**UNIT III**

**CIRCUIT DESIGN PROCESSES:** MOS Layers, Stick Diagrams, Lamda-based CMOS Design rules for Wires, Contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling

**GATES**: CMOS Logic Gates and Structures, Switch logic, NAND, NOR, Compound gates, Multiplexers, Layout Diagrams Gates

**Application** – IC Physical Design – NAND and NOR

**UNIT IV**

**PART A - CIRCUIT CHARACTERIZATION AND PERFORMANCE**

Switching characteristics – fall time, Rise time, Delay time, CMOS Gate sizing, Power consumption (Static and Dynamic), Charge sharing

**PART B – CMOS CIRCUIT AND LOGIC DESIGN**

Logic structures / styles – Pseudo NMOS, Dynamic, Clock CMOS, Domino logic, CVSL, Modified domino logic, Pass transistor logic, transmission gate

**UNIT V**

**MEMORY:** Latches and Registers**,** Clocking strategies (Single Phase),Memory cells (SRAM & DRAM), Row decoders, Column decoders, Read/Write circuitry, LIFO

**UNIT VI**

**SUBSYSTEM DESIGN:** Adders, parity generators, comparators, binary counters, multipliers, Shifter, ALUs

**TEXTBOOKS**:

1. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 2nd Edition, 2009.
2. Digital Integrated Circuits: A Design Perspective - John M. Rabaey, 2nd Edition, 2002.

**REFERENCES:**

* 1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson Learning.
  2. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.
  3. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition.
  4. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
  5. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**OPERATING SYSTEMS CONCEPTS**

(Open Elective-II**)**

**Code: 8EC76**

**L T P/D C**

**2 0 0 2**

**Course Objectives:**

Learn the basics of Operating Systems. Understand process management and synchronization. Learn principles of memory, I/O and file management in a secured environment.

**Course Outcomes:**

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

1. Describe the basic functionalities and structure of the OperatingSystem
2. Explain the concepts and implementations of: Processes, Process Scheduling. Describe, contrast and compare various types of Operating systems like Windows and Linux.
3. Comprehend the concepts of Synchronization and Deadlocks in the Operating System
4. Discuss the concepts of Memory Management (Physical and Virtualmemory)
5. Explain the concepts of File System with regard to directory and disk management algorithms.
6. Students understand the concepts of I/O systems, protection and security in a case studygiven

**UNIT 1:**

**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, Types of OS Services, System Calls, Types of System Calls, Structure of an OS- single structure, layeredapproach.

**UNIT 2:**

**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Process Vs Thread **Process Scheduling**: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; MultiprocessorScheduling

**UNIT 3:**

**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson’s Solution, The Producer\ Consumer Problem, Semaphores, Monitors, Message Passing, Classical IPC Problems: Reader’s & Writer Problem, Dinning Philosopher Problem etc.

**UNIT 4:**

**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker’s algorithm, Deadlock detection and Recovery.

**UNIT 5:**

**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page

allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

**Virtual Memory**: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC),

Not recently used (NRU) and Least Recently used (LRU).

**UNIT 6:**

**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O

Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software,

Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

**File Management**: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation

(linear list, hash table),

**Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN,

Disk

reliability, Disk formatting, Boot-block, Bad blocks

**TEXT BOOKS:**

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin,

Greg Gagne, Wiley Asia Student Edition.

1. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall ofIndia.

**REFERENCE BOOKS:**

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin

Publishing

1. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison- Wesley
2. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall ofIndia
3. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly andAssociates

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**SPECIAL MECHINES**

(Open Elective-II**)**

**Code: 8AC36**

**L T P/D C**

**2 0 0 2**

**Course Objective**

Ability to model and analyze electrical apparatus and their application to power system

**COURSE OUTCOMES:**

1. To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
2. To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
3. To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors.
4. To impart knowledge on the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
5. To impart knowledge on the Construction, principle of operation and performance of permanent magnet synchronous motors.

**UNIT I SYNCHRONOUS RELUCTANCE MOTORS**

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance Motors – Voltage and Torque Equations - Phasor diagram - performance characteristics – Applications.

**UNIT II STEPPER MOTORS**

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control-Concept of lead angle– Applications.

**UNIT III SWITCHED RELUCTANCE MOTORS**

Constructional features – Rotary and Linear SRM - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensor less operation – Characteristics and Closed loop control – Applications.

**UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS**

Permanent Magnet materials – Minor hysteresis loop and recoil line-Magnetic Characteristics – Permeance coefficient -Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power Converter Circuits and their controllers – Motor characteristics and control– Applications.

**UNIT V & VI PERMANENT MAGNET SYNCHRONOUS MOTORS** (PMSM)

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements– Applications.

**TEXT BOOKS:**

1. K.Venkataratnam, ‘Special Electrical Machines’, Universities Press (India) Private Limited, 2008.

2. T. Kenjo, ‘Stepping Motors and Their Microprocessor Controls’, Clarendon Press London, 2nd edition, 1995.

**REFERENCES:**

1. R.Krishnan, ‘Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application’, CRC Press, New York, 2001.

2. T. Kenjo and S. Nagamori, ‘Permanent Magnet and Brushless DC Motors’, Clarendon Press, London, 1988.

3. E.G. Janardanan, ‘Special electrical machines’, PHI learning Private Limited, Delhi, 2014.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**CAD/CAM LAB**

**Code: 8B671**

**L T P/D C**

**-- -- 2 1**

**Pre-requisites : CAD/CAM Theory.**

**Course Objectives:**

Upon completion of this course the students will be able to

• Execute steps required for modeling 3D objects by using protrusion, cut, sweep, extrude commands

• Convert 3D solid models into 2D drawing-different views, sections

• Use isometric views and dimensioning of part models

• Machine simple components on CNC machines • Use CAM software to generate NC code

**Course Outcomes**

After completing the subject, students will be able to:

1. Draw computer Aided 2D drawings to solve design and manufacturing problems using CAD CAM principles.

2. Acquire skills of developing geometric modelingof 3D components

3. Developing assemblies different machine elements and import and export CAD models one software to anther

software

4. Learn skills of writing CNC part programming.

5. Understand how to machine simple components on CNC lathe and CNC mill

6. Understand how to simulate the articulated robot and Fabricate simple components on 3D printing machine

**List of Experiments:**

1. Generation of various 2D Drawings (Minimum of five exercises

2. Three Dimensional Modeling of simple components (Minimum of five exercises)

3.3D Modeling and Assembly of Flange Coupling

4. Developing Assembly from part models of the Plummer block components.

5. Developing Assembly from part models of the Bench vice assembly components.

6. Developing Assembly of Press tool assembly.

7. Simulation of Tool path for CNC Lathe Operations.

8. Simulation of Tool path for CNC Mill Operations.

9. Machining of Simple Components on CNC Lathe.

10. Machining of Simple Components on CNC Mill.

11. Demo of Articulated Robot.

12. Demo of 3D-Printing machine.

**LIST OF EQUIPMENT**

CNC Lathe

CNC Mill

6 Axis Robot

3d Printer

PRO-E / Creo University plus (Perpetual)

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**HEAT TRANSFER LAB**

**Code: 8B672**

**L T P/D C**

**--- --- 2 1**

**Pre-requisites : Heat Transfer Theory.**

**Course Objectives**

Through this course, students will study about the various heat transfer processes, so as to train the students practically to utilize this knowledge in heat transfer related industries

**Course Outcomes**

*After completing the subject, students will be able to*

1. Compute the thermal conductivity of a given material rod and composite wall understand the physical significance of the thermal conductivity of the given material.**(CO1)**

2. To calculate thermal conductivity of lagged pipe and insulating powder under given conditions.**(CO2)**

3. To Understand the forced ad free convection heat transfer coefficients under given conditions from fundamentals.**(CO3)**

4. Understand the LMTD for parallel flow and counter flow heat exchangers and overall heat transfer coefficient.and

pinfin apparatus. **(CO4)**

5. Understand theemissivity of a given surface and to calculate Stefan-Boltzmann’s constant

experimentally.**(CO5)**

6. Understand the phenomena of pool boiling and to draw the boiling curve by showing different phases of boiling.and

study the heat pipe **(CO6)**

**List of Experiments**

1. Composite Slab Apparatus – Overall heat transfer co-efficient.

2. Heat transfer through lagged pipe.

3. Thermal Conductivity of given metal rod.

4. Heat transfer in pin-fin

5. Experiment on Transient Heat Conduction

6. Heat transfer in forced convection apparatus.

7. Heat transfer in natural convection

8. Parallel and counter flow heat exchanger.

9. Emissivity apparatus.

10. Stefan Boltzman Apparatus.

11. Heat transfer in drop and film wise condensation.

**LIST OF EQUIPMENT**

1. Emmisivity Measurement Apparatus
2. Heat Transfer Through Lagged Pipe
3. Heat Transfer in Natural Convection
4. Heat Transfer in forced convection
5. Heat Transfer Composite wall
6. Parallel and counter flow Heat exchanger
7. Stefan Boltzman Apparatus
8. Thermal Conductivity of Metal Rod
9. Condensation in Drop wise Film wise forms
10. Heat Transfer from Pin Fin Apparatus
11. Transient Heat Conduction Apparatus

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Group Project**

**Code: 8B673**

**L T P/D C**

**--- --- 2 1**

**Course Objectives:**

To acquaire basic knowledge on selecting a projcet , learn related tools and enhance Design and production skills for employabilty.

**Course Outcomes:**

* Students use the concepts learned in the courses, so far, in conceptualizing, designing and executing the projects.
* Enables to apply modern tools and technologies for project works
* Inculcates an enthusiasm to use the creative ideas to execute projects to meet the current needs of the society.
* Enhances communicative skills and team work
* The students learn the ability to work as an individual with multidisciplinary approach

A group project shall be carried out by a group of students consisting of 2 to 3 in number in third year first semester. This work shall be carried out under the guidance of the teacher and shall involve design, fabrication, software development or any other significant activity. This can be of interdisciplinary nature also. There will be 100 marks in total with 30 marks of internal evaluation.

**The Internal evaluation shall consist of**:

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Literature survey and presenting seminar at the  end of 6 weeks | 10 marks |
| 2 | Report | 10 marks |
| 3 | Demonstration/presentation at the end of 14  weeks | 10 marks |
| 4 | Total sessional marks | 30 marks |

**Semesterendexamination - 70 marks**

The end examination will be carried out by a committee consisting of an external examiner, head of the department, a senior faculty member and the supervisor.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**|Comprehensive Viva-voce-II**

**Code: 8B695**

**L T P/D C**

**--- 1 -- 1**

**Course Objectives**

1. To enable the examiners to assess the candidate’s knowledge in his or her particular field of learning.

2. To test the student’s awareness of the latest developments and relate them to the knowledge acquired during the classroom teaching.

**Course Outcomes**

After completing the subject, students will be able to:

1. Perform well in Technical interviews
2. Apply knowledge in building their career in particular fields.
3. Enhance their communication skills and interactive-ness.

There shall be comprehensive viva voce as stated above which will be evaluated for 100 marks. Out of 100 marks, 30 marks are internal and 70 marks are external.

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Description** | **Marks** |
| 1 | First mid-sessional viva at the end of 5 weeks (Internal) | 15 marks |
| 2 | Second mid-sessional viva at the end of 10 weeks  (Internal) | 15 marks |
| 3 | Final viva during practical examinations (External) | 70 marks |
| 4 | Total | 100 Marks |

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

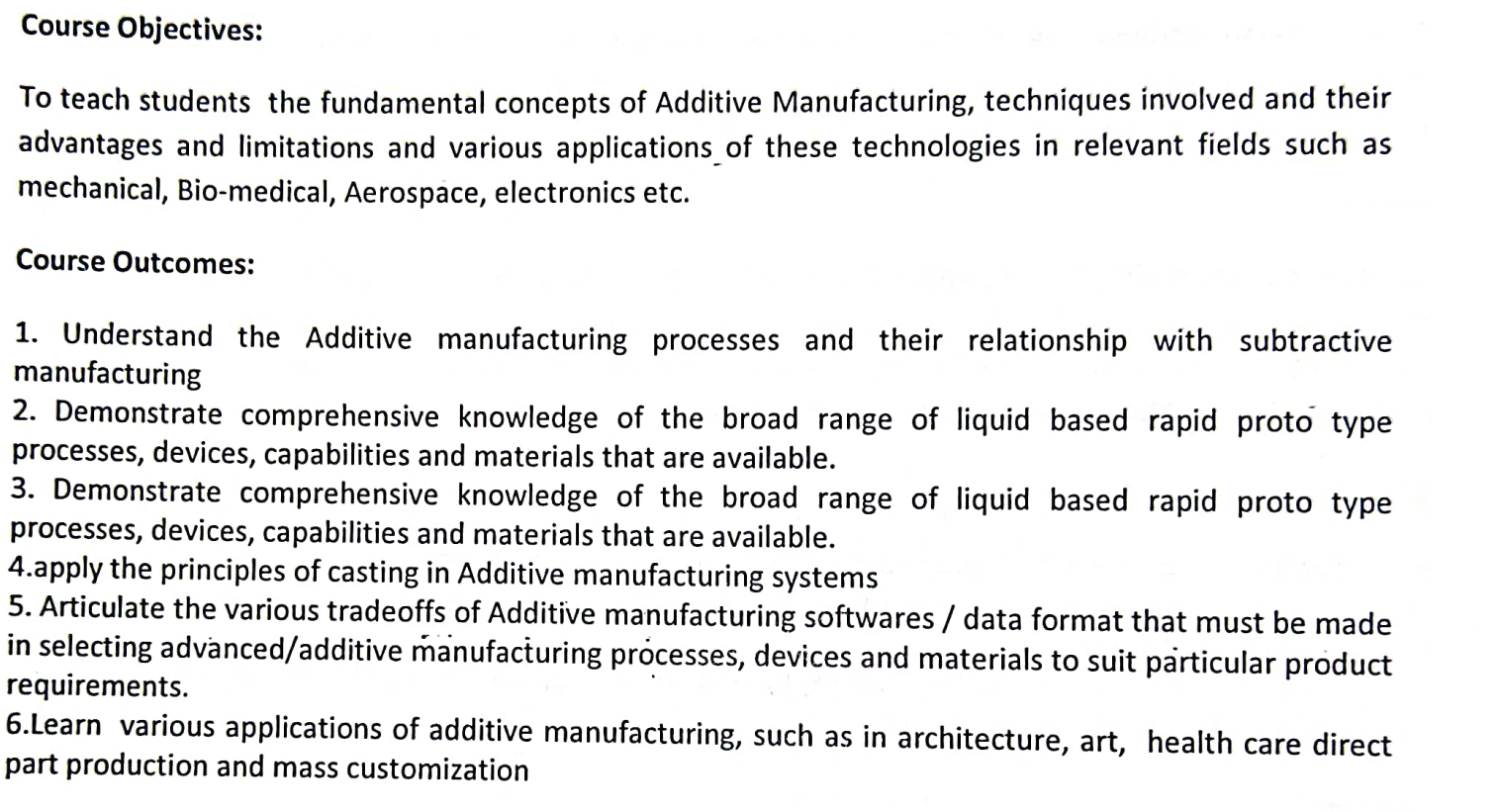
**ADDITIVE MANUFACTURING PROCESSES**

**Code: 8B728**

**L T P/D C**

3 **- - 3**

**Prerequisites:** Metal Cutting

****

**UNIT-I**

**Introduction:**

Development of AM, Fundamentals of AM, Classification of AMS, Advantages,Standards on AM, Commonly used terms, AM process chain

**UNIT-II Liquid-based Additive manufacturing Systems:** Stereo lithography Apparatus (SLA), process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, 3D bioprinting**Solid-based Additive manufacturingSystems:**, Laminated Object Manufacturing (LOM): process, working principle, Applications, Advantages and Disadvantages, Fused Deposition Modeling (FDM): working principle, Applications, Advantages and Disadvantages

**UNIT-III**

**Powder Based Additive manufacturingSystems**: Selective laser sintering (SLS): working principle, Applications, Advantages and Disadvantages, Color Jet printing, working principle, Applications, Advantages and Disadvantages, **Build time calculations –** SLA, FDM**,** Problems

**UNIT-IV**

**Additive manufacturing Data Formats:** STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Features of various AM software’s like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor. **Design for AM** – Basic Principles and Practices

**UNIT-V**

**Rapid Tooling:** Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification, Spray Metal Deposition, Silicone rubber molds, , Casting-Sand Casting ,Investment Casting,evaporative Casting

**Reverse engineering** – what is RE, Why use RE, RE Generic process, Overview of RE-Software and Hardware, CMMs-applications and types

**UNIT-VI**

**Applications and examples :** Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, Arts and Architecture. Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants and Prosthesis, Design and Production of Medical Devices, Bionic ear, dentistry

**Suggested Reading:**

1.Chua C.K., Leong K.F. and LIM C.S, Rapid prototyping; Principles and Applications, World Scientific Publications , Third Edition, 2010.

2. Reverse Engineering: An Industrial Perspective, Springer- Verlag, 2008. ISBN: 978-1-84628-855-5

3. Ian\_Gibson\_· David\_Rosen, Brent\_Stucker, AdditiveManufacturingTechnologies3D Printing, Rapid Prototyping, andDirect Digital Manufacturing,Springer

4.PaulF.Jacobs, Rapid Prototyping and Manufacturing ASME Press, 1996.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**ROBOTICS**

**Code: 8B729**

**L T P/D C**

**3 - - 3**

**Prerequisites:** KOM & DOM

**Course Objectives:**

-to be able to Understand the typical applications of robots in material transfer, machine loading/unloading; processing operations; assembly and inspection.

-to be able to model the motions of Robotics with the concepts of kinematics and dynamics of robots.

-to be able to understand the role of the sensors and Programming in implementing Robots in various applications.

**Course Outcomes:**

* Student demonstrate the basic knowledge in robotic systems their classification and application areas.[CO-1]
* Student demonstrate the Robotic Kinematic Models and its importance[CO-2]
* Student demonstrate the Robotic dynamically models[CO-3]
* Student demonstrate the ability to plan trajectories in the presence/absence of obstacles.[CO-4]
* Student learn the control system concepts and their application in robotics through linear and nonlinear control schemes.[CO-5]
* Student understand commonly used sensory and vision systems used in robotics.[CO-6]

**UNIT – I**

**Introduction and Applications to Robotics:** An over view and applications of Robotics, classification by coordinate system. Different types of robotic manipulators, Robotic actuators: pneumatic, hydraulic and electric.

**UNIT – II**

**Transformation and Manipulator Kinematics:**coordinateframesSpecifications of matrices, Homogeneous transformations as applicable to rotation and translation, D-H notation, Forward and inverse kinematics – problems.

**UNIT – III**

**Differential Motion , Statics and Dynamics of manipulators:** Differential transformations, Jacobians; Force and moment balance, Velocity analysis, Lagrange – Euler and Newton formulations– Euler formations for dynamics of 2D manipulators – Problems.

**UNIT - IV**

**Trajectory Planning**: Path planning, Skew motion, joint integrated motion – straight line motion.Problems

**UNIT - V**

**Control of Manipulators:** Introduction to control systems: open and closed loop control, transfer functions, characteristics of linear and nonlinear systems and their control schemes; model of a manipulator joint, actuator; control schemes applied in robotics: PID

**UNIT - VI**

**Robotics Sensors, Vision& Programming:** Classification of sensors, sensors in robotics; introduction to machine vision, image representation and processing. Introduction to Robotic Programming

**TEXT BOOKS:**

1. Robotics and Control / Mittal R K &Nagrath I J / TMH.

**REFERENCES:**

1. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley & Sons
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robotics / Fu K S/ McGraw Hill.
4. Industrial Robotics MikelP.Groover Tata McGraw-Hill
5. A Text book of INDUSTRIAL ROBOTICS /Ganesh S.Hegde/Laxmi Publications

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**FINITE ELEMNT METHODS**

**Code: 8B730**

**L T P/D C**

**2 1 -- 3**

**Pre-requisites**: Mechanics of Solids, Heat Transfer and Dynamics.

**Course Objectives:** The course is intended to

Gain a fundamental understanding of the finite element method for solving 1-D structural problem.

Formulate the finite element equations for truss and beam elements.

Study two-dimensional problems such as plain stress and plain strain elasticity problems.

Learn finite element analysis of 1-D and 2-D heat conduction and torsion problem Analysis the structures

by considering the mechanical vibrations.

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

1. Apply finite element method to solve problems in solid mechanics.

2.Formulate and solve problems in one dimensional structures including trusses

3.Formulate and solve problems of Beams with FEM

4. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain,

axi-symmetric and plate bending problems.

5.Formulate and apply FE characteristic equations for steady state heat transfer Problems

6.Apply FEM on Structural Dynamics Problems

**UNIT – I:**

Introduction to Finite Element Methods for solving field problems, Methods of Engineering Analysis, Functional Approximation Methods: Rayleigh- Ritz Method, Weighted Residual Methods, Applications of FEM, Advantages and Disadvantages of FEM, Stress and Equilibrium, Strain – Displacement relations, Stress – strain relations for 2D and 3D Problems. Basic Steps of FEM, Characteristics of Finite Element, Principle of Minimum Potential Energy, Convergence Requirements.

**UNIT – II:**

**One Dimensional Problems**: Formulation of Stiffness Matrix for a Bar Element by the Principle of Minimum

Potential Energy, Properties of Stiffness Matrix, Characteristics of Shape Functions, Quadratic shape functions.Problems on uniform and stepped bars for different loading conditions.

**Analysis of Trusses:** Derivation of Stiffness Matrix for Trusses, Stress and strain Calculations, Calculation of

reaction forces and displacements.

**UNIT – III:**

**Analysis of Beams:** Derivation of Stiffness matrix for two noded, two degrees of freedom per node beam element,Load Vector, Deflection, Stresses, Shear force and Bending moment, Problems on uniform and stepped beams for different types of loads applied on beams.

**UNIT – IV:**

**Finite element – formulation of 2D Problems:** Derivation of Element stiffness matrix for two dimensional CST Element, Derivation of shape functions for CST Element, Elasticity Equations, constitutive matrix formulation, Formulation of Gradient matrix. Two dimensional Isoperimetric Elements and Numerical integration.

**UNIT – V:**

**Steady state heat transfer analysis**: Galerkin’s approach, Steady state on-dimensional heat conduction problems, steady state heat transfer in thin fins, Two dimensional steady state heat conduction with triangular element.

**UNIT – VI:**

**Dynamic Analysis**: Formulation of mass matrices for uniform bar and beam Elements using lumped and consistent mass methods, Evaluation of Eigen values and Eigen vectors for a stepped bar and beam Problems.

**TEXT BOOKS**:

1. Introduction to Finite Elements in Engineering by Chandrupatla, Ashok and Belegundu, Prentice, Hall, Pearson

2. The Finite Element Methods in Engineering by SS Rao, Pergamon.

**REFERENCE BOOKS:**

1. Finite Element Methods: Basic Concepts and applicationsbyAlavala, PHI

2. Finite Element Method by Zincowitz, Mc Graw Hill

3. Introduction to Fininte element analysis by S.Md.Jalaludeen, Anuradha Publications, print-2012

4. Finite Element Analysis by P.Seshu, PHI

5. Finite Element Analysis by Hutton, TMH

6. Finite Element Analysis by Bathe, PHI

7. Finite Element Method by Krishna Murthy, TMH

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**METROLOGY AND INSTRUMENTATION**

**Code:8B731**

**L T P/D C**

**3 -- -- 3**

**Course Objectives:**

**The objectives of the course are to** provide required knowledge for mechanical measurements

The course exposes the students to the principles of measurement, gauges

**Course Outcomes:**

*After completing the subject, students will be able to :*

* Understand the concept limits,fits,and tolerances and their practical applications,different linear measurements and angular measuring instruments.
* Understand and design the limit gauges, evaluate surface roughness & its measurement
* Understand screw threads and gear metrology and application of interferometry to flatness measurement
* Understand the features of basic measurement system and various static and dynamic characteristics of instruments
* Understand the principle of various instruments to measure pressure and temperature
* Understand the principle of various instruments to measure the displacement, force, torque and vibrations

**A. METROLOGY :**

**UNIT – I**

**Systems of limits and fits:** Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly, Indian standard system-Problems

**Linear Measurement:** Length standard, line and end standard, slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

**Measurement Of Angles And Tapers:** Bevel protractor, angle slip Gauges, spirit levels, Sine bar, rollers and spheres used to determine the tapers, problems.

**UNIT – II**

**Limit Gauges:** Taylor’s principle – Design of go and No go gauges, plug, ring, snap, gap gauges, Problems.

**Optical Measuring Instruments:** Tool maker’s microscope and its uses

**Surface Roughness Measurement:** Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA, R.M.S Values, Rz value, Methods of measurement of surface finish-profilograph, Talysurf, Problems

**UNIT- III**

**Screw Thread Measurement:** Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch.

**Gear Measurement:** Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.

**B. INSTRUMENTATION:**

**UNIT – IV**

**Introduction and Basic principles of Measurement** – Measurement systems, Generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics, Sources of error, Classification and elimination of error.

**UNIT – V**

**Measurement of Pressure:** Units – classification – different principles used. Manometers, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mc leod pressure gauge.

**Measurement of Temperature:** Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

**UNIT – VI**

**Measurement of Displacement:** Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

**Measurement of Force And Torque -** Elastic force meters, load cells, Torsion meters, Strain gauge Rosettes.

**Measurement of Acceleration and Vibration:** Different simple instruments – Principles of Seismic instruments – Vibro meter and accelerometer using this principle.

**TEXT BOOKS:**

1. Engineering Metrology / I C Gupta./Danpath Rai

2. Engineering Metrology / R.K. Jain / Khanna Publishers

3. Measurement Systems: Applications and Design by D.S Kumar.

4. Mechanical Measurements / BeckWith, Marangoni,Linehard, PHI / PE

**REFERENCES:**

1. Production Engineering/P.C.Sharma

2. Measurement systems: Application and Design, Doeblin Earnest. O. Adaptation by      Manik and      Dhanesh/ TMH

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**MEMS**

**(Professional Elective Course –III)**

**Code: 8B732**

**L T P/D C**

3 **0 0 3**

**Pre-requisite**: NIL

**Course Objectives:**

To learn Applications o f MEMS in industries, Micro sensors

To learn the process of Diffusion and plasma physics

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

CO1: Understand the principles of MEMS and micro systems

CO2: Gain knowledge on design of Microsystems

CO3: learn Engineering mechanics concepts for micro systems

CO4: Explain the Applications of Thermal Fluid Engineering

CO5:learn methods of micro system design

CO6: Understand the material and fabrication requirements for MEMS

**UNIT - I:**

**Overview and working principles of MEMS and Microsystems:** MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & miniaturization, Applications of MEMs in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics

**UNIT - II:**

**Engineering Science for Microsystems Design and Fabrication:** 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 Microsystems Design:** Static Bending of Thin plates, Mechanical Vibration,

Thermo mechanics, Fracture Mechanics, Thin- Film Mechanics, Overview of Finite Element Stress Analysis.

**UNIT - IV:**

**Thermo Fluid Engineering -:** Overview of Basics of Fluid Mechanics in Macro and

Micro scales, 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 Nano scale,Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale,

**UNIT - V:**

**Microsystems Design**Design Considerations, Process Design Mechanical Design, Mechanical design using FEM,Design of a Silicon Die for a Micro pressure sensor.

**UNIT VI:**

**Materials for MEMS & Microsystems and their fabrication:** Substrates and Wafers, Active substrate materials,Silicon as a substrate material, Silicon compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation, Chemical and Physical vapor deposition, etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process.

**TEXT BOOKS:**

1. Tia-Ran Hsu, MEMS & Microsystems. Design & Manufacturing, TMH 2002

2. Foundation of MEMS/ Chang Liu/Pearson, 2012

**REFERENCE BOOKS:**

1. Maluf, M., “An Introduction to Microelectromechanical Systems Engineering”. Artech House, Boston 2000

2. Trimmer, W.S.N., “Micro robots and Micromechnaical Systems”, Sensors & Actuators, Vol 19, 1989

3. Trim., D.W., “Applied Partial Differential Equations”., PWS-Kent Publishing, Boston, 1990

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**RENEWABLE ENERGY SOURCES**

(Professional Elective Course **-III)**

**Code: 8B733**

**L T P/D C**

3 **0 0 3**

**Prerequisites:** None

**COURSE OBJECTIVES:**

To explain the concepts of Non-renewable and renewable energy systems

To outline utilization of renewable energy sources for both domestic and industrial applications

Toanalyse the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

**COURSE OUTCOMES:**

1. Understanding of renewable energy sources gain Knowledge of working principle of solar energy systems

2.Capability to carry out basic design of wind energy systems

3.Learn implementation of Biogas plants

4. Learn the details or ocean Energy

5. Demonstrate Hydro power plants and

6. Understand theGeothermal plants.

**UNIT-I:**

**Global and National Energy Scenario:** Over view of conventional & renewable energy sources, need &

development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development,Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO2reduction potential of renewable energy- concept of Hybrid systems.

**UNIT-II:**

**Solar Energy:** Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal,applications of solar energy systems.

**UNIT-III:**

**Wind Energy:** Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors

influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics,applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management,energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

**UNIT-IV:**

**Biogas:** Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy

system, design and constructional features. Biomass resources and their classification, Biomass conversion

processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction,

biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass,bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

**UNIT-V:**

**Ocean Energy:** Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

**UNIT-VI:**

a. **Small hydro Power Plant:** Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.

b. **Geothermal Energy**: Geothermal power plants, various types, hot springs and steam ejection.

**Text Books:**

1. Power plant technology by J Wakhil

2. Non-Conventional Energy Sources by G.D Rai

**Reference Books:**

1. Solar Energy - Principles of thermal collection and storage by S. P. Sukhatme

2. Solar Engineering of Thermal Processes by J. A. Duffie and W. A. Beckman

3. Biomass Regenerable Energy by D. D. Hall and R. P. Grover.

4. Renewable Energy Sources by Twidell, J.W. and Weir, A., EFN Spon Ltd., 1986.

5. Renewable Energy Engineering and Technology by Kishore VVN,, Teri Press, New Delhi, 2012

6. Sustainable Energy Systems Engineering by Peter Gevorkian, McGraw Hill,2007

7. Principles of Solar Engineering by Kreith, F and Kreider, J. F., McGraw-Hill, 1978.

8. Renewable Energy, Power for a Sustainable Future by Godfrey Boyle,, Oxford University Press, U.K, 1996.

9. Alternative Energy Sources by Veziroglu, T.N.,,Vol 5 and 6, McGraw-Hill, 1990

10. Biochemical and Photosynthetic aspects of Energy Production by Anthony San Pietro, Academic Press, 1980.

11. Thermochemical processing of Biomass by Bridgurater, A.V., Academic Press, 1981.

12. Renewable Energy by Bent Sorensen, Elsevier, Academic Press, 2011

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**PRODUCTION PLANNING & CONTROL**

(Professional Elective Course**-III)**

**IV Year B.Tech. I-Sem**

**Code: 8B734**

**L T P/D C**

3 **0 0 3**

**Pre-requisites:** NIL

**Course Objectives**:

Understand the importance of Production planning & control. Learning way of carrying out various functions so as

to produce right product, right quanity at right time with minimum cost.

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

CO1: Understand the role of PPC

CO2: Understand production systems and their characteristics to evaluate MRP and JIT systems against

traditional inventory control systems and Analyze aggregate planning strategies.

CO3: Apply line balancing in production plants

CO4: Apply forecasting and scheduling techniques to production systems.

CO5: Demonstrate the concepts of Dispatch in PPC

CO6: Understand theory of follow up for effective management of production systems.

**UNIT – I:**

**Introduction**: Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department.

**Forecasting:** Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques.Measures of forecasting errors.

**UNIT – II:**

**Inventory management:** Functions of inventories – relevant inventory costs – ABC analysis – VED analysis –Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I,MRP II, ERP, JIT Systems - Basic Treatment only.

**Aggregate planning –** Definition – aggregate-planning strategies – aggregate planning methods – transportationmodel.

**UNIT –III:**

**Line Balancing**: Terminology, Methods of Line Balancing, RPW method& Largest Candidate method.Routing–Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

**UNIT – IV:**

**Scheduling:** Definition – Scheduling Policies – types of scheduling methods – differences with loading – flow shop scheduling **–** job shop scheduling, line of balance (LOB) – objectives - steps involved.

**UNIT – V:**

**Dispatching**: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.

**UNIT-VI:**

**Follow up**: definition – types of follow up – expediting – definition – expediting procedures-Applications of

computers in planning and control.

**TEXT BOOKS:**

1. Production Planning and Control by M.Mahajan, Dhanpatirai& Co

2. Production Planning and Control by Jain & Jain, Khanna publications

**REFRENCE BOOKS:**

1. Production Planning and Control- Text & cases by SK Mukhopadhyaya, PHI.

2. Production and operations Management by R.PanneerSelvam, PHI

3. Operations Management by Chase, PHI

4. Operations Management by William J. Stevensan, MC Graw Hills.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**AUTOMOTIVE ELECTRICAL AND ELECTRONICS**

(Professional Elective Course**-III)**

**Code: 8B735**

**L T P/D C**

3 **0 0 3**

**COURSE PRE-REQUISITES:** Basic Electrical and Electronics Engineering, Automotive Chassis and Automotive Engines

**COURSE OBJECTIVES:**

• To study the fundamentals, working and advanced concepts of automotive battery, ignition and starting systems

• To learn basics of automotive electronics and working principle of sensors and actuators

• To understand the working of basic and advanced concepts of automotive charging and lighting systems

• To provide an overview on control system concepts in engine control

**COURSE OUTCOMES:** After completion of the course, the student should be able to

**CO-1:** Explain the fundamentals, working and advanced concepts of automotive battery system.

**CO-2:**Explainthe working of ignition and starting system

**CO3:** Discuss the working of basic and advanced concepts of automotive charging and lighting systems

**CO-4:** Present basics of automotive electronics.

**CO-5:** Gain knowledge of Automotive Embedded system

CO-6: Apply Electronic Management systems in engine control

**UNIT – I:**

**Starting System and Battery:** Principle and construction of starter motor, working of different starter drive units and solenoid switches. Battery – Lead acid battery, rating, characteristics and testing.

**UNIT – II:**

**Ignition System:** Ignition system types and components, ignition timing, spark advance and retarding mechanisms, types of spark plugs. Electronic ignition systems, programmed ignition and distributor-less ignition.

**UNIT – III:**

**Charging and Lighting System:** Generator and alternator - principle, construction and working, third brush regulation, rectification, cut-outs, relays and regulators. Details of head light and side light, LED lighting system, head light dazzling and preventive methods.

**UNIT – IV:**

**Accessories and Wiring:** Horn, wiper, speedometer, fuel, oil and temperature gauges, power windows, mirrors, sun roof and defrosters. Fuses, cables, connectors, automotive wiring - Insulated and earth return system, wiring diagrams, symbols and standards.

**UNIT – V:**

**Fundamentals of Embedded System:** Microcomputer - Fundamentals, tasks and operations, CPU registers, microprocessor architecture, reading instructions, microcomputer hardware and microcontroller applications in automotive systems.

**UNIT – VI:**

**Electronic Management System:** Role of engine management system, power train control Systems – air/fuel ratio control, control of spark timing, idle-speed control, transmission control, body control module, engine mapping and on-board diagnostics.

**TEXTBOOKS:**

1. Automobile Electrical Equipment, Crouse W H, McGraw Hill Book Co., Inc., New York 3rd Edition,1986

2. Understanding Automotive Electronics, William B Ribbens, 5th Edition, Butter worth Heinemann Woburn, 1998

3. Understanding Automotive Electronics, Bechhold SAE, 1998

**REFERENCES:**

1. Modern Electrical Equipment of Automobiles, Judge A W, Chapman & Hall, London,1992

2. Automotive Handbook, Robert Bosch, SAE, 5th Edition, 2000

3. Automotive Electrical Equipment, Kholi P L, Tata McGraw Hill Co., Ltd., New Delhi, 1975

4. Automotive Electrical Equipment, Young A P and Griffiths L, ELBS & New Press, 1999

5. Automotive Electrics Automotive Electronics, 4th Edition, Robert Bosch GmbH, 2004

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**INDUSTRIAL MANAGEMENT**

**(Professional Elective Course –IV)**

**Code: 8B736**

**L T P/D C**

3 **0 0 3**

**Pre-requisite**: NIL

**Course Objectives:**

• Understand the philosophies of management gurus

• Understand the various types of organization structures and their features, and Their advantages and disadvantages.

• Learning various Industrial Engineering Practices like Operations Management techniques, work study, statistical quality control techniques, Job evaluation techniques and network analysis techniques

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

1. Able to apply principles of management
2. Able to design the organization structure
3. Able to apply techniques for plant location, design plant layout and value analysis
4. Able to carry out work study to find the best method for doing the work and establish standard time for a given method
5. Able to apply various quality control techniques and sampling plans
6. Able to do job evaluation and network analysis.

**UNIT – I**

**Introduction to Management:** Entrepreneurship and organization – Nature and Importance of Management, Functions of Management, Taylor’s Scientific Management Theory, Fayol’s Principles of Management, Maslow’s Theory of Human Needs, Douglas McGregor’s Theory X and Theory Y, Herzberg’s Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

**UNIT - II**

**Designing Organizational Structures:** Departmentalization and Decentralization, Types of Organization structures – Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

**UNIT - III**

**Operations Management: Objectives-** product design process- Process selection-Types of production system (Job, batch and Mass Production), Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing (RPW method) Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

**UNIT - IV:**

**Work Study:** Introduction — definition — objectives — steps in work study — Method study — definition, objectives — steps of method study. Work Measurement — purpose — types of study — stop watch methods — steps — key rating — allowances — standard time calculations — work sampling. Statistical Quality Control: variables-attributes, Shewart control charts for variables- chart, R chart, – Attributes- Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

**UNIT - V**

**Job Evaluation: Methods of job evaluation —** simple routing objective systems — classification method factor comparison method, point method, benefits of job evaluation and limitations.

**UNIT - VI**

**Project Management (PERT/CPM):** Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

**TEXT BOOKS**

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.

2. Industrial Engineering and Management Science/T.R. Banga and S.C. Sarma/Khanna Publishers. **REFERENCE BOOKS**

1. Motion and Time Study by Ralph M Barnes! John Willey & Sons Work Study by lLO.

2. Human factors in Engineering & Design/Ernest J McCormick /TMH.

3. Production & Operation Management /Paneer Selvam/PHI.

4. Industrial Engineering Management/NVS Raju/Cengage Learning.

5. Industrial Engineering Hand Book/Maynard.

6. Industrial Engineering Management I Ravi Shankar/Galgotia.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**COMPUTATIONAL FLUID DYNAMICS**

(ProfessionalElective Course – IV)

**Code: 8B737**

**L T P/D C**

3 **0 0 3**

**Pre-requisite**: Heat Transfer and Fluid Mechanics

**Course Objective**: To apply the principles of Heat Transfer and Fluid Mechanics to formulate governing equations

for physical problems and to solve them using different numerical techniques

**Course Outcomes**: At the end of the course, the student should be able to

CO1: Understand the various methods and boundary conditions of Heat transfer models

CO2: Differentiate between different types of Partial Differential Equations and to apply appropriate numerical

techniques

CO3: Solve the simple heat transfer and fluid flow problems using different numerical techniques, viz., FDM

CO4:Apply FDM for Heat transfer problems

CO5: Signify the parabolic equations in CFD.

CO6:Understand and to appreciate the need for validation of numerical solution in CFD

**UNIT – I:**

Review of Modes of Heat Transfer – Governing Equations – Initial and boundary conditions

Methods to solve a physical problem –Relative advantages and disadvantages of experimental, analytical and

numerical methods – Scope of CFD – Its applications and limitations - Brief comparison between different

numerical methods, viz., FDM,FEM & FVM Methods to solve a system of simultaneous Linear Algebraic

Equations, - Direct Method – Banded Matrices – Thomas algorithm / TDMA - iterative schemes of Matrix

Inversion.

**UNIT – II:**

Classification of PDE – Elliptic, parabolic and hyperbolic PDE as governing equations – Examples and their

physical significance FDM – Discretization of Partial Derivative Terms using Taylor’s series of approximation – Finite Difference Formulae – Application and implementation aspects of finite-difference equations –Consistency

**UNIT – III:**

Application of FDM to elliptic equations, viz., Laplace Equations – solution of 1D steady state heat conduction

using FDM – Systems with heat generation –Systems with variable thermal conductivity – Fins

**UNIT – IV:**

Application of FDM to solve 1D steady state heat conduction in Curvelinear geometry – Singularities – Treatment of singularities

Application of FDM to solve 2D steady state heat conduction– with and without heat generation and subjected to different boundary conditions

**UNIT – V:**

Parabolic Equations – Use of Explicit, implicit and semi implicit methods – Errors and Stability analysis -

application of FDM to solve 1D transient heat conduction equations – ADI Scheme – Treatment and

Implementation

**UNIT-VI:**

Numerical methods for incompressible flow – Governing equations –Difficulties in solving N-S equations – Stream function and Vorticity method – Advantages and disadvantages – treatment of boundary conditions – Determination of Pressure for viscous flows – Disadvantages – Staggered Grid – SIMPLE algorithm for pressure liked equations.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**AUTOMATION IN MANUFACTURING**

**(Professional Elective Course – IV)**

**Code: 8B738**

**L T P/D C**

3 **0 0 3**

**Prerequisites**: Production Technology

**Course Objectives:**

Lower Cost and Improve Time-to-Market

Automation investment life-cycle analysis

Empowered teams of talented employees

Partnering with automation suppliers

On-line process analysis

Procedural process control

Information integration and data warehousing

**Course Outcomes:**

**CO1:**Understand the basicof automation and its elements

CO2: Overview various material Handling systems

CO3: demonstrate models on transport and storage systems

CO4: learn techniques of Assembly lines

CO5: learn operations of transfer lines

CO6: Interpret the Automated Assembly system

**UNIT-I:**

**Introduction to Automation:** Automation in Production Systems-Automated Manufacturing Systems,

Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies.Manufacturing operations, Production Concepts and Mathematical Models.Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

**UNIT-II:**

**Introduction to Material Handling:** Overview of Material Handling Equipment, Considerations in Material

Handling System Design, the 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material

**UNIT-III:**

Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

**UNIT -IV:**

**Manual Assembly Lines:** Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

**UNIT-V:**

**Transfer lines:** Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

**UNIT-VI:**

**Automated Assembly Systems**, Fundamentals of Automated Assembly Systems, Design for Automated Assembly,and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

**TEXT BOOKS:**

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover/ Pearson Eduction.

2. CAD CAM: Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne / Pearson

edu. (LPE)

**REFERENCE BOOKS:**

1. Automation, Buckinghsm W, Haper& Row Publishers, New York, 1961

2. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**VEHICLE DYNAMICS**

**(Professional Elective Course – IV)**

**Code: 8B739**

**L T P/D C**

3 **0 0 3**

**COURSE PRE-REQUISITES:** Engineering Physics, Mathematics, Engineering Mechanics and Automotive Chassis

**COURSE OBJECTIVES:**

• To identify different vehicle performance parameters

• To provide knowledge on vehicle ride model

• To study vehicle handling characteristics

**COURSE OUTCOMES:** After completion of the course, the student should be able to

**CO-1:** Understandthe different vehicle performance parameters

**CO-2:**UnderstandtheEstimate Braking performance of the vehicle

**CO-3:**Understand theLearn concepts of Tyre Dynamics

**CO-4:**Understadthe various roadload including aerodynamics loads on the vehicle

**CO-5:** Understand theDevelop a vehicle ride model

**CO-6:** Understand the vehicle handling characteristics

**UNIT – I:**

**Vehicle Performance:** Fundamental approach to modelling - lumped mass, vehicle fixed coordinate system, motion variables, earth fixed coordinate system, Euler angles, forces, newton’s second law, dynamic axle loads - static loads on level ground, low- speed acceleration and loads on grades.

**Acceleration Performance:** Power-limited acceleration-engines, power train, automatic transmissions, traction-limited acceleration - transverse weight shift due to drive torque and traction limits.

**UNIT – II:**

**Braking Performance:** Constant deceleration, deceleration with wind resistance, energy/power, braking forces - rolling resistance aerodynamic drag, driveline drag, grade, brakes - brake factor, tyre-road friction – velocity, inflation pressure, vertical load, brake proportionating, anti-lock braking systems, braking efficiency, rear wheel lockup and pedal force gain.

**UNIT – III:**

**Tyre Dynamics:** Mechanics of pneumatic tyres, tyre forces and moments, rolling resistance of tyres, tractive (braking) effort and longitudinal slip (skid), cornering properties of tyres-slip angle and cornering force, slip angle and aligning torque, camber and camber thrust, performance of tyres on wet surfaces and ride properties of tyres.

**UNIT – IV:**

**Road Loads:** Aerodynamics - mechanics of air flow around a vehicle, pressure distribution on a vehicle, aerodynamic forces, drag components, aerodynamics aids - bumper spoilers, air dams, deck lid spoilers, window and pillar treatments, optimization, drag - air density, drag coefficient, side force, lift force, pitching moment, yawing moment, rolling moment, crosswind sensitivity.

**UNIT – V:**

**Ride:** Excitation sources - road roughness, tyre/wheel assembly, driveline excitation, engine/transmission, vehicle response properties - suspension isolation, suspension stiffness, suspension damping, active control, wheel hop responses, suspension nonlinearities, rigid body bounce/pitch motions and bounce pitch frequencies.

**UNIT – VI:**

**Handling:** Introduction, low speed turning, high speed cornering - tyre cornering forces and cornering equations, understeer gradient, characteristic speed, critical speed, lateral acceleration gain, yaw velocity gain, sideslip angle, static margin, suspension effects on cornering - roll moment distribution, camber change, roll steer, lateral force compliance steer, aligning torque, effect of tractive force on cornering and summery of under steer effects.

**TEXT BOOK:**

1. Fundamentals of Vehicle Dynamics, Thomas D. Gillespie, SAE, USA, 1992

**REFERENCES:**

1. Theory of Ground Vehicles, Wong J. Y., 4th Edition, John Wiley & Sons, USA, 2008

2. Automobile Mechanics, Giri N. K., 10th Edition, Khanna Pub, 2015

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**Metrology& Instrumentation Lab**

**Code: 8B774**

**L T P/D C**

0 **0 2 1**

**A: Metrology Lab**

**Pre-requisites: Metrology Theory**

**Course Objective:**

The Metrology and instrumentation Laboratory course is designed for measuring and gauging instruments for inspection of precision linear, geometric forms, angular and surface finish measurements.

**Course Outcomes:**

Student will become familiar with the different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc).

**LIST OF EXPERIMENTS:**

1. Measurement of lengths, heights, diameters by vernier calipers and micrometers
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier for checking the chordal addendum and chordal height of      spur gear.
4. Thread measurement by Two-wire/ Three-wire method
5. Tool makers microscope and its application.
6. Angle and taper measurements by Bevel protractor and Sine bar.
7. Surface roughness measurement by Taly Surf.
8. Measurement of gear parameters and thread parameters using Profile Projector
9. Measurement of alignment using Autocollimator / Roller set
10. Calibration of Micrometer and vernier caliper using slip gauges
11. Measurement of roundness of cylindrical specimen using dial indicator and V-block
12. Measurement of heights using vernier height gauge

**B:Instrumentation Lab**

**Course Objective:**

The student can learn the measurements with and calibration of instruments. They also understand the machine tool alignment test. Instrumentation lab introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various instruments for measuring pressure, temperature, displacement, speed, vibration etc.

**Course Out comes:**

After completion of the experiments in Instrumentation Lab:

1. Student will able to Understand the principle of and working procedure of Linear Variable Differential Transformer (LVDT) for measurement of displacement.

2. Student will able to Understand the Principle of Pressure measurement.

3.Student will able to Understand the Principle of Vibration measurement.

4. Student will able to Understand the Principle of Torque measurement and load cell

5. Student will able to Understand the principle of displacement measurement.

6.Student will able to Understand the principle of Temperature measurement.

**LIST OF EXPERIMENTS:**

1. Calibration of Pressure Gauges

2. Calibration of transducer for temperature measurement.

3. Study and calibration of LVDT transducer for displacement measurement.

4. Calibration of strain gauge for temperature measurement.

5. Calibration of thermocouple for temperature measurement.

6. Calibration of capacitive transducer for angular displacement.

7. Calibration of Load Cells

8. Study and use of a Seismic pickup for the measurement of vibration amplitude of an Engine bed at various loads.

9. Study and calibration of photo and magnetic speed pickups for the measurement of speed

10. Measurement of force using strain gauge based dynamometer

**LIST OF EQUIPMENT**

1. Micro meters
2. Verniercaliper
3. Dial Bore guage
4. Inside Calilper 4"
5. Bevel protractor 150/300mm
6. Sine Bar ( 100mm)
7. Surface Plate (Granite)
8. Slip Gauge set (83 Pieces)
9. Dial Guage 10 mm Range
10. Gear tooth Vernier 0-26 mm
11. Three wire sets
12. Tool maker's micro scope
13. Screw thread plug Gauge Go/NOGO
14. Surface Roughness Tester
15. V-Block
16. Mechanical Comparator ( Millimess) 1 micron
17. Height Gauge
18. Profile Projector

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**CAE LAB**

**Code: 8B775**

**L T P/D C**

0 **0 21**

**Pre-requisites: CAE Theory**

**Course Objectives:**

**Upon completion of this course the students will be able to**

 Execute steps required for analysis of objects by using analysis software

 Select the suitable finite element for different types of problems

 Interpret the results finite element results with different boundary conditions

 Know the data exchange formats for importing and exporting the model

 Understand the CAE software applicability for analyzing structural and thermal problems

**Course Outcomes:**

**After completing the subject, students will be able to:**

1. Select appropriate finite element for solving structural and thermal problems.

2. Correlate mathematical formulation of beams using FE method

3. Analyze Stresses and deflections of trusses and bars under static loading.

4. Analyze Stresses and deflections of thin plates subjected to in-plane loading and solids.

5. Interpret the results after model analysis and transient dynamic analysis

6. Simulate real life structural and thermal problems.

**LIST OF EXPERIMENTS**

1. Analysis using 1D-bar elements. [CO-3]

2. Analysis of simple 2D Trusses [C0-3]

3. Analysis deflection of simple Beams [CO-2]

4. Analysis of Plane stress problems [CO-4]

5. Analysis of axi-symmetric problems [CO-4]

6. Steady state Heat Transfer Analysis of a composite wall and a Fin [CO-6]

7. Evaluation of SFD and BMD of Beams with different loading conditions [CO-2]

8. Analysis of three dimensional FEA [C0-4].

9. Modal Analysis of a Beam. CO-5]

10. Harmonic Analysis of a Beam. [CO-5]

11. Transient Analysis of a Beam [CO-5]

12. Developing a 3-D Model in a modelling software and analyzing it by importing into FEA software[CO-1]

**LIST OF EQUIPMENTS& SOFTWARES:** Software used: ANSYS APDL &ANSYS WORKBENCH

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**PRODUCTION DRAWING PRACTICES LAB**

**Code: 8B776**

**L T P/D C**

**-- -- 2 1**

**Pre-requisites: EG, MD**

**Course Objective:**

* *Understand the various symbols used in machine drawing.*
* *Understand the principles and requirements of various Assembly drawings.*
* *Drawing of different machine components*
* *Imagine and drawing the assembly by seeing the components given.*
* *Ability to understand the existing geometric modeling and develop a geometric modeling for a new component in design process*

**Course Outcomes:**

* *able to understands the significance symbols used in drawing.*
* *able to learn the complete requirements of various Assembly drawings.*
* *Become proficient Drawing of different machine components*
* *become proficientImagine and drawing the assembly by seeing the components given.*
* *understand the existing geometric modeling.*
* *understand the existing new component in design process*

**UNIT – I**

Conventional representation of Materials – conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

**UNIT – II**

**Limits and Fits:** Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

**UNIT – III**

**Form and Positional Tolerances:** Introduction and indication of the tolerances of from and position on drawings, deformation of run out and total run out and their indication.

**UNIT – IV**

**Surface roughness and its indication:** Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

Heat treatment and surface treatment symbols used on drawings.

**UNIT – V**

**Detailed and Part drawings:** Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

**UNIT – VI**

Part drawing using computer aided drafting by CAD software

**Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script,DXE AND IGES FILES.

**Text Books:**

1) Production Drawing: P.N.Reddy and T.A.Janardhan Reddy/Hi-Tech Publishers

**References:**

1) Geometric dimensioning and tolerancing-James D. Meadows/B.S. Publications.

Engineering Metrology, R.K. Jain, Khanna Publications

2) Production Drawing K.L.Narayana and P.Kannaiah /New AGE Publishers

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**COMPOSITE MATERIALS**

**(Professional Elective Course – V)**

**Code: 8B840**

**L T P/D C**

3 **0 0 3**

**Pre-requisites:**  materials and mechanics of solids.

**Course objectives:** Provides the concepts of composite materials. To analyze macro and micro mechanical

behavior of a lamina.

**Course Outcomes:**

At the end of course students will be abletounderstand

CO1: Understand various types of composites

CO2: Demonstrate Reinforcements in composites

CO3: Analyze macro properties of composite lamina

CO4: Analyze macro properties of composite laminate

CO5: Explain Failures of composites

CO6: Understand the Joining methods of composites

**UNIT-I:**

**Introduction to Composite Materials**: Introduction ,ClassificationPolymer Matrix Composites, Metal Matrix

Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber-Reinforced Composites and naturemade composites, and applications .

**UNIT-II:**

**Reinforcements:** Fibers- Glass, Silica, Kevlar, carbon, boron, siliconcarbide, and borncarbidefibers. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

**UNIT-III:**

**Macro mechanicalAnalysis of a Lamina**: Introduction, Definitions Stress, Strain, ElasticModuli, StrainEnergy.Hooke’s Law for Different Types of Materials, Hooke’s Law for a Two-DimensionalUnidirectional Lamina, Angle of lamina, Plane Stress Assumption, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

**UNIT-IV:**

**Macro mechanical Analysis of Laminates**: Introduction, Laminate Code, Stress–Strain Relations for a Laminate,In-Plane and Flexural Modulus.

**UNIT-V:**

**Failure Analysis of Laminates**: Introduction, Special Cases of Laminates, Applications, Failure Criterion for a Laminate.

**UNIT-VI**

**Joining Methods and Composite Tests** :Joining –Advantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths and test procedures.

**Text Books:**

1. R. M. Jones, Mechanics of Composite Materials, McGraw Hill Company, New York, 1975.

2. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.

**Reference Books:**

1. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley- Interscience, New York, 1980.

2. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), By Autar K. Kaw, Publisher:

CRC

3. L. R. Calcote, Analysis of Laminated Composite Structures, Van NostrandRainfold, New York, 1969.

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**JET PROPULSION and ROCKET ENGINEERING**

**(Professional Elective-V)**

**Code: 8B841**

**L T P/D C**

3 **0 0 3**

**Pre-requisites:** Applied Thermodynamics

**Course Objectives:**

*To make the student aware of various propulsion devices and use of thrust equations.*

*To make the student to know the working of Ramjet engine in detail.*

*To make the student to understand the working of rocket engine and detail study on fuels used in rocket*

. **Course Outcomes:**

After completing the subject, students will be able to:

* understand open, closed and semi closed cycle of gas turbines, thermal jet engines, classification of energy flow, trust power and propulsion efficiency
* understand essential components of turbo pro and turbo jet performance evaluation, thrust augmentation
* understand plant layout of Ramjet , principle of operation,
* understand liquid propellant Rocket engines, compassion of propulsion systems.
* understand flight mechanics, applications of trust profiles, rocket heat transfer and ablative to cooling
* understand cryogenics, advanced propulsion systems, elementary treatment of Electrical Nuclear and Plasma Arc propulsion.

**UNIT-I**

Elements of Gas Turbine theory – Thermo dynamic Cycles, open closed and semi-closed – Parameters of performances – Refinements to simple cycle

**Jet Propulsion:** Historical sketch – Reaction Principle – Essential features of propulsion devices – Thermal Jet Engines, Classification of – Energy flow, thrust, thrust power and propulsion efficiency – Need for Thermal jet engines and applications.

**UNIT – II**

**Turboprop and Turbojet** – Thermo dynamic cycles, Plant layout, essential components, principles of operation – performance evaluation – Thrust Augmentation and Thrust reversal – Contrasting with Piston Engine Propeller plant.

**UNIT – III**

**Ramjet** – Thermo dynamic Cycle, plant lay-out, essential components – Principle of operation – performance evaluation – Comparison among atmospheric thermal jet engines – elementary treatment of Scram jet and pulse jet.

**UNIT – IV**

**Rocket Engines:** Need for, applications – Basic principle of operation and parameters of performance – Classification, solid and liquid Propellant rocket engines, advantages, domains of application – Propellants – Comparison of propulsion systems.

**UNIT – V**

**Rocket technology-I:** Flight mechanics, Application Thrust Profiles, Acceleration – staging of Rockets, need for – Feed systems, injectors and expansion nozzles – Rocket heat transfer and ablative cooling

**UNIT – VI**

**Rocket technology-II** – Testing and Instrumentation – Need for Cryogenics – Advanced Propulsion Systems, elementary treatment of Electrical Nuclear and Plasma Arc Propulsion.

**TEXT BOOKS:**

1. Fundamentals of I.C. Enginers/Gill, Smith and Zierys
2. Rocket Propulsion / Sutton
3. Gas Turbines/V.Ganesan/TMH
4. Thermodynamics of Propulsion / Hill and Paterson

**REFERENCE BOOK:**

1. Gas Turbines / Cohen, Rogers and SarvanaMuttoo / Addison Wesley and Longman
2. Compresssible fluid flow by Yahya

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**MECHATRONICS**

**(Professional Elective-V)**

**Code: 8B842**

**L T P/D C**

3 **0 0 3**

**Pre-requisites:** CAD/CAM

**Course Objective:**

to model and analyze electrical and mechanical systems and their interconnection for engineering applications.

**Course Outcomes:**

Student

1. able to understands the significance of integration of mechanical, electronics, control and computer engineering and also focuses the role of sensors.

2. able to learn the complete theory of various sensors.

3. be able to get skill to select appropriate actuators for different applications.

4. become proficient in building linear models of mechatronics

5. become proficient in the programming of microcontrollers.

6.able to demonstrate PLCprogramming

**UNIT-I**

**Introduction:** History of Mechatronics, Scope and Significance of Mechatronics systems, elements of mechatronic systems, needs and benefits of mechatronics in manufacturing Sensors: classification of sensors basic working principles, Displacement Sensor - Linear and rotary potentiometers, LVDT and RVDT, incremental and absolute encoders. Strain gauges. Force/Torque – Load cells. Temperature – Thermocouple, Bimetallic Strips, Thermistor, RTD

**UNIT-II**

Accelerometers, Velocity sensors – Tachometers, Proximity and Range sensors – Eddy current sensor, ultrasonic sensor, laser interferometer transducer, Hall Effect sensor, inductive proximity switch. Light sensors – Photodiodes, phototransistors, Flow sensors – Ultrasonic sensor, laser Doppler anemometer tactile sensors – PVDF tactile sensor, micro-switch and reed switch Piezoelectric sensors, vision sensor

**UNIT-III**

Actuators: Electrical Actuators : Solenoids, relays, diodes, thyristors, triacs, BJT, FET, DC motor, Servo motor, BLDC Motor, AC Motor, stepper motors. Hydraulic & Pneumatic devices – Power supplies, valves, cylinder sequencing. Design of Hydraulic & Pneumatic circuits. Piezoelectric actuators, Shape memory alloys.

**UNIT-IV**

Basic System Models & Analysis: Modelling of one and two degrees of freedom Mechanical, Electrical, Fluid and thermal systems, Block diagram representations for these systems. Dynamic Responses of System: Transfer function, Modelling Dynamic systems, first order systems, second order systems.

**UNIT-V**

Controllers: Classification of control systems, Feed back, closed loop and open loop systems, Continuous and discrete processes, control modes, Two step Proportional, Derivative, Integral, PID controllers.

**UNIT-VI**

PLC Programming: PLC Principles of operation PLC sizes PLC hardware components I/O section Analog I/O section Analog I/O modules, digital I/O modules CPU Processor memory module Programming. Ladder Programming, ladder diagrams, timers, internal relays and counters, data handling, analogue input and output. Application on real time industrial automation

**Reading:**

1. W. Bolton, “Mechatronics‟, 5 thedition, Addison Wesley Longman Ltd, 2010

2. DevdasShetty& Richard Kolk “Mechatronics System Design”, 3rd edition. PWS Publishing, 2009.

3. Alciatore David G &Histand Michael B, “Introduction to Mechatronics and Measurement systems”, 4th edition, Tata McGraw Hill, 2006.

Video references:

1. <http://video_demos.colostate.edu/mechatronics>

2. http:// mechatronics.me.wisc.edu

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**ALTERNATIVE FUELS**

**(Professional Elective-V)**

**Code: 8B843**

**L T P/D C**

3 **0 0 3**

**COURSE PRE-REQUISITES:** Engineering Chemistry and Automotive Engines

**COURSE OBJECTIVES:**

• To identify various sources of alternative fuels for SI and CI engines

• To know the benefits and engine modifications required for using alternative fuels

• To provide the quality standards, regulations and third-party inspection for alternative fuel vehicles

**COURSE OUTCOMES:** After completion of the course, the student should be able to

**CO-1:** Understand thehydrogen as Alternative fuel for IC engines

**CO-2:** Demonstrate the CNG and LNG engines

**CO-3:** Understand the working of LPG engines and LPG standards

**CO-4:**Understand the role of Biogas, methonal and Ethonal

**CO-5:**Understand theadvantageous of Biodiesel

**CO-6:**Understand theperformance of engines with synthetic Alternative fuels.

**UNIT – I:**

**Hydrogen:** Properties, production, on-board storage, material compatibility, stationary storage, piping, dispensing, transportation, advantages and disadvantages, safety, standards, usage in IC engines and emissions.

**Liquid Hydrogen:** Properties, production, advantages and disadvantages, hazards, storage, transportation, piping, dispensing and emissions.

**UNIT – II:**

**Compressed Natural Gas:** Production, properties, storage, piping, advantages and disadvantages, dispensing, transportation, material compatibility, CNG fuel kits, engine modifications for CNG operations, CNG combustion, stoichiometric vs. lean burn CNG engines, engine optimization, vehicle emission, after treatment of exhaust, fueling station safety systems, CNG standards and regulations and third-party inspection for alternative fuels vehicles.

**Liquefied Natural Gas:** Production, properties, economics, advantages and disadvantages, transportation, storage, piping, dispensers, LNG to CNG conversion system, regulations for LNG, vehicle performance characteristics and emission.

**UNIT – III:**

**Liquefied Petroleum Natural Gas:** Production, properties, storage, dispensing and receptacles, material compatibility, piping, safety systems, transportation, advantages and disadvantages, LPG engine developments, LPG fuel kits, combustion, emissions and LPG Standards.

**Landfill Gas or Marsh Gas:** Production, properties, composition, monitoring pretreatment, usage, advantages and disadvantages, emissions and applications.

**UNIT – IV:**

**Biogas or Biomethane:** Production, composition, properties, biogas plants, treatment, storage, dispensing, advantages and disadvantages, hazards, emissions and regulations. **Methanol:** Properties, production, applications, advantages and disadvantages, hazards, economics, storage, dispensing, combustion and emissions.

**Ethanol:** Properties, production, dry milling, material compatibility, storage, transportation, piping, dispensing, advantages and disadvantages, hazards, blends, engine modifications, combustion, emissions and standards.

**UNIT – V:**

**Straight Vegetable Oils:** Feedstock selection, iodine value, properties, production, degumming, storage, dispensing, material compatibility, advantages and disadvantages, engine modifications, combustion, emissions and standards.

**Biodiesel:** Feedstock selection, raw material, properties, production, storage, dispensing, material compatibility, standards, transportation, advantages and disadvantages, hazards, engine modifications, combustion and emissions.

**UNIT – VI:**

**Synthetic Alternative Fuels:** Properties, composition, production, storage, engine modifications, blends, combustion, performance and emission characteristics in SI and CI engines, advantages and disadvantages of HCNG and hythane, dimethyl ether, diehyl ether, syngas, plastic fuel and tyre pyrolysis oil.

**TEXT BOOK:**

1. Alternative Fuels, Thipse S. S., Jaico Publishers, 2010

**REFERENCES:**

1. A Textbook of Alternative Fuel of Automobile Engine, Rami Reddy and Yousuf, Front line Publishers

2. Powering Your Vehicle with Straight Vegetable Oil, Forest Gregg

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**PRODUCT & SERVICES**

**(OPEN ELECTIVE - III)**

**Code: 8ZC24**

**L T P/D C**

2 **0 0 2**

**Objectives**: This course helps to provide the basic concepts of Product and Services. This course will enable the students to study areas of basic insights in product management and Services Design.

**Course Out Comes**:

1. The students will be introduced to basic concepts of product .
2. Will enlighten the students with the process of new product development and stages in the process.
3. Will help the students understand the concept of product testing, product planning and the preparatory groundwork for launching a new product
4. Will help the students to understand the nature of services, its differences with the goods and the application of marketing principles for services.
5. Will enlighten the students to understand the attributes of a good service design and the tools for producing and distributing the services.
6. To make the students understand about the importance of quality of services and also introduce some measurement scales to evaluate the service quality.

**UNIT- I**

**INTERPRETATIONS ON PRODUCT**

Meaning of Product, Product Market Fit Analysis, Product Levels, Product Mix, Product Pruning, and Product Cannibalization.Types of Product Classification

**UNIT- II**

**PRODUCT INNOVATION and VALIDATION**

New products-What is a new product, New Product Development Process, Idea generationSystems,Concept test,Product testing, Pre-launch,Market test, Final evaluation using “Stage / Gate Process. Product Validity, Break Even Analysis, Financial and Market Analysis.

**UNIT- III**

LAUNCHING PRODUCT

Cost Analysis, Steps to fix the final price, Promotion planning, Digital Marketing and Methods, Retailing, Types of Retailing online Retailing, Post Market Analysis of the Launch

**UNIT - IV: INTRODUCTION TO SERVICE:**

Meaning and Definition of Service, Characteristics of Services, Classification of Service, Five levels of Service, Service verses Physical Goods, 7 P’s for Marketing of Services, Servicescape

**UNIT – V: SERVICE PROCESS DESIGN and SERVICE DISTRIBUTION:**

Service Design Meaning, Tools for Service Design, Attributes of a Good Design Customer involvement in the Production Process, Role of Intermediaries, Methods of Distribution of Services

**UNIT – VI: QUALITY OF SERVICE:**

Definition of Service Quality, Elements of Service Quality, Service Quality Measuring Tools; SERVQUAL Scale, Service Quality Gap Analysis, Objective Service Metrics, Cost of Quality in Service. Challenges and Problems of Service Quality in India.

**Essential Readings:**

* Dr. S.L. Gupta, Product Management, Wisdom Publications
* C.Merle Crawford ,New Product Management
* Valarie A.Zeithaml& Mary Jo-Bitner: Services Marketing—Integrating Customer Focus Across the Firm, 3/e, Tata McGraw Hill, 2007.
* Thomas J.Delong&Asish Nanda: Managing Professional Servies—Text and Cases, McGraw-Hill International, 2006.
* Christopher Lovelock: Services Marketing People, Technology, Strategy, Fourth Edition, Pearson Education, 2006

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**INDIAN HISTORY, CULTURE AND GEOGRAPHY**

**(OPEN ELECTIVE - III)**

**Code: 8ZC27**

**L T P/D C**

2 **0 0 2**

**Course Objectives**: To equip the students with necessary knowledge relating to ancient, medieval and modern Indian and its culture and also facts relating to existence of earth.

**Course Outcomes**:

1. To appreciate and understand our Indian History, Culture and Indian heritage.
2. To understand secularism of our country.
3. To appreciate and understand the social reformers who brought revolutionary changes in

Indian society.

1. To understand earth evolution and world climatic change.
2. To understand India Oceanography,
3. Able to enhance and understand Indian monsoons, Indian agriculture.

**Unit I: Ancient Indian History**

Fundamental Unity of Indian Harappan and Vedic Civilization – Evolution of Caste System – ainism and Buddhism – Gandhara Art., Political unification of India under Mauryas and Guptas, Historical evolution of Satavahanas., Contribution of Pallavas and Cholas to Art – Chola Administrative Systems .

**Unit II: Medieval India and Culture**

Influence of Islam on Indian Culture – The Sufi, Bhakthi and Vishnavite movements, Historical Achievements of Vijayanagara Rulers., Contribution of Shershah and Akbar to the evolution of administration system in India – Cultural Development under Mughals.

**Unit III: Modern India**

Western Impact on India – Introduction of Western Education – Social and Cultural awakening and social reform movements – Raja Rama Mohan Roy – DayanandaSaraswathi – Theosophical Society – Ramakrishna Paramahamsa and Vivekananda – Iswara Chandra Vidyasagar and Veeresalingam – Emancipaition of women and struggle against Caste. Rise of Indian Nationalism – Mahatma Gandhi – Non Violence and Satyagraha – Eradication of untouchability – Legacy of British rule.

**Unit IV:Geo Morphology and Climatology**

The Origin and Evolution of the Earth, Interior of the Earth, Distribution of Oceans and Continents , Minerals and Rocks, Geomorphic Processes, Landforms and their Evolution Composition and Structure of Atmosphere, Solar Radiation, Heat Balance and Temperature.  
Atmospheric Circulation and Weather Systems, World Climate and Climate Change

**Unit V: Oceanography**

Water (Oceans), Movements of Ocean Water, Physical features of India viz., The Mountains in the North , The Northern Plains, The Peninsular Plateau, The Great Indian Desert, The Coast; and The Islands.

**Unit VI: Physical Features Of India And India’s Monsoon**

India’s monsoon., Winter, Summer(pre-monsoon),rainy (monsoon),autumn (post-monsoon)., Indian Agriculture, Agriculture and colonialism, Indian Agriculture after Independence Major crops and yields, Horticulture, Organic farming.

**References:**

* Sharma .R.S., (2011).Indian Ancient past.,Oxford Publications.
* Nitin Singhaniya.,(2017). Indian Culture and Heritage., Publisher: McgrawTestPrep., Second Edition.
* Certificate of Physical and Human Geography,Goh Cheng Leong,Oxford University Press.
* Bipin Chandra.(2000). India’s Struggle for Independence., Penguin Global Publishers
* Saveendra Singh: Physical Geograpghy.,PrayagPustakBhavan ISBN-10: 8186539298. Edition : 1st Edition Number of Pages : 641 Pages Publication : Year 2006.
* Majumdar, R. C. et al. *An Advanced History of India* London: Macmillan. 1960. [ISBN 0-333-90298-X](http://en.citizendium.org/wiki/Special:BookSources/033390298X)
* Basham, A.L. : The wonder that was India ,New York: Grove Press, 1954. (OUP, Madras 1983)
* Basham, A.L. : Cultural heritage of India , Vols.I to IV ,Oxford University Press, Delhi, 1975.

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**ENTREPRENEURSHIP AND BUSINESS DESIGN**

**(OPEN ELECTIVE - III)**

**Code: 8ZC10**

**L T P/D C**

2 **0 0 2**

**Course Objective:** The objective of the course is to make students understand the essentials of building their startups and to familiarize with business design process develop business models, and market their product.

**Course Outcomes:**

1. The students gain the knowledge on the essentials of entrepreneurship and the key role played by the entrepreneurs.
2. The students gain knowledge on exploring the different phases of UI /UX.
3. The students grasp the attentiveness on designing a business strategy.
4. The students gain familiarity on designing and delivery of services.
5. The students understand reverse engineering methods in product development.
6. The students have access to information on IPR, and patent application.

**Unit – I: Introduction to Entrepreneurship**: Meaning of Entrepreneurship. Reasons feeding the Entrepreneurial fire. Understanding Entrepreneurship as a Process. Multiple roles of Entrepreneur: Intrapreneur, Inventor, Coordinator, Manager and Controller. Psychological and behavioral aspects of First-Generation Entrepreneur.

**Unit – II: Introduction to UI/UX:** Human centered design and benefits, the distinction between UX and UI, UX process – user research, prototyping strategies, UI principles, UI analysis, UI design, UI components and Responsive design.

**Unit – III: Designing a Business Strategy:** Define a problem and frame a strategic question, map the lives of users, journey mapping and ideation, color theory, killing the ideas through Stage Gate Models, pitching of full-fledged, idea, choosing the Start-Up Team.

**Unit – IV: Designing Services and Services Delivery:**Services as solutions, Service delivery pathways, rapid branding and marketing strategies, key metrics for Design thinking. Types of New services, Mix of core services and secondary and enhancing services, service flower and service design matrix.

**Unit – V: Business Model:**Meaning of business model, Difference between business model and business planning, the business model canvas, Risks and Assumptions, Validation of business models, building solution demo and MVP, revenue streams and pricing strategies.

**Unit – VI: Entrepreneurial Funding and Risk Management:**Bootstrapping, Angel Investors, Venture capitalists, Private equity funding, customer acquisition, return on equity and Break even analysis, Risk propensity Vs. Risk avoidance, Locus of control of entrepreneur, Risk estimation techniques, risk avoidance strategies.

**Text Book(s)**

1. Adrian McEwen, Hakim Cassimally – “Designing the Internet of Things”, Wiley Publications, 2012
2. Hedman, J., &Kalling, T. (2003). The business model concept: theoretical underpinnings and empirical illustrations. *European journal of information systems*, *12*(1), 49-59.
3. Cabrera, J. (2017). *Modular Design Frameworks: A Projects-based Guide for UI/UX Designers*. Apress.

**References**

1. J. Chris Leach & Ronald W. Melicher “Entrepreneurial Finance, Fourth Edition”, South Western, Cengage Learning, 2012.

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**FINANCIAL INSTITUTIONS, MARKETS AND SERVICES**

**(OPEN ELECTIVE - III)**

**Code: 8ZC15**

**L T P/D C**

2 **0 0 2**

**Course Objective:** The objective of the course is to provide to students an understanding of Financial Markets, the major Institutions involved and the Services offered within this framework.

**Course Outcomes:**

1. 1.This unit enables the students to understand the financial structure and the financial sector reforms after 1991.
2. The unit gives the exposure on the role of RBI and the Regulating and credit policies adopted by the RBI.
3. The students get awareness on the role of Non-Banking financial institutions and the role of financial institutions in India.
4. The unit educates the students to know the role of regulatory bodies like SEBI and also to know the capital and money market instruments
5. The unit equips the students to understand about the asset fund based financial services
6. The students will get exposure about the investment banking and merchant banking.

**UNIT I**

**INTRODUCTION:** The structure of financial system, Equilibrium in financial markets, Indicators of Financial Development, Financial system and Economic Development, Financial Sector Reforms after 1991.

**UNIT II**

**BANKING INSTITUTIONS**: Structure and Comparative performance, Functions and Role of RBI, Competition, Interest rates, Spread; Bank Capital Adequacy norms; Banking Innovations – BPLR to Base rate, Core Banking System, Financial Inclusion, Current rates: Policy rates, Reserve Ratios, Exchange rates, Lending/ Deposit rates.

**UNIT III**

**NON BANKING FINANCIAL INSTITUTIONS:** Structure and functioning of Unit Trust of India and Mutual Funds, Growth of Indian Mutual funds and their Regulation, Role of AMFI. Performance of Non-Statutory Financial Organizations: IFCI, IRBI, NABARD, SIDBI and SFCs.

**UNIT IV**

**FINANCIAL AND SECURITIES MARKETS**: -, Role and functions of SEBI, Structure and functions of Call Money Market, Government Securities Market – T-bills Market, Commercial Bills Market, Commercial paper and Certificate of Deposits; Securities Market – Organization and Structure, Listing, Trading and Settlement, SEBI and Regulation of Primary and Secondary Markets.

**UNIT V**

**ASSET/FUND BASED FINANCIAL SERVICES:** Lease Finance, Consumer Credit and Hire purchase Finance, Factoring - Definition, Functions, Advantages, Evaluation, Forfeiting, Bills Discounting, Housing Finance, Venture Capital Financing. Fee-based Advisory services: Stock Broking, Credit Rating.

**UNIT VI**

**INVESTMENT BANKING AND MERCHANT BANKING**:

Investment Banking: Introduction, Functions and Activities, Underwriting, Banker to an Issue, Debenture Trustees and Portfolio managers, Challenges faced by Investment Bankers.

Merchant Banking: Definition, Merchant Banks Vs Commercial Banks, Services of Merchant Banks.

**References:**

* L.M. Bhole: Financial Institutions and Markets, TMH, 2009.
* E. Gordon, K. Natarajan: Financial Markets and Services, Himalaya Publishing House, 2013.
* Vasant Desai: Financial Markets and Financial Services, Himalaya,2009
* Pathak: Indian Financial Systems, Pearson, 2009
* M.Y. Khan: Financial Services, TMH, 2009.
* S. Gurusamy: Financial Services and System, Cengage,2009
* Justin Paul and Padmalatha Suresh: Management of Banking and Financial Services, Pearson, 2009.
* Gomez, Financial Markets, Institutions and Financial Services, PHI, 2012.
* R M Srivatsava: Dynamics of Financial Markets and Institutions in India, Excel, 2013.

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**INTERNET OF THINGS(IOT)**

**(OPEN ELECTIVE - III)**

**Code: 8DC44**

**L T P/D C**

2 **0 0 2**

***Course Objectives: The student will learn about***

1. *Terminology, technology and applications of IoT*

*2. IoT system management using M2M (machine to machine) with necessary protocols*

*3. Python Scripting Language preferred for many IoT applications*

*4. Raspberry PI as a hardware platform for IoT sensor interfacing*

*5. Implementation of web based services for IoT with case studies*

***Course Outcomes: After completing this course, student shall be able to***

1. *Identify the implementation layers of an IoT application system*
2. *Summarize the characteristics and challenges of designing SDN and NFV*
3. *Describe the management of an IoT system using necessary protocols*
4. *Design, Develop and Illustrate IoT applications using Raspberry PI platform and Python Scripting*
5. *Implement web based services on IoT devices*
6. *Design new projects using Raspberry PI*

**UNIT I: Introduction to Internet of Things**

Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies like Wireless Sensor Networks, Cloud Computing, Big data analytics, and Communication protocols, Embedded Systems, IoT Levels and Templates

**UNIT II: IoT and M2M**

Software defined networks, network function virtualization, difference between SDN and NFV for IoT; Basics of IoT System Management with NETCOZF-YANG (Block Diagrams)

**UNIT III: Developing IoT**

**IoT Design Methodology** – The 10 steps design methodology; **Logical design using Python:** Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, date/time operations, Python packages of interest for IoT

**UNIT IV:** **IoT Physical Devices and Endpoints**

**Raspberry PI** – Introduction to Raspberry PI and its Interfaces (serial, SPI, I2C) **Programming** – Python programming with Raspberry PI – Controlling Input / output (Interfacing with LED and LDR).

**UNIT V:** **IoT Physical Servers and Cloud Offerings**

Cloud concepts (IaaS, PaaS, Saas), Introduction to Cloud Storage models and communication APIs – WAMP, Xively; Python web application framework with Django, Designing a RESTful web API

**UNIT VI: Case Studies Illustrating IoT Design**

***Home Automation*** – Smart Lighting, Home intrusion detection, ***Cities*** – Smart parking, ***Environment*** – Weather monitoring system, Weather reporting bot, Air pollution monitoring, Forest fire detection, ***Agriculture*** – Smart irrigation, ***Productivity applications*** – IoT printer

**TEXT BOOKS:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**COMPUTER NETWORKS**

**(OPEN ELECTIVE - III)**

**Code: 8EC77**

**L T P/D C**

2 **0 0 2**

**Course Objective:**

1. The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computernetworks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols and functions of the variouslayers.

**Course Outcomes:**

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

1. Classify network topologies and apply the same to different networks with the knowledge acquired from the network reference models and fundamentals of computernetworks
2. Illustrate the design issues of data link layer and detect the transmission errors and flow controlproblems
3. Categorize the Channel allocation issues, MAC protocols such as ALOHA, CSMA and CSMA/CD and MAC addresses with IEEE 802.X and wirelessLAN.
4. Distinguish the knowledge of the several routing algorithms and Internetworking concepts.
5. Obtain and use the skills of subnetting and routingmechanisms
6. Distinguish the knowledge of the functions of transport and applicationlayer

**UNIT I**

**Introduction:** Uses of Computer Networks, Types of networks: WAN, LAN, MAN, Network Topologies, Reference models: OSI, TCP/IP.

**Physical Layer:** Transmission media: magnetic media, twisted pair, coaxial cable, fiber optics, wireless transmission.

**UNIT II**

**Data link layer**: Design issues in data link layer: framing, flow control, error control, Error Detection and Correction: Parity, CRC checksum, Hamming code, Flow Control: Sliding Window Protocols, Applications: Data link layer protocols HDLC, PPP.

**UNIT III**

**Medium Access sub layer:** Channel allocation problem, MAC Protocols: ALOHA, CSMA, CSMA/CD, MAC addresses, IEEE 802.X, Standard Ethernet, Wireless LANS. Bridges, Types of Bridges.

**UNIT IV**

**Network Layer:** Design issues in Network Layer, Virtual circuit and Datagram Subnets-Routing algorithm: Shortest path routing, Flooding, distance vector routing,

Link state routing, Hierarchical routing, Broad casting, Multi casting, Routing for mobile hosts.

Internetworking: Concatenated Virtual Circuits, Connectionless internetworking, Tunneling, Internetwork routing, Fragmentation

**UNIT V**

Network layer in internet: IPv4, IP addresses, Sub netting, Super netting, NAT Internet control protocols: ICMP, ARP, RARP,DHCP**.**

Congestion Control: Principles of Congestion, Congestion Prevention Policies. Congestion Control in datagram Subnet: Choke packet, load shedding, jitter control. Quality of Service: Leaky Bucket algorithm and token bucket algorithm.

**UNIT VI**

**Transport Layer:** Transport Services, Connection establishment, Connection release and TCP and UDP protocols.

**Application Layer**: Domain name system, FTP, HTTP, SMTP, [WWW.](http://WWW/)

### TEXTBOOKS:

1. Computer Networks — Andrew S Tanenbaum, 4th Edition. PearsonEducation/PHI
2. Data Communications and Networking – Behrouz A. Forouzan, Third Edition TMH.
3. Data Communication and Networks-Bhushan Trivedi-OXFORDPublications.

**Recommended Textbooks & Other Readings:**

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, PearsonEducation
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**FUNDAMENTALS OF MEASUREMENTS AND INSTRUMENTATION**

**(OPEN ELECTIVE - III)**

**Code: 8AC44**

**L T P/D C**

2 **0 0 2**

**Course Objective:**

The basic principles of all measuring instruments and in measurement of electrical and non-electrical parameters viz., Resistance, Inductance, Capacitance, voltage, current Power factor, Power, Energy, Strain, Temperature, Torque, Displacement etc. and the different types of electrical and non electrical transducers. It introduces the different signal analyzers and oscilloscopes.

**Course Outcomes**

The student should be able to

1. Understand the principle of operation of different types of instruments viz., PMMC, moving iron type of instruments, the required characteristics of an instrument in general. The student demonstrates the ability to compensate for the errors in the instruments and to extend the range of the instruments.
2. Demonstrates the knowledge of Potential and Current transformers; the errors in them and the effect of having an open/short in the secondary circuits; Understand the principle of operation of Dynamometer and Moving-iron type of Power factor meters.
3. Comprehends the principle of operation of dynamometer type of Wattmeter and Induction type of Energy meter; use the wattmeter to measure the Active and Reactive power and demonstrates the ability to extend the range of them.
4. Identify and use different techniques of measurement of Resistance, Inductance and Capacitance values.
5. Understand the principle of operation of Different type of digital voltmeters, wave analyzers, spectrum analyzers and Cathode ray Oscilloscope.
6. Demonstrates the ability in characterizing the different types of transducers and uses them to measure Strain, Gauge Sensitivity, Displacement, Velocity, Acceleration, Force, Torque and Temperature.

**UNIT-I MEASURING INSTRUMENTS- INSTRUMENT TRANSFORMERS:**

Significance of Measurement, static characteristic of system- Linearity, Sensitivity, Precision, Accuracy - Classification - Deflecting, Control and Damping torques, Ammeters and Voltmeters, PMMC, Moving iron type instruments, Expression for the Deflecting torque and Control torque, Errors and Compensations, Extension of range using Shunts and Series resistance.

**UNIT –II: INSTRUMENT TRANSFORMERS**

Introduction, advantages, burden of instrument transformer, Current Transformer - errors in current transformer, Effect of secondary open circuit, Potential transformer- errors in potential transformer, Testing of current transformers with silsbee’s method.

Power Factor Meters: Type of P.F. Meters, Dynamometer and Moving iron type, 1- ph and 3-ph meters.

**UNIT –III MEASUREMENT OF POWER& ENERGY:**

Single phase dynamometer wattmeter-LPF and UPF-Double element and three element dynamometer wattmeter, Expression for deflecting and control torques, Extension of range of wattmeter using instrument transformers, Measurement of active and reactive powers in balanced and unbalanced systems, Single phase induction type energy meter, Driving and braking torques, Testing by phantom loading, Three phase energy meter .

**UNIT - IV MEASUREMENT OF RESISTANCE - MAGNETIC MEASUREMENTS- A.C. BRIDGES:**

Principle and operation of D.C. Crompton’s potentiometer, Standardization, Measurement of unknown resistance, current, voltage. Method of measuring low- Medium and High resistance, sensitivity of Wheatstone’s bridge, Carey Foster’s bridge, Kelvin’s double bridge for measuring low resistance, Measurement of high resistance, loss of charge method, Measurement of inductance, Quality Factor, Maxwell’s bridge, Hay’s bridge, Anderson’s bridge, Owen’s bridge. Measurement of capacitance and loss angle, Desauty Bridge, Wien’s bridge, Schering Bridge.

**UNIT-V DIGITAL VOLTMETERS- SIGNAL ANALYZERS- CRO:**

Digital voltmeters, Successive approximation, Ramp, Dual slope integration continuous balance type, Wave Analyzers, Frequency selective analyzers, Heterodyne, Application of Wave analyzers, Harmonic Analyzers, Total Harmonic distortion, spectrum analyzers, Basic spectrum analyzers, Spectral displays, Q meter and RMS voltmeters . CRO- Cathode Ray Tube (CRT), Screens, Probes, Applications of CRO, Measurement of frequency and phase using CRO, Block diagram.

**UNIT-VI MEASUREMENT OF NON-ELECTRICAL QUANTITIES:**

Transducers - Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers, Principle operation of Resistor, Inductor, LVDT and Capacitor transducers, LVDT Applications, Strain gauge and its principle of operation, Guage factor- Thermistors, Thermocouples, Piezo electric transducers, Photovoltaic, Photo conductive cells. Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Acceleration, Force, Torque, Measurement of Temperature.

**TEXT BOOKS:**

1. Electrical Measurements and measuring Instruments – E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publishing.

2. Transducers and Instrumentation– D.V.S Murthy, Prentice Hall of India, 2nd Edition.

3. A course in Electrical and Electronic Measurements and Instrumentation -A.K. Sawhney, Dhanpatrai & Co. 18th Edition.

**REFERENCE BOOKS:**

1. Measurements Systems, Applications and Design – D O Doeblin- Tata MC Graw-Hill.

2. Principles of Measurement and Instrumentation – A.S Morris, Pearson /Prentice Hall of India.

3. Electronic Instrumentation- H.S.Kalsi Tata MC Graw – Hill Edition, 3rd Edition.

4. Modern Electronic Instrumentation and Measurement techniques – A.D Helfrick and W.D.Cooper, Pearson/Prentice Hall of India.

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**MAJOR PROJECT**

**Code: 8B877**

**L T P/D C**

0  **0 10 5**

**Division of marks for External Evaluation:**

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Progress of Project work and the corresponding interim report as  evaluated by Project Review Committee at the end of 6 weeks | 3 marks |
| 2 | Seminar at the end of 6 weeks | 3 marks |
| 3 | Progress of Project work as evaluated by Project Review Committee at  the end of 11 weeks | 3marks |
| 4 | Seminar at the end of 11 weeks | 3 marks |
| 5 | Evaluation by Project Review Committee at the end of 15 weeks | 6 marks |
| 6 | Final Project Report | 3 marks |
| 7 | Final presentation and defence of project | 9 marks |
| 8 | Total | 30 marks |

**Division of marks for External Evaluation :**

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Final Project Report | 15 marks |
| 2 | Presentation | 10 marks |
| 3 | Demonstration / Defense of Project | 45 marks |
| 4 | **TOTAL** | **70 marks** |

|  |  |  |  |
| --- | --- | --- | --- |
| **S.NO** | **SUBJECT CODE -(A20)** | **SUBJECT NAME** | **L T P C** |
| 1 | 8BC01 | Workshop/ Manufacturing practices (Theory) | 1 0 0 1 |
| 2 | 8BC61 | Workshop/ Manufacturing practices lab | 0 0 2 1 |
| 3 | 8BC02 | Engineering Graphics & Design | 1 0 4 3 |
| 4 | 8BC04 | **ELEMENTS OF MECHANICAL ENGINEERING** | **2 0 0 2** |
| 5 | 8BC51 | **INTRODUCTION TO ADDITIVE MANUFACTURING PROCESSES** | 2 0 0 2 |
| 6 | 8BC52 | **PRINCIPLES OF OPERATIONS RESEARCH** | 2 0 0 2 |
| 7 | 8BC53 | **PRINCIPLES OF AUTOMATION AND ROBOTICS** | 2 0 0 2 |

**Syllabus for B. Tech I Year II semester**

**(Mechanical Engineering)**

**WORKSHOP/MANUFACTURING PRACTICES (THEORY)**

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| --- | --- | --- | --- |
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| 1 | 0 | 0 | 1 |

**B.Tech I year I sem (CSE, ECE, IT & CE) II sem (EEE, ECE & ME)**

**Code: 8BC01**

**Course Objectives:**

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

**COURSE OUTCOMES:**

1. To understand various basic tools to perform simple joints using metal and wood.
2. To understand the principle of various electrical and electronic appliances and their applications.
3. To understand the manufacturing process of welding, casting and tin smithy and their applications.
4. To understand the operation of basic as well as advanced machines used for fabrication of Metals, Plastics and Glass.

**Theory:** In theory classes the following syllabus is to be covered in 10hrsusing PPTS and Videos (Elementary treatment only)

* 1. Fitting & Power Tools
  2. Electrical & Electronics Appliances
  3. Carpentry
  4. Plastic molding & Glass Cutting
  5. Metal Casting
  6. Metal Joining: Arc & gas welding and brazing
  7. Metal forming
  8. Machining
  9. Advanced manufacturing methods: (Micro machining, USM,ECM,EDM )
  10. CNC machining & Additive Manufacturing

**Suggested Text/Reference Books:**

1 Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

2.Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

**DETAILED SYLLABUS**

**Unit-I**

**Fitting & Power Tools** : Fitting Tools- Marking and Measuring tools, Cutting tool, Finishing tools-etc- basic Fitting operations, Safe working practices

Introduction to power tools- Power Hacksaw, Drill, Grinder ,etc.

**Unit-II**

**Electrical & Electronics Appliances**: Introduction, wires and wires sizes, wiring boards, common house wiring methods, symbols and house hold electrical appliances.

**Unit-III**

**Carpentry:** Introduction-Timber, Wood joints- Lap, dovetail, Tools- Marking tools, Cutting tool, Finishing tools-etc- basic carpentry operations, Wood turning lathe

**Unit-IV**

**Plastic molding & Glass Cutting**: Types of Plastics, Processing of Plastics: Injection moulding and Blow moulding. Introduction to Glass materials and physical properties -Cutting tools.

**Metal Casting, Metal Joining & Metal forming:**

**Unit-V**

**Casting:** Importance, Advantages and limitations, Patterns, Moulding and Moulding materials, Sand Casting – Casting terms, Procedure, Applications, Die Casting– Types, Principle and Applications,

**Metal joining** - Various methods of Joining, Welding - Types of Welding - Weld joints, Electric Arc welding – Principle, Coated electrode, arc welding equipment, Gas welding - equipment details, Flame types, Applications, Resistance Spot welding, Soldering and Brazing

**Metal forming** – Advantages, Rolling- Principle, Rolling products, Forging- principle and applications, hand forging operations, Extrusion - basic principle and applications,

Principles and applications of Sheet Metal Operations - Punching, Blanking, Bending and Drawing

**Unit-VI**

Machining meaning, Advantages and Drawbacks, Basic concepts of machine tool, chips and cutting tool, Principle and simple Construction of Lathe, **D**rilling, and Grinding, CNC machine tools-Advantages, parts of a CNC system,

Advanced manufacturing methods – Need for micromachining, principle and applications of USM,ECM and EDM,

Additive manufacturing – Need, Principles of SLS, FDM methods

**(Mechanical Engineering)**

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**WORKSHOP/MANUFACTURING PRACTICES (LAB)**

**Code: 8BC61**

Course Objectives:

1. To identify various basic tools to perform simple joints using metal and wood.
2. To recognize various electrical and electronic and their applications.
3. To understand the manufacturing process of welding , casting and tinsmithy and apply the processes in making simple products.
4. To understand and operate basic machines for fabrication of Metals, Plastics and Glass.
5. To understand the functions and parts of commonly used domestic appliances.

**COURSE OUTCOMES:**

1. After completion of the course , the student will be able tofabricate components with their own hands.
2. Assemble different components and produce small devices of their interest.

**Work shop and Manufacturing Practices**:Minimum of 10 experiments out of twelve given here under are to be completed

**LIST OF EXPERIMENTS**

|  |  |  |
| --- | --- | --- |
| **S.No** | **Trades** | **List of Experiments** |
| 1 | Fitting Shop | **1**. Preparation of T-Shape Work piece  **2.** Preparation of U-Shape Work piece which contains: Filing, Sawing, Drilling, Grinding. |
| 2 | Carpentry | 3.Practice of Cross Half lap joint  4. Practice of Half lap Dovetail joint |
| 3 | Electrical & Electronics | 5. One lamp one switch Practice  6. Stair case wiring: Practice |
| 4 | Welding shop  ( Arc & Gas) | Demonstration of Gas and Resistance welding  7. Practice of Lap and Butt joint using Arc welding |
| 5 | Casting | 8.Preparation of mould by using split pattern  9. Mould preparation and pouring of molten metal. |
| 6 | Tin Smithy | 10.Preparation of Rectangular Tray & Square box |
| 7 | Machine Shop | 11. Demonstration of turning , Drilling and Reaming operations |
| 8 | Plastic molding & Glass Cutting | 12 a) Demonstration of Injection Moulding  b) Demonstration of Glass Cutting with hand tools |
| 9 | Domestic Appliances | 13.Demonstration of Fans, Mixers, Air blower, Iron box, Rice cooker, Emergency light etc |
| 10 | Lab project | 14. Making various components and / or assembling the components which can be useful in domestic / engineering applications |

**ENGINEERING GRAPHICS & DESIGN**

**B.Tech I year I sem (EEE, ECE IT& ME) II sem (CSE, ECE, & CE)**

**Code : 8BC02**

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| **L** | **T** | **P** | **C** |
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**Course objectives:**

1: To teach students the basic principles of Engineering graphics and instruments used

2: To introduce the concept of projections in drawing and its applications for simple drawing entities

3: To impart the knowledge of various types of solids and their projections in different position wrt principle planes

4: To teach the concept of sections of solids and their applications

5: To develop a clear understanding of the basic principles involved in three dimensional Engineering drawings.

6: To train the students for the extraction of multiple views from a solid model using AutoCAD

**Course outcomes**

After completing this course, the student will able to:

1. Get familiar to use the instruments to solve the engineering problem and draw various type of curves used in engineering
2. Understand and Implement Orthographic projections and draw projections of simple drawing entities such as points Lines, and Planes
3. Draw projections of different types of regular solids in various positions wrt principal planes of projection
4. Draw Sections of various Solids including Cylinders, cones, prisms and pyramids and draw the developments of these solids and their sections.
5. Construct Isometric Scale, Isometric Projections and Views and convert 3D views to 2D orthographic views
6. Understand from basic sketching through 2D and 3-D solid modeling using computer aided design (CAD) software

**UNIT – I**

**Introduction to Engineering Drawing:** Drawing Instruments and their uses, types of lines, Types and uses of pencils, Lettering, Rules of dimensioning.

**Curves used in Engineering Practice and their Constructions**:

Conic Sections including Rectangular Hyperbola - General method, Cycloid, Epicyloid, and Involutes of circles.

**UNIT – II**

**Orthographic Projection:** Principles of Orthographic Projections – Conventions – First angle and third angle projections (however all drawing exercises must be in first angle only) - Projection of Points, Lines - Inclined to both planes, Projections of regular Plane, inclined planes - Auxiliary views.

**UNIT –III**

**Projections of Regular Solids:** Projections of Regular Solids:Prisms, Cylinders, Pyramids, Cones –Axis inclined to both planes, Auxiliary views.

**UNIT –IV**

**Sections and sectional views of Solids:** Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

**Development of Surfaces:** Development of Surfaces of Right Regular Solids – Prisms, Cylinders, Pyramids, Cones and their sections.

**UNIT – V**

**Isometric Projections/views:** Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane, Simple Solids. Conversion of isometric views to orthographic views.

**UNIT –VI**

**Overview of Computer Graphics :** Demonstrating features of the CAD software - The Menu System, Toolbars, , Dialog boxes and windows, Drawing entities - lines, circles, arcs etc and editing commands, Dimensioning of objects,2D drawings-simple exercises , 3D wire-frame and shaded solids- Commands, Boolean operations.

**Text/Reference Books:**

(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

(iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers

(v) AUTOCAD Software Theory and User Manuals

**Syllabus for B. Tech.**

**ELEMENTS OF MECHANICAL ENGINEERING**

(Common to All BranchesExcept Mechanical Engineering)

**Code : 8BC04**

**L T P/D C**

2**-- -- 2**

**Course Objectives:**

*The main objective of the course is to offer the students fundamental knowledge of* First Law of Thermodynamics*. Working of SI and CI engines, working principle of different types of Turbines&pumps.*

*properties of material and engineering application. Working principles of various types of power transmission systems*

**COURSE OUTCOMES:**

At the end of basic mechanical engineering a student should be able to

1. To acquire the knowledge of basic concepts of thermodynamics and analyze the p-v & t-s diagrams of the different cycles.
2. To acquire the knowledge two and four stroke engines,the function of components used in the steam power plant
3. To identify & understand the function of components used in VCR & VAR system, & about the working of hydraulic pumps & hydraulic turbines.
4. To identify & understand *properties of material and engineering application*
5. To acquire the knowledge *of various types of power transmission systems*
6. To acquire the knowledge the different NC and CNC machine.

**UNIT - I**

Energy Resources and Conversion,Basic concepts of Thermodynamics – general classification of heat engines, Property and state, System, Boundary and surroundings , Zeroth Law, First Law of Thermodynamics and its applications- Joule’s experiment, reversible non-flow processes-Constant volume, constant pressure, constant temperature process, polytropic process, Second Law of Thermodynamics – Statements, Heat engines, Carnot cycle, Air standard cycles – Otto, Diesel Cycles.

**UNIT-II**

**Internal combustion engines:** Internal combustion engines, definition, classification, components, working of four stroke cycle engines, SI and CI Engines, Performance parameters, Need for cooling, and lubrication of IC engines.

**Steam Power plant, Boiler, Steam Turbines:** Layout of steam power plant, Water tube and Fire tube Boilers :- Simple cross-tube boiler, Cochran, Babcock and Wilcox Boiler and High Pressure Boilers. (Benson & La-mount only).

**UNIT- III**

1. **Hydraulic pumps & turbines:-** Centrifugal Pumps, Pelton wheel, Francis turbine and Kaplan Turbine -- Layout of Hydro electric power plant

b) **Refrigeration & Air conditioning systems:-** Description of Vapour Compression and Vapour Absorption systems

**UNIT-IV**

**Engineering Materials –** Classification, mechanical properties, Ferrous Materials – Constituents of Cast Iron & types of Cast Iron, Steels – manufacture by Bessemer converter, Arc furnace, types of steel, effect of alloying elements on steel, Stainless steel, Non- Ferrous Materials: Properties and applications of Aluminum & alloys, Copper and alloys, composite materials – types, fabrication methods, Ceramics – Properties and applications

**UNIT-V**

**Transmission of Motion and Power –** Shafting, Belt drive, types of belt drive, types of belts, chain drives, types of chain drive, Pulleys, parts, types of pulleys, gear drive- classification, Terminology of spur gear, Gear trains – simple and compound, Clutches – purpose and basic principle of contact clutch, brakes - purpose and basic principle of block brake

**UNIT-VI**

**Robot and sensors –** Introduction, definition, Robot component,**CNC Machine tools** – Introduction, Machine control, Vertical and Horizontal spindles, CNC drill, mill, boring and tapping, Adaptive control, NC and CNC turning centers

**TEXT BOOKS :**

Mathur, M.L., Mehta, F.S. and Tiwari, R.P., Elements of Mechanical Engineering, Jain Brothers, New Delhi, 2005.

R.K. Rajput, “Elements of Mechanical Engineering”, Laxmi Publications, 1994.

**Mechanical Engineering**

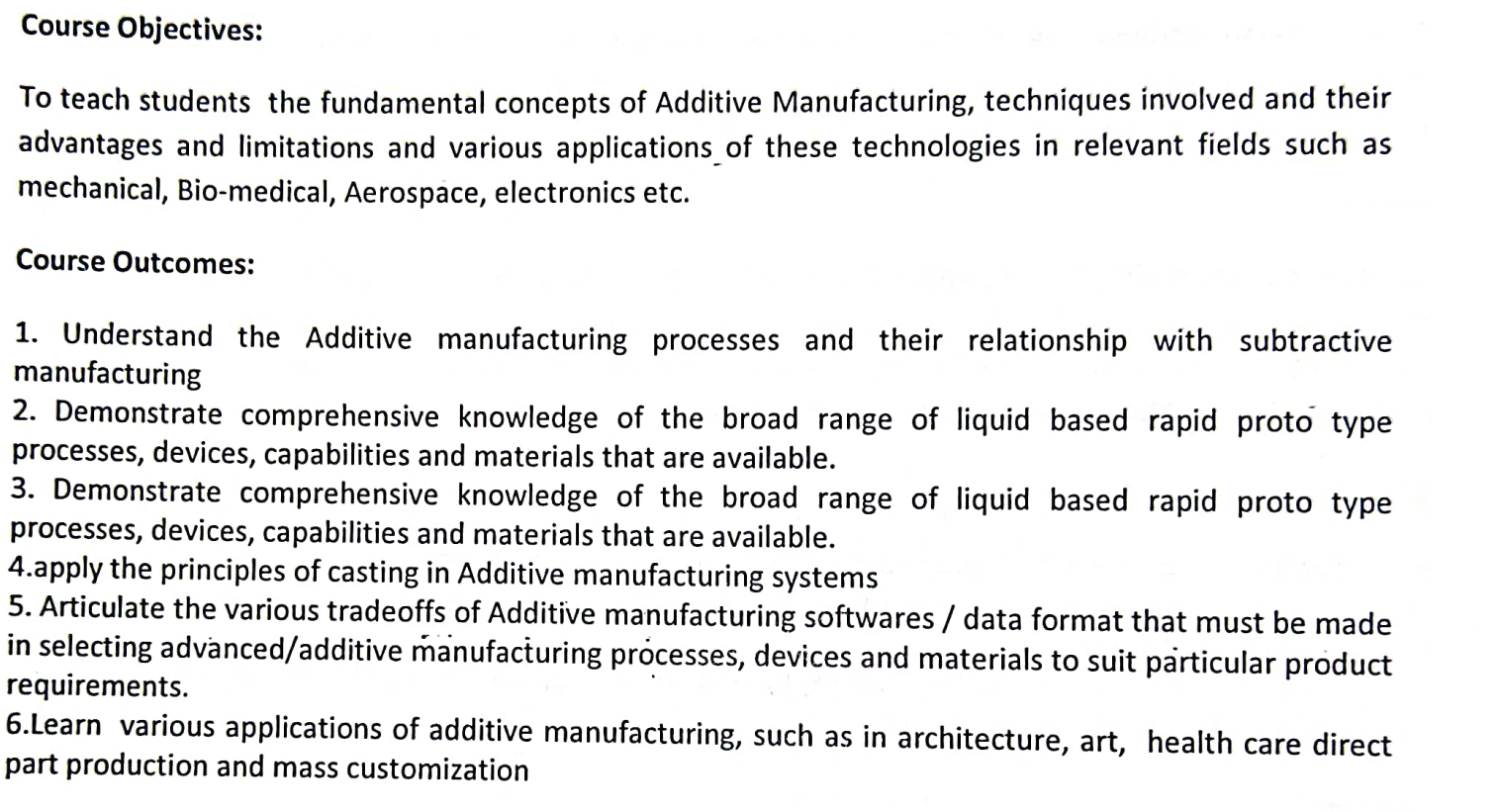
**INTRODUCTION TO ADDITIVE MANUFACTURING PROCESSES**

**Code: 8BC51**

**L T P/D C**

2 **- - 2**

**Prerequisites:** Metal Cutting

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**UNIT-I**

**Introduction:**

Development of AM, Fundamentals of AM, Classification of AMS, Advantages,Standards on AM, Commonly used terms, AM process chain

**UNIT-II Liquid-based Additive manufacturing Systems:** Stereo lithography Apparatus (SLA), process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, 3D bioprinting**Solid-based Additive manufacturingSystems:**, Laminated Object Manufacturing (LOM): process, working principle, Applications, Advantages and Disadvantages, Fused Deposition Modeling (FDM): working principle, Applications, Advantages and Disadvantages

**UNIT-III**

**Powder Based Additive manufacturingSystems**: Selective laser sintering (SLS): working principle, Applications, Advantages and Disadvantages, Color Jet printing, working principle, Applications, Advantages and Disadvantages, **Build time calculations –** SLA, FDM**,** Problems

**UNIT-IV**

**Additive manufacturing Data Formats:** STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Features of various AM software’s like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor. **Design for AM** – Basic Principles and Practices

**UNIT-V**

**Rapid Tooling:** Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification, Spray Metal Deposition, Silicone rubber molds, , Casting-Sand Casting ,Investment Casting,evaporative Casting

**Reverse engineering** – what is RE, Why use RE, RE Generic process, Overview of RE-Software and Hardware, CMMs-applications and types

**UNIT-VI**

**Applications and examples :** Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, Arts and Architecture. Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants and Prosthesis, Design and Production of Medical Devices, Bionic ear, dentistry

**Suggested Reading:**

1.Chua C.K., Leong K.F. and LIM C.S, Rapid prototyping; Principles and Applications, World Scientific Publications , Third Edition, 2010.

2. Reverse Engineering: An Industrial Perspective, Springer- Verlag, 2008. ISBN: 978-1-84628-855-5

3. Ian\_Gibson\_· David\_Rosen, Brent\_Stucker, AdditiveManufacturingTechnologies3D Printing, Rapid Prototyping, andDirect Digital Manufacturing,Springer

4.PaulF.Jacobs, Rapid Prototyping and Manufacturing ASME Press, 1996.

**Department of Mechanical Engineering**

**PRINCIPLES OF OPERATIONS RESEARCH**

**L T P/D C**

2**-- -- 2**

**Code: 8BC52**

**Course Objectives:**

The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints.

**Course Outcomes:**

**CO1:**Formulate and solve mathematical model (linear programming problem) for a physical situations like production, distribution of goods and economics.

**CO2:**Recognize and Solve the problem of transportation involving a large number of shipping routes with least transportation cost and generate optimal assignment strategy for different situations

**CO4:**Use Johnson’s rule to create the optimal sequencing schedule for a sequencing problem and make decisions about replacing an item using replacement policy

**CO5:**Analyze the performance measures of Queing system and Calculate the EOQ for minimizing the total inventory cost

**CO6:** Apply simulation techniques for solving various types of problems and general idea development about Markov chains

**UNIT – I**

**INTRODUCTION:**Definition, Characteristics and Phases and Types of models, applications.

**LINEAR PROGRAMMING PROBLEM**- Formulation – Graphical solution, Simplex method-Types of variables, Unique and Multiple optimal solution, Redundancy & Degeneracy in LPP, Unbounded solution, Artificial variables techniques - Big-M method with feasible and infeasible solutions, Two–phase method, Primal to Dual formation with Duality Principle.

**UNIT – II**

**TRANSPORTATION PROBLEM** – Formulation – methods of finding initial solution (NW corner, VAM, Least cost Method) Optimal solution (Stepping stone Method, MODI method) Special cases in TP: unbalanced, Degeneracy, Restriction and maximization case.

**ASSIGNMENT PROBLEM** – Formulation – Optimal solution (Hungarian Method) - Variants of Assignment Problem-Unbalanced, Restriction, Maximization, Airlines layover case, Traveling Salesman problem.

**UNIT – III**

**SEQUENCING** – Introduction – Terminology, Assumptions, Johnson’s procedure- Processing n jobs through two machines – Processing n jobs through three machines – Processing two jobs through ‘m’ machines (Gantt Chart).

**REPLACEMENT:** Introduction – Types of failure, Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, Group replacement.

**UNIT – IV**

**THEORY OF GAMES:** Introduction andTerminologies, Criterion and optimal strategy – Solution of games with saddle points: Mixed Strategies-Rectangular games without saddle points, Dominance principle, Average Relational Dominance, m X 2 & 2 X n games -Graphical method and Sub Game Method, Matrix Method, Application of LPP in game theory.

**UNIT – V**

**WAITING LINES:** Introduction, Terminology, Structure of a queue, calling population characteristics-size, behavior, pattern of arrivals, Kendall-Lee notation, Queuing Models: Single Channel: Poisson arrivals: exponential service times: with finite and infinite population, Multichannel: Poisson arrivals: exponential service times with infinite population

**INVENTORY :** Introduction, Inventory costs, Concept of EOQ, Single item Deterministic models with and without shortages, Single item inventory models with one price break and multiple price breaks, Stochastic models – Instantaneous demand and no set up cost.

**UNIT – VI**

**SIMULATION:** Definition – Types of simulation – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages

Markov chains: Introduction to Markov chains, Analysis Assumptions, Input output probabilities, Applications (Only basic understanding)

**TEXT BOOKS:**

1. Operations research / Hira & Gupta

2. Operation Research /J.K.Sharma/Macmillan Publishers.

**REFERENCES:**

1. Quantitative Techniques in Management: N D Vohra, TMH

**Department of Mechanical Engineering**

**PRINCIPLES OF AUTOMATION and ROBOTICS**

**L T P/D C**

2**-- -- 2**

**Code: 8BC53**

**Course Outcomes:**

After completing the subject, students will be able to:

* Understand a production system, principles of automobile
* understand the methods of work part transfer mechanical buffer storage control functions
* understand the implementation of automated flow lines
* know the analysis and design of material handling systems, automated guided vehicle system
* understand adaptive control systems and Applications.
* understanding the business process Engineering. Concept of concurrent Engineering, techniques of rapid prototype.

**UNIT – I**

Introduction: Production system, Automated manufacturing systems, Reasons, Principles and strategies of automation, Basic elements of automated system, pneumatic and hydraulic circuit components, Assembly system and line balancing: Manual Assembly process, and work transport systems, Line pacing, Analysis of manual assembly lines, line balancing methods-problems, ways of improving line balance

lines.

**UNIT – II**

Analysis of Automated flow lines: System configuration, Workpart transfer, General terminology and analysis of transfer lines without and with buffer storage.

Automated Assembly systems: Fundamentals and Design of assembly systems.

**UNIT – III**

Automated material handling: Principles, Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems-technology, Analysis of material transport systems.

Automated storage systems: Basic terminology, AS/RS; Carousel storage, work in process storage,

**UNIT – IV**

Adaptive control systems: Introduction, Adaptive control with optimization, Adaptive control with constraints, Application of A.C. in Machining operations. Use of various parameters such as cutting force, Temperature, vibration and acoustic emission.Concept of Concurrent Engineering, MRP,MRP II,Techniques of Rapid Proto typing.

**Unit – V**:**Robotics**:

Classification and structure of Robotic systems, structure of continuous path robot systems, drives and control systems, control approaches for robots.

**Unit – VII**

Robot arm kinematics, the direct kinematics problem and inverse kinematic solutions, planning of manipulator trajectories, robot sensors, range sensors, proximity sensors, touch sensors, force and torque sensors, programming, manual teaching, lead through teaching, programming languages, storing and operating task programmes, robot selection and application.

**TEXT BOOK:**

1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover./PE/PHI

2. Mittal and Nagrath, ‘Robotics and Control’, Tata Mc Graw Hill.

**REFERENCES:**

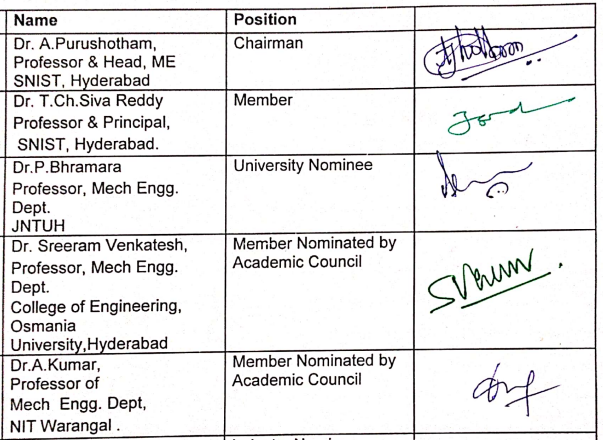
1. Computer control of Manufacturing Systems by Yoram Coreom.

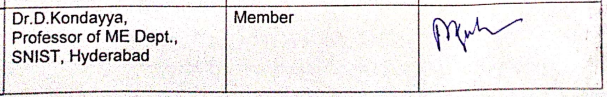
2. CAD / CAM/ CIM by Radhakrishnan.

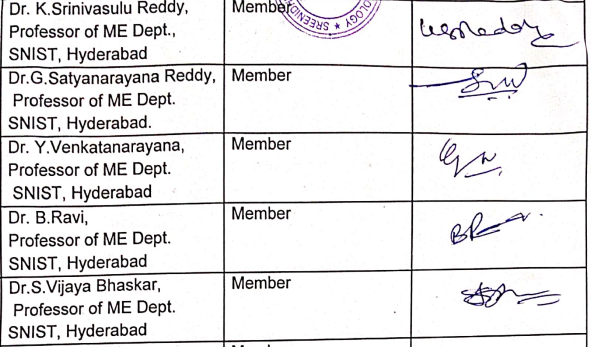
**6. Summary and BOS Approval of Minutes**

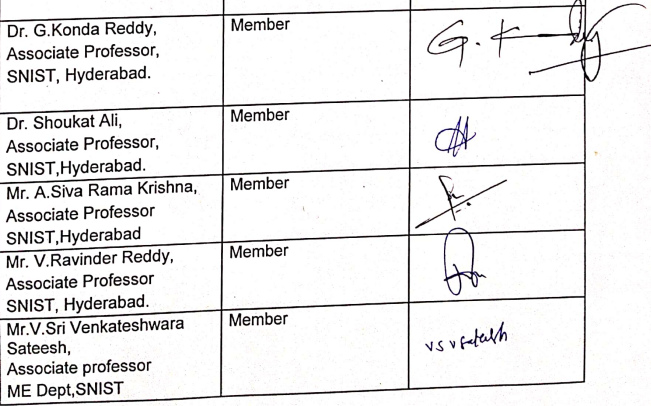
Curriculum has been revised for B.Tech Mechanical Engineering Programme III & IV year for A20 Regulation

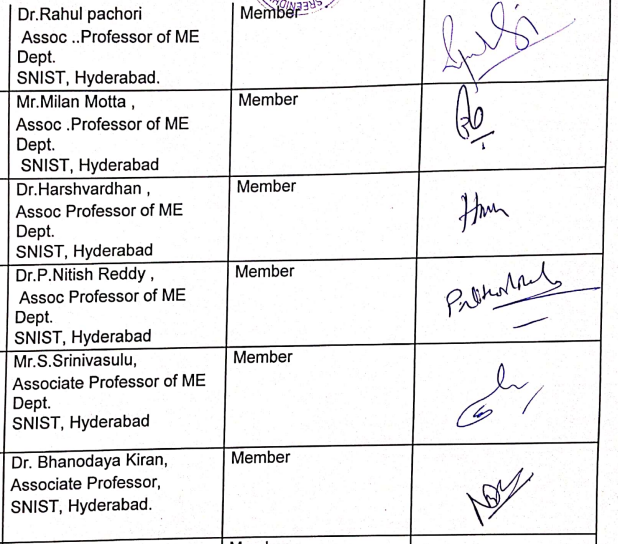
The common format of structure and syllabus has been prepared as per the suggestions and guidelines of BOS members and it is presented in BOS meeting. BOS members approved minutes of all the agenda items of Thirteenth BOS Meeting.

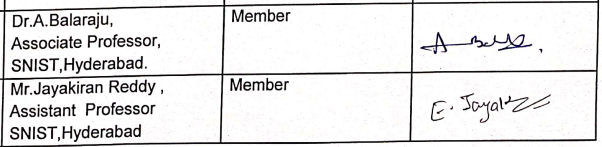


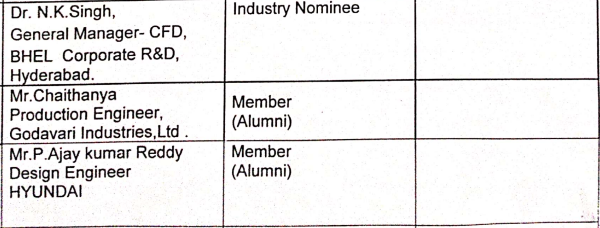












**Chairman of BOS Mechanical Engineering**