# B.TECH. (MECHANICAL ENGINEERING) PROGRAM STRUCTURE (2025-29)

| Semester | | I | II | III | IV | V | VI | VII | VIII | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| Basic Science Course | BSC/ESC | 08 | 07 | | -- | -- | -- | -- | -- | 15 |
| Engineering Science Course | | 08 | 07 | | -- | -- | -- | -- | -- | 15 |
| Program Core Course (PCC) | Program Courses | -- | 02 | 10 | 10 | 10 | 10 | 12 | -- | 54 |
| Program Elective Course (PEC) | | -- | -- | -- | -- | 04 | 06 | 04 | 06 | 20 |
| Vocational Courses (**Industrial Collaboration Course)** | Skill Courses | -- | -- | -- | -- | -- | -- | 02 | -- | 10 |
| Skill Enhancement Course **(Professional Development)** | | 01 | 01 | 01 | 01 | 02 | 02 | -- | -- | |
| Ability Enhancement Course (AEC -01, AEC-02) **(Ex. Language Lab, CS, EEE)** | Humanities Social Science and Management (HSSM) | 02 | -- | -- | 02 | -- | -- | -- | -- | 04 |
| Entrepreneurship/Economics/ Management Courses | | -- | | 02 | 02 | -- | -- | -- | -- | 04 |
| Indian Knowledge System (IKS) | | | 02 | | -- | -- | -- | -- | -- | 02 |
| Value Education Course (VEC) (Ex, UHV-II, Environmental Courses) | | -- | -- | 02 | 02 | -- | -- | -- | -- | 04 |
| Constitution of India | | | | | | | AU | | | AU |
| Do It Yourself (DIY) | Experiential Learning Courses | AU | AU | 01 | 01 | 01 | 01 | 01 | -- | 05 |
| PBL | | 01 | 01 | 01 | 01 | 01 | 01 | 01 | -- | 07 |
| Internship/ OJT | | -- | --- | | | -- | -- | -- | 12 | 12 |
| Co-curricular Courses (CC) (NSS / YOGA/ Health & Wellness) | Liberal Learning Courses | 01 | 01 | -- | -- | -- | -- | -- | -- | 02 |
| Open Elective (OE) | | -- | -- | 04 | 02 | 02 | -- | -- | -- | 08 |
| **Total Credits (Major)** | | **21** | **21** | **21** | **21** | **20** | **20** | **20** | **18** | **162** |
| Multidisciplinary Minor (MDM) | Multidisciplinary Courses | | - | 02 | 03 | 03 | 03 | 03 | -- | **14** |
| • **(B.E./ B.Tech. or Equivalent) in Engg./ Tech. with Multidisciplinary Minor**<br>• **Major + MDM = 162+14 = 176 Credits** | | | | | | | | | | **176** |
| Honors and Multidisciplinary Minor | | - | - | 2 | 4 | 4 | 4 | 4 | - | **18** |

MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| • **4-Year Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Honors and Multidisciplinary Minor**<br>• **Major + Honors + MDM = 162+18+14 = 194 Credits**<br>• Students with a minimum **CGPA of 7.5** without backlog courses at the end of the second semester and should have earned **42 credits** are eligible for admission to the UG Bachelor's Degree with Honors. | | | | | | | | | | **194** |
| Honors with Research and Multidisciplinary Minor | | | | | | | | 08 | 10 | **18** |
| • **4-Year Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg. / Tech.- Honors with Research and Multidisciplinary Minor**<br>• **Major + Research MDM = 162+18+14 = 194 Credits**<br>• Students with a minimum **CGPA of 7.5** without backlog courses at the end of Sixth semester and should have earned **124 credits** are eligible for admission to the UG Bachelor's Degree with Research. | | | | | | | | | | **194** |
| Double Minors (Multidisciplinary and Specialization Minors) | | | | 2 | 4 | 4 | 4 | 4 | | **18** |
| **1. 4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg. / Tech.- Major Engg. Discipline with Double Minors (Multidisciplinary and Specialization Minors)**<br>**2. Major + MDM + Specialized Minor= 162+14+18 = 194 Credits**<br>3. Students with a minimum **CGPA of 7.5** without backlog courses at the end of the second semester and should have earned **42 credits** are eligible for admission to the UG Bachelor's Degree with Double Minor. | | | | | | | | | | **194** |

Note:

1. Multiple entry & exit criteria will be in accordance with the AICTE/UGC/DTE/NEP-2020 guidelines.
2. For Audit course (AU), participation is mandatory but not included in Grade calculations.
3. The Honors and Specialization Minor (Double Minor) offered by the program is exclusively for students of that program. Only students with a minimum CGPA of 7.5 and no backlogs at the end of the Second Semester are eligible. Students must maintain a minimum CGPA of 7.5 and remain without backlogs throughout the program. To earn the Honors and Specialization Minor (Double Minor), students must complete all the courses offered by the program.
4. Honors and Specialization Minor (Double Minor) courses shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards.

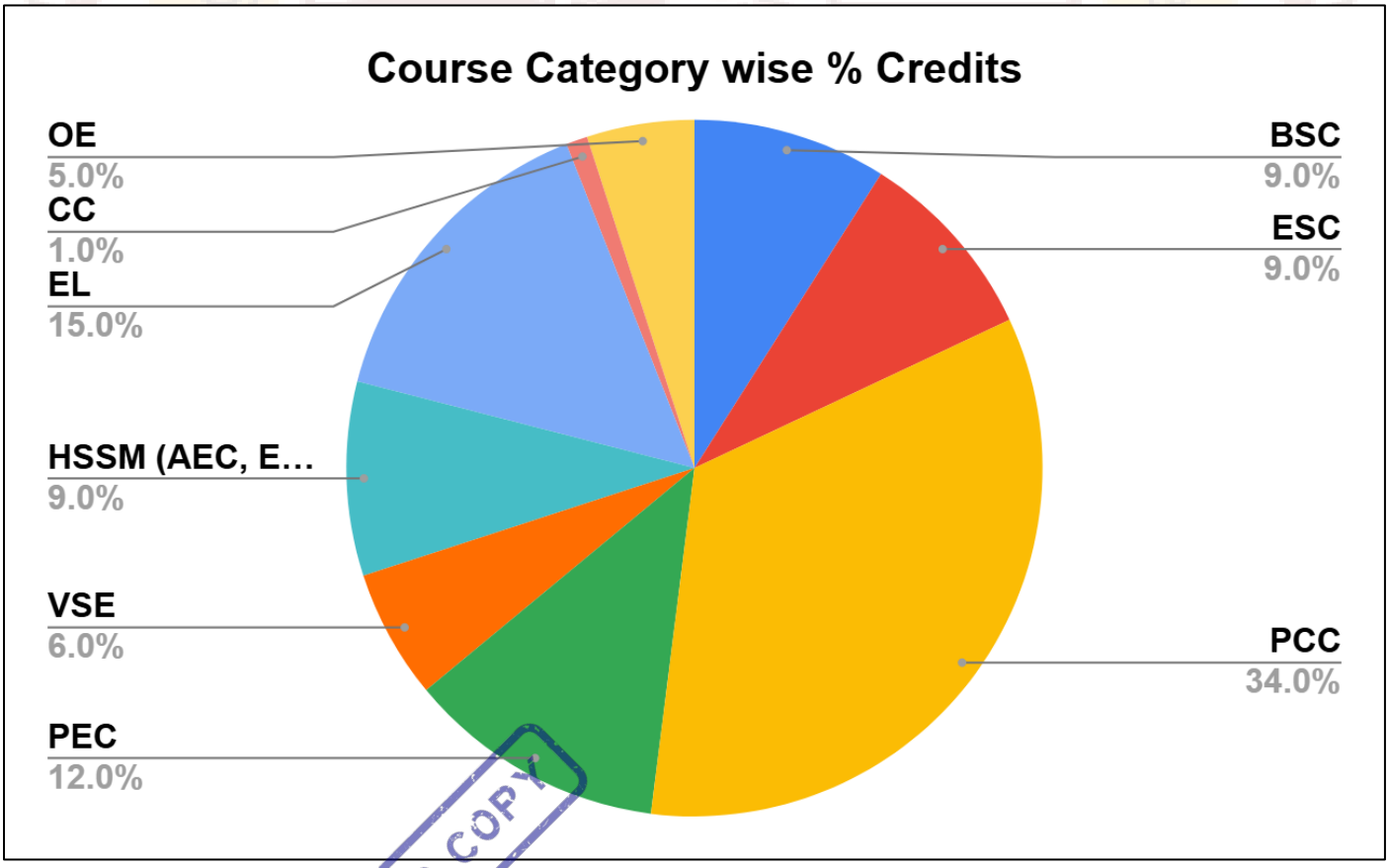
MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

| B.Tech. in Mechanical Engineering | | |
|---|---|---|
| **Course Category** | **Credits** | **% Credits** |
| Basic Science **(BSC)** | 15 | 9% |
| Engineering Science **(ESC)** | 15 | 9% |
| Program Core Courses **(PCC)** | 54 | 34% |
| Program Elective Courses **(PEC)** | 20 | 12% |
| Vocational & Skill Enhancement **(VSE)** | 10 | 6% |
| Humanity, Social Science & Management (AEC, EM, IKS, VEC) **HSSM** | 14 | 9% |
| Experiential Learning **(EL)** | 24 | 15% |
| Co-Curriculum Courses **(CC)** | 2 | 1% |
| Open Electives **(OE)** | 8 | 5% |
| **Total Credits** | **162** | |




MASTER COPY

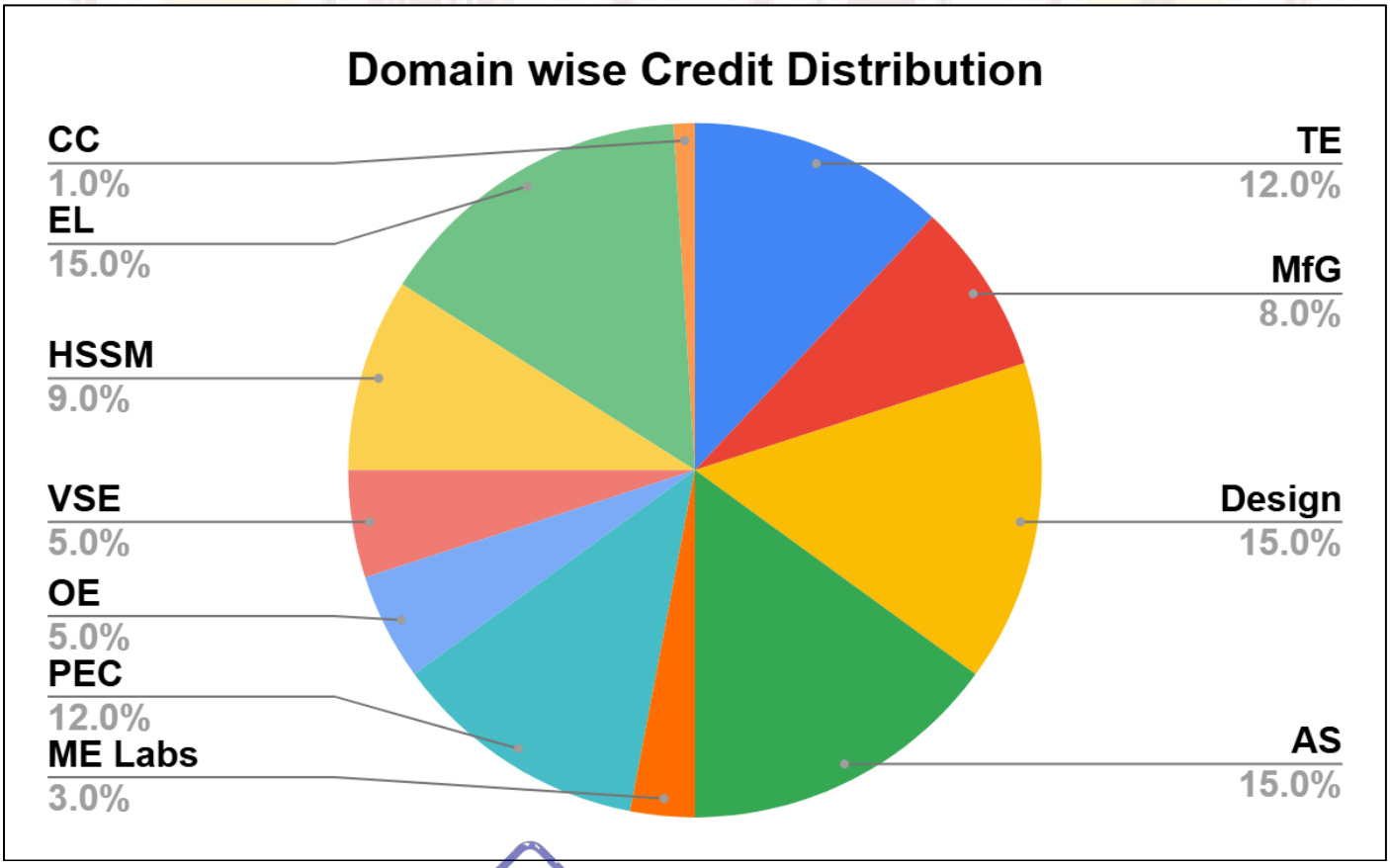
Chairman, BoS
Mechanical Engg.

Dean Academics

Deogiri Institute of Engg & Mgmt Studies ★ Chhatrapati Sambhajinagar ★

Chairman
Academic Council

| B.Tech. in Mechanical Engineering | | |
|---|---|---|
| **Domain** | **Credits** | **% Credits** |
| Thermal and Heat Power Engineering (**TE**) | 20 | 12 |
| Manufacturing Engineering (**MfG**) | 13 | 8 |
| Design Engineering (**Design)** | 25 | 15 |
| Allied Science (**AS)** | 24 | 15 |
| Mechanical Engineering Labs (**ME Labs)** | 4 | 3 |
| Program Elective Courses (**PEC**) | 20 | 12 |
| Open Electives (**OE)** | 8 | 5 |
| Vocational & Skill Enhancement (**VSE**) | 8 | 5 |
| Humanity, Social Science & Management (AEC, EM, IKS, VEC) **HSSM** | 14 | 9 |
| Experiential Learning (**EL**) | 24 | 15 |
| Co-Curriculum Courses (**CC**) | 2 | 1 |
| **Total Credits** | **162** | |




MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Deogiri Institute of Engg & Mgmt Studies Chhatrapati Sambhajinagar

Chairman
Academic Council

| SEMESTER I | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Course Code | BOS | Name of the Course | Teaching Scheme | | | | Evaluation Scheme | | | | | Credits |
| | | | | L | T | PR | Total | CA-I | CA-II | MSE | ESE | Total | |
| BSC | NT251001 | BSH | Linear Algebra and Calculus | 3 | 1 | | 4 | 10 | 10 | 20 | 60 | 100 | 4 |
| BSC | NT251002 | BSH | Applied Science II | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| ESC | GE251101 | ME | Engineering Graphics | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| ESC | NT251102 | CS | Programming for Problem Solving | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| HSSM-AEC | GE251701 | BSH | Modern Indian Language I | 2 | | | 2 | 10 | 10 | 20 | 60 | 100 | 2 |
| BSC | NT251003 | BSH | Applied Science II Lab | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| ESC | GE251103 | ME | Engineering Graphics Lab | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| ESC | NT251104 | CS | Programming for Problem Solving Lab | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| LLC | GE251901 | BSH | NSS | | | 2 | 2 | 25 | 25 | | | 50 | 1 |
| ELC | GE251801 | - | PBL: Design Thinking Lab | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| ELC | GE251802 | ME/ CE | Do It Yourself I | | | 2 | 2 | 25 | 25 | | | 50 | AU |
| SC-SEC | GE251601 | - | Professional Development I | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| **Total** | | | | **14** | **1** | **14** | **29** | | | | | **800** | **21** |

MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

| SEMESTER II | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Course Code | BOS | Name of the Course | Teaching Scheme | | | | Evaluation Scheme | | | | | Credits |
| | | | | L | T | PR | Total | CA-I | CA-II | MSE | ESE | Total | |
| BSC | NT252004 | BSH | Multivariable Calculus | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| BSC | NT252005 | BSH | Applied Science I | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| ESC | GE252102 | ET | Basic Electronics and Electrical Engineering | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| ESC | NT252105 | CE | Engineering Mechanics | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| PCC | NT252201 | ME/CE | Applied Engineering | 2 | | | 2 | 10 | 10 | 20 | 60 | 100 | 2 |
| HSSM-IKS | GE252702 | BSH | Indian Knowledge System | 2 | | | 2 | 10 | 10 | 20 | 60 | 100 | 2 |
| BSC | NT252006 | BSH | Applied Science I Lab | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| ESC | NT252106 | ME | Workshop Practices | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| LLC | GE252902 | BSH | Sports | | | 2 | 2 | 25 | 25 | | | 50 | 1 |
| ELC | GE252803 | - | PBL: Engineering Exploration Lab | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| ELC | GE252804 | ET | Do It Yourself II | | | 2 | 2 | 25 | 25 | | | 50 | AU |
| SC-SEC | GE252602 | - | Professional Development II | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| **Total** | | | | **16** | | **12** | **28** | | | | | **850** | **21** |

MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

| SEMESTER III | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Course Code | BOS | Name of the Course | Teaching Scheme | | | | Evaluation Scheme | | | | | Credits |
| | | | | L | T | PR | Total | CA-I | CA-II | MSE | ESE | Total | |
| PCC | ME253202 | ME | Fluid Mechanics | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| PCC | ME253203 | ME | Material Science and Metallurgy | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| PCC | ME253204 | ME | Machine Drawing and CAD | 2 | | | 2 | 10 | 10 | 20 | 60 | 100 | 2 |
| #HSSM-EEMC | ME253703 | ME | Entrepreneurship Development | 2 | | | 2 | 10 | 10 | 20 | 60# | 100 | 2 |
| #HSSM-VEC | GE253704 | BSH | Universal Human Values II | 2 | | | 2 | 10 | 10 | 20 | 60# | 100 | 2 |
| *OE | ME253501 - 503 | ME | Open Elective I | 4 | | | 4 | 10 | 10 | 20 | 60 | 100 | 4 |
| PCC | ME253205 | ME | Mechanical Engineering Lab I | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| PCC | ME253206 | ME | Machine Drawing and CAD Lab | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| SC-SEC | ME253603 | ME | Professional Development III | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| ELC | ME253805 | ME | Do It Yourself III | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| ELC | ME253806 | ME | PBL: Problem based Learning | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| **Total for Major** | | | | **16** | | **10** | **26** | | | | | **850** | **21** |
| *MDM | ME253401 | ME | MDM I | 2 | | | 2 | 10 | 10 | 20 | 60 | 100 | 2 |
| **Total for Major with Multidisciplinary Minor (Mandatory Credits)** | | | | | | | | | | | | | **23** |
| HMM | ME253207 | ME | HMM I | 2 | | | 2 | 10 | 10 | 20 | 60 | 100 | 2 |
| **OR (Students will be allotted either HMM or DM as per defined criteria)** | | | | | | | | | | | | | |
| DM | ME253208-210 | ME | DM I | 2 | | | 2 | 10 | 10 | 20 | 60 | 100 | 2 |
| **Total for Major with MDM + (HMM/DM)** | | | | **20** | | **10** | **30** | | | | | **1050** | **25** |

*Courses offered by the Mechanical Engineering department for other department students.

#End semester Evaluation will be done at department level.

MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

| SEMESTER IV | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Course Code | BOS | Name of the Course | Teaching Scheme | | | | Evaluation Scheme | | | | | Credits |
| | | | | L | T | PR | Total | CA-I | CA-II | MSE | ESE | Total | |
| PCC | ME254211 | ME | Basic Thermodynamics | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| PCC | ME254212 | ME | Strength of Materials | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| PCC | ME254213 | ME | Manufacturing Processes | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| #HSSM-AEC | GE254705 | BSH | Modern Indian Language II | 2 | | | 2 | 10 | 10 | 20 | 60# | 100 | 2 |
| $HSSM-EEMC | ME254706 | ME | Industrial Engineering and Financial Management | 2 | | | 2 | 10 | 10 | 20 | 60$ | 100 | 2 |
| #HSSM-VEC | ME254707 | ME | Environmental and Sustainable Engineering | 2 | | | 2 | 10 | 10 | 20 | 60# | 100 | 2 |
| *OE | ME254504-506 | ME | Open Elective II | 2 | | | 2 | 10 | 10 | 20 | 60 | 100 | 2 |
| PCC | ME254214 | ME | Mechanical Engineering Lab II | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| SC-SEC | ME254604 | ME | Professional Development IV | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| ELC | ME254807 | ME | Do It Yourself IV | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| ELC | ME254808 | ME | PBL: Problem to Project based Learning | | | 2 | 2 | 15 | 15 | | 20 | 50 | 1 |
| **Total for Major** | | | | **17** | | **08** | **25** | | | | | **900** | **21** |
| *MDM | ME254402 | ME | MDM II | 3 | | | 3 | 10 | 10 | 20 | 60 | 100 | 3 |
| **Total for Major with Multidisciplinary Minor (Mandatory Credits)** | | | | | | | | | | | | | **24** |
| HMM | ME254215 | ME | HMM II | 4 | | | 4 | 10 | 10 | 20 | 60 | 100 | 4 |
| **OR (Students will be allotted either HMM or DM as per defined criteria)** | | | | | | | | | | | | | |
| DM | ME254216-218 | ME | DM II | 4 | | | 4 | 10 | 10 | 20 | 60 | 100 | 4 |
| **Total for Major with MDM + (HMM/DM)** | | | | **24** | | **08** | **32** | | | | | **1100** | **28** |

*Courses offered by the Mechanical Engineering department for other department students.

#End semester Evaluation will be done at department level.

$End semester Evaluation will be done at department level by Open-Book Examination

MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

| Open Elective Bucket Offered by All Departments | | | | | | |
|---|---|---|---|---|---|---|
| **Department** | **OE I (SEM III)** | | **OE II (SEM IV)** | | **OE III (SEM V)** | |
| | Credit: 4 | | Credit: 2 | | Credit: 2 | |
| | Course code | Course Name | Course code | Course Name | Course code | Course Name |
| **Mechanical*** | ME253501 | Mechatronics | **ME254504** | **3D Printing Technologies** | **ME255507** | **3D Printing and Rapid Prototyping** |
| | ME253502 | Project Management for Engineers | ME254505 | Robotics and Automation | ME255508 | EV Technology |
| | ME253503 | Numerical Methods in Engineering | ME254506 | Energy Storage and Management Systems | ME255509 | Renewable Energy Sources |
| **Civil** | CE253501 | Environmental Impact Assessment | **CE254504** | **Remote Sensing and Geographic Information Systems** | **CE256507** | **Interior Designs and Drawing** |
| | CE253502 | Experimental Stress Analysis | CE254505 | Town Planning | CE256508 | Development Engineering |
| | CE253503 | Composite Materials | CE254506 | Operation Research | CE256509 | Planning for Sustainable Development |
| **E&TC** | **ET253501** | **Digital Electronics** | **ET254504** | **Sensors and Actuators** | **ET255507** | **Internet of Things** |
| | ET253502 | Signals & Systems | ET254505 | Electrical Machines | ET255508 | Instrumentation Engineering |
| | ET253503 | Electronic Devices and Circuits | ET254506 | Computer Architecture | ET255509 | Wireless Communication Basics |
| **CSE** | **CS253501** | **C Programming** | **CS254504** | **Object Oriented Programming using Java** | **CS255507** | **Advanced JAVA** |
| | CS253502 | Data Science and Analytics | CS254505 | Fundamentals of Machine Learning | CS255508 | Artificial Intelligence and Applications |
| | CS253503 | Open Source and Software Technology | CS254506 | Web Development Technologies | CS255509 | Computer Network and Security |
| **AIML** | **AI253501** | **Python Programming** | AI254504 | Cyber Security Fundamentals | **AI255507** | **Internet of Things** |

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

| | | | | | | |
|---|---|---|---|---|---|---|
| | AI253502 | Prompt Engineering | AI254505 | Artificial Intelligence & Data Science | AI255508 | Autonomous Intelligent System |
| | AI253503 | Components and Applications of the Internet of Things | AI254506 | Ethical Hacking | AI255509 | Quantum Computing |

***The Open Elective (OE) courses offered by the Department of Mechanical Engineering are exclusively intended for students of other departments and are not open to students of the Mechanical Engineering Department.**

MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

| Multidisciplinary Minor (MDM) Courses Offered by All Departments | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Department | MDM-I (SEM III) | | MDM-II (SEM IV) | | MDM- III (SEM V) | | MDM- IV (SEM VI) | | MDM-V (SEM VII) | |
| | Credit: 2 | | Credit: 3 | | Credit: 3 | | Credit: 3 | | Credit: 3 | |
| | Course code | Course Name | Course code | Course Name | Course code | Course Name | Course code | Course Name | Course code | Course Name |
| **Mechanical*** | ME253401 | Basic Mechanical Engineering | ME254402 | Metrology and Mechanical Measurements | ME255403 | Product Design and Development | ME256404 | Smart Materials | ME257405 | Automobile Engineering |
| **Civil** | CE253401 | Basic Civil Engineering | CE254402 | Building Construction and Materials | CE255403 | Building Planning & Drawing | CE254404 | Building Estimates & Tendering | CE254405 | Construction Management |
| **E&TC** | ET253401 | Basic Electronics and Communication Engineering | ET254402 | Digital Electronics and Logic Design | ET255403 | Microprocessors and Microcontrollers | ET256404 | Communication Systems and Networking | ET257405 | Embedded Systems |
| **CSE** | CS253401 | Introduction to Computer Systems | CS254402 | Computational Statistics for AI | CS255403 | Predictive Analytics and Visualization | CS256404 | Advanced Machine Learning | CS257405 | Prompt Engineering |
| **AIML** | AI253401 | Introduction to Computer Systems | AI254402 | Computational Statistics for AI | AI255403 | Predictive Analytics and Visualization | AI256404 | Advanced Machine Learning | AI257405 | Prompt Engineering |

***The MDM courses offered by the Department of Mechanical Engineering are exclusively intended for students of other departments and are not open to students of the Mechanical Engineering Department.**

MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

**Honors

| Semester | Code | BOS | Courses | No. of Credits |
|---|---|---|---|---|
| SEM III | ME253207 | ME | SWAYAM/NPTEL | 2 |
| SEM IV | ME254215 | ME | SWAYAM/NPTEL | 4 |

**Specialization Minor (Double Minor)

| Semester | No. Of Credits | | Design Engineering | Fluid and Thermal Engineering | Manufacturing and Materials Technology |
|---|---|---|---|---|---|
| SEM III | 2 | DM I | | | |
| | | Course Code | ME253208 | ME253209 | ME253210 |
| | | BOS | ME | ME | ME |
| | | Course | SWAYAM/NPTEL | SWAYAM/NPTEL | SWAYAM/NPTEL |
| SEM IV | 4 | DM II | | | |
| | | Course Code | ME254216 | ME254217 | ME254218 |
| | | BOS | ME | ME | ME |
| | | Course | SWAYAM/NPTEL | SWAYAM/NPTEL | SWAYAM/NPTEL |

**The Honors and Specialization Minor (Double Minor) offered by the Department of Mechanical Engineering is exclusively for Mechanical Engineering students. Only students with a minimum CGPA of 7.5 and no backlogs at the end of the Second Semester are eligible. Students must maintain a minimum CGPA of 7.5 and remain without backlogs throughout the program. To earn the Specialization Minor (Double Minor), students must complete one specialization track in a Mechanical Engineering domain offered by the Department. These courses shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards.

MASTER COPY

Chairman, BoS
Mechanical Engg.

Dean Academics

Chairman
Academic Council

| **Course Title: Fluid Mechanics**<br>**Course Code: ME253202** | | **Course Category: PCC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 03 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 03 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Prerequisite:** Engineering Mathematics, Basic Physics | | |
| **Course Description:** The Fluid Mechanics course provides a comprehensive understanding of fluid properties, behaviour, and dynamics, emphasizing their applications in mechanical engineering. Covering topics like fluid properties, fluid statics, kinematics, dynamics, internal and external flows, and boundary layer theory, this course integrates theoretical concepts with practical applications. Students will gain proficiency in analysing fluid behaviour using mathematical models and experimental techniques, equipping them to solve real-world engineering problems in areas such as energy systems, hydraulic machinery, and aerodynamics. | | |
| **Course Objectives:**<br>1. To introduce the fundamental properties and behaviour of fluids, establishing the baseline for fluid mechanics applications in engineering.<br>2. To explain the principles of fluid statics, focusing on pressure measurement, hydrostatic forces, and the stability of submerged bodies.<br>3. To establish a strong theoretical foundation in fluid kinematics, emphasizing flow visualization, control volume analysis, and mass conservation.<br>4. To impart knowledge of fluid dynamics through the fundamental governing equations of momentum and energy, alongside an introduction to computational numerical workflows.<br>5. To present the analytical techniques required to evaluate internal fluid flows, turbulent regimes, and energy losses in complex piping systems. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
| CO1 | **Define** fundamental principles and concepts encompassing properties of the fluids, fluid statics, fluid kinematics, fluid dynamics, internal flows, external flows, and boundary layer theory. | Remember (Level 1) |
| CO2 | **Explain** the physical behaviour and characteristics of engineering fluid systems by integrating concepts from properties of the fluids, fluid statics, fluid kinematics, fluid dynamics, internal flows, external flows, and boundary layer theory. | Understand (Level 2) |
| CO3 | **Solve** practical problems related to properties of fluids, fluid statics, fluid kinematics, fluid dynamics, internal flows, external flows, and boundary layer theory by applying governing equations and measurement techniques. | Apply (Level 3) |
| CO4 | **Demonstrate** the ability to quantify fluid properties and flow parameters by executing standard laboratory procedures and implementing computational tools to validate theoretical principles of fluid mechanics. | Apply (Level 3) |
| CO5 | **Investigate** fluid systems to determine flow behaviour and performance under different conditions using the core principles of properties of the fluids, fluid statics, fluid kinematics, fluid dynamics, internal flows, external flows, and boundary layer theory. | Analyze (Level 4) |
| CO6 | **Assess** fluid systems to justify appropriate engineering selections using the core principles of properties of the fluids, fluid statics, fluid kinematics, fluid dynamics, internal flows, external flows, and boundary layer theory. | Evaluate (Level 5) |

MASTER COPY

Chairman, BoS
Mechanical Engg.

**CO-PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | | | | | | | | | | 1 | |
| **CO2** | 3 | 2 | | | | | | | | | | 2 | |
| **CO3** | 3 | 3 | | | 2 | | | | | | | 2 | |
| **CO4** | 2 | 1 | | 2 | 3 | | | | | | | 1 | 2 |
| **CO5** | 2 | 3 | | 2 | 1 | | | | | | | 2 | |
| **CO6** | 2 | 3 | 2 | 2 | | | | | | | | 3 | |

| **Assessment** | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test, etc. |
| CA-2 (b) | Literature Review/ Subjective Test / Assignment/ MCQ Test, etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End-Semester Exam |
| Practical (e) | Practical Performance and Evaluation |

| **Course Contents** | | |
|---|---|---|
| Unit 1 | **Properties of the Fluids**<br>Definition of Fluid, Fluid as a Continuum, Application of Fluid Mechanics, Units of Parameters related to Fluids, Properties of Fluids: Mass Density; Specific Weight; Specific Volume; Specific Gravity; Viscosity (Newton's Law of Viscosity, Different Types of Fluids, Dynamic Viscosity, Kinematic Viscosity, Newtonian vs Non-Newtonian Fluids, Effects of Temperature on Viscosity, No Slip Condition); Surface Tension and Capillarity; Vapour Pressure and Cavitation, Difference between Liquids and Gases, Compressibility and Compressible Fluids | 5 Hours |
| Unit 2 | **Fluid Statics**<br>Fluid Pressure, Various Units of Pressure, Pascal's Law and Its Applications, Hydrostatic Law and Pressure Head, Hydrostatic Paradox, Types of Pressure: Atmospheric; Absolute, Gauge; Vacuum; Total Pressures, Measurement of Pressure, Buoyancy: Archimedes Principle; Metacentre; Stability of Submerged and Floating Bodies | 4 Hours |
| Unit 3 | **Fluid Kinematics**<br>Control Volume Analysis, Eulerian and Lagrangian Approaches to Fluid Flow, Types of Fluid Flow, Flow Visualization: Streamlines; Stream Tube; Path Lines; Streak Lines; Time Lines, Velocity Vector and Equation of Streamlines, Volume and Mass Flow Rate, Conservation of Mass: Principle; General Equation (Integral and Differential) and its Physical Interpretation, Simplified Continuity Equations, Mass Balance in Steady Flows and Incompressible Flows, Types of Motions of a Fluid Element: Linear Translation; Linear Deformation; Angular Deformation; Rotation; Vorticity, Circulation | 6 Hours |
| Unit 4 | **Fluid Dynamics**<br>Types of Energy and Forces Acting on a Flowing Fluid, Conservation of Momentum: Linear and Angular Momentum Principles; the General Equations (Integral and Differential); Physical Interpretation; Navier-Stokes Equation, Euler's Equation of Motion, Bernoulli Equation from Euler's Equation, Bernoulli Equation from Energy Conservation Equation, Bernoulli Equation in terms of Energies and Heads, Pressures or Heads in Bernoulli Equation: Static; Dynamic; Hydrostatic; Stagnation; Total Pressures, Applications of Bernoulli Equation: Pitot Tube; Pitot-Static Tube; Venturi Meter; Orifice Meter, Bernoulli Equation for Real Fluids, Conservation of Energy: | 7 Hours |

MATTER

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| | Principle; General Equation (Integral and Differential) and its Physical Interpretation, Introduction to Computational Fluid Dynamics and Basic Workflow | |
| Unit 5 | **Internal Flows**<br>Reynolds Number, The Nature of Turbulence, Hydraulic Diameter, Development of Flow and Boundary Layer in Flow through Pipe: The Entrance Region; Hydrodynamic Entry Lengths; Laminar and Turbulent Boundary Layer, Laminar Flow Through Pipe (Hagen-Poiseuille Theory): Derivation for Shear Stress; Velocity Distribution, Pressure Drop and Darcy Friction Factor, Energy Loss (Head Loss) in Pipes: Major Losses; Minor Losses, Network of Pipes: Pipes in Series; Equivalent Pipe; Pipes in Parallel; Branched Pipe System, Power Transmission through Pipes, Piping Systems with Pumps and Turbines | 8 Hours |
| Unit 6 | **External Flows and Boundary Layer Theory**<br>Boundary Layer Theory: Hydrodynamic Laminar and Turbulent Boundary Layer Over a Flat Plate, Boundary Layer Thickness: Displacement Boundary Layer Thickness; Momentum Boundary Layer Thickness; Energy Boundary Layer Thickness, Prandtl Boundary Layer Equations and Blasius Solution for Laminar Boundary Layer Flows, Boundary Layer Separation: Effect of Pressure Gradient; Effects of Separation; Methods of Controlling Separation<br>External Flows: Drag and Lift, Types of Drag, Streamlined and Bluff Bodies, Methods of Drag Reduction, Friction and Pressure Drag on a Flat Plate, Basic Terminology for an Aerofoil, Lift and Drag on an Aerofoil | 6 Hours |

| Sr. No. | Textbooks |
|---|---|
| 1. | Yunus A. Çengel, John M. Cimbala, Fluid Mechanics: Fundamentals and Applications (SI Units), McGraw-Hill. |
| 2. | Mahesh Kumar, Fluid Mechanics and Hydraulic Machines, Pearson (2019). |
| 3. | Dr. P.N. Modi, Dr. S.M. Seth, Hydraulics and Fluid Mechanics Including Hydraulic Machines (SI Units), Standard Book House. |
| 4. | K. Subramanya, Fluid Mechanics and Hydraulic Machines: Problems and Solutions, McGraw-Hill Education. |
| | **Reference Books** |
| 1. | Frank M. White, Fluid Mechanics, McGraw-Hill. |
| 2. | Philip M. Gerhart, Andrew L. Gerhart, John I. Hochstein, Munson, Young, and Okiishi's Fundamentals of Fluid Mechanics, Wiley |
| 3. | Philip J. Pritchard, John W. Mitchell, Fox and McDonald's Introduction to Fluid Mechanics, Wiley. |
| 4. | Dr. R.K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, Delhi (2010). |
| 5. | S.K. Som, Gautam Biswas, S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, McGraw-Hill Education. |
| | **Web Resources** |
| 1. | Prof. Suman Chakraborty, Fluid Mechanics Video Lectures, NPTEL - IIT Kharagpur (https://nptel.ac.in/courses/112105171) |
| 2. | ONLINE FLUID MECHANICS, Professor D. Naylor (https://www.drdavidnaylor.net/) |
| 3. | Prof. S. Chakraborty, Introduction to Fluid Mechanics and Fluid Engineering NPTEL - IIT Kharagpur (https://nptel.ac.in/courses/112105183) |
| 4. | Dr. Donald Webster, Fluid Mechanics (CEE3040) Lecture Videos, Georgia Tech (https://webster.ce.gatech.edu/fluid-mechanics-cee3040-lecture-videos/) |
| 5. | National Committee for Fluid Mechanics Films (https://web.mit.edu/hml/ncfmf.html) |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| **Course Title: Materials Science and Metallurgy**<br>**Course Code: ME253203** | | **Course Category: PCC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 03 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 03 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Prerequisite:** Fundamentals of Physics and Chemistry | | |
| **Course Description:** This course introduces the structure, properties, processing, and testing of engineering materials. It covers crystal structures, crystal defects, and plastic deformation mechanisms to understand the behavior of materials. The course also discusses mechanical properties and testing methods, including tensile, hardness, impact, and non-destructive testing. Students learn about phase diagrams and the iron–carbon equilibrium diagram, which explain microstructural transformations in steels. The course further explores engineering materials such as steel, cast irons, non-ferrous alloys, and composites, along with heat treatment processes used to modify their properties. Basic metallography techniques for microstructural analysis are also introduced. | | |
| **Course Objectives:**<br>1. To guide students in differentiating between crystalline and amorphous materials, calculating key crystallographic parameters, deriving Miller indices, and identifying various crystal defects.<br>2. To demonstrate the mechanisms of plastic deformation and teach students how to evaluate mechanical properties using engineering and true stress-strain data.<br>3. To train students in conducting and interpreting standard destructive tests and non-destructive testing techniques.<br>4. To enable students to apply Gibb's phase rule, the Lever rule, and Hume-Rothery rules to analyse binary systems, the Iron-Iron Carbide equilibrium diagram, and non-equilibrium transformations<br>5. To familiarize students with the composition, microstructure, properties, industrial applications, and grading standards of ferrous metals, non-ferrous alloys, composites, and nanomaterials.<br>6. To instruct students on the principles of various heat treatment processes and the standard metallurgical procedures used for microstructural and macrostructural characterization. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
| CO1 | **Recall** fundamental concepts of material structure, crystal systems, crystalline defects, deformation mechanisms, equilibrium diagrams, types of steels, heat treatment processes, and metallography techniques. | Remember (Level 1) |
| CO2 | **Explain** the relationships between crystal structures, defects, mechanical properties, phase transformations, heat treatment processes, and microstructural changes in materials**.** | Understand (Level 2) |
| CO3 | **Implement** principles of crystallography, mechanical testing, phase diagrams, and heat treatment methods to solve engineering problems related to material selection and performance. | Apply (Level 3) |
| CO4 | **Choose** appropriate material processing routes, heat treatment cycles, and testing/inspection methods to achieve desired properties for specific engineering applications. | Apply (Level 3) |
| CO5 | **Examine** the influence of crystalline defects, deformation mechanisms, microstructural changes, and heat treatment on the mechanical properties and behavior of metals and alloys. | Analyze (Level 4) |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| CO6 | **Assess** different materials (steels, cast irons, nonferrous alloys, composites, and nanomaterials) and processing techniques based on performance, microstructure, and application requirements. | Evaluate (Level 5) |

**CO-PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | | | | | | | | | | 1 | |
| **CO2** | 3 | 3 | | 1 | | | | | | | | 2 | |
| **CO3** | 3 | 3 | 2 | 2 | | | | | | | | 2 | |
| **CO4** | 3 | 3 | | 3 | 1 | | | | | | | 3 | |
| **CO5** | 3 | 3 | 2 | 2 | 3 | | | | | | 1 | 3 | 3 |
| **CO6** | 3 | 3 | 3 | 2 | 2 | | | | | | 1 | 3 | 2 |

| **Assessment** | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End Semester Examination |
| Practical(e) | Performance & evaluation of practical |

| **Course Contents** | | |
|---|---|---|
| Unit 1 | **Structure of materials**<br>Atomic arrangement, Crystalline and amorphous materials, Unit cell, Space lattice, BCC, FCC and HCP structures, Average number of atoms per unit cell, Coordination number, Atomic packing factor, Indexing of lattice planes: Finding Miller indices of a given plane; Drawing a plane with given Miller indices; Inter-planar spacing for cubic systems; Indexing for hexagonal system; Indexing of lattice directions, Crystal imperfections: Point defects; Vacancy; Interstitials; Impurities; Frenkel; Schottky defects; Line defects, Planar defects, Grain boundaries**.** | 6 Hours |
| Unit 2 | **Plastic deformation and mechanical properties**<br>Mechanism of plastic deformation: Slip and twinning, Types of twinning, Deformation of polycrystalline metals, Critical resolved shear stress, Strain hardening mechanisms, Mechanical properties and their testing: Tension test; Engineering stress-strain curves; True stress-strain curves, Mechanical properties: Proportional stress; Elastic limit; Ultimate tensile strength; Breaking or fracture stress; Yield stress; Proof stress; Resilience; Toughness; Stiffness and Ductility, Compression test, Types of fracture, formability, Erichsen cupping test, Brinell Hardness tests, Rockwell Hardness tests and Vickers Hardness tests, Impact tests: Charpy Test; Izod Test, Non-destructive testing: Dye penetrant test; Magnetic particle inspection; Ultrasonic test; Eddy current test. | 6 Hours |
| Unit 3 | **Equilibrium diagrams**<br>Introduction, Definitions of terms, Hume-Rothery rules of solid-solubility, Gibb's phase rule, Solidification of metals: Cooling curves for pure metals; Cooling curves for Plotting of equilibrium diagrams; Lever rule, Iron-iron carbide equilibrium diagram: Phases present; Isothermal reactions; Critical temperatures. Non- | 8 Hours |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| | equilibrium transformation diagrams: Continuous-Cooling-Transformation (CCT) and Time-Temperature-Transformation (TTT). | |
| Unit 4 | **Engineering metals**<br>Plain carbon steels, Alloy steels and their types, Specification of steels, cast irons: Types; Composition; Microstructure; Properties and Applications, Nonferrous metals and alloys: Brasses; Bronzes; Bearing metals; Superalloys, Composite materials: Types; Properties and applications. Nanomaterials: Structure; Properties and Applications. | 6 Hours |
| Unit 5 | **Heat treatment of metals**<br>Introduction, Heat treatment of steels: Objectives and purposes, Cooling media, Annealing processes: Full annealing; Types of annealing, Normalizing, Hardening and tempering, Hardenability: Jominey end quench test, Surface hardening processes: Carburizing; types of carburizing, Nitriding: Mechanism; White layer; Advantages and limitations, Case hardening: Carbonitriding; Flame hardening, Induction hardening: principle; Types; Advantages and drawbacks. | 6 Hours |
| Unit 6 | **Metallographic techniques**<br>Microscopy; Specimen preparation: Procedure; Metallographic polishing abrasives; Metallographic polishing clothes; Mounting of specimens; Etching Mechanism for single- and two-phase alloys; Etching reagents, Optical metallurgical microscope: Construction and working, Important terms, Electron microscopy, Macroscopic examination: Sulphur printing; Flow lines examination and Spark test. | 4 Hours |

| Sr. No. | Textbooks |
|---|---|
| 1. | V. D. Kodgire, S.V. Kodgire, Material Science and Metallurgy for Engineers, Everest Publishing House, Pune, 24th edition, 2008. |
| 2. | V. Raghvan, Material Science Engineering, Prentice Hall of India Ltd.,1992. |
| 3. | W. D. Callister, Materials Science and Engineering: An Introduction, John Wiley and Sons, 5th edition, 2001. |
| 4 | S. H. Avner, Introduction to Physical Metallurgy, Tata McGraw Hill, 2nd edition, 1997 |
| 5 | R. A. Higgins, Engineering Metallurgy: Part I, ELBS, 6th edition,1996. |
| | **Reference Books** |
| 1. | Romesh C. Sharma, Principles of heat treatment of steels, New Age International, 2003 |
| 2. | V. B. John, Introduction to Engineering Materials, ELBS, 6th edition,2001. |
| 3. | G. F. Carter, D. E. Paul, Materials Science and Engineering, ASM International, 3rd edition, 2000. |
| 4. | T. E. Reed-Hill, R. Abbas Chian, Physical Metallurgy Principles, Thomson, 3rd edition, 2003. |
| | **Web Resources** |
| 1. | NPTEL: Materials Science and Engineering, IIT Roorkee<br>https://nptel.ac.in/courses/113107078 |
| 2. | Composite Materials and Structures, IIT Kanpur, Dr. P.M. Mohite,<br>https://nptel.ac.in/courses/101104010 |

MASTER COPY

Deogiri Institute of Engg & Mgmt Studies * Chhatrapati Sambhajinagar *

Chairman, BoS
Mechanical Engg.

| **Course Title: Machine Drawing and CAD**<br>**Course Code: ME253204** | **Course Category: PCC** | |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/week | CA-1 | 10 Marks |
| Tutorial: – | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Prerequisite:** Engineering Graphics | | |
| **Course Description:** The course of Machine Drawing and CAD introduces students to mechanical drawing conventions and standards, Geometric Dimensioning and Tolerancing (GD&T), elements of production drawing, and CAD essentials for mechanical engineering. Through hands-on practice and theoretical instruction, students will master the creation and interpretation of mechanical drawings, understand the critical role of GD&T in ensuring precision, and learn to use CAD software to transform 2D sketches into 3D models. This course equips students with the essential skills needed for modern mechanical engineering design and manufacturing. | | |
| **Course Objectives:**<br>1. To enable students to gain proficiency in conventional representations as per SP46, and to develop their understanding of materials, fasteners, joints, and machining symbols used in technical drawings.<br>2. To instruct students in Geometric Dimensioning and Tolerancing and help them grasp the principles of limits, fits, tolerances, and GD&T symbols.<br>3. To guide students in mastering production drawing elements by developing their ability to create detailed and assembly drawings, prepare bills of materials (BOM), and interpret production drawing requirements for machine components.<br>4. To introduce students to CAD tools and support them in acquiring foundational skills in drafting and solid modeling of mechanical components. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course Students will be able to:** | **Bloom's Level** |
| CO1 | **Identify** and recall various Sectional Views, intersecting surfaces, mechanical drawing conventions, GD&T symbols, and CAD tools used in mechanical engineering. | Remember (Level 1) |
| CO2 | **Explain** the principles of GD&T, the significance of mechanical drawing standards, and the functionalities of different CAD software. | Understand (Level 2) |
| CO3 | **Demonstrate** the ability to produce various Sectional Views, curves of Intersection of surfaces, accurate mechanical component drawings and apply GD&T principles to make assembly and detail drawing | Apply (Level 3) |
| CO4 | **Implement** engineering drawing principles and use CAD software to create, modify, and interpret 2D and 3D drawings of machine components, including symbols, projections, assembly, and detail drawings | Apply (Level 3) |
| CO5 | **Interpret** GD&T specifications, limits, fits, tolerance and production drawing elements to establish design intent, manufacturing requirements, and functional relationships in machine assemblies. | Analyze (Level 4) |
| CO6 | **Assess** engineering drawings and CAD models for correctness of sectional views, intersections, standard conventions (SP46), and completeness of machine element representation. | Evaluate (Level 5) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

**CO-PO Mapping**

| CO-PO Mapping | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
| **CO1** | 3 | 2 | 2 | | 2 | | | | | | | 2 | 2 |
| **CO2** | 2 | 2 | 1 | | 2 | | | | | | | 3 | 2 |
| **CO3** | 2 | 2 | 3 | 2 | | | | 1 | | | | 2 | 2 |
| **CO4** | 2 | 2 | 2 | 2 | 3 | | | | | | | 2 | 3 |
| **CO5** | 2 | 1 | 2 | 2 | 2 | | | 2 | | | | 3 | |
| **CO6** | 2 | 2 | 1 | 2 | 2 | | | | | | | 2 | 3 |

| Assessment | |
|---|---|
| CA-1 (a) | Drawing Test / Assignment |
| CA-2 (b) | CAD Test / Assignment/ Design Project |
| MSE (c) | Subjective Test |
| ESE (d) | End Semester Exam |
| Practical (e) | Practical/Viva/Mini Project |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Sectional Orthographic Views**<br>Full Section, Half Section, Partial Section, Off-Set Section, Revolved Sections, Removed Sections, Auxiliary Section, Guidelines For Hatching, Examples on All Above Types of Sections of Machine Elements | 4 Hours |
| Unit 2 | **Intersection of Surfaces**<br>Line And Curves of Intersection of Two Penetrating Cylinders, Cone and Cylinder, Prism and Cylinder, Prism and Prism | 4 Hours |
| Unit 3 | **Elements of Machine Drawing and Standard Components**<br>Conventional Representation As Per (SP46): Conventions Used To Represent Materials in Section and Standard Machine Elements in Machine Drawings, Screwed Fasteners: Types Nuts; Bolts; Screw; Washer; Stud; Foundation Bolts, Nomenclature and Selection Criteria of Screwed Fasteners, Types of Springs, Gears, Bearings, Shaft Couplings, Pipe Joints: Flanged; Socket and Spigot Joints; Union Joints; Expansion Joints, Riveted Joints: Single and Double Riveted Butt And Lap Joints, Welding Joints: Weld Joints and Symbols; Conventional Signs; Position and Dimensioning of Weld Symbols In Drawing | 4 Hours |

MASTER COPY

Deogiri Institute of Engg & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| Unit 4 | **Geometric Dimensioning & Tolerancing (GD&T)**<br>Limits Fits and Tolerances: Types of Limits; Types of Fits; Tolerance Types, Introduction to GD&T: Dimensioning System; GD&T Symbols; Form Tolerances; Datum; Orientation Tolerances; Location Tolerances; Concentricity & Symmetry Tolerances; Unilateral and Bilateral Tolerance, Hole and Shaft Based Systems, Hole and Shaft Tolerances, Maximum Material Condition(MMC) and Least Material Condition(LMC), Machining Symbols, Surface Roughness Grades and Symbols, Indication of Surface Roughness on Production Drawing, Indication of Machining Allowances, Reading the Production Blueprint | 4 Hours |
| Unit 5 | **Elements of Production Drawing**<br>Types of Production Drawing, Details and Assembly Drawing, Steps Involved in Preparing Assembly Drawing from Details, Preparing Details Drawing from the Given Assembly Drawing, Prepare Bill of Material(BOM), Preparation of Details and Assembly Drawings for: Machine Tool Parts; Engine Parts; Valves; Shaft Couplings and Joints; Automobile Components | 4 Hours |
| Unit 6 | **Mechanical Engineering CAD Essentials**<br>CAD Fundamentals: Introduction to CAD; Advantages of CAD Over Manual Drafting; Applications of Various CAD Tools in Mechanical Engineering; Graphical User Interface of CAD Software: Coordinate Systems; Drawing Sheet Layout; Units and Limits; Layers; File Operations and Drawing Standards | 4 Hours |

| Sr. No. | Textbooks |
|---|---|
| 1. | N.D.Bhatt, V.M.Panchal, Machine Drawing, Charotar Publications |
| 2. | R.K.Dhawan, Machine Drawing, S. Chand Limited |
| 3. | J.D.Bethune, Engineering Design Graphics with Autodesk Inventor, Pearson Education |
| **Sr. No.** | **Reference Books** |
| 1. | N. Sidheswar, P. Kannaiah, Machine Drawing, Tata McGraw Hill |
| 2. | P. S. Gill, A Textbook of Machine Drawing, S.K. Kataria & Sons Publishers |
| 3. | K.L.Narayana, P. Kannaiah and K. Venkata Reddy, Machine drawing, New Age International |
| 4. | David A. Madsen, Engineering Drawing and Design, Cengage Learning |
| 5. | Auto CAD and AutoLISP manuals from Autodesk Corp. U.S.A. |
| 6. | IS Code: SP46-1988, Standard Drawing Practices for Engineering Institutes |
| **Sr. No.** | **Web Resources** |
| 1. | A course on Introduction to Engineering Drawing Prof.P.S.Robi, IIT Guwahati https://nptel.ac.in/courses/112103019 |
| 2. | A course on Engineering Drawing and Computer Graphics, Prof.Rajaram Lakkaraju IIT Kharagpur https://nptel.ac.in/courses/112105294 |
| 3. | Autodesk Learning Portal https://www.autodesk.com/learn |

MASTER COPY

Deogiri Institute of Engg & Mgmt. Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: Entrepreneurship Development**<br>**Course Code: ME253703** | | **Course Category: HSSM-EEMC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/ week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Prerequisite:** Basic knowledge of economics, management principles, and interest in entrepreneurship and innovation will be beneficial. | | |
| **Course Description:** This course introduces the fundamentals of entrepreneurship, startup ecosystems, and innovation-driven business development. It covers idea generation, business model design, startup funding, financial planning, and government support initiatives for entrepreneurs. Learners will explore practical tools such as Business Model Canvas, value proposition design, and strategies for launching and scaling ventures. The course aims to develop entrepreneurial mindset, problem-solving ability, and business planning skills for creating sustainable enterprises. | | |
| **Course Objectives:**<br>▪ To develop understanding of the entrepreneurial mindset, attitudes, and core competencies required for entrepreneurship.<br>▪ To introduce the fundamentals of business planning, startup creation, and venture management.<br>▪ To equip with knowledge of funding opportunities, financial planning, and investment strategies for startups.<br>▪ To provide insights into market research, product development, customer needs, and business growth strategies.<br>▪ To build awareness of government policies, incubation support systems, startup ecosystems, and emerging industry trends. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course: Student will be able to** | **Bloom's Level** |
| CO1 | **Demonstrate** and explain fundamental concepts related to entrepreneurship and business practices. | Remember (Level 1) |
| CO2 | **Implement** systematic methods for identifying opportunities and making informed decisions. | Understand (Level 2) |
| CO3 | **Utilize** appropriate techniques for planning, organizing, and managing activities in an entrepreneurial context. | Apply (Level 3) |
| CO4 | **Examine** various factors influencing performance, growth, and sustainability in business environments. | (Analyze) (Level 4) |

MASTER COPY

Chairman, BoS
Mechanical Engg.

**CO-PO Mapping**

| COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | | | | 1 | | | 2 | 1 | 1 |
| CO2 | 2 | 3 | 2 | 2 | | | | | | | 2 | 1 | 2 |
| CO3 | 1 | 2 | 3 | 1 | 1 | | | 1 | 2 | 2 | 3 | 2 | 2 |
| CO4 | 2 | 3 | 2 | 2 | 1 | 2 | 3 | 2 | 1 | 1 | 2 | 3 | 2 |

| Assessment | |
|---|---|
| CA-1 (a) | Entrepreneurial Ideation / Business Idea Exploration/MCQ Test etc. |
| CA-2 (b) | Case Study/ Business Plan Assignment / Startup Pitch Presentation / etc. |
| MSE (c) | Subjective Test |
| ESE (d) | The end-semester exam will be conducted by the departments. |

| Course Contents | | |
|---|---|---|
| **Unit 1** | **Introduction To Entrepreneurship**<br>Concept And Importance of Entrepreneurship, Competencies of Successful Entrepreneurs, Types of Entrepreneurs, Role of Entrepreneurship in Economic Development, Entrepreneurial Mindset and Motivation Theories, Barriers to Entrepreneurship. | 4 Hours |
| **Unit 2** | **Business Idea Generation and Market Research**<br>Advanced Techniques for Idea Generation and Opportunity Recognition, Opportunity Screening and Feasibility Analysis (Technical, Financial, Market), Market Research Methods, Consumer Behavior Analysis, Competitor Analysis. | 4 Hours |
| **Unit 3** | **Business Plan Development**<br>Business Model Canvas (BMC): Value Proposition; Channels; Revenue Streams; Structure and Components of a Business Plan, Financial Planning Including Costing, Pricing, Budgeting and Break-Even Analysis, Risk Assessment and Mitigation Strategies. | 4 Hours |
| **Unit 4** | **Funding And Financial Management**<br>Sources of Startup Funding: Bootstrapping; Angel Investors; Venture Capital; Crowd funding; Institutional Finance, Stages of Funding, Financial Statements, Valuation Basics, Overview of Government Initiatives and Schemes. | 4 Hours |
| **Unit 5** | **Business Operations and Legal Aspects**<br>Forms of Business Organization, Business Registration Procedures and Regulatory Compliance, Intellectual Property Rights, Contract Management Basics, Startup Taxation Basics, Ethical Issues in | 4 Hours |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| | Entrepreneurship, Corporate Social Responsibility (CSR) and Sustainability. | |
| **Unit 6** | **Growth Strategies and Case Studies**<br>Startup Growth and Scaling Strategies, Branding and Positioning, Digital Marketing Strategies, Technology-Driven Entrepreneurship, Startup Ecosystem, Startup Pitching, Case Studies of Successful and Failed Startups. | 4 Hours |

| **Textbooks** | |
|---|---|
| 1. | Vasant Desai, "Entrepreneurial Development", Himalaya Publishing House, Mumbai. |
| 2 | S.S. Khanka, "Entrepreneurial Development", S. Chand Publishing, New Delhi. |
| 3 | Robert D. Hisrich, "Entrepreneurship", McGraw-Hill Education. |
| 4 | Rajeev Roy, "Entrepreneurship", Oxford University Press, New Delhi. |
| **Reference Books** | |
| 1 | Peter F. Drucker, "Innovation and Entrepreneurship", Harper Business Publications. |
| 2 | Eric Ries, "The Lean Startup", Crown Business Publications. |
| 3 | Steve Blank and Bob Dorf, "The Startup Owner's Manual", K&S Ranch Press. |
| 4 | Alexander Osterwalder and Yves Pigneur, "Business Model Generation", Wiley Publications. |
| 5 | Aswath Damodaran, "Applied Corporate Finance", Wiley India. |
| **Web Resources** | |
| 1 | NITI Aayog – Startups: Policies, innovation strategies, and initiatives supporting entrepreneurship and startup growth (https://www.niti.gov.in/verticals/industry/startups) |
| 2 | Strategyzer Business Model Canvas: (https://www.strategyzer.com/canvas/business-model-canvas) |
| 3 | Investopedia – Venture Capital: Covers startup funding sources such as venture capital, angel investment, valuation (https://www.investopedia.com/terms/v/venturecapital.asp) |
| 4 | Harvard Business Review – Entrepreneurship: Articles and insights on innovation, startup strategy, leadership, and business growth (https://hbr.org/topic/entrepreneurship) |
| 5 | Startup India – Government of India Startup Portal: Information on startup registration, schemes, entrepreneurship ecosystem support (https://www.startupindia.gov.in/) |
| 6 | MSME Ministry, Government of India: Resources for small business development, MSME schemes, entrepreneurship support, and policy initiatives (https://msme.gov.in/) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: Universal Human Values II**<br>**Course Code: GE253704** | **Course Category: HSSM-VEC** | |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs. / Week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Prerequisite:** Universal Human Values I | | |
| **Course Description:** This course introduces the fundamentals of **value education**, focusing on self-exploration, human aspirations, and continuous happiness. It emphasizes harmony within the individual, in relationships, society, and nature. The course develops understanding of **human values, ethics, and professional responsibility**. It encourages students to adopt a **holistic and sustainable approach** to life and decision-making. Learners are guided to apply these values in personal and professional contexts. | | |
| **Course Objectives:**<br>1. Explain the concept of value education, self-exploration, and the relationship between happiness, prosperity, and basic human aspirations.<br>2. Distinguish between the needs of self and the body and apply methods to achieve harmony within the individual and between the self and the body.<br>3. Demonstrate understanding of harmony in the family and society by applying foundational values such as trust and respect in human relationships.<br>4. Analyze the interconnectedness and mutual fulfilment among the four orders of nature and relate it to sustainable living and coexistence.<br>5. Apply a holistic understanding of human values to professional ethics, decision-making, and strategies for value-based life and profession. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course students will be able to** | **Bloom's Level** |
| CO1 | **Define** the concepts of value education, human aspirations, harmony in human beings, family, society, nature and professional ethics. | Remember (Level 1) |
| CO2 | **Explain** the role of self-exploration, human values, relationships and harmony in achieving continuous happiness and prosperity. | Understand (Level 2) |
| CO3 | **Demonstrate** the interrelationship among human beings, society, nature and ethical conduct for universal human order. | Apply (Level 3) |
| CO4 | **Distinguish** the human values and professional ethics in personal and professional life. | Analyze (Level 4) |

| **CO-PO-PSO Mapping** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
| **CO1** | | | | | | 2 | 3 | 1 | | | 3 | | |
| **CO2** | | | | | | 2 | 3 | 2 | | | 3 | | |
| **CO3** | | | | | | 3 | 3 | 2 | | | 2 | | |
| **CO4** | | | | | | 3 | 3 | 3 | | | 3 | | |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test |
| CA-2 (b) | Subjective Test / Assignment/ MCQ Test |
| MSE (c) | Subjective Test |
| ESE (d) | The end-semester exam will be conducted by the departments. |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Introduction to Value Education:**<br>Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity, the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity, Current Scenario, Method to Fulfill the Basic Human Aspirations. | 4 Hrs. |
| Unit 2 | **Harmony in the Human Being**<br>Understanding human beings as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, Harmony of the Self with the Body, self-regulation, and Health. | 4 Hrs. |
| Unit 3 | **Harmony in the Family and Society:**<br>Harmony in the Family, the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect'– as the Right Evaluation, Understanding Harmony in the Society,<br>Vision for the Universal Human Order | 4 Hrs. |
| Unit 4 | **Harmony in Nature (Existence)**<br>Understanding Harmony in Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. | 4 Hrs. |
| Unit 5 | **Implications of Holistic Understanding**<br>Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order. | 4 Hrs. |
| Unit 6 | **Value-Based life and Professional Practices**<br>Competence in Professional Ethics- Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession. | 4 Hrs. |

| Sr. No. | Textbooks |
|---|---|
| 1. | A Foundation Course in Human Values and Professional Ethics R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1. |
| 2. | Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2 |
| **Sr. No.** | **Reference Books** |
| 1. | Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999. |
| 2. | Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 3. | The Story of Stuff (Book). |
| 4. | The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi |
| 5. | Small is Beautiful - E. F Schumacher. |
| 6. | Slow is Beautiful - Cecile Andrews |
| 7. | Economy of Permanence - J C Kumarappa |
| 8. | Bharat Mein Angreji Raj - Pandit Sunderlal |
| 9. | Rediscovering India - by Dharampal |
| 10. | Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi |
| 11. | India Wins Freedom - Maulana Abdul Kalam Azad |
| 12. | Vivekananda - Romain Rolland (English) |
| 13. | Gandhi - Romain Rolland (English) |
| **Sr. No.** | **Web Resources** |
| 1. | https://uhv.org.in/UHV-II_Course_Material |

MASTER COPY

Deogiri Institute of Engg & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: Mechatronics**<br>**Course Code: ME253501** | | **Course Category: OE I** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 04 hrs / week | CA-1 | 10 Marks |
| Tutorial: - - | CA-2 | 10 Marks |
| Credits: 04 | MSE | 20 Marks |
| **Semester**: Second Year (Semester-III) | ESE | 60 Marks |

**Course Prerequisite:** Basic of Mechanical, Electrical and Electronics Engineering, Engineering Mathematics.

**Course Description:** This course introduces students from non-mechanical disciplines to the interdisciplinary field of Mechatronics by integrating fundamental concepts of mechanical systems, electronics, sensors, actuators, control systems, and automation. It provides foundational knowledge of how modern intelligent systems combine mechanical engineering with electronics and computing for industrial and consumer applications. The course emphasizes broad understanding, practical relevance, and cross-disciplinary exposure rather than advanced design or specialization.

**Course Objectives:**

1. To develop students' foundational understanding of mechatronics concepts, system architecture, terminology, sensors, actuators, signal conditioning elements, industrial controllers, and automation system components used in modern engineering systems.
2. To equip students to interpret the working principles and functional characteristics of mechatronics system architecture, including sensors, actuators, signal conditioning devices, industrial controllers, and automation technologies used in engineering applications.
3. To encourage students to apply the principles of sensors, actuators, signal conditioning, control systems, and industrial controllers for interpreting and implementing basic mechatronics automation systems.
4. To help students analyze the architecture and functional interactions of mechatronics systems by examining the relationships among mechanical elements, sensors, actuators, signal conditioning circuits, and industrial controllers in automation applications.
5. To enable students to develop integrated mechatronics systems by selecting appropriate sensors, actuators, signal conditioning circuits, controllers, and embedded or PLC-based control strategies using system modelling, simulation, and industrial automation concepts.

**Course Outcomes:**

| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
|---|---|---|
| CO1 | **Identify and recall** the fundamental concepts, architecture, components, sensors, actuators, controllers, and applications of mechatronics systems used in industrial automation. | Remember (Level 1) |
| CO2 | **Explain** the operating principles, characteristics, and functions of transducers, control systems, signal conditioning circuits, data acquisition systems, microcontrollers, PLCs, and automation components used in mechatronics systems. | Understand (Level 2) |
| CO3 | **Utilise** sensors, actuators, interfacing techniques, Arduino programming, and PLC ladder logic to develop basic mechatronics and automation systems. | Apply (Level 3) |
| CO4 | **Examine** the architecture, programming methods, interfacing techniques, and control strategies of industrial controllers, microcontrollers, Arduino systems, and PLC-based automation systems for industrial applications. | Analyze (Level 4) |

MASTER COPY

Deogiri Institute of Engg & Mgmt Studies * Chhatrapati Sambhajinagar *

Chairman, BoS
Mechanical Engg.

**CO PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | | | | | | | | | | |
| **CO2** | 3 | 2 | | 1 | | | | | | | | | |
| **CO3** | 3 | 2 | 2 | 1 | 3 | | | | | | 2 | | |
| **CO4** | 2 | 3 | 2 | 2 | 2 | 1 | | | | | 2 | | |

| Assessment | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Literature Review/ Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End-Semester Exam |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Introduction to Mechatronics**<br>Mechatronics Systems: Definition Mechatronics; System Architecture; Key Elements of Mechatronics Systems; Practical Examples of Mechatronics Systems, Open-Loop and Closed-Loop Systems, Mathematical Modelling of Control Systems and Block Diagram Representation. | 8 Hours |
| Unit 2 | **Sensors and transducers**<br>Sensors and Transducers used in Mechatronics System: Position Sensors (LVDT, Potentiometer, and Encoder); Pressure and Force Sensors (Bourdon Tube, Strain Gauge, and Load Cell, Piezoelectric, Capacitive); Proximity Sensors (Inductive, Capacitive, and Optical Ultrasonic); Temperature Sensors (Thermocouple, RTD, Thermistors, and Infrared Temperature Sensor); Flow Sensors (Magnetic Flow, Velocity Sensors, and Acceleration Sensors); Light Sensors (Photo Resistor (LDR), Photodiode, Phototransistor). | 10 Hours |
| Unit 3 | **Actuators, Drives, and Mechanical Systems**<br>Mechanical Actuation Systems, Power Transmission Elements, Electrical Actuators, Hydraulic and Pneumatic Actuators, Relay Systems and Switching Devices, Drive Selection Criteria, Practical Applications in Automation Systems. | 6 Hours |
| Unit 4 | **Signal Conditioning and Data Acquisition**<br>Types of Electronic Signals, Need for Signal Processing, Types of Signal Conditioning Processes, Operational Amplifiers, Opto-Isolators and Protection Devices, Analogue to Digital and Digital to Analog Converters, Data Acquisition System, Display and Interface Devices: Seven Segment Displays; LCD Displays; Industrial Human Machine Interface (HMI). | 8 Hours |
| Unit 5 | **Industrial Controllers and Automation Systems**<br>Introduction to Industrial Controllers, Basics of Microprocessors and Microcontrollers: Introduction; Architecture; I/O Ports; Instruction Set; Functions and Applications; Comparison between Microprocessors and Microcontrollers, Introduction to Arduino Controllers, Arduino Programming and Sensor Interfacing.<br>Programmable Logic Controller: Introduction; Architecture; Types of Inputs/Outputs; PLC Programming Using Ladder Logic Diagram. | 8 Hours |
| Unit 6 | **Mechatronics System Design and Industrial Case studies**<br>Stages In Designing Mechatronics Systems, Difference between Traditional and Mechatronics Approaches, Overview of Simulation Software's Used in Control Systems: Matlab; Simulink; Scilab, Industrial Case Studies: CNC Machine Tool System; Automatic Car Park System; Engine Management System; Automated Guided Vehicle (AGV); Smart HVAC System; 3D Printing System. | 8 Hours |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| Sr. No. | Textbooks |
|---|---|
| 1. | Bolton W, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 7th Edition, Pearson (2018). |
| 2. | R. K. Rajput, A Textbook of Mechatronics, S. Chand Publication. |
| | **Reference Books** |
| 1. | Bishop R H, The Mechatronics Handbook, 2nd Edition, CRC Press (2018). |
| 2. | de Silva C, Mechatronics: A Foundation Course, 1st Edition, CRC Press/Taylor Francis (2010). |
| 3. | A. Smaili and F. Mrad, Applied Mechatronics, Oxford University Press, 2016. |
| 4. | HMT, Mechatronics, McGraw Hill Education, 2017 |
| | **Web Resources** |
| 1. | Prof. Pushparaj Mani Pathak, "Mechatronics" NPTEL -IIT Roorkee (https://onlinecourses.nptel.ac.in) |
| 2. | Prof. David Trumper, "Mechatronics" -, MIT Open Course Ware (https://ocw.mit.edu/courses/2-737-mechatronics-fall-2014/?utm_source=chatgpt.com) |
| 3. | Prof. Prasanna Gandhi, Design of Mechatronics Systems, NPTEL- IIT Bombay (https://onlinecourses.nptel.ac.in/noc25_me179) |

MASTER COPY

Deogiri Institute of Engg & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Project Management for Engineers**<br>**Course Code: ME253502** | **Course Category: OE I** |
|---|---|

| **Teaching Scheme** | **Examination Scheme** | |
|---|---|---|
| Lectures: 04 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 04 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |

**Course Prerequisite:** Basic understanding of engineering systems and processes, Elementary knowledge of mathematics and analytical skills, Awareness of engineering applications and industrial activities

**Course Description:** This course introduces the fundamental principles and tools of project management applicable to engineering and technology projects. It focuses on project planning, scheduling, cost estimation, risk assessment and project monitoring techniques widely used in engineering industries. Analytical tools such as Gantt charts, CPM and PERT are introduced to help students understand scheduling and resource optimization. The course emphasizes interdisciplinary engineering applications including manufacturing, construction, electronics and software projects. It aims to develop managerial and analytical skills required for effective execution of engineering projects.

**Course Objectives:**

1. To introduce the fundamental principles, terminology, lifecycle phases, and organizational structure of engineering project management across multidisciplinary engineering domains.
2. To impart knowledge of project planning, scope definition, scheduling methodologies, and resource allocation techniques used in engineering projects.
3. To develop understanding of project cost estimation, budgeting, financial evaluation, risk assessment and quality management practices in engineering systems.
4. To demonstrate the application of analytical tools, project monitoring techniques, and modern digital project management software for effective execution and control of engineering projects.

**Course Outcomes:**

| **COs** | **After completion of the course: Students will be able to** | **Bloom's Level** |
|---|---|---|
| CO1 | **Illustrate** the fundamental principles, lifecycle phases, and organizational aspects of engineering project management. | Remember (Level 1) |
| CO2 | **Interpret** planning, scheduling, cost, risk, and quality management concepts in engineering projects. | Understand (Level 2) |
| CO3 | **Execute** project management tools and techniques for planning and scheduling engineering activities. | Apply (Level 3) |
| CO4 | **Examine** engineering projects considering technical, financial, quality, and risk-related factors. | Analyze (Level 4) |
| CO5 | **Assess** project performance and recommend suitable strategies for improving engineering project execution. | Evaluate (Level 5) |

**CO-PO Mapping**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 1 | | | | | | | | | 1 | | |
| **CO 2** | 3 | 1 | 1 | | | | | | | | 2 | | |
| **CO 3** | 3 | 2 | 1 | | 1 | | | | 1 | | 2 | | |
| **CO 4** | 3 | 2 | 1 | 1 | 1 | | | | 1 | | 2 | | |

MASTER COPY

Deogiri Institute of Engg & Management Studies * Chhatrapati Sambhajinagar *

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End-Semester Exam |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Introduction to Engineering Projects**<br>Engineering Projects and Project Management Concepts, Characteristics of Engineering Projects, Difference Between Projects and Routine Operations, Project Lifecycle Phases, Types of Engineering Projects Including Manufacturing, Construction, Software, and Product Development Projects, Organizational Structures in Project Management, Role, Responsibilities, and Skills of Project Manager, Engineering Ethics in Projects | 8 Hours |
| Unit 2 | **Project Planning and Scope Management**<br>Project Planning Process and Objectives, Project Scope Definition and Deliverables, Work Breakdown Structure (WBS), Responsibility Assignment Matrix (RAM) and RACI Chart, Resource Planning and Allocation Concepts, Project Feasibility Analysis Including Technical, Economic, and Operational Feasibility, Project Documentation and Project Charter Preparation. | 8 Hours |
| Unit 3 | **Project Scheduling Techniques**<br>Importance of Project Scheduling; Gantt Charts and Network Diagrams, Activity on Arrow (AOA) and Activity on Node (AON) Concepts, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Critical Path Determination, Float and Slack Concepts; Schedule Control and Time Optimization Concepts | 8 Hours |
| Unit 4 | **Project Cost and Financial Evaluation**<br>Project Cost Estimation Techniques, Types of Project Costs, Cost Budgeting and Project Financing Concepts, Cash Flow Diagrams, Break-Even Analysis, Time Value of Money, Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period Concept; Economic Feasibility of Engineering Projects | 8 Hours |
| Unit 5 | **Project Risk and Quality Management**<br>Concept of Project Risk Management, Risk Identification, Assessment, and Mitigation Strategies, Types of Project Risks Including Technical, Financial, and Schedule Risks, Fundamentals of Quality Management, Quality Planning, Quality Assurance, and Quality Control Concepts, Quality Standards and Continuous Improvement Concepts in Engineering Projects | 8 Hours |
| Unit 6 | **Project Monitoring and Digital Tools**<br>Project Monitoring and Control Techniques, Earned Value Analysis (Conceptual), Project Reporting Systems and Documentation, Project Closure Process; Introduction to Project Management Software Such as MS Project, Primavera, and Agile Tools, Basics of Agile Project Management Methodology, Emerging Trends in Digital Project Management | 8 Hours |

MASTER COPY

Deogiri Institute of Engg & Mgmt Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| Sr. No. | Textbooks |
|---|---|
| 1. | Grewal B.S. Higher Engineering Mathematics, Khanna Publishers, 2012. |
| 2. | Prasanna Chandra, Projects: Planning, Analysis, Financing, Implementation and Review, McGraw Hill. |
| 3. | K.K. Chitkara, Construction Project Management, McGraw Hill. |
| | **Reference Books** |
| 1. | Harold Kerzner, Project Management: A Systems Approach, Wiley. |
| 2. | Jack Meredith & Samuel Mantel, Project Management: A Managerial Approach, Wiley. |
| 3. | Nicholas & Steyn, Project Management for Engineering, Routledge. |
| 4. | Kathy Schwalbe, Information Technology Project Management, Cengage. |
| 5. | Singh, Ravish & Bhatt, Mukul, Engineering Mathematics: A Tutorial Approach, McGraw Hill Education India, 2017. |
| | **Web Resources** |
| 1. | NPTEL – Project Management https://onlinecourses.nptel.ac.in/noc26_mg77/preview?user_email=deepakmagar@dietms.org |
| 2. | Project Management Institute https://www.pmi.org |

MASTER COPY

Deogiri Institute of Engg.& Mgmt.Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Numerical Methods in Engineering**<br>**Course Code: ME253503** | | **Course Category: OE I** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 04 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 04 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Prerequisite:** Engineering Mathematics, Basic Programming (e.g., C, Python, or MATLAB) | | |
| **Course Description:** This course introduces foundational and advanced numerical techniques required to solve complex engineering problems that are difficult or impossible to solve analytically. Covering topics such as error analysis, root-finding algorithms, linear algebraic equations, curve fitting, numerical calculus, and differential equations, this course bridges mathematical theory with computational practice. Tailored as an open elective for students across diverse engineering disciplines, it equips them with the logical framework to develop algorithms and utilize computational methods to analyze, model, and simulate real-world physical systems. | | |
| **Course Objectives:**<br>1. To introduce the concept of numerical approximations, computer arithmetic, and the analysis of errors in engineering computations.<br>2. To explain standard numerical algorithms for finding roots of non-linear equations and solving large systems of linear algebraic equations.<br>3. To establish a strong foundation in techniques for curve fitting, interpolation, and extrapolation of experimental engineering data.<br>4. To impart knowledge of numerical techniques for differentiation and integration, applying them to practical engineering scenarios.<br>5. To present numerical schemes for solving ordinary and partial differential equations governing various dynamic and structural systems. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
| CO1 | Identify the fundamental principles of computational errors and numerical methods | Remember (Level 1) |
| CO2 | Describe the theoretical characteristics of errors and numerical methods. | Understand (Level 2) |
| CO3 | Implement numerical methods to formulate and solve practical engineering problems. | Apply (Level 3) |
| CO4 | Investigate numerical methods to assess their computational performance and system behaviour. | Analyze (Level 4) |

**CO-PO Mapping**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | | | | | | | | | | |
| **CO2** | 3 | 2 | 1 | | | | | | | | | | |
| **CO3** | 3 | 3 | 2 | 1 | | | | | | | | | |
| **CO4** | 2 | 3 | 2 | 2 | | | | | | | | | |

MASTER COPY

Deogiri Institute of Engg & Mgmt Studies * Chhatrapati Sambhajinagar *

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test, etc. |
| CA-2 (b) | Subjective Test / Assignment/ MCQ Test, etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End-Semester Exam |
| Practical (e) | Practical Performance and Evaluation |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Error Analysis**<br>Mathematical Modeling and Engineering Problem-Solving, Significant Figures, Accuracy and Precision, Types of Errors: Absolute/Relative and Percentage Errors; Absolute/Approximate Errors; Round-Off Errors; Truncation Errors, The Taylor Series, Error Propagation in Arithmetic Operations and Single Variable Functions and Multi-variable Functions, Introduction to Algorithmic Logic and Flowcharts, Convergence and Stability | 6 Hours |
| Unit 2 | **Roots of Equations**<br>Bracketing Methods: Bisection Method; False-position (Regula Falsi) Method, Open Methods: Newton-Raphson Method; Secant Method, Convergence Criteria and Rate of Convergence, Engineering Case Studies Involving Root-finding. | 8 Hours |
| Unit 3 | **Linear Algebraic Equations**<br>Matrix Representation of Physical Systems. Direct methods: Gauss Elimination with Partial Pivoting; LU decomposition, Iterative methods: Jacobi Method; Gauss-Seidel Method, Eigenvalues and Eigenvectors, The Power Method, Engineering Case Studies Involving Linear Algebraic Equations | 8 Hours |
| Unit 4 | **Curve Fitting, Interpolation, and Introduction to Machine Learning**<br>Least-Squares Regression: Linear; Polynomial; Multiple, Newton's Divided-Difference and Spline Interpolation, Introduction to Machine Learning: Interpreting Least-Squares Regression as a Basic Supervised Learning Model; Data-driven Modeling and Explicit Mathematical Equations; Practical Model Evaluation: Training vs. Testing Data Splits; Identifying Overfitting and Underfitting in Generalized Engineering Datasets, Engineering Case Studies Involving Curve Fitting and Interpolation | 10 Hours |
| Unit 5 | **Numerical Integration and Differentiation**<br>Numerical Integration: Newton-Cotes Formulas (Trapezoidal rule, Simpson's 1/3 and 3/8 Rule); Integration of Unequal Segments for Experimental Data; Gauss Quadrature (2-Point and 3-Point), Numerical Differentiation: Finite Difference Formulations (Forward, Backward, and Central Differences), Engineering Case Studies Involving Numerical Integration and Differentiation | 8 Hours |
| Unit 6 | **Differential Equations and Introduction to Computational Methods**<br>Ordinary Differential Equations (ODEs): Euler's Method and the Runge-Kutta 4th order (RK4) Method for Initial-value Problems, Partial Differential Equations (PDEs): Physical Classification (Elliptic, Parabolic, Hyperbolic); The Finite Difference Method (FDM) for 1D boundary-value Problems, Introduction of the Finite Element Method (FEM) and the Finite Volume Method (FVM), Introduction to Numerical Discretization, Commercial and Open Source Computation Tools for Verious Engineering Applications, Engineering Case Studies Involving Differential Equations | 8 Hours |

MASTER COPY

| Sr. No. | Textbooks |
|---|---|
| 1. | Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, McGraw-Hill Education. |

Deogiri Institute of Engg. & Mgmt. Studies Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 2. | Rajesh Kumar Gupta, Numerical Methods Fundamentals and Applications, Cambridge University Press |
| | **Reference Books** |
| 1. | Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. |
| 2. | Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill. |
| 3. | Richard L. Burden, J. Douglas Faires, Numerical Analysis, Cengage Learning. |
| 4. | A.K. Jaiswal, Anju Khandelwal, A Textbook of Computer Based Numerical and Statistical Techniques, New Age International Publishers. |
| | **Web Resources** |
| 1. | Prof. Ameeya Kumar Nayak, Numerical Methods, NPTEL - IIT Roorkee (https://nptel.ac.in/courses/111107105) |
| 2. | Prof. Niket Kaisare, Numerical Methods for Engineers, NPTEL - IIT Madras (https://nptel.ac.in/courses/127106019) |
| 3. | Prof. Niket Kaisare, MATLAB Programming for Numerical Computation, NPTEL - IIT Madras (https://nptel.ac.in/courses/103106118) |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: Mechanical Engineering Lab I**<br>**Course Code: ME253205** | | **Course Category: PCC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Practicals/Sessions: 02 Hours/Week | CA-I | 15 Marks |
| Credits: 01 | CA-II | 15 Marks |
| Semester: Second Year (Semester III) | ESE | 20 Marks |
| **Course Prerequisite:** Fluid Mechanics, Metallurgy and Material Science | | |
| **Course Description:** This laboratory course provides essential hands-on experience bridging the theoretical concepts of Fluid Mechanics and Metallurgy and Material Science. The course is structured to develop practical skills in analyzing fluid behavior and characterizing material properties. Students will conduct classical experiments on fluid flow, pressure measurement, and energy losses, alongside modern computational approaches like CFD analysis. Furthermore, the laboratory explores the mechanical properties, heat treatment responses, and microstructural characteristics of ferrous and non-ferrous metals through standard destructive testing, non-destructive testing (NDT), and microscopy. These sessions are designed to cultivate critical proficiency in experimental setup, data analysis, and technical evaluation necessary for modern mechanical engineering applications. | | |
| **Course Objectives:**<br>1. To demonstrate fundamental fluid mechanics principles, including Bernoulli's theorem, flow measurement techniques, and pipe friction, through hands-on physical experimentation and Computational Fluid Dynamics (CFD).<br>2. To equip students with the practical skills required to execute standard mechanical and non-destructive tests (such as hardness, ductility, hardenability, and flaw detection) in order to assess material performance, structural integrity, and suitability for industrial processing.<br>3. To guide the examination and interpretation of material microstructures across various ferrous and non-ferrous metals, illustrating the correlation between material composition, heat treatments (like the Jominy end quench test), and resulting structural properties.<br>4. To train students in the techniques of metallographic specimen preparation and microscopic examination, enabling them to identify alloy compositions and correlate the microstructural phases of ferrous and non-ferrous metals with their respective mechanical behaviors. | | |

Note: The Course Outcomes (COs) and the corresponding CO-PO mapping for this laboratory course are aligned with and detailed in the respective Theory Course Syllabus.

| **Assessment** | |
|---|---|
| CA-I (a) | Performance of Evaluation of Experiments/Activities |
| CA-II (b) | Performance of Evaluation of Experiments/Activities |
| ESE(c) | Performance of Evaluation of Experiments/Activities; Oral Exam |

| **Sr. No.** | **List of Experiments/Activities** |
|---|---|
| 1. | To measure water pressure using a Bourdon tube gauge and a U-tube manometer to develop proficiency in reading analog instruments and performing standard pressure unit conversions. |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 2. | To determine the viscosity of a liquid using a Redwood Viscometer to evaluate the flow characteristics of the fluid at specific temperatures. |
| 3. | To analyze the total energy head at various pipe sections to verify the validity of Bernoulli's Theorem in real-fluid flow. |
| 4. | To quantify the rate of discharge through a pipe using a Venturi or Orifice meter to determine its coefficient of discharge. |
| 5. | To evaluate Darcy's friction factor across various pipe diameters/materials to understand the impact of pipe roughness on head loss. |
| 6. | To determine minor energy losses caused by pipe fittings and geometry changes to account for localized pressure drops in hydraulic systems. |
| 7. | To perform a CFD analysis of pipe flow to simulate and visualize velocity profiles and pressure distributions using computational tools. |
| 8. | To construct a logic-based computer program to automate the identification of fluid properties and flow characteristics based on user-input parameters. |
| 9. | To measure the indentation diameter of a material using the Brinell Hardness Test to determine the Brinell Hardness Number (BHN). |
| 10. | To assess the hardness of a specimen using the Rockwell Hardness Test to determine its resistance to plastic deformation under varying loads. |
| 11. | To examine the ductility of a metal sheet using the Erichsen Cupping Test to evaluate its formability and suitability for deep drawing processes. |
| 12. | To demonstrate the standard procedures of specimen preparation to produce a mirror-like finish suitable for metallographic microscopic examination. |
| 13. | To identify the approximate carbon content and alloying elements of a steel sample via a Spark Test to quickly classify the material based on spark characteristics. |
| 14. | To analyze the microstructures of plain carbon steels with varying carbon percentages to correlate phases and phase distribution with mechanical properties. |
| 15. | To conduct a Jominy End Quench Test to evaluate the hardenability of metal. |
| 16. | To analyze the microstructures of non-ferrous metals to understand the grain structure of alloys like brass, bronze, or aluminum. |
| 17. | To apply a Non-Destructive Testing (NDT) method to detect internal or surface defects without compromising the structural integrity of the component. |

| Sr. No. | Textbooks |
|---|---|
| 1. | Fluid Mechanics Manual |
| 2. | Metallurgy and Material Science Manual |
| | **Reference Books** |
| 1. | Yunus A. Çengel, John M. Cimbala, Fluid Mechanics: Fundamentals and Applications (SI Units), McGraw-Hill. |
| 2. | V. D. Kodgire, S.V. Kodgire, "Material Science and Metallurgy for Engineers", Everest Publishing House, Pune, 24th edition, 2008. |
| | **Web Resources** |
| 1. | Fluid Mechanics Virtual Lab, IIT Bombay (https://iitb.vlabs.co.in/beta-labs.html) |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 2. | Virtual Fluid Laboratory, IIT Patna, (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/) |
| 3. | Mechanical Metallurgy Virtual Lab, IIT Kanpur, (https://mec-met-iitk.vlabs.ac.in/Introduction.html) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Machine Drawing and CAD Lab**<br>**Course Code: ME253206** | | **Course Category: PCC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Practicals/Sessions: 02 Hours/Week | CA-I | 15 Marks |
| Credits: 01 | CA-II | 15 Marks |
| **Semester**: Second Year (Semester III) | ESE | 20 Marks |
| **Course Prerequisite:** Engineering Graphics | | |

**Course Description:** The Machine Drawing and CAD Lab course will provide hands-on experience with mechanical drawing conventions, Geometric Dimensioning and Tolerancing (GD&T), production drawing elements, and CAD software. The experiments are designed to ensure that students gain practical skills and a deep understanding of CAD tools and their applications in mechanical engineering. This lab course will ensure students gain practical exposure to all key concepts, with a significant focus on CAD tools and their applications in mechanical engineering design and manufacturing.

**Course Objectives:**

1. To develop proficiency of students in mechanical drawing standards, including SP46 conventions, materials, fasteners, joints, and machining symbols.
2. To instruct students in Geometric Dimensioning and Tolerancing and enable understanding of limits, fits, tolerances, and GD&T symbols.
3. To train students in production drawing by developing skills in detailed and assembly drawings and preparing BOMs.
4. To introduce CAD tools and build foundational skills in sheet layout, sketching and solid modeling.

| **Assessment** | |
|---|---|
| CA-I | Performance of Evaluation of Experiments/Activities |
| CA-II | Performance of Evaluation of Experiments/Activities |
| ESE | Performance of Evaluation of Experiments/Activities; Oral Exam |

| **Sr. No.** | **List of Experiments/Activities** |
|---|---|
| 1. | To draw standard machine components and symbols on a drawing sheet for understanding conventional representation practices. |
| 2. | To solve problems of intersection of surfaces on a drawing sheet for visualizing geometric interactions of solids. |
| 3. | To develop assembly drawings on a drawing sheet for representing component relationships and assembly structure. |
| 4. | To prepare part drawings on a drawing sheet for detailing individual machine components with dimensions. |
| 5. | To apply draw, modify, and annotation tools in CAD software for creating and editing engineering drawings efficiently. |
| 6. | To create sectional orthographic projections of a simple machine component in CAD software for visualizing internal features digitally. |
| 7. | To generate assembly or part production drawings using CAD software for producing industry-standard detailed drawings. |
| 8. | To model a 3D representation of a simple machine component in CAD software for understanding solid modeling concepts. |

MASTER COPY

Chhatrapati Sambhajinagar Deogiri Institute of Engg. & Mgmt. Studies

Chairman, BoS
Mechanical Engg.

| Sr. No. | Textbooks |
|---|---|
| 1. | N.D.Bhatt, V.M.Panchal, Machine Drawing, Charotar Publications |
| 2. | J.D.Bethune, Engineering Design Graphics with Autodesk Inventor, Pearson Education |
| **Sr. No.** | **Reference Books** |
| 1. | N. Sidheswar, P. Kannaiah Machine Drawing, Tata McGraw Hill |
| 2. | P. S. Gill, A Textbook of Machine Drawing, S.K. Kataria & Sons Publishers |
| 3. | Auto CAD and AutoLISP manuals from Autodesk Corp. U.S.A. |
| 4. | IS Code: SP46, Standard Drawing Practices for Engineering Institutes |
| **Sr. No.** | **Web Resources** |
| 1. | A course on Introduction to Engineering Drawing Prof.P.S.Robi, IIT Guwahati https://nptel.ac.in/courses/112103019 |
| 2. | A course on Engineering Drawing and Computer Graphics, Prof.Rajaram Lakkaraju IIT Kharagpur https://nptel.ac.in/courses/112105294 |
| 3. | Autodesk Learning Portal https://www.autodesk.com/learn |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Professional Development III**<br>**Course Code: ME253603** | | **Course Category: SC-SEC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Practicals/Sessions: 02 Hours/Week | CA-I | 15 Marks |
| Credits: 01 | CA-II | 15 Marks |
| **Semester**: Second Year (Semester III) | ESE | 20 Marks |
| **Course Prerequisite:** Basic Computer Literacy, Mathematical Knowledge, Keyboard Skills. | | |
| **Course Description:** This course introduces students to essential office productivity tools used for professional documentation, presentations, and data management. Students will learn to create and format documents using word processing software, design effective presentations using presentation tools, and organize and analyze data using spreadsheet applications. The course emphasizes hands-on practice with features such as formatting, charts, data validation, pivot tables, and spreadsheet functions. Through practical exercises, students will develop skills in preparing professional documents, visual presentations, and structured data sheets. The course is important for improving digital literacy and enabling students to efficiently handle academic, professional, and workplace documentation tasks. | | |
| **Course Objectives:**<br>1. To introduce students to the fundamental features and tools of office productivity software used for document preparation, presentations, and spreadsheet management.<br>2. To provide practical exposure to creating, formatting, and presenting professional documents and presentations using appropriate digital tools.<br>3. To equip students with spreadsheet techniques for organizing, managing, and visualizing data using charts, tables, and formatting tools.<br>4. To develop digital competency by training students in spreadsheet functions, data validation, pivot tables, and other tools for efficient data handling and analysis in academic and professional environments. | | |

**Course Outcomes:**

| **COs** | **After completion of the course, students will be able to** | **Bloom's Level** |
|---|---|---|
| CO1 | **Recall** fundamental concepts, features, and interfaces of office productivity tools including word processing, presentation software, spreadsheets, and professional email communication. | Remember (Level 1) |
| CO2 | **Explain** the working principles, functionalities, and best practices of word processing, presentation design, spreadsheet operations, and email writing etiquettes for professional communication. | Understand (Level 2) |
| CO3 | **Implement** office productivity tools to create structured documents, professional emails, effective presentations, and organized spreadsheets using appropriate features and formatting techniques. | Apply (Level 3) |
| CO4 | **Examine** data using spreadsheet techniques such as charts, validation, pivot tables, and functions to support information processing and decision-making in real-world scenarios. | Analyze (Level 4) |

**CO-PO Mapping:**

| **CO-PO Mapping** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
| **CO1** | 1 | 1 | | | 2 | | | | 1 | | 1 | 1 | 1 |
| **CO2** | 1 | 2 | 1 | | 2 | | | | 2 | | 1 | 2 | 2 |
| **CO3** | 2 | 2 | 2 | 1 | 3 | | | 1 | 3 | 1 | 2 | 2 | 3 |
| **CO4** | 2 | 3 | 2 | 2 | 3 | 1 | | 1 | 2 | 1 | 2 | 2 | 3 |

MASTER COPY
Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-I (a) | Performance & Evaluation of activities on word & Presentation Module. |
| CA-II (b) | Performance & Evaluation of activities on spreadsheet Module |
| ESE (c) | Viva-voce/Activity Evaluation of different module. |

| Sr. No. | List of Experiments/Activities |
|---|---|
| 1. | To explore word processor interface and navigation tools for efficient document handling and professional email drafting. |
| 2. | To apply basic text entry and formatting tools in word processor for creating structured documents and formal email communication. |
| 3. | To compose professional emails using proper email writing etiquettes for effective workplace communication. |
| 4. | To create presentations using slides, themes, and multimedia elements for effective communication. |
| 5. | To analyze and modify presentation designs using software tools for improving visual impact. |
| 6. | To perform data entry and worksheet formatting in spreadsheet software for organized data management. |
| 7. | To apply conditional formatting and create charts in spreadsheets for data visualization. |
| 8. | To implement data validation and filtering techniques in spreadsheets for accurate data analysis. |
| 9. | To generate pivot tables using spreadsheet tools for summarizing and analyzing large datasets. |
| 10. | To apply spreadsheet functions (text, date-time, mathematical, statistical, and logical) for data processing and decision-making. |

| Sr. No. | Textbooks |
|---|---|
| 1. | Abigail Rusu, Andrea Long, Heather Maye, Jennifer Evans, Amy Ledgerwood, and Jeanine Preuss, Introduction to Microsoft Office, Maricopa Millions Grant. |
| 2. | Helen Holding, Clare Martin, Mastering Microsoft Office, Red Globe Press. |
| 3. | R. P. Soni, Harshal Arolkar, Sonal Jain, Working with Personal Computer Software, Wiley India. |
| | **Reference Books** |
| 1. | Stephanie Krieger, Documents, Presentations, and Workbooks: Using Microsoft Office to Create Content That Gets Noticed, Microsoft Press. |
| 2. | Marjorie S. Hunt, Barbara Clemens, Illustrated Microsoft Office 365 & Office 2016, Cengage Learning. |
| 3. | Linda Foulkes, Learn Microsoft Office 2021 - Second Edition, Packt Publishing. |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | Web Resources |
|---|---|
| 1. | Step-by-step learning resources for office software,<br>https://www.tutorialspoint.com/word<br>https://www.tutorialspoint.com/excel<br>https://www.tutorialspoint.com/powerpoint |
| 2. | Spreadsheet concepts and functions tutorials,<br>https://www.w3schools.com/excel |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Do It Yourself lll**<br>**Course Code: ME253805** | | **Course Category: ELC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Practicals/Sessions: 02 Hours/Week | CA-I | 15 Marks |
| Credits: 01 | CA-II | 15 Marks |
| **Semester**: Second Year (Semester III) | ESE | 20 Marks |
| **Course Prerequisite:** Engineering Mechanics, Applied Science. | | |
| **Course Description:** This course focuses on DIY-based learning in Manufacturing Processes, enabling students to understand fundamental manufacturing concepts through hands-on activities, simple models, and practical experiments. The course covers basic manufacturing operations such as turning, milling, drilling, welding, forming, and machining along with the working principles of machine tools like lathe, milling machine, shaper, slotter, and hydraulic press.<br>Emphasis is given to innovation, creativity, teamwork, safety awareness, and experiential learning through the development of simple prototypes and low-cost manufacturing models. By the end of the course, students will be able to understand manufacturing operations and apply engineering concepts to practical industrial problems. | | |
| **Course Objectives:**<br>1. To develop safe working habits and practical awareness of manufacturing processes through hands-on DIY and workshop-based activities.<br>2. To build foundational skills in casting, prototyping, machining, and material processing using machine tools such as lathe, milling, drilling, shaper, and slotter machines.<br>3. To enhance fabrication and manufacturing competencies through practical exposure to welding, hydraulic pressing, and basic metal forming operations.<br>4. To foster creativity, innovation, problem-solving, and experiential learning through the design and development of simple manufacturing models and prototypes**.** | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course: Students will be able to** | **Bloom's Level** |
| CO1 | **Describe and demonstrate** safety practices in a mechanical engineering workshop to ensure safe working conditions. | Understand (Level 2) |
| CO2 | **Develop** simple components using sand casting and prototyping techniques to understand material behavior and manufacturing principles. | Apply (Level 3) |
| CO3 | **Execute** machining operations such as lathe, milling, drilling, shaping, and slotting to produce basic mechanical components. | Apply (Level 3) |
| CO4 | **Examine and perform** metal joining and forming operations such as welding and hydraulic pressing for fabrication applications. | Analyze (Level 4) |

**CO-PO Mapping:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | | 1 | | 1 | | | 1 | | | | 2 | |
| **CO2** | 2 | | 2 | 1 | 2 | | | 1 | | | | 2 | 1 |
| **CO3** | 3 | 1 | 3 | 3 | 2 | 2 | | | | | | 3 | 2 |
| **CO4** | 2 | 2 | 2 | 3 | 1 | 3 | | | 3 | 2 | | 3 | 2 |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-I (a) | Performance and Evaluation of Activities |
| CA-II (b) | Performance and Evaluation of Activities |
| ESE (c) | Mini project/Test/Viva Exam/ etc |

| Sr. No. | List of Experiments/Activities |
|---|---|
| 1. | To understand safety rules in a mechanical engineering workshop to ensure safe working practices |
| 2. | To develop a simple sand mold and cast a basic shape using plaster/wax to learn the fundamentals of casting processes. |
| 3. | To fabricate a cutting tool prototype using soap to understand tool geometry and design concepts. |
| 4. | To perform machining operations on a lathe machine to understand turning processes and material removal. |
| 5. | To perform machining operations on a milling machine to understand surface generation. |
| 6. | To perform drilling operations for hole making to understand drilling techniques and tool usage. |
| 7. | To perform shaping and slotting operations to understand linear cutting and surface generation processes. |
| 8. | To perform metal joining using welding to understand joining techniques and weld quality. |
| 9. | To operate a hydraulic press machine for metal forming to understand pressing and deformation processes. |

| Sr.No. | Textbooks |
|---|---|
| 1. | P. N.Rao, Manufacturing Technology, Vol. 1: Foundry, Forming and Welding,McGraw-Hill Education. |
| 2. | P. N.Rao, Manufacturing Technology, Vol. 2: Metal Cutting and Machine Tools,McGraw-Hill Education. |
| | **Reference Books** |
| 1. | Serope Kalpakjian,Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education. |
| 2. | E. Paul DeGarmo,J. T. Black, Ronald A. Kohser, Materials and Processes in Manufacturing,John Wiley & Sons. |
| | **Web Resources** |
| 1. | Prof. Sounak Kumar Choudhury, Manufacturing Processes - Casting and Joining, NPTEL - Indian Institute of Technology Kanpur(https://onlinecourses.nptel.ac.in/noc23_me90/preview) |
| 2. | Prof. Shantanu Bhattacharya, Manufacturing Process Technology 1 & II, NPTEL - Indian Institute of Technology Kanpur(https://onlinecourses.nptel.ac.in/noc26_me47/preview) |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| **Course Title: PBL: Problem based Learning**<br>**Course Code:ME253806** | | **Course Category: ELC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Practicals/Sessions: 02 Hours/Week | CA-I | 15 Marks |
| Credits: 01 | CA-II | 15 Marks |
| **Semester**: Second Year (Semester III) | ESE | 20 Marks |
| **Course Prerequisite:** PBL: Design Thinking, Analytical skills and drawing tools. | | |
| **Course Description:** This course enables students to learn engineering concepts through solving real-world course related technical problems at detailed project level. It emphasizes application of domain knowledge, critical thinking, and systematic problem-solving. In this course students will stay involved in need identification, solution development, prototyping, and validation within given constraints. The course promotes teamwork and hands-on learning. Outcomes are demonstrated through a representational prototype of proposed solution along with detailed documentation. | | |
| **Course Objectives:**<br>1. To enable students to apply domain knowledge for solving real-world course related technical problems through a structured problem-based learning approach.<br>2. To guide students in analyzing problems, generating feasible solutions, and making informed engineering decisions.<br>3. To facilitate the development of design, implementation, and testing skills through project-based activities.<br>4. To cultivate teamwork, communication, and professional skills through continuous mentoring and evaluation. | | |

**Course Outcomes:**

| **COs** | **After completion of the course: Student will be able to** | **Bloom's Level** |
|---|---|---|
| CO1 | **Comprehend** real-world engineering problems by identifying basic requirements, limitations, and relevant knowledge. | Understand (Level 2) |
| CO2 | **Implement** engineering concepts, tools, and methods to develop a working solution. | Apply (Level 3) |
| CO3 | **Interpret** engineering problems by connecting theory with practical situations and finding possible solution approaches. | Analyze (Level 4) |
| CO4 | **Examine** different engineering solutions based on factors like feasibility, cost, efficiency, and sustainability. | Evaluate (Level 5) |
| CO5 | **Develop** and present engineering solutions by testing performance and explaining results clearly. | Create (Level 6) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

**CO-PO Mapping:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | | 1 | | | | | | | | 1 | |
| **CO2** | 3 | 2 | 2 | 2 | 2 | | | 2 | | | 1 | 2 | 2 |
| **CO3** | 3 | 3 | 3 | 1 | 1 | | | 2 | | | 1 | 2 | 2 |
| **CO4** | 2 | 2 | 3 | 2 | 2 | 1 | | 1 | | | 1 | 2 | 3 |
| **CO5** | | | 3 | | 2 | | | 3 | 2 | 2 | 2 | 1 | 2 |

| **Assessment** | |
|---|---|
| CA-I (a) | Identify a real-life problem. Clearly explain the problem, understand the needs of users, and list the important constraints (such as cost, materials, and time). Study existing solutions for the same problem. Then, generate different possible solutions and select the best one based on practicality, cost, and effectiveness. |
| CA-II (b) | Based on the selected solution, design and build a representational model of prototype. Prepare a proper plan, use suitable tools and methods to develop it. Make improvements if needed, and finally demonstrate the representational model with clear documentation. |
| ESE (c) | Assigned Task Completion. |

| **Sr. No.** | **List of Experiments/Activities** |
|---|---|
| 1. | To identify a real-world technical problem. |
| 2. | To define the problem clearly with objectives, basic requirements, and constraints. |
| 3. | To study existing solutions or methods related to the problem and find the gap |
| 4. | To generate different possible solutions using basic engineering concepts. |
| 5. | To select the best solution based on different applicable criteria's i.e. feasibility, simplicity, and cost-effectiveness. |
| 6. | To prepare the design, list of materials and use the required tools for the solution. |
| 7. | To develop a basic representational model of prototype using available resources. |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 8. | To test the developed solution based on the peer-reviewed feedback. |
| 9. | To improve the solution based on test results and feedback. |
| 10. | To present the final solution and prepare a simple technical report. |

| Sr. No. | Textbooks |
|---|---|
| 1. | Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers. |
| 2. | Nigel Cross, Engineering Design Methods: Strategies for Product Design, John Wiley & Sons. |
| | **Reference Books** |
| 1. | Guerra, Aida, Ulseth, Ronald, Kolmos, Anette, PBL in Engineering Education: International Perspectives on Curriculum Change, Springer, 2017. |
| | **Web Resources** |
| 1. | NPTEL Online Courses- Problem Based learning, NITTTR. (https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr20_ed12) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

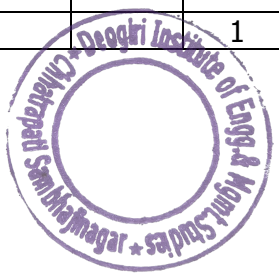
| **Course Title: Basic Mechanical Engineering**<br>**Course Code: ME253401** | | **Course Category: MDM I** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Prerequisite:** Basic Mathematics, Basic Physics | | |
| **Course Description:** This introductory course provides non-mechanical engineering students with a foundational understanding of physical systems, materials, and motion. Students will explore core principles spanning structural design, fluid and thermal sciences, power transmission, and modern manufacturing without relying on heavy mathematical derivations. By examining real-world applications like electronic thermal management, smart factory automation, and electric vehicle mobility, the curriculum highlights the highly interdisciplinary nature of modern technology. Ultimately, learners will develop the practical intuition necessary to seamlessly integrate mechanical hardware with software, electrical circuits, and civil infrastructure within their specific engineering domains. | | |
| **Course Objectives:**<br>1. To introduce engineering materials and basic structural mechanics for interdisciplinary design applications.<br>2. To explain fundamental fluid mechanics and heat transfer principles relevant to thermal management.<br>3. To familiarize students with basic mechanisms, power transmission, and electromechanical integration.<br>4. To provide an overview of conventional, additive, and smart manufacturing technologies.<br>5. To illustrate multidisciplinary system integration in modern mobility and electric vehicles. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
| CO1 | **Outline** the basic terminology and core elements of material properties, solid mechanics, thermal-fluid sciences, mechanical drives, production methods, and transportation systems. | Remember (Level 1) |
| CO2 | **Explain** the foundational principles of material properties, solid mechanics, thermal-fluid sciences, mechanical drives, production methods, and transportation systems. | Understand (Level 2) |
| CO3 | **Implement** fundamental mechanical engineering concepts spanning materials, structural mechanics, thermal management, kinematics, and manufacturing to address multidisciplinary technical challenges. | Apply (Level 3) |
| CO4 | **Assess** multidisciplinary engineering systems by examining the roles of materials, structural mechanics, thermal management, kinematics, and manufacturing in addressing technical challenges. | Analyze (Level 4) |

**CO-PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | | | | | | | | | 1 | | |
| **CO2** | 3 | 1 | | | | | | | | | 1 | | |
| **CO3** | 3 | 2 | 2 | | | | | | | | 1 | | |
| **CO4** | 3 | 2 | 2 | 2 | | | | | | | 1 | | |

MASTER COPY



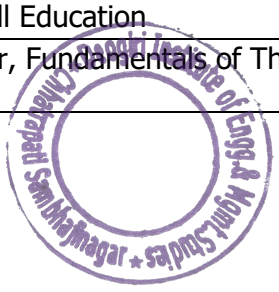

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-1 (a) | Poster Presentation/Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Casestudy/Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End-Semester Exam |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Engineering Materials**<br>Introduction and Scope of Mechanical Engineering, Classification of Engineering Materials: Metals; Polymers; Ceramics; Composites, Key Material Properties, Interdisciplinary Material Selection Criteria: Electronic Applications; Electrical Components; Civil Engineering Structures | 4 Hours |
| Unit 2 | **Design And Structural Mechanics**<br>Product and Engineering Design Process, Types of Mechanical Loads, Fundamentals of Stress and Strain, Types of Stresses, Hooke's Law, Thermal Stresses, Factor of Safety, Introduction to Computer-Aided Tools: CAD; CAE; CAM | 4 Hours |
| Unit 3 | **Fluid Mechanics and Heat Transfer**<br>Definition of Fluid, Properties of Fluid, Pressure, Laminar Flow and Turbulent Flow, Mode of Heat Transfer, Basic Laws of Heat Transfer, Natural Convection and Forced Convection, Thermal Management: Electric Equipment; Battery; Electronics; Data Centers, Heat Sink, HVAC Systems for Buildings | 4 Hours |
| Unit 4 | **Mechanisms And Power Transmission**<br>Introduction To Mechanisms, Types of Motions, Converting Rotary to Linear Motion, Basic Mechanisms, Power Transmission Elements: Gear Drives; Belt Drives; Chain Drives, Electromechanical Integration: Interfacing Motors with Mechanical Actuators; Basic Robotics | 4 Hours |
| Unit 5 | **Manufacturing And Production Technologies**<br>Conventional Manufacturing Processes: Casting; Forging; Machining, Additive Manufacturing: Principles Of 3D Printing; Rapid Prototyping, Polymer Manufacturing Techniques: Injection Molding; Extrusion, Electronics Manufacturing and Assembly: PCB Fabrication; Electronic Packaging | 4 Hours |
| Unit 6 | **Mobility Engineering**<br>Evolution of Mobility, Classification of Mobility Devices, Fundamentals of Internal Combustion (IC) Engines, Systems in IC Engine Vehicles, Systems in Electric Vehicles (EVs), Fundamentals of Gas Turbine Engines, Systems in Aeroplanes | 4 Hours |

| Sr. No. | Textbooks |
|---|---|
| 1. | Jonathan Wickert and Kemper Lewis, An Introduction to Mechanical Engineering, Cengage Learning |
| 2. | Pravin Kumar, Basic Mechanical Engineering, Pearson Education |
| | **Reference Books** |
| 1. | V. D. Kodgire, S.V. Kodgire, "Material Science and Metallurgy for Engineers", Everest Publishing House |
| 2. | S.S. Rattan, Strength of Materials, Tata McGraw-Hill |
| 3. | V. B. Bhandari, Design of Machine Elements, McGraw-Hill Education |
| 4. | Yunus A. Cengel, John M. Cimbala, and Robert H. Turner, Fundamentals of Thermal-Fluid Sciences, McGraw-Hill Education |

MASTER COPY



Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 5. | S.S. Rattan, Theory of Machines, McGraw-Hill Education |
| 6. | Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson |
| 7. | V. Ganesan, Internal Combustion Engines, McGraw-Hill Education |
| 8. | James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons |
| | **Web Resources** |
| 1. | Prof. Janakranjan Ramkumar Prof. Amandeep Singh Oberoi, Basics of Mechanical Engineering - 1, NPTEL - IIT Kanpur (https://nptel.ac.in/courses/112104526) |
| 2. | Prof. Janakranjan Ramkumar Prof. Amandeep Singh Oberoi, Basics of Mechanical Engineering - 2, NPTEL - IIT Kanpur (https://nptel.ac.in/courses/112104616) |
| 3. | Prof. Janakranjan Ramkumar Prof. Amandeep Singh Oberoi, Basics of Mechanical Engineering - 3, NPTEL - IIT Kanpur (https://nptel.ac.in/courses/112104769) |

Chairman, BoS
Mechanical Engg.

| **Course Title: HMM I**<br>**Course Code: ME253207** | | **Course Category: Honors** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/ week | CA-1 | 10 Marks |
| Tutorial: ----- | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Description:**<br>This course shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards. | | |

MASTER COPY

Deogiri Institute of Engg & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: DM I**<br>**Course Code: ME253208** | | **Course Category: Double Minor** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/ week | CA-1 | 10 Marks |
| Tutorial: ----- | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Description:**<br>This course shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards. | | |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: DM I**<br>**Course Code: ME253209** | | **Course Category: Double Minor** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/ week | CA-1 | 10 Marks |
| Tutorial: ----- | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Description:**<br>This course shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards. | | |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: DM I**<br>**Course Code: ME253210** | | **Course Category: Double Minor** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/ week | CA-1 | 10 Marks |
| Tutorial: ----- | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester III) | ESE | 60 Marks |
| **Course Description:**<br>This course shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards. | | |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Basic Thermodynamics**<br>**Course Code: ME254211** | | **Course Category: PCC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 03 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 03 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Prerequisite:** Applied Science I, Linear Algebra and Calculus | | |
| **Course Description:** This course introduces the foundational principles of thermodynamics, focusing on the interactions between energy, heat, and work within various engineering systems. Students will explore the First and Second Laws of Thermodynamics, applying these governing rules to evaluate energy conservation and transformation in both closed systems and open control volumes. The curriculum systematically covers the concepts of entropy and exergy to assess system irreversibility, evaluate performance limits, and optimize thermal energy utilization. Additionally, the course analyzes the properties and phase-change behaviors of pure substances, ideal gases, and real gases using property diagrams and fundamental equations of state. Ultimately, this knowledge equips students with the essential analytical framework required to evaluate and conceptualize practical energy conversion and thermal management applications. | | |
| **Course Objectives:**<br>1. To introduce the foundational terminology, system boundary concepts, thermodynamic properties, and the Zeroth Law, laying the critical groundwork required for analyzing physical engineering systems.<br>2. To explain the fundamental principles of energy conservation and the interconvertibility of heat and work, demonstrating how to apply the First Law to practical closed-system heating, cooling, and compression processes.<br>3. To equip students with mass conservation and control volume analysis techniques-specifically the Steady Flow Energy Equation (SFEE) to evaluate energy interactions in real-world industrial devices like turbines, compressors, and heat exchangers.<br>4. To establish the directional limitations of energy transfer via the Second Law, guiding students to evaluate theoretical efficiency bounds and reversibility using heat engines, heat pumps, and the Carnot cycle.<br>5. To demonstrate the advanced principles of entropy generation and exergy, providing students with the analytical framework necessary to quantify system irreversibility, evaluate energy degradation, and optimize thermal performance.<br>6. To familiarize students with the P-V-T phase-change behavior of pure substances and governing gas laws, ensuring their practical proficiency in utilizing steam tables, Mollier charts, and equations of state for thermodynamic calculations. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
| CO1 | **Recall** the fundamental concepts, laws of thermodynamics, principles of control volume analysis, concepts of entropy and exergy, and the properties of pure substances and gases. | Remember (Level 1) |
| CO2 | **Explain** basic thermodynamic concepts, first law energy interactions, control volume flow processes, second law principles, entropy and exergy fundamentals, and the behavior of pure substances. | Understand (Level 2) |
| CO3 | **Utilize** basic concepts, first and second law principles, control volume analysis, exergy evaluation, and gas properties to solve practical engineering and numerical problems. | Apply (Level 3) |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| CO4 | **Investigate** thermal systems by examining basic concepts, closed and open system energy balances, second-law irreversibility, entropy generation, and pure substance behavior. | Analyze (Level 4) |
| CO5 | **Explore** engineering thermal systems using basic concepts, the first and second laws, flow process data, exergy analysis, and kinetic theory principles. | Evaluate (Level 5) |

**CO-PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | | | | | | | | | 1 | |
| **CO2** | 3 | 2 | | | | | | | | | | 2 | |
| **CO3** | 3 | 3 | 1 | 1 | | | | | | | | 2 | |
| **CO4** | 3 | 3 | 2 | 2 | | | | | | | | 3 | |
| **CO5** | 3 | 3 | 2 | 2 | | | | | | | | 3 | |

| **Assessment** | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End-Semester Exam |

| **Course Contents** | | |
|---|---|---|
| Unit 1 | **Introduction and Basic Concepts**<br>Definition, Scope, and Importance of Thermodynamics, Macroscopic and Microscopic Views of Thermodynamics. Concept of System, Surroundings, and Boundaries, Types of Systems: Closed; Open, and Isolated. Intensive and Extensive Properties, State Functions, Path Functions, State, and Thermodynamic Equilibrium. Quasi-Static (Quasi-Equilibrium) Processes and Cycles. Temperature, Pressure, Specific Volume, and Their Relationships. Equality of Temperature, the Zeroth Law of Thermodynamics, and Temperature Scales. | 6 Hrs. |
| Unit 2 | **First Law, Closed Systems, and Energy**<br>Thermodynamic Work and Heat, Modes of Work Transfer, Heat Transfer, Sign Convention, and the Interconvertibility of Heat and Work. Mechanical Work, Boundary/Displacement Work. First Law of Thermodynamics: Statement; Mathematical Formulation, and Application to a Cycle. First Law for a Change of State of a Closed System. Internal Energy, Enthalpy, and Specific Heats at Constant Volume and Constant Pressure. Practical Applications of the First Law in Basic Heating, Cooling, and Compression Processes. | 6 Hrs. |
| Unit 3 | **Control Volume Analysis and Flow Processes**<br>Conservation of Mass for a Control Volume. Flow Work and the Total Energy of a Flowing Fluid. Derivations and Applications of the Steady Flow Energy Equation (SFEE). SFEE Analysis of Common Engineering Devices: Nozzles; Diffusers; Turbines; Compressors; Throttling Valves, and Heat Exchangers. Unsteady-Flow (Transient) Analysis. | 6 Hrs. |
| Unit 4 | **Second Law of Thermodynamics**<br>Limitations of the First Law, Qualitative Difference Between Heat and Work. Thermal Energy Reservoirs; Heat Engines; Refrigerators, and Heat Pumps. Kelvin-Planck and Clausius Statements of the Second Law and their Equivalence. Reversible and Irreversible Processes, Internal and External Irreversibility. The Carnot Cycle: | 6 Hrs. |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| | Derivation; Efficiency; Maximum Efficiency Bounds, and Significance, Carnot Theorem. Thermodynamic Temperature Scale. | |
| Unit 5 | **Entropy and Exergy Analysis**<br>Clausius Inequality and the Definition of Entropy. Entropy as a Property, Entropy Changes of Pure Substances, and Ideal Gases. Increase of Entropy Principle, Entropy Generation. Exergy: Definition of Exergy; Dead State; Reversible Work. Exergy Destruction; Irreversibility, and Second-Law Efficiency. Application of Exergy in System Performance; Evaluation, and Optimization. | 6 Hrs. |
| Unit 6 | **Properties of Pure Substances and Kinetic Theory of Gases**<br>Definition of Pure Substance: Solid; Liquid, and Vapor Phases. Phase Transitions, and the Gibbs Phase Rule. P-V-T Behavior of Simple Compressible Substances and Property Diagrams. Use of Steam Tables and the Mollier Diagram (h-s Chart). Dryness Fraction (Quality) and its Measurement. Ideal Gas Law, Compressibility Factor Chart, and Real Gas Equations of State. Avogadro's Law, Charles Law, Boyles Law, Equation of State of a Gas, Ideal Gas, and Real Gas. | 6 Hrs. |

| Sr. No. | Textbooks |
|---|---|
| 1. | Moran M. J. and Shapiro H. N., "Fundamentals of Engineering Thermodynamics", John Wiley & Sons (2015). |
| 2. | P.K. Nag, "Engineering Thermodynamics", McGraw-Hill Education (2020). |
| 3. | Yunus A. Cengel & Michael A. Boles, "Thermodynamics: An Engineering Approach", McGraw-Hill Education (2015). |
| 4. | Claus Borgnakke and Richard E. Sonntag, "Fundamentals of Thermodynamics", John Wiley & Sons (2013). |
| | **Reference Books** |
| 1. | Ballaney, "Thermal Engineering", Khanna Publishers, India (2012). |
| 2. | R.K. Rajput, "Engineering Thermodynamics", Laxmi Publications, India (2010). |
| 3. | Mahesh M. Rathore, "Thermal Engineering", McGraw-Hill Education, India (2010). |
| 4. | C.P. Arora, "Thermodynamics", McGraw-Hill Education, India (2001). |
| | **Web Resources** |
| 1. | Engineering Thermodynamics by Prof. Jayant K. Singh, NPTEL, IIT Kanpur (https://nptel.ac.in/courses/101104067) |
| 2. | Thermodynamics by Prof. S.R. Kale, NPTEL, IIT Delhi (https://nptel.ac.in/courses/112102255) |
| 3. | Thermodynamics by Professor Z. S. Spakovszky, Massachusetts Institute of Technology, (https://web.mit.edu/16.unified/www/FALL/thermodynamics/) |
| 4. | NIST Chemistry WebBook, National Institute of Standards and Technology (https://webbook.nist.gov/) |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: Strength of Materials**<br>**Course Code: ME254212** | | **Course Category: PCC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 03 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 03 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Prerequisite:** Engineering Mechanics, Engineering Calculus and differential equations | | |
| **Course Description:** Strength of Materials is a core engineering course that studies how materials and structural members behave when subjected to different types of loads. The course introduces the fundamental concepts of stress, strain and deformation. It also explains how these concepts are used to analyze and design structural elements. It focuses on understanding the distribution of internal forces in members such as beams and shafts, and the factors affecting their strength and stability. Students also learn methods to evaluate stress, deflection, and energy stored in materials under different loading. This course is important as it provides the analytical foundation required for the safe and efficient design of engineering structures and mechanical components. | | |
| **Course Objectives:**<br>1. To introduce the fundamental concepts of stress, strain and the mechanical behavior of materials under different loading conditions.<br>2. To provide instruction on the analysis of internal forces such as shear force, bending moment, and torsion in structural members.<br>3. To develop understanding of stress distribution and deformation in beams, shafts, columns and other structural elements.<br>4. To enable students to apply analytical methods for determining principal stresses, combined stresses, and beam deflection. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
| CO1 | **Recall** the fundamental concepts of stress, strain, internal force in beams, torsion in shafts, column behavior, principal stresses and deflection of structural members. | Remember (Level 1) |
| CO2 | **Explain** the behavior of materials and structural elements under different loading conditions, including stress–strain relationships, shear force and bending moment concepts, torsional effects, column stability, combined stresses and beam deflection principles. | Understand (Level 2) |
| CO3 | **Utilize** principles of Strength of Materials to analyze stresses, strains, shear force and bending moment, torsion, column behavior, principal stresses, beam deflection, and strain energy, and validate results using experiments. | Apply (Level 3) |
| CO4 | **Demonstrate** graphical, programming, and computer-aided engineering (CAE) tools for determining stresses in engineering components and structures. | Apply (Level 3) |
| CO5 | **Examine** the behavior of structural members using principles of Strength of Materials by studying stresses, shear force and bending moment distributions, torsional effects in shafts, column buckling, combined stress states, and deflection characteristics of beams. | Analyze (Level 4) |
| CO6 | **Assess** the performance and behavior of structural members under various loading and boundary conditions by examining stress distribution, stability, deformation, and safety of beams, shafts, and columns. | Evaluate (Level 5) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies * Chhatrapati Sambhajinagar *

Chairman, BoS
Mechanical Engg.

**CO-PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | | | | | | | | 1 | | |
| **CO2** | 3 | 2 | 1 | | | | | | 1 | | 1 | | |
| **CO3** | 3 | 3 | 1 | 2 | 2 | | | 1 | 1 | | 1 | 3 | 2 |
| **CO4** | 2 | 2 | 1 | 2 | 3 | | | 1 | 1 | | 2 | 2 | 3 |
| **CO5** | 2 | 3 | 2 | 2 | 2 | | | 1 | 1 | | 2 | | |
| **CO6** | 2 | 3 | 2 | 2 | 2 | | | 1 | 2 | | 2 | 3 | 2 |

| **Assessment** | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Literature Review/Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End-Semester Exam |
| Practical (e) | Practical Performance and Evaluation |

| **Course Contents** | | |
|---|---|---|
| Unit 1 | **Simple Stress and Strain**<br>Simple Stress and Strain: Types of Stresses and Strains, Poisson's Ratio, Elastic Constants and Relationship between them, Hooke's Law, Factor of Safety, Stresses and Strains in Determinate and Indeterminate Members, Principle of Superposition, Stresses due to Self-Weight, Thermal Stresses and Strains. | 7 Hours |
| Unit 2 | **Shear Force and Bending Moment Diagram**<br>Types of Beams: Cantilever Beam; Simply Supported Beam; Overhang Beam, Types of Loads: Concentrated Load; Uniformly Distributed Load (UDL), Shear Force and Bending Moment Diagrams for Simply Supported Beams; Cantilever Beams; Overhang Beam Subjected to Different Types of Loads and Couples, Sign Conventions for Bending Moment, and Shear Force. | 5 Hours |
| Unit 3 | **Stresses in Beams**<br>Pure Bending, Theory of Simple Bending with Assumptions, Derivation of Bending Equation, Bending Stresses in Rectangular; Circular; T Beam and I Beam Sections.<br>Shear Stresses in Beams: Concept, Shear Stress Distribution Diagram for Common Sections, Maximum and Average Shear Stress. | 6 Hours |
| Unit 4 | **Column, Struts, and Combined Stresses**<br>Column & Struts: Introduction to Long & Short Column, Slenderness Ratio, Euler's Column Theory, End Conditions for Column. Expression for Crippling Load for Various End Conditions of Column, Limitations of Euler's Formula, Rankine Formula.<br>Combined Stresses: Eccentrically Applied Load, Combined Axial and Flexural Loads, Middle One Third Rule, Kernel of a Section. | 6 Hours |
| Unit 5 | **Principal Stresses, Strains, and Torsion**<br>Principal Stresses: Introduction, Transformation of Plane Stress, Principal Planes and Principal Stresses, Analytical Method for Determining Stresses on Oblique Section, Mohr's Circle, Strain on Oblique Plane.<br>Torsion: Derivation of Torsion Equation, Torsional Shear Stress in The Shaft, Design of Shaft Based on Strength and Rigidity. | 6 Hours |
| Unit 6 | **Deflection of Beams and Strain Energy**<br>Deflection of Beams: Differential Equation of Elastic Curve, Deflection & Slope of Cantilever; Simply Supported; Overhang Beams Subjected to Concentrated Loads; UDL by Mccauley's Method and Moment Area Method. | 6 Hours |

MATTER COPY

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| | Strain Energy: Concept of Strain Energy; Derivation; Use of Expressions for Deformation of Axially Loaded Members under Gradual; Sudden and Impact Loads. Introduction to Computer Aided Engineering (CAE). | |

| Sr. No. | Textbooks |
|---|---|
| 1 | Popov E. P, "Engineering Mechanics of Solids", Prentice-Hall of India |
| 2 | S. Ramamrutham, "Strength of Materials", Dhanpat Rai Publication |
| 3 | Beer and Johnston, "Strength of Materials", McGraw Hill Publication Co. Ltd. |
| 4 | R K Bansal, "Strength of Materials", Laxmi Publication |
| 5 | Dr. B.C. Punmia,"Mechanics of Materials", Laxmi Publications Ltd. |
| 6 | Singer and Pytel, "Strength of Materials", Harper and Row Publication |
| | **Reference Books** |
| 1. | Timoshenko and Young, "Strength of Materials", CBS Publication |
| 2. | Subramanian R., "Strength of Materials", Oxford University Press |
| 3. | William A.Nash, "Theory and Problems of Strength of Materials, Schaum's Outline series", Tata McGrawHill |
| | **Web Resources** |
| 1. | NPTEL Course on Strength of Materials by Dr. Satish C. Sharma, IIT Roorkee. https://nptel.ac.in/courses/112107146 |
| 2. | NPTEL Course on Strength of Materials by Dr. M. S. Shivakumar, IIT Madras. https://nptel.ac.in/courses/112106141 |
| 3. | NPTEL Course on Strength of Materials by Prof. K. Ramesh, Prof. Hariprasad, IIT Madras. https://nptel.ac.in/courses/112106319 |

MASTER COPY

Deogiri Institute of Engg. & Management Studies Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: Manufacturing Processes**<br>**Course Code: ME254213** | **Course Category: PCC** |
|---|---|

| **Teaching Scheme** | **Examination Scheme** | |
|---|---|---|
| Lectures: 03 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 03 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 arks |

**Course Prerequisite:** Engineering Graphics, Engineering Mechanics, Material Science and Metallurgy

**Course Description:** This course introduces students to the fundamentals of manufacturing processes used in mechanical engineering industries. It covers basic production techniques such as casting, metal forming, machining, and welding, along with modern and non-traditional manufacturing methods. The course focuses on understanding the principles, equipment, and applications of different manufacturing processes, enabling students to select appropriate methods for producing engineering components with required quality and efficiency

**Course Objectives:**

1. To introduce students to basic manufacturing techniques used in mechanical industries.
2. To elucidate metal casting, forming, joining, and machining processes.
3. To develop knowledge about modern manufacturing methods and automation.
4. To enable students to select appropriate manufacturing processes for engineering components.

**Course Outcomes:**

| **Cos** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
|---|---|---|
| CO1 | **Recall** fundamental concepts of metal casting, metal, joining processes, and machining operations along with their equipment, tools, and defects. | Remember (Level 1) |
| CO2 | **Explain** the working principles, process parameters, and defect formation mechanisms in casting, forming, joining, and machining processes. | Understand (Level 2) |
| CO3 | **Apply** principles of manufacturing processes to select suitable methods, calculate process parameters, and perform operations in casting, forming, welding, and machining. | Apply (Level 3) |
| CO4 | **Examine** the effect of process parameters, material behavior, and defects on the quality and performance of products manufactured through casting, forming, joining, and machining processes. | Analyze (Level 4) |
| CO5 | **Compare** different manufacturing processes, tools, and techniques to select the most suitable method based on quality, cost, productivity, and application requirements. | Evaluate (Level 5) |
| CO6 | **Design** and develop integrated products with desired specifications and quality by combining casting, forming, joining, and machining operations. | Create (Level 6) |

**CO-PO Mapping**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | | | | | | | | | | 1 | |
| **CO2** | 3 | 2 | | 1 | | | | | | | | 3 | |
| **CO3** | 3 | 3 | 2 | 2 | 2 | | | | | | | 3 | |
| **CO4** | 3 | 3 | 2 | 2 | 1 | | | | | | | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 2 | 2 | | | | | | | 3 | 3 |
| **CO6** | 3 | 3 | 3 | 2 | 2 | | | | | | | 3 | |

MASTER COPY

Deogiri Institute of Engg & Mgmt Studies * Chhatrapati Sambhajinagar *

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End Semester Exam |
| Practical(e) | Performance and Evaluation of Practical |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Metal casting**<br>Definition of manufacturing process, Selection of manufacturing processes, Introduction to casting, Solidification of Pure metals and Alloys, Fluid flow, Fluidity of molten metal, Heat transfer, Solidification time, Shrinkage defects, Porosity, Patterns: Types; Pattern materials; Pattern allowances, Elements of gating system, Metal casting processes: Sand casting; Shell molding; Investment casting; Permanent-mold casting; Vacuum casting; Die casting; Centrifugal casting; Continuous casting, Defects in casting. | 6 Hours |
| Unit 2 | **Rolling and forging processes**<br>Rolling: Introduction to Rolling; Classification of rolling mill; Hot rolling; Cold rolling, Flat-rolling Process, Roll Force, Torque, and Power Requirements, Parameters controlling rolling load, Geometric Consideration, Flat-rolling Practice, Defects in Rolled Plates and Sheets.<br>Forging: Introduction to forging; Open-die forging; Impression-die and Closed-die forging; Various forging Operations and Forging Defect; Forging Machines. | 6 Hours |
| Unit 3 | **Extrusion and drawing**<br>Extrusion: Introduction; Extrusion Process; Extrusion Equipment; Direct Extrusion, Indirect Extrusion; Hot Extrusion; Cold Extrusion; Impact extrusion; Hydrostatic Extrusion and Extrusion Defects.<br>Drawing**:** Drawing Process; Drawing Equipment; Drawing Practice; Wire drawing; Deep drawing; Drawing Defects and Residual Stresses. | 6 Hours |
| Unit 4 | **Joining processes**<br>Oxy-fuel-gas Welding, Arc-Welding Processes: Shielded Metal-arc Welding; Submerged-arc Welding; Gas Metal-arc Welding; Electrodes for Arc Welding, Weld joint, Weld defect, Weld quality, Solid state welding, Friction Welding, Resistance Welding: Spot Welding; Seam Welding and Projection Welding, brazing, Soldering and riveting. | 6 Hours |
| Unit 5 | **Machining processes-I**<br>Lathes and Lathe Operations**,** Lathe Components, Work holding Devices and Accessories, CNC Lathes: Structure; Principle; Advantages and applications, Types of chips. Boring and Boring Machines**:** Types; Construction and Working, Drilling Machines**:** Drills; Drill Materials and Sizes; Drilling Practice; Drilling Machines, Reaming operation and Reamers; Tapping and Taps. | 6 Hours |
| Unit 6 | **Machining processes-II**<br>Introduction, Milling and Milling Machines, CNC Milling Operations and Milling Cutters, Tool holders, Planning and Shaping, Broaching and Broaching Machines, Gear Manufacturing by various Machining methods, Gear-finishing Processes. | 6 Hours |

| Sr. No. | Textbooks |
|---|---|
| 1. | P. N. Rao, Manufacturing Technology: Foundry, Forming and Welding Vol. 1 Mc Graw Hill. |
| 2. | P. N. Rao, Manufacturing Technology: Metal Cutting and Machine Tools Vol. 2, Mc Graw Hill. |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 3. | P. C. Sharma, Production Technology, S. Chand Publications. |
| | **Reference Books** |
| 1. | Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education. |
| 2. | E. Paul DeGarmo, J. T. Black, Ronald A. Kohser, Materials and Processes in Manufacturing, John Wiley & Sons |
| 3. | W. A. J. Chapman, Workshop Technology, CBS Publishers. |
| 4. | R. K. Jain, Production Technology, Khanna Publishers. |
| | **Web Resources** |
| 1 | Manufacturing Process Technology -Part I, Prof. Shantanu Bhattacharya, IIT Kanpur, https://nptel.ac.in/courses/112104195 |
| 2 | Manufacturing Systems Technology Part I, Prof. Shantanu Bhattacharya, IIT Kanpur https://nptel.ac.in/courses/112104188 |
| 3 | Manufacturing Processes I, IIT Roorkee, Prof. H.S. Shan, Prof. S.R. Gupta, Dr. Pradeep Kumar, https://nptel.ac.in/courses/112107144 |

MASTER COPY

Deogiri Institute of Engg & Mgmt Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: Modern Indian Language II**<br>**Course Code: GE254705** | **Course Category: HSSM-AEC** | |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| व्याख्याने (Lectures): ०२ तास/आठवडा (02 hrs / week) | CA-1 | 10 Marks |
| ट्युटोरियल (Tutorial): - | CA-2 | 10 Marks |
| श्रेयांक (Credits): 02 | MSE | 20 Marks |
| सत्र (Semester): द्वितीय वर्ष (सत्र ४) (Second Year (Semester IV)) | ESE | 60 Marks |

**Course Prerequisite:** देवनागरी लिपी वाचण्याचे आणि लिहिण्याचे प्राथमिक ज्ञान

**Course Description:**

हा अभ्यासक्रम सर्व शाखांच्या अभियंत्यांना मराठी भाषेचे व्यावहारिक आणि उद्योगभिमुख ज्ञान प्रदान करण्यासाठी तयार करण्यात आला आहे. यामध्ये विद्यार्थी मराठी भाषेचा इतिहास आणि व्याकरणाचा भक्कम पाया रचतील आणि त्यानंतर आकलन कौशल्ये व शब्दसंपत्ती वाढवण्यावर लक्ष केंद्रित करतील. हा अभ्यासक्रम प्रामुख्याने व्यावसायिक उपयोजनावर भर देतो, ज्यामध्ये अधिकृत पत्रव्यवहार, इतिवृत्त लेखन आणि अचूक पारिभाषिक व प्रशासकीय संज्ञांचा वापर शिकवला जाईल. याव्यतिरिक्त, तांत्रिक संकल्पनांचे अचूक संप्रेषण सुनिश्चित करण्यासाठी विद्यार्थी इंग्रजी आणि मराठी या दोन्ही भाषांमधील भाषांतर कौशल्ये विकसित करतील. सरतेशेवटी, हा अभ्यासक्रम भावी अभियंत्यांना स्थानिक उद्योग, कॉर्पोरेट क्षेत्र आणि शासकीय कार्यालयांमध्ये आत्मविश्वासाने आणि प्रभावीपणे संवाद साधण्यास सक्षम बनवतो.

**Course Objectives:**

1. विद्यार्थ्यांना मराठी भाषेचा उगम, विकास, देवनागरी लिपी आणि विविध साहित्य प्रकारांची ओळख करून देणे.
2. विद्यार्थ्यांना मराठी व्याकरणाचे मूलभूत नियम, शुद्धलेखन आणि अचूक वाक्यरचना यांचे सखोल ज्ञान देणे.
3. विद्यार्थ्यांची शब्दसंपत्ती वाढवणे आणि दैनंदिन तसेच व्यावसायिक संवादात वाक्प्रचार व म्हणींचा योग्य वापर करण्यास शिकवणे.
4. विद्यार्थ्यांमध्ये तांत्रिक आणि प्रशासकीय उताऱ्यांचे वाचन, विश्लेषण आणि अचूक आकलन करण्याची क्षमता विकसित करणे.
5. विद्यार्थ्यांना कार्यालयीन कामकाज, पत्रव्यवहार आणि अभियांत्रिकी क्षेत्रात वापरल्या जाणाऱ्या पारिभाषिक संज्ञांचे व्यावहारिक प्रशिक्षण देणे.
6. विद्यार्थ्यांना भाषांतराची तत्त्वे आणि पद्धती समजावून सांगणे आणि इंग्रजी-मराठी भाषांतराचा (विशेषतः तांत्रिक संदर्भात) सराव करून घेणे.

**Course Outcomes:**

| **COs** | अभ्यासक्रम पूर्ण झाल्यानंतर विद्यार्थी सक्षम असतील (**After completion of the course: Students will be able to)** | **Bloom's Level** |
|---|---|---|
| CO1 | मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांच्याशी संबंधित मूलभूत तथ्ये, माहिती, नियम आणि मानकांचे स्मरण करणे. | स्मरण Remember (Level 1) |
| CO2 | मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांच्याशी संबंधित विविध संकल्पना, रचना, आशय आणि कार्यपद्धती स्पष्ट करणे. | समज Understand (Level 2) |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| CO3 | मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांमधील शिकलेल्या नियमांचे, तत्त्वांचे आणि कौशल्यांचे प्रत्यक्ष कामकाजात उपयोजन करणे. | उपयोजन Apply (Level 3) |
| CO4 | मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांच्याशी संबंधित विविध भाषिक घटक, रचना, साहित्याचा आशय आणि माहितीचे पृथक्करण व विश्लेषण करणे. | विश्लेषण Analyze (Level 4) |

**CO-PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | 2 | | | | |
| **CO2** | | | | | | | | | 2 | | | | |
| **CO3** | | | | | | | | | 3 | | 1 | | |
| **CO4** | | | | | | | | | 3 | | 1 | | |

| Assessment | |
|---|---|
| CA-1 (a) | **वर्णनात्मक चाचणी / गृहपाठ / बहुपर्यायी प्रश्न चाचणी इत्यादी. (**Subjective Test / Assignment / MCQ Test etc.) |
| CA-2 (b) | **वर्णनात्मक चाचणी / गृहपाठ / बहुपर्यायी प्रश्न चाचणी इत्यादी. (**Subjective Test / Assignment / MCQ Test etc.) |
| MSE (c) | **वर्णनात्मक चाचणी (**Subjective Test) |
| ESE (d) | **अंतिम सत्र मूल्यमापन विभागीय स्तरावर केले जाईल**( End semester Evaluation will be done at department level.) |

| Course Contents | | |
|---|---|---|
| Unit 1 | **मराठीचा इतिहास आणि विकास (History and Literature of Marathi)**<br>मराठी भाषेचा उगम (Origin of Marathi Language), मराठी भाषेचा विकास (Development of Marathi Language), विविध मराठी साहित्य प्रकारांचा परिचय (Introduction to Various Marathi Literary Forms), प्रसिद्ध मराठी साहित्यिक (Famous Marathi Authors), निवडक साहित्यकृतींचा परिचय (Introduction to Selected Literary Works). | 4 Hrs. |
| Unit 2 | **मराठी व्याकरण (Marathi Grammar)**<br>मराठी वर्णमाला (Marathi Alphabet), शब्दांच्या जाती (Parts of Speech), काळांचे प्रकार (Types of Tenses), अचूक वाक्यरचना (Correct Sentence Formation), शुद्धलेखनाचे नियम (Rules of Orthography/Spelling), विरामचिन्हांचा योग्य वापर (Proper Use of Punctuation). | 4 Hrs. |
| Unit 3 | **शब्दसंपत्ती आणि भाषासमृद्धी (Vocabulary Building)**<br>समानार्थी शब्द (Synonyms), विरुद्धार्थी शब्द (Antonyms), शब्दांची उत्पत्ती: तत्सम, तद्भव, देशी शब्द (Word Origin), शुद्ध आणि अशुद्ध शब्दांची ओळख व दुरुस्ती (Identifying and Correcting Spelling Errors), दैनंदिन संवादात म्हणींचा वापर (Use of Proverbs in Daily Communication), वाक्प्रचारांचा वापर (Use of Idioms). | 4 Hrs. |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| Unit 4 | **आकलन कौशल्ये (Reading & Comprehension)**<br>दिलेल्या उताऱ्याचे वाचन, विश्लेषण आणि त्यावरील प्रश्नांची अचूक उत्तरे लिहिणे (Reading, Analysis, and Answering Questions on a Given Passage), तांत्रिक किंवा प्रशासकीय उताऱ्यांचे वाचन आणि सारांश लेखन (Reading technical or administrative passages in Marathi and summarizing them). | 4 Hrs. |
| Unit 5 | **व्यावहारिक आणि उपयोजित मराठी (Practical & Applied Marathi)**<br>औपचारिक पत्रे (Formal Letters), इतिवृत्त लेखन (Meeting Minutes Writing), पारिभाषिक संज्ञा (Technical Terminology), अभियांत्रिकी कामात वापरले जाणारे इंग्रजी-मराठी शब्द (English-Marathi Words Used in Engineering Work), प्रशासकीय कामात वापरले जाणारे इंग्रजी-मराठी शब्द (English-Marathi Words Used in Administrative Work). | 4 Hrs. |
| Unit 6 | **भाषांतर कौशल्ये (Translation Skills)**<br>भाषांतराची तत्त्वे (Principles of Translation), भाषांतराच्या पद्धती (Methods of Translation), शब्दशः भाषांतर (Literal Translation), आशयनिष्ठ भाषांतर (Contextual/Sense Translation), मराठीतून इंग्रजीत भाषांतर (Marathi to English Translation), इंग्रजीतून मराठीत भाषांतर (English to Marathi Translation). | 4 Hrs. |

| Sr. No. | Textbooks |
|---|---|
| 1. | मो. रा. वाळिंबे, सुगम मराठी व्याकरण व लेखन, नितीन प्रकाशन. |
| 2. | डॉ. ल. रा. नसिराबादकर, व्यावहारिक मराठी, फडके प्रकाशन. |
| | **Reference Books** |
| 1. | यास्मिन शेख, मराठी लेखन मार्गदर्शिका, पद्मगंधा प्रकाशन. |
| 2. | डॉ. स्नेहल तावरे, व्यावहारिक मराठी, स्नेहवर्धन प्रकाशन. |
| 3. | भाषा संचालनालय, शासन व्यवहार कोश, महाराष्ट्र शासन. |
| 4. | डॉ. कल्याण काळे, डॉ. अंजली सोमण, भाषांतर मीमांसा, प्रतिमा प्रकाशन |
| 5. | अ. ना. देशपांडे, मराठी साहित्याचा इतिहास (खंड १ आणि २), व्हीनस प्रकाशन. |
| 6. | शब्दकोश आणि शास्त्रीय व तांत्रिक परिभाषा कोश, महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ. |
| 7. | कृ. पां. कुलकर्णी, मराठी भाषा: उद्गम व विकास, मेहता पब्लिशिंग हाऊस. |
| | **Web Resources** |
| 1. | महाराष्ट्र शासन, भाषा संचालनालय (Directorate of Languages, Govt. of Maharashtra): https://languages.maharashtra.gov.in |
| 2. | राज्य मराठी विकास संस्था (RMVS): https://rmvs.maharashtra.gov.in |
| 3. | मराठी विश्वकोश (Marathi Vishwakosh): https://marathivishwakosh.org |
| 4. | भारत वाणी (Bharatavani Portal): https://bharatavani.in |
| 5. | महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ: https://sahitya.marathi.gov.in |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Industrial Engineering and Financial Management**<br>**Course Code: ME254706** | | **Course Category: HSSM-EEMC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Prerequisite:** Basic knowledge of engineering mathematics, statistics, and fundamental concepts of economics or management. | | |
| **Course Description:** This course introduces the fundamentals of financial management and their application in industrial settings, including financial statements, planning, and investment decision-making. It covers capital budgeting, working capital, productivity, and cost analysis for effective operational control. The course also provides an overview of industrial organization, production systems, process planning, and plant layout. Additionally, it highlights modern practices such as inventory management, lean manufacturing, Industry 4.0, and sustainable industrial approaches. | | |
| **Course Objectives:**<br>1. To introduce the fundamental concepts and significance of financial management in industrial operations.<br>2. To develop the ability to apply capital budgeting techniques and working capital management for financial decision-making.<br>3. To enable analysis of productivity and cost components for improving operational efficiency.<br>4. To provide knowledge of industrial organizational structures and the functions of various departments.<br>5. To impart understanding of production systems, process planning, and plant layout for efficient manufacturing operations.<br>6. To introduce modern industrial practices such as Lean Manufacturing, Just-in-Time (JIT), Industry 4.0, and sustainable manufacturing approaches for enhanced industrial performance. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course Students will be able to:** | **Bloom's Level** |
| CO1 | **Define** and recall fundamental concepts of financial management and industrial systems | **Remember** (Level 1) |
| CO2 | **Explain** the concepts and principles of financial planning, capital budgeting, and industrial processes. | **Understand** (Level 2) |
| CO3 | **Implement** financial and operational techniques for solving engineering and managerial problems. | **Apply** (Level 3) |
| CO4 | **Examine** modern industrial practices, digital systems, and sustainability concepts for improving productivity and organizational performance. | **Analyze** (Level 4) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

**CO-PO Mapping**

| CO-PO Mapping | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
| CO1 | 3 | 1 | | | | | | | | | 2 | 2 | |
| CO2 | 2 | 2 | 1 | | | | | | | | 3 | 2 | 1 |
| CO3 | 2 | 3 | 2 | 1 | 1 | | | | | | 3 | 3 | 2 |
| CO4 | 1 | 3 | 2 | 2 | 3 | 1 | 3 | | 1 | | 2 | 2 | 3 |

| Assessment | |
|---|---|
| CA-1 (a) | Subjective Test / Open book test / etc. |
| CA-2 (b) | Model Making / Assignment / Presentation / etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End semester Evaluation will be done at department level by Open-Book Examination |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Industrial Structure and Functional Departments**<br>Overview of Industrial Organizations, Types of Industries, Organizational Structure, Functions of Major Departments Such as Production, Quality, Research & Development, Maintenance and Supply Chain, Interdepartmental Coordination, Method Study and Time Study | 4 Hours |
| Unit 2 | **Industrial Processes and Operations**<br>Types of Production Systems: Job; Batch; Mass; And Continuous, Plant Layout Types and Material Flow, Fundamentals of Production Planning and Control, Basics of Quality, Safety and Maintenance Management | 4 Hours |
| Unit 3 | **Production Management and Modern Industrial Practices**<br>Production Planning and Control, Inventory Management, MRP and ERP Systems, JIT, TPM, Kaizen, Industry 4.0, Sustainable Manufacturing Practices | 4 Hours |
| Unit 4 | **Fundamentals of Financial Management**<br>Introduction To Financial Management, Overview of Financial Statements: Balance Sheet; Income Statement (Profit & Loss Account); Cash Flow Statement, Financial Planning and Its Key Steps, Concept of Time Value of Money, Including Simple and Compound Interest | 4 Hours |
| Unit 5 | **Capital Budgeting and Working Capital Management**<br>Capital Budgeting Process and Identification of Investment Opportunities, Evaluation of Projects Using Appraisal Techniques: Net Present Value (NPV); Internal Rate of Return (IRR) And Payback Period, Concept and Management of Working Capital, Inventory Control Using Economic Order Quantity (EOQ) | 4 Hours |
| Unit 6 | **Cost Analysis and Financial Decision-Making**<br>Cost Concepts: Fixed; Variable; Direct and Indirect; Costing Techniques, Cost Control and Break-Even Analysis, Pricing and Budgeting, Decision-Making (Make-or-Buy, Product Mix) | 4 Hours |

MASTER COPY

Deogiri Institute of Engg. & Management Studies * Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| Sr. No. | Textbooks |
|---|---|
| 1. | I. M. Pandey – Financial Management – Vikas Publishing House |
| 2. | Prasanna Chandra – Financial Management: Theory and Practice – McGraw Hill Education |
| 3. | S. N. Maheshwari – Financial Management Principles and Practice – Sultan Chand & Sons |
| 4 | O. P. Khanna – Industrial Engineering and Management – Dhanpat Rai Publications |
| 5 | Martand T. Telsang – Industrial Engineering and Production Management – S. Chand Publishing |
| | **Reference Books** |
| 1. | R. Panneerselvam – Production and Operations Management – PHI Learning |
| 2. | K. K. Chitkara – Construction Project Management: Planning, Scheduling and Controlling – McGraw Hill Education |
| 3. | B. Mahadevan – Operations Management: Theory and Practice – Pearson Education |
| 4. | Mikell P. Groover – Automation, Production Systems, and Computer-Integrated Manufacturing – Pearson |
| | **Web Resources** |
| 1. | Lean Enterprise Institute – Lean Manufacturing Principles- https://www.lean.org/lexicon-terms/lean-manufacturing |
| 2. | Capital budgeting and investment appraisal techniques https://www.investopedia.com/terms/c/capitalbudgeting.asp |
| 3. | Lean manufacturing and waste reduction principles-https://www.lean.org/lexicon-terms/lean-manufacturing |
| 4 | Total Productive Maintenance (TPM) Overview – https://www.maintenance.org/total-productive-maintenance/ |
| 5 | Industry 4.0 and Smart Manufacturing Concepts – https://www.ibm.com/topics/industry-4-0 |

MASTER COPY

Deogiri Institute of Engg & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: Environmental and Sustainable Engineering**<br>**Course Code: ME254707** | **Course Category: HSSM-VEC** | |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |

**Course Prerequisite:**
Basic knowledge of science (physics, chemistry basics), Fundamental understanding of engineering concepts Awareness of environmental issues and energy usage.

**Course Description:**
This course consists of different energy resources, environmental issues, and sustainable development. It also covers conventional and renewable energy systems, including solar, wind and hydropower, along with their working principles and applications. The course also covers environmental pollution and its causes, effects, and control measures. It also involves solid waste management techniques. Emphasis is given to sustainability concepts such as life cycle assessment, green technologies, and environmental impact assessment. Additionally, the course explores sustainable design practices, energy-efficient systems, e-waste management, and global initiatives like the United Nations Sustainable Development Goals (SDGs).

**Course Objectives:**

- To introduce concepts of energy resources and environmental impacts.
- To understand renewable energy systems and their applications.
- To develop knowledge of pollution control and waste management techniques
- To familiarize with sustainability principles and assessment tools (EIA)
- To promote awareness of sustainable design, green technologies, and SDGs

**Course Outcomes:**

| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
|---|---|---|
| CO1 | **Define** basic concepts of energy and environment. | Remember (Level 1) |
| CO2 | **Identify** energy systems, environmental issues, and sustainability principles. | Understand (Level 2) |
| CO3 | **Describe** methods for renewable energy use and pollution control. | Understand (Level 2) |
| CO4 | **Apply** methods to address environmental impacts and sustainable solutions. | Apply (Level 3) |

**CO-PO Mapping**

| **CO-PO Mapping** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
| **CO1** | 3 | 1 | - | - | - | 1 | - | - | - | - | 1 | | |
| **CO2** | 3 | 2 | 1 | - | - | 2 | - | - | - | - | 1 | | |
| **CO3** | 3 | 3 | 2 | 1 | - | 3 | - | 1 | - | - | 2 | | |
| **CO4** | 2 | 3 | 2 | 2 | - | 3 | - | 1 | - | - | 2 | | |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Subjective Test / Assignment/ MCQ Test/ Case study/ PPT etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End semester Evaluation will be done at department level. |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Energy and Environmental Studies**<br>Introduction, Renewable and Non-renewable Energy Resources, Global Energy Scenario, Indian Energy Scenario, Energy demand and environmental impacts: Climate Change; Global Warming; Necessity of Decarbonization; Carbon Footprinting Basics. | 4 Hrs. |
| Unit 2 | **Solar Energy Systems**<br>Introduction, Solar radiation fundamentals and measurement, Operational Principles of Flat-plate and Concentrating Solar Thermal Collectors, Solar photovoltaic (PV) systems: principles and components, Design basics of solar PV systems, Applications: Rooftop Systems; Solar Pumps; Street Lighting. | 4 Hrs. |
| Unit 3 | **Renewable Energy Sources**<br>Introduction, Basic Working Principles and Plant Layout: Wind Energy; Nuclear Energy; Biomass Energy; Hydropower; Geothermal; Tidal Energy. | 4 Hrs. |
| Unit 4 | **Environmental Pollution and Control**<br>Introduction, Environmental Pollution: Definition, Cause, Effects & Control Measures of Air Pollution; Water Pollution; Soil Pollution; Marine Pollution, Solid Waste Management: Landfill; Incineration; Composting. | 4 Hrs. |
| Unit 5 | **Sustainable Engineering**<br>Introduction, Principles of Sustainability, Life Cycle Assessment (LCA), Green Technology and Green Business, Sustainable Materials and Manufacturing, Sustainable Agriculture, Environmental Impact Assessment (EIA). | 4 Hrs. |
| Unit 6 | **Sustainable Design and Development**<br>Introduction, Energy-Efficient Machines and Thermal Systems, E- Waste Reduction and Recycling, Green Computing and Data Center Efficiency , United Nations Sustainable Development Goals (SDGs). | 4 Hrs. |

| Sr. No. | Textbooks |
|---|---|
| 1. | G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers |
| 2. | B. H. Khan, Non-Conventional Energy Resources, McGraw Hill Education |
| 3. | C. S. Rao, Environmental Pollution Control Engineering, New Age International |
| 4. | Bhavik R. Bakshi, Sustainable Engineering: Principles & Practice, Cambridge University Press |
| | **Reference Books** |
| 1. | S. P. Sukhatme and J.K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill |
| 2. | D. P. Kothari, K. C. Singal and Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI Learning |
| 3. | R. C. Gaur, Basic Environmental Engineering, New Age International |
| 4. | D. L. Reeg, Industrial Energy Conservation, Pergamon Press |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 5. | Catherine N. Mulligan, Sustainable Engineering:Principles & Implementation, CRC Press |
| 6. | Kailas L. Wasewar and Sunita Neti Rao, Sustainable Engineering, Energy & the Environment, CRC Press |
| | **Web Resources** |
| 1. | Prof. Vaibhav Vasant Goud and Prof. R. Anandalakshmi, Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems, IIT Guwahati (https://nptel.ac.in/courses/103103206) |
| 2. | Prof. P. Mondal, Basic Environmental Engineering and Pollution Abatement, IIT Roorkee (https://nptel.ac.in/courses/103107215) |
| 3. | Prof. Prasanta Kumar Das and Prof. A Bhattacharya, Energy Conservation and Waste Heat Recovery, IIT Kharagpur (https://nptel.ac.in/courses/112105221) |
| 4. | Prof. Brajesh Kumar Dubey, Sustainable Engineering Concepts and Life Cycle Analysis, IIT Kharagpur (https://onlinecourses.nptel.ac.in/noc21_ce47/preview) |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: 3D Printing Technologies**<br>**Course Code: ME254504** | **Course Category: OE** | |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs. / week | CA-1 | 10 Marks |
| Tutorial: ---- | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Prerequisite:** Engineering Graphics | | |
| **Course Description:** This course introduces the fundamental concepts of Additive Manufacturing (AM) used in modern product development. It covers the classification of major Additive Manufacturing technologies such as liquid-based; solid-based; and powder-based systems. The course explains the workflow of 3D printing from CAD modeling; STL generation; slicing; and fabrication to post-processing. It also discusses slicing parameters; materials used in additive manufacturing and their properties. Additionally; the course highlights cost considerations and interdisciplinary applications of 3D printing in various engineering fields. | | |
| **Course Objectives:**<br>1. To introduce the fundamental concepts of Additive Manufacturing (AM) and their significance in modern product development.<br>2. To understand the working principles; advantages and limitations of solid-based; liquid-based and powder-based Additive Manufacturing (AM) systems.<br>3. To develop students ability to apply DfAM concepts; 3D modeling; and slicing parameters in additive manufacturing processes.<br>4. To familiarize students with post-processing techniques and methods for improving part quality and performance.<br>5. To provide knowledge of material selection; process economics and interdisciplinary applications of additive manufacturing. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
| CO1 | **Recall** fundamental concepts of Additive Manufacturing; including process types; workflows; materials; and post-processing methods. | Remember (Level 1) |
| CO2 | **Explain** working principles; advantages; limitations; and applications of various AM processes and design concepts like DFAM and slicing. | Understand (Level 2) |
| CO3 | **Apply** AM knowledge to design 3D models; select materials and estimate production costs | Apply (Level 3) |
| CO4 | **Analyze** manufacturing methods; process parameters; and economic aspects to evaluate AM solutions and applications. | Analyze (Level 4) |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies * Chhatrapati Sambhajinagar *

Chairman, BoS
Mechanical Engg.

**CO-PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | | | | | | | | | | | |
| **CO2** | 3 | 2 | | | | | | | | | | | |
| **CO3** | 3 | 3 | 3 | 2 | 3 | | | | | | 1 | | |
| **CO4** | 3 | 2 | 2 | 2 | 3 | | | | | | | | |

| **Assessment** | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End Semester Exam |

| **Course Contents** | | |
|---|---|---|
| Unit 1 | **Fundamentals of Additive Manufacturing.**<br>Additive Manufacturing: General Classification of Additive Manufacturing Processes; Comparison of Subtractive (Machining); Formative (Casting) and Additive manufacturing; Additive Manufacturing (AM) Workflow. Rapid Prototyping (RP): Definition; Basic concepts, Post-Processing Techniques: Introduction; Natural Support Post-processing; Surface Texture Improvements. | 3 Hrs. |
| Unit 2 | **Solid & Liquid-Based Additive Manufacturing Systems**<br>Working Principles of Solid-Based Systems: Basic Principles Material Loading; Liquification; Extrusion; Solidification; Positional Control; Bonding; Support Generation. Solid-Based System Types: Fused Deposition Modeling (FDM) / Fused Filament Fabrication (FFF); Advantages; Limitations and Industrial Applications. Working principles of Liquid-based Systems: Stereolithography (SLA) and Digital Light Processing (DLP); Advantages; Limitations and Industrial Applications. | 5 Hrs. |
| Unit 3 | **Powder-Based Additive Manufacturing Systems**<br>Working principles of Polymer/Powder Based Systems: Selective Laser Sintering (SLS); Electron Beam Melting (EBM). Binder-Based Powder Bed 3D Printing: Sand Printing; Concrete-Based 3D Printing. Advantages and Limitations; Applications of Powder-Based Additive Manufacturing (AM). | 5 Hrs. |
| Unit 4 | **3D Geometry & Slicing**<br>DfAM Introduction: Design Thinking for Additive Manufacturing. CAD Tools for Additive Manufacturing; Introduction of File Formats. Slicing Theory: Role of Slicing Parameters: | 4 Hrs. |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| | Temperature; Speed; Flow; Cooling; Infill; Supports; Layer Height; Shell Thickness; Bed Adhesion. Role of Slicing Parameters on surface Quality; Strength & Time of printing. | |
| Unit 5 | **Materials for 3D Printing in Civil Engineering**<br>Cement-based Printable materials, Concrete and Geopolymer Materials, Polymer and Composite Materials, Rheological properties of Printable concrete, Material Properties: Strength; Durability and Sustainability, Recycling and Eco-friendly Construction Materials. | 4 Hrs. |
| Unit 6 | **Process Economics & Application**<br>Process Economics: Cost Estimation Models for 3D Printing (Machine Hourly Rate; Material Cost; Pre/Post-Processing Costs).<br>Case Studies & Applications: Concrete 3D printing & Contour Crafting for Construction (Civil). | 3 Hrs. |

| Sr.No. | Textbooks |
|---|---|
| 1. | Ian Gibson; David Rosen; Brent Stucker; Additive Manufacturing Technologies; Springer. |
| 2. | Kamrani; A. K.; & Nasr; E. A.; Rapid Prototyping: Theory and Practice; Springer. |
| 3. | Olaf Diegel et al; Design for Additive Manufacturing. |
| 4. | L. Jyothish Kumar & Pulak M. Pandey; 3D Printing and Additive Manufacturing Technologies; Spinger |
| | **Reference Books** |
| 1. | Gibson; I.; Rosen; D. W.; & Stucker; B.; Additive Manufacturing Technologies: 3D Printing; Rapid Prototyping and Direct Digital Manufacturing; Springer. |
| 2. | Chua; C. K.; & Leong; K. F.; 3D Printing and Additive Manufacturing: Principles and Applications; World Scientific. |
| 3. | Kompakt erklärt ;3D-Druck/Rapid Prototyping; Springer. |
| 4. | User manuals of cura slicing software. |
| | **Web Resources** |
| 1. | Fundamentals of Additive Manufacturing Technologies; IIT Guwahati<br>Prof. Sajan Kapil https://nptel.ac.in/courses/112103306 |
| 2. | Introduction to 3D Printing with Metals by Prof. Chinedum "Chi" Okwudire; University of Michigan; Available on Coursera https://www.coursera.org/learn/introduction-to-3d-printing-with-metals#modules |
| 3. | Introduction to Additive Manufacturing Processes by Prof. Dhruv Bhate; Arizona State University; Available on Coursera https://www.coursera.org/learn/introduction-to-additive-manufacturing-processes |

MASTER COPY

Deogiri Institute of Engg & Mgmt Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Robotics and Automation**<br>**Course Code: ME254505** | | **Course Category: OE II** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02hrs/ week | CA-1 | 10 Marks |
| Tutorial: - - | CA-2 | 10 Marks |
| Credits:02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester-IV) | ESE | 60 Marks |

**Course Prerequisite:** Basics of Mathematics, Engineering Mechanics, Electrical and Electronics Engineering, Computer Skills.

**Course Description:** This open elective course introduces students from all engineering disciplines to industrial robotics and automation, focusing on multi-axis robots. Students will learn robotics fundamentals, forward and inverse kinematics, teach pendant programming, and industrial automation concepts including PLCs, sensors, and control loops. The course emphasizes practical applications in manufacturing and mechanical systems while exposing students to emerging technologies such as collaborative robots, IoT, and AI in automation. It is designed to provide foundational interdisciplinary knowledge without extensive mathematical or advanced technical complexity.

**Course Objectives:**

1. To Develop foundational knowledge of robotics and industrial automation, including historical evolution, system components, automation types, ethical considerations, and emerging technologies relevant to modern industries.
2. To build conceptual understanding of robot structures, mechanical configurations, sensors, actuators, control systems, PLCs, and programming methodologies used in industrial robotic systems.
3. To gain practical competency in applying robotic kinematics, programming, simulation tools, sensor-actuator integration, and industrial automation techniques to solve real-world manufacturing and mechanical engineering challenges.
4. To strengthen analytical skills to investigate robotic performance, motion planning, automation architectures, and manufacturing integration for improving industrial productivity and system efficiency.
5. To foster design and innovation capabilities to create sustainable, advanced robotic and automation solutions for contemporary and future industrial applications.

**Course Outcomes:**

| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
|---|---|---|
| CO1 | **Define** the fundamental concepts, historical development, robot structures, automation types, mechanical components, sensors, actuators, control systems, programming basics, industrial automation systems, and contemporary developments in robotics and industrial automation. | Remember (Level 1) |
| CO2 | **Explain** robot anatomy, multi-axis configurations, sensors, actuators, control systems, PLC architecture, programming methods, and industrial automation frameworks. | Understand (Level 2) |
| CO3 | **Utilize** robotic kinematics, programming techniques, sensor-actuator integration, PLC-based control, and automation principles to operate, simulate, and solve practical industrial automation and manufacturing problems. | Apply (Level 3) |
| CO4 | **Examine** robotic system configurations, motion planning, control strategies, manufacturing integration systems, and automation technologies to optimize performance in mechanical and industrial applications. | Analyze (Level 4) |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| CO5 | **Critique** the impact of contemporary robotic technologies such as collaborative robots (cobots), artificial intelligence, machine learning, IoT-enabled automation, and autonomous mobile robots on industrial automation, sustainability, and future mechanical industries. | Evaluate (Level 5) |

**CO-PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | | | 1 | | | | | | | |
| **CO2** | 3 | 2 | 1 | | | | | | | | | | |
| **CO3** | 3 | 2 | 2 | 1 | 2 | | | | | | 2 | | |
| **CO4** | 2 | 3 | 2 | 1 | 1 | 2 | | | | | 2 | | |
| **CO5** | 2 | 2 | 1 | | 2 | 3 | 3 | | | | 1 | | |

| **Assessment** | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Literature Review/ Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End Semester Examination |

| **Course Contents** | | |
|---|---|---|
| Unit 1 | **Fundamentals of Robotics and Industrial Automation**<br>Definition and Scope of Robotics and Automation, Historical Development and Evolution, Need for Automation In Modern Industries, Types of Automation: Fixed; Programmable; Flexible, Basic Laws of Robotics and Ethical Considerations. | 3 Hours |
| Unit 2 | **Robot Structure, Configurations, and Mechanical Components**<br>Basic Anatomy of Industrial Robots, Joints, and Links, Multi-Axis Robot Concept, Common Robot Configurations, Robot Work Envelope, Degrees of Freedom (DOF) Manipulators, and End Effectors: Grippers; Tools; Material Handling Attachments, Robot Performance Characteristics. | 5 Hours |
| Unit 3 | **Sensors, Actuation, and Basic Control in Automation**<br>Introduction to Sensors used in Robotics: Position; Proximity; Force; Tactile; and Vision Sensors, Introduction Robotic system Actuators: Servo Motors; Stepper Motors; Hydraulic; Pneumatic, Fundamentals of Feedback Systems and Control Loops, Basic PLC Architecture and its Role in Industrial Automation, Practical Examples of Automation Control In Mechanical Systems. | 4 Hours |
| Unit 4 | **Robot Kinematics and Programming Basics**<br>Coordinate Systems and Robot Movement Concepts, Introduction to Forward and Inverse Kinematics, Basic Motion Planning and Trajectory Concepts, Teach Pendant Programming for Industrial Robots, Writing, Testing, and Debugging Simple Robot Motion Programs, Introduction to Robotic Simulation Software for Industrial Applications. | 4 Hours |
| Unit 5 | **Industrial Automation Systems and Manufacturing Integration**<br>Introduction to Flexible Manufacturing Systems (FMS), Automated Assembly Lines and Mechanical Production Systems, Integration of Robots; Production and Assembly Operations; Material Handling Systems; Conveyor Systems; Automated Transport Mechanisms, Overview of SCADA Systems for Industrial Monitoring. | 4 Hours |

MASTER COPY

Deogiri Institute of Engg & Mgmt Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| | | |
|---|---|---|
| Unit 6 | **Contemporary Developments and Future Scope**<br>Introduction to Collaborative Robots (Cobots), Artificial Intelligence and Machine Learning in Robotics, Internet of Things (IOT) in Automation Systems, Autonomous Mobile Robots in Logistics and Manufacturing, Societal Impact of Automation, Future Trends in Mechanical Automation Industries, Sustainability Challenges. | 4 Hours |

| Sr. No. | Textbooks |
|---|---|
| 1. | Groover, M.P., Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson, 2020 |
| 2. | Craig, J.J., Introduction to Robotics: Mechanics and Control, 4th Edition, Pearson, 2018 |
| **Sr. No.** | **Reference Books** |
| 1. | Fu, K.S., Gonzalez, R.C., Lee, C.S.G., Robotics: Control, Sensing, Vision, and Intelligence, McGraw-Hill, 1987 |
| 2. | Deb, S.R., Robotics Technology and Flexible Automation, McGraw Hill, 2015 |
| 3. | Robort J. Schilling, Fundamental of Robotics, Prentice Hall, 2003 |
| 4. | K. S. Fu, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill Education, 1987. |
| 5. | Mikell, P.G., Industrial Robotics: Technology, Programming and Applications, McGraw Hill, 2016. |
| **Sr. No.** | **Web Resources** |
| 1. | Prof. Asokan T, Prof. Balaraman Ravindran, Prof. Krishna Vasudevan, "Introduction to robotics", NPTEL- IIT Madras (https://onlinecourses.nptel.ac.in/noc20_de11) |
| 2. | Prof. Ashish Dutta, "Advanced Robotics Applications" NPTEL- IIT Kanpur (https://onlinecourses.nptel.ac.in/noc26_me36) |
| 3. | Prof. Nikolaus Correll, "Industrial Robotics and Automation" Coursera (https://www.coursera.org/specializations/introduction-robotics-webots) |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Energy Storage and Management Systems**<br>**Course Code: ME254506** | | **Course Category: OE II** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 02 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 02 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Prerequisite:** Basic Physics, Basic Chemistry, and Basic Electrical Engineering | | |
| **Course Description:** The Energy Storage and Management Systems course provides a foundational understanding of various energy storage technologies, their operational principles, and critical thermal management strategies, specifically designed for non-mechanical engineering students. Covering basic thermodynamics, electrochemical storage, battery thermal management systems (BTMS), and electronic cooling, this course connects theoretical concepts with modern applications. Students will gain the ability to analyze different storage solutions and evaluate their suitability for real-world applications such as electric vehicles, renewable energy integration, and smart grids. | | |
| **Course Objectives:**<br>1. To introduce the fundamental principles of thermodynamics, heat transfer, and the necessity of energy storage metrics.<br>2. To explain the principles and applications of mechanical and thermal energy storage systems.<br>3. To establish a strong foundation in electrochemical energy storage, focusing on various battery chemistries.<br>4. To impart knowledge on alternative storage methods like supercapacitors and hydrogen fuel cells.<br>5. To present the analytical concepts required to manage energy systems, focusing specifically on battery and electronic thermal management to ensure safety and efficiency. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
| CO1 | **Define** fundamental principles, parameters, thermodynamics basics, and metrics associated with various energy storage and thermal systems. | Remember (Level 1) |
| CO2 | **Explain** the working mechanisms, heat generation, and physical characteristics of mechanical, electrical, electrochemical, and thermal storage systems. | Understand (Level 2) |
| CO3 | **Use** the concepts of energy storage and thermal management to identify suitable technologies for specific applications like EVs and smart grids. | Apply (Level 3) |
| CO4 | **Investigate** the thermal performance, efficiency, and limitations of different energy storage and management systems under varying operational conditions. | Analyze (Level 4) |

**CO-PO Mapping**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | | | | | | | | | | | |
| **CO2** | 3 | 2 | | | | | | | | | | | |
| **CO3** | 3 | 3 | 2 | | | | | | | | | | |
| **CO4** | 2 | 3 | 3 | | | | | | | | | | |

MASTER COPY

Deogiri Institute of Engg & Management Studies * Chhatrapati Sambhajinagar *

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test, etc. |
| CA-2 (b) | Literature Review/ Subjective Test / Assignment/ MCQ Test, etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End-Semester Exam |
| Practical (e) | Practical Performance and Evaluation |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Fundamentals of Thermodynamics, Heat Transfer, and Energy Storage**<br>Thermodynamics and Heat Transfer Basics: System, Surroundings, and Boundaries, First and Second Laws of Thermodynamics. Modes of Heat Transfer: Conduction (Fourier's Law), Convection (Newton's Law of Cooling), and Radiation Basics.<br>Energy Storage: Need for Energy Storage, Supply and Demand Mismatch, Classification of Energy Storage Systems, Key Performance Indicators: Energy Density; Power Density; Specific Energy; Specific Power; Efficiency; Cycle Life; And Ragone Plots | 4 Hours |
| Unit 2 | **Mechanical and Thermal Energy Storage**<br>Working Principles and Applications of Pumped Hydroelectric Storage (PHS), Compressed Air Energy Storage (CAES), and Flywheel Energy Storage (FES). Thermal Storage: Sensible Heat, Latent Heat (Phase Change Materials), and Thermochemical Storage. | 4 Hours |
| Unit 3 | **Electrochemical Energy Storage (Batteries)**<br>Basic Principles of Electrochemistry, Primary and Secondary Batteries, Lead-Acid Batteries and Nickel-Based Batteries, Lithium-Ion Batteries: Working Mechanism; Types Of Cathodes/Anodes; Advantages And Limitations, Introduction To Solid-State Batteries. | 4 Hours |
| Unit 4 | **Electrical and Chemical Energy Storage**<br>Electrical Storage: Capacitors, Supercapacitors (Ultracapacitors), and Superconducting Magnetic Energy Storage (SMES).<br>Chemical Storage: The Hydrogen Economy, Methods of Hydrogen production and Storage. Fuel Cells (PEM and SOFC) and their Basic Working Principles. | 4 Hours |
| Unit 5 | **Battery Thermal Management Systems (BTMS)**<br>Battery Heat Generation: Ohmic Heating; Entropic Heating; And Behavior During Rapid Charging/Discharging, Thermal Runaway: Causes; Stages; And Safety Implications in Battery Packs, Management Strategies: Estimation of State of Charge (SoC) And State of Health (SoH); Passive Cooling Methods (Heat Sinks, Phase Change Materials); Active Cooling and Heating Strategies (Forced Air, Direct/Indirect Liquid Cooling) | 4 Hours |
| Unit 6 | **Electronic Thermal Management**<br>Heat Generation in Electronics: Causes and Effects; Passive Cooling Technologies: Heat Sinks; Heat Pipes; Vapor Chambers; Thermal Interface Materials (TIMs), Active Cooling Technologies: Fan-Cooled Systems And Liquid Cooling Plates (Cold Plates) | 4 Hours |

| Sr. No. | Textbooks |
|---|---|
| 1. | R. A. Huggins, Energy Storage: Fundamentals, Materials and Applications, Springer. |
| 2. | P. Jayarama Reddy, Principles of Energy Storage Systems, BS Publications. |
| 3. | G. Pistoia, Lithium-Ion Batteries: Advances and Applications, Elsevier. |
| 4. | Younes Shabany, Heat Transfer: Thermal Management of Electronics, CRC Press, 2009. |
| | **Reference Books** |
| 1. | Dincer, I., and Rosen, M. A., Thermal Energy Storage: Systems and Applications, Wiley. |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 2. | Dhameja, S., Electric Vehicle Battery Systems, Newnes. |
| | **Web Resources** |
| 1. | Prof. Sarthak Nag and Prof. Parmod Kumar, Thermal Management of Electronics, NPTEL - IIT Mandi(https://nptel.ac.in/courses/112106005) |

MASTER COPY

Deogiri Institute of Engg & Mgmt. Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: Mechanical Engineering Lab II**<br>**Course Code: ME254214** | | **Course Category: PCC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Practicals/Sessions: 02 Hours/Week | CA-I | 15 Marks |
| Credits: 01 | CA-II | 15 Marks |
| Semester: Second Year (Semester IV) | ESE | 20 Marks |
| **Course Prerequisite:** Engineering Workshop Practices, Engineering Mechanics, Material Science | | |
| **Course Description:** Mechanical Engineering Lab II course provides practical exposure to manufacturing processes such as welding, casting and forging along with mechanical testing methods. It also introduces basic stress analysis, programming applications, and Finite Element Analysis to connect theory with practical engineering applications. | | |
| **Course Objectives:**<br>1. To enable students to develop foundational skills in manufacturing and fabrication processes.<br>2. To guide students in understanding material properties through mechanical testing methods.<br>3. To help students apply stress–strain concepts to practical engineering problems.<br>4. To introduce students to computational tools and basic finite element analysis (FEA) techniques.<br>5. To enhance students' analytical thinking and problem-solving abilities through engineering applications. | | |

| **Assessment** | |
|---|---|
| CA-I (a) | Performance of Evaluation of Experiments/Activities |
| CA-II (b) | Performance of Evaluation of Experiments/Activities |
| ESE (c) | Performance of Evaluation of Experiments/Activities; Oral Exam |

| **Sr. No.** | **List of Experiments/Activities** |
|---|---|
| 1. | To Construct a utility frame using the Metal Arc Welding (MAW) process to demonstrate proficiency in joint preparation, bead consistency, and structural alignment. |
| 2. | To Produce a solid aluminum or lead casting using the green sand molding process to evaluate the effects of pattern draft and shrinkage allowance on final part geometry. |
| 3. | To forge a hexagonal chisel or a S-hook using hot forging operations to examine the effects of plastic deformation on material grain structure and mechanical strength. |
| 4. | To conduct a tension test on mild steel to study its mechanical properties. |
| 5. | To determine the ultimate shear strength of a given specimen using a double shear test to establish its mechanical resistance to shear forces |
| 6. | To determine the impact strength of a given specimen using a Charpy/Izod impact test to establish its behavior under sudden loading conditions |

MASTER COPY

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 7. | To construct a graphical representation (Mohr's Circle) for a given state of stress to determine the principal stresses and maximum shear stress |
| 8. | To conduct a torsion test on a mild steel bar to study its mechanical properties under torsion. |
| 9. | To construct a C or Python-based logic program to compute basic stress and strain values for structural components. |
| 10. | To simulate simple structural components using Computer Aided Engineering (CAE) software like ANSYS to determine stress distribution and deformation under load. |

| Sr. No. | Textbooks |
|---|---|
| 1. | Workshop Technology (Vol. I & II) – S.K. Hajra Choudhury |
| 3. | Production Technology – R.K. Jain |
| 4. | Engineering Mechanics of Solids- Popov E. P, Prentice-Hall of India |
| 5. | Beer and Johnston, Strength of Materials, McGraw Hill Publication Co. Ltd. |
| | **Reference Books** |
| 1. | Serope Kalpakjian & Steven Schmid, Manufacturing Engineering and Technology, Pearson |
| 2. | Hazra Choudhury,Elements of Workshop Technology, Media Promoters and Publishers Pvt. Ltd. |
| 3. | John A. Schey, Introduction to Manufacturing Processes, McGraw-Hill |
| 4. | E. Paul,DeGarmo, J.Temple Black and Ronald A Kosher, John Wiley and Sons ,Materials and Processes in Manufacturing, Wiley |
| 5. | Subramanian R,Strength of Materials, Oxford University Press |
| 6. | Timoshenko and Young,Strength of Materials, CBS Publication |
| | **Web Resources** |
| 1. | Metal Forming Virtual Lab, Dayalbagh https://msvs-dei.vlabs.ac.in/ |
| 2. | Manufacturing Processes I & II – IIT Kanpur / IIT Kharagpur https://nptel.ac.in/courses/112105126 |
| 3. | NPTEL Course on Strength of Materials by Prof. K. Ramesh, Prof. Hariprasad, IIT Madras. https://nptel.ac.in/courses/112106319 |
| 4. | NPTEL Course on Strength of Materials by Dr. M. S. Shivakumar, IIT Madras. https://nptel.ac.in/courses/112106141 |
| 5. | Virtual Labs Ministry of Education https://sm-nitk.vlabs.ac.in/ |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Professional Development IV**<br>**Course Code: ME254604** | | **Course Category: SC-SEC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Practicals/Sessions: 02 Hours/Week | CA-I | 15 Marks |
| Credits: 01 | CA-II | 15 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 20 Marks |
| **Course Prerequisite:** Engineering Graphics, Machine Drawing, Do It Yourself-III | | |

**Course Description:** This course introduces students to the fundamentals of computer-aided design, assembly modeling, engineering drafting, and computer-aided manufacturing used in modern mechanical engineering practice. The course focuses on developing the ability to interpret mechanical component geometry and create accurate 2D sketches and 3D models using CAD tools. Students learn the principles of assembling multiple components and generating detailed engineering drawings using standard drafting practices and GD&T concepts. The course also provides basic exposure to computer-aided manufacturing processes such as toolpath generation and CNC machining operations. Through hands-on activities, the course enhances students' skills in digital product development and manufacturing workflow used in industrial applications.

**Course Objectives:**

1. To develop the ability to identify different features from orthographic/Isometric views of components used in industrial and household applications.
2. To impart proficiency in creating 2D and 3D models for specific mechanical components based on the given drawings or components.
3. To impart skills in creating Assembly design of components by combining various 3D models.
4. To develop proficiency in creation of Detailed drawings of components using various GD&T symbols.
5. To introduce students to Computer Aided Manufacturing (CAM) for CNC machining applications.

**Course Outcomes:**

| **COs** | **After completion of the course, Students will be able to,** | **Bloom's Level** |
|---|---|---|
| CO1 | **Recall** fundamental concepts of computer-aided design, 3D modeling, assembly modeling, engineering drafting, and computer-aided manufacturing. | Remember (Level 1) |
| CO2 | **Explain** principles and workflows involved in geometric modeling, component assembly, engineering drawing standards, and manufacturing toolpath generation. | Understand (Level 2) |
| CO3 | **Demonstrate** computer-aided design and manufacturing tools to create mechanical component models, assemblies, engineering drawings, and basic | Apply (Level 3) |
| CO4 | **Examine** mechanical components and manufacturing requirements to select appropriate modeling strategies, assembly constraints, and machining operations. | Analyze (Level 4) |

**CO-PO Mapping:**

| **CO-PO Mapping** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
| **CO1** | 1 | | | | 2 | | | | | | 1 | 2 | 1 |
| **CO2** | 2 | 2 | | | 2 | | | | | | 1 | 2 | 2 |
| **CO3** | 2 | 2 | 3 | | 3 | | | | | | 1 | 3 | 3 |
| **CO4** | 2 | 3 | 2 | 2 | 2 | | | | | | 2 | 3 | 3 |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-I (a) | Performance & Evaluation of activities on two-dimensional sketch and three-dimensional solid modeling modules. |
| CA-II (b) | Performance & Evaluation of activities on Assembly, Drafting and CAM modules. |
| ESE (c) | Viva-voce/Activity Evaluation of different modules. |

| Sr. No. | List of Experiments/Activities |
|---|---|
| 1. | To examine mechanical components using CAD tools for understanding geometry and function. |
| 2. | To create two-dimensional sketches using CAD software for basic design representation. |
| 3. | To develop three-dimensional solid models of mechanical components for visualization and analysis. |
| 4. | To modify 3D models using CAD features for improving design accuracy and functionality. |
| 5. | To construct assembly models of mechanical parts for understanding fit and interaction. |
| 6. | To apply constraints in assembly modeling for ensuring proper alignment and motion. |
| 7. | To prepare engineering drawings using CAD for manufacturing documentation. |
| 8. | To apply geometric dimensioning and tolerancing (GD&T) in drawings for precision and standardization. |
| 9. | To explore computer-aided manufacturing (CAM) concepts for production planning. |
| 10. | To generate CNC toolpaths using CAM software for automated machining operations. |

| Sr. No. | Textbooks |
|---|---|
| 1. | Ibrahim Zeid, Mastering CAD/CAM, McGraw-Hill Education. |
| 2. | Mikell P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson Education |
| 3. | P. N. Rao, CAD/CAM: Principles and Applications, McGraw-Hill Education. |
| | **Reference Books** |
| 1. | Sham Tickoo, CAD/CAM Exercises and Practice Drawings, Dreamtech Press. |
| 2. | Mikell P. Groover and Emory W. Zimmers, CAD/CAM: Computer-Aided Design and Manufacturing, Prentice Hall |
| 3. | Sham Tickoo, Siemens NX 2026 with Videos for Designers, 17th Edition, CADCIM Technologies. |
| | **Web Resources** |
| 1. | NPTEL – Computer Aided Design and Manufacturing Course https://digimat.in/nptel/courses/video/112102101/L43.html |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 2. | MIT OpenCourseWare – Design and Manufacturing II<br>https://ocw.mit.edu/courses/2-008-design-and-manufacturing-ii-spring-2003/pages/labs/ |
| 3. | NPTEL – CAD/CAM Lecture Materials (IIT Delhi)<br>https://web.iitd.ac.in/~jpkhatait/cadcam.html |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Do It Yourself IV**<br>**Course Code: ME254807** | | **Course Category: ELC** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Practicals/Sessions: 02 Hours/Week | CA-I | 15 Marks |
| Credits: 01 | CA-II | 15 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 20 Marks |
| **Course Prerequisite:** Basic Computer Skills | | |
| **Course Description:** This hands-on course is designed to equip students with practical skills in modern digital design and additive manufacturing workflows. Building upon a foundation of basic computer skills, students will gain proficiency in sketching, parametric part modeling, and creating assemblies utilizing Autodesk Fusion. The curriculum introduces the practical application of reverse engineering, focusing on precision measurement and digital replication techniques. Furthermore, students will navigate the complete 3D printing pipeline, from understanding Design for 3D Printing (DfAM) principles to executing both elementary and advanced configurations in slicing software and physical 3D printing operations. | | |
| **Course Objectives:**<br>1. To instruct students in the foundational and advanced techniques of sketching, parametric part modeling, and assembly creation using Autodesk Fusion.<br>2. To train students in the practical application of reverse engineering, specifically focusing on precision measurement and the digital replication of existing physical components.<br>3. To introduce the core principles of Design for 3D Printing (DfAM) and guide students through configuring both elementary and advanced parameters in slicing software.<br>4. To facilitate hands-on experience in executing the complete additive manufacturing workflow, enabling students to successfully transition digital models into physical 3D printed parts. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course:**<br>**Students will be able to** | **Bloom's Level** |
| CO1 | **Recall** the fundamental principles, terminology, and tools used in sketching, part modeling, assembly, parametric modeling, reverse engineering, Design for 3D Printing (DfAM), slicing software, and additive manufacturing. | Remember (Level 1) |
| CO2 | **Explain** the procedures for sketching, part modeling, assembly, parametric modeling, reverse engineering, Design for 3D Printing (DfAM), slicing software, and additive manufacturing. | Understand (Level 2) |
| CO3 | **Use** sketching, part modeling, assembly, parametric modeling, and reverse engineering techniques to prepare functional 3D models. | Apply (Level 3) |
| CO4 | **Design** and fabricate a functional physical prototype by integrating parametric modeling, reverse engineering data, and optimized 3D printing processes. | Apply (Level 3) |

**CO-PO Mapping:**

| **COs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | | | | | | | | | | | | |
| **CO2** | 2 | | | | 1 | | | | | | | 1 | 1 |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 2 | | 2 | | 3 | | | | | | 2 | 3 | 3 |
| **CO4** | 3 | | 2 | | 3 | | | | | 1 | 2 | 3 | 3 |

| **Assessment** | |
|---|---|
| CA-I (a) | Performance and Evaluation of Activities |
| CA-II (b) | Performance and Evaluation of Activities |
| ESE (c) | Mini project/Test/Viva Exam/ etc |

| **Sr. No.** | **List of Experiments/Activities** |
|---|---|
| 1. | To construct 2D sketches and 3D part models in Autodesk Fusion to define exact geometric shapes and dimensional constraints. |
| 2. | To execute reverse engineering of physical objects using precision measurement tools to create accurate digital replicas for modification or reproduction. |
| 3. | To model multiple individual components and integrate them into a complete assembly to evaluate the spatial relationships and physical constraints of a multi-part system. |
| 4. | To implement parametric modeling techniques in Autodesk Fusion to automate design changes and create adaptable models driven by dimensional variables. |
| 5. | To configure basic print settings in slicing software to generate standard machine instructions (G-code) for producing a simple geometric shape. |
| 6. | To operate a 3D printer to fabricate an elementary component to demonstrate basic machine setup, material handling, and the additive manufacturing process. |
| 7. | To apply Design for Additive Manufacturing (DfAM) principles to a CAD model to optimize part orientation, minimize support structures, and improve overall printability. |
| 8. | To customize advanced parameters in slicing software to optimize print time and structural integrity for complex geometries. |
| 9. | To manufacture a complex or functional prototype using a 3D printer to evaluate its dimensional accuracy, surface finish, and real-world physical functionality. |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| Sr. No. | Textbooks |
|---|---|
| 1. | Gibson, I., Rosen, D., & Stucker, B., Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Springer. |
| 2. | Verma, G., & Weber, M., Autodesk Fusion 360 Black Book, CADCAMCAE Works. |
| | **Reference Books** |
| 1. | Wang, W., Reverse Engineering: Technology of Reinvention, CRC Press. |
| 2. | Leary, M., Design for Additive Manufacturing, Elsevier. |
| | **Web Resources** |
| 1. | Self-Paced Learning for Fusion, Autodesk (https://www.autodesk.com/learn/ondemand/collection/self-paced-learning-for-fusion) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: PBL: Problem to Project based Learning** | | |
|---|---|---|
| **Course Code: ME254808** | | **Course Category: ELC** |
| **Teaching Scheme** | **Examination Scheme** | |
| Practicals/Sessions: 02 Hours/Week | CA-I | 15 Marks |
| Credits: 01 | CA-II | 15 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 20 Marks |
| **Course Prerequisite:** PBL: Design Thinking, PBL: Problem based Learning, Analytical skills and drawing tools. | | |
| **Course Description:** This course extends problem-based learning into project realization, where students convert identified problems into working engineering solutions. It emphasizes design, development, and validation of mini-project prototypes using domain knowledge. Students apply systematic engineering approaches to build functional systems within constraints. The course promotes innovation, teamwork, and hands-on skills. Outcomes are demonstrated through a working prototype and technical presentation. | | |
| **Course Objectives:**<br>1. To guide students in transforming identified problems into implementable engineering solutions.<br>2. To facilitate the design, development, and testing of working prototypes using domain knowledge.<br>3. To mentor students in applying systematic engineering and project management approaches.<br>4. To develop students technical competency, teamwork, and communication through mini-project execution. | | |

| **Course Outcomes:** | | |
|---|---|---|
| **COs** | **After completion of the course: Student will be able to** | **Bloom's Level** |
| CO1 | **Interpret** engineering problems and establish solution requirements in a practical context | Understand (Level 2) |
| CO2 | **Implement** suitable tools and techniques to develop a working model or prototype. | Apply (Level 3) |
| CO3 | **Interpret** and formulate solution strategies using relevant engineering principles | Analyze (Level 4) |
| CO4 | **Examine** alternative approaches and select appropriate design solutions | Evaluate (Level 5) |
| CO5 | **Develop** a functional working prototype using suitable tools and techniques | Create (Level 6) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

**CO-PO Mapping:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | | 1 | | | | | | | | 1 | |
| **CO2** | 3 | 2 | 2 | 2 | 2 | | | 2 | | | 1 | 2 | 2 |
| **CO3** | 3 | 3 | 3 | 1 | 1 | | | | | | 1 | 2 | 2 |
| **CO4** | 2 | 2 | 3 | 2 | 2 | 1 | | 1 | | | 1 | 2 | 3 |
| **CO5** | | | 3 | | 2 | | | 3 | 2 | 2 | 2 | 1 | 2 |

| **Assessment** | |
|---|---|
| CA-I (a) | Identify a real-life problem related to the course, clearly explain it with its needs and limitations, study existing solutions, suggest different possible solutions, and choose the best one based on cost, simplicity, and practicality. |
| CA-II (b) | Design a working model using suitable tools, test its performance, improve it based on results, and finally present the working solution with a simple report. |
| ESE (c) | Assigned Task Completion. |

| Sr. No. | List of Experiments/Activities |
|---|---|
| 1. | To identify an open-ended problem statement for the mini-project. |
| 2. | To define the problem with its objectives, basic requirements, and limitations. |
| 3. | Literature review/survey of existing solutions and understand their drawbacks. |
| 4. | To identify different possible solutions using domain-related concepts. |
| 5. | To select the best solution based on different criteria i.e. simplicity, cost, and practicality. |
| 6. | To prepare the design, list of materials and use the required tools for the solution. |

MASTER COPY

Deogiri Institute of Engg.& Mgmt.Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 7. | To build a basic working model or prototype using available resources. |
| 8. | To test the model and check whether it meets the expected results. |
| 9. | To improve the model based on testing results and feedback. |
| 10. | To present the final mini-project with a simple report. |

| Sr. No. | Textbooks |
|---|---|
| 1. | Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers. |
| 2. | Karl T. Ulrich, Steven D. Eppinger, Product Design and Development, McGraw-Hill Education. |
| | **Reference Books** |
| 1. | M. Moallem, W. Hung, and N. Dabbagh, The Wiley Handbook of Problem-Based Learning, Wiley, 2019. |
| 2. | Kothari, C. R., & Garg, Research Methodology: Methods and Techniques, 2nd Revised Edition, 2019- New Age International Publishers, New Delhi. |
| | **Web Resources** |
| 1. | NPTEL Online Courses- Problem Based learning, NITTTR. (https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr20_ed12) |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: Metrology & Mechanical Measurement**<br>**Course Code: ME254402** | | **Course Category: MDM II** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 03 hrs/week | CA-1 | 10 Marks |
| Tutorial: - | CA-2 | 10 Marks |
| Credits: 03 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |

**Course Prerequisite:** Basic knowledge of engineering fundamentals, physics, and elementary mathematics and basic instrumentation concepts.

**Course Description:**
This course introduces the fundamentals of measurement, metrology, precision instruments, sensors, and modern smart measurement systems used in engineering applications. It covers measurement standards, error analysis, tolerances, surface metrology, comparators, sensors, transducers, IoT-enabled monitoring, AI-based fault detection, and Industry 4.0 applications in automation, robotics, and machine vision for industrial quality control and predictive maintenance.

**Course Objectives:**

1. To introduce the fundamental principles of measurement, metrology, standards, calibration, and error analysis.
2. To develop knowledge of precision measuring instruments and techniques for dimensional and angular measurements.
3. To provide understanding of surface metrology, comparators, tolerances, fits, and Geometric Dimensioning & Tolerancing (GD&T) used in quality control.
4. To explain the principles, characteristics, and applications of sensors, transducers, and measurement systems.
5. To provide exposure to industrial sensors, smart transducers, IoT-enabled monitoring, AI-based fault detection, and Industry 4.0 applications in automation and predictive maintenance.

**Course Outcomes:**

| **COs** | **After completion of the course:<br>Students will be able to** | **Bloom's Level** |
|---|---|---|
| CO1 | **Recall** the fundamental concepts of measurement, metrology, standards, precision measuring instruments, sensors, and modern measurement systems. | Remember (Level 1) |
| CO2 | **Explain** the principles of precision measurement techniques, surface metrology, comparators, tolerances, fits, GD&T, and sensor characteristics used in engineering measurements. | Understand (Level 2) |
| CO3 | **Utilize** appropriate measuring instruments, sensors, and smart measurement techniques for dimensional measurement, industrial monitoring, automation, and quality control applications. | Apply (Level 3) |
| CO4 | **Examine** advanced measurement systems, IoT-enabled monitoring, AI-based fault detection, predictive maintenance, and Industry 4.0 applications in industrial automation and robotics. | Analyze (Level 4) |

**CO-PO Mapping**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO-1** | **PSO-2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | | 1 | | | | | | | | |
| **CO2** | 3 | 2 | | 1 | 1 | | | | | | | | |
| **CO3** | 2 | 2 | 1 | 2 | 3 | | | | | | | | |
| **CO4** | 2 | 3 | 1 | 3 | 3 | | 1 | | | | | | |

MASTER COPY

Deogiri Institute of Engg. & Management Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| Assessment | |
|---|---|
| CA-1 (a) | Subjective Test / Assignment/ MCQ Test etc. |
| CA-2 (b) | Subjective Test / Assignment/ MCQ Test etc. |
| MSE (c) | Subjective Test |
| ESE (d) | End-Semester Exam |

| Course Contents | | |
|---|---|---|
| Unit 1 | **Fundamentals of Measurement and Metrology**<br>Introduction to Measurement and Metrology, Standards of Measurement, Units, Calibration, Errors in Measurement, Accuracy, Precision, Sensitivity and Traceability. | 4 Hours |
| Unit 2 | **Precision Measurement Techniques and Instruments**<br>Linear Measuring Instruments: Vernier Caliper; Micrometer; Slip Gauges. Angular Measurement: Sine Bar; Bevel Protractor; Basic Alignment and Measurement Techniques, Introduction to Digital Measuring Instruments, Coordinate Measuring Machine (CMM) | 4 Hours |
| Unit 3 | **Surface Metrology, Comparators and GD&T**<br>Surface Metrology: Surface Texture; Roughness; Waviness; Lay; Methods of Surface Roughness Measurement; Surface Measurement Instruments. Types of Comparators, Engineering Tolerances and Fits: Concept of Limits; Fits and Tolerances; Types of Fits, Interchangeability, Geometric Dimensioning and Tolerancing (GD&T) | 4 Hours |
| Unit 4 | **Fundamentals of Sensors and Measurement Systems**<br>Introduction to Sensors and Transducers, Classification of Transducers: Active and Passive; Analog and Digital; Primary and Secondary, Generalised Measurement System: Elements and block diagram; Characteristics of Sensors: Accuracy; Sensitivity; Linearity; Range; Resolution; Repeatability. | 4 Hours |
| Unit 5 | **Industrial Sensors and Smart Transducers**<br>Temperature Sensors: Thermocouple and RTD; Pressure Sensors; Displacement Sensors; Proximity Sensors: Inductive and Capacitive; Optical Sensors; Smart Sensors & IoT-enabled Sensors in Industrial Automation, Industrial Applications in Robotics and Automation | 4 Hours |
| Unit 6 | **Advanced Measurement Systems and Industry 4.0 Applications**<br>IoT-based Measurement and Monitoring Systems, AI-Based Fault Detection and Predictive Maintenance, Machine Vision-based Inspection Systems, Applications in Smart Manufacturing, and Industry 4.0. | 4 Hours |

| Sr. No. | Textbooks |
|---|---|
| 1. | Jain R. K. – Engineering Metrology, Khanna Publishers. |
| 2. | Beckwith T. G., Marangoni, R. D. & Lienhard, J. H. – Mechanical Measurements, Pearson Education. |
| 3. | Sawhney A. K. – Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai Publications. |
| | **Reference Books** |
| 1. | Doebelin E. O. & Manik, D. N. – Measurement Systems: Application and Design, McGraw Hill. |
| 2. | Bentley J. P. – Principles of Measurement Systems, Pearson Education. |

MASTER COPY

Dengal Institute of Engg.& Mgmt.Studies Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| | |
|---|---|
| 3. | Patranabis D. – Sensors and Transducers, PHI Learning. |
| | **Web Resources** |
| 1. | Covers vernier calipers, micrometers, slip gauges, CMM, and precision measurement techniques. https://www.mitutoyo.com/education/ |
| 2. | Covers Industry 4.0, industrial automation, smart factories, IoT monitoring, and predictive maintenance. https://www.siemens.com/global/en/company/topic-areas/industry.html |
| 3. | Covers machine vision inspection systems and industrial automation applications. https://www.cognex.com/what-is/machine-vision |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar

Chairman, BoS
Mechanical Engg.

| **Course Title: HMM II**<br>**Course Code: ME254215** | | **Course Category: Honors** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 04 hrs/ week | CA-1 | 10 Marks |
| Tutorial: ----- | CA-2 | 10 Marks |
| Credits: 04 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Description:**<br>This course shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards. | | |

MASTER COPY

Deogiri Institute of Engg & Mgmt Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: DM II**<br>**Course Code: ME254216** | | **Course Category: Double Minor** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 04 hrs/ week | CA-1 | 10 Marks |
| Tutorial: ----- | CA-2 | 10 Marks |
| Credits: 04 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Description:**<br>This course shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards. | | |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: DM II**<br>**Course Code: ME254217** | | **Course Category: Double Minor** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 04 hrs/ week | CA-1 | 10 Marks |
| Tutorial: ----- | CA-2 | 10 Marks |
| Credits: 04 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Description:**<br>This course shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards. | | |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.

| **Course Title: DM II**<br>**Course Code: ME254218** | | **Course Category: Double Minor** |
|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | |
| Lectures: 04 hrs/ week | CA-1 | 10 Marks |
| Tutorial: ----- | CA-2 | 10 Marks |
| Credits: 04 | MSE | 20 Marks |
| **Semester**: Second Year (Semester IV) | ESE | 60 Marks |
| **Course Description:**<br>This course shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards. | | |

MASTER COPY

Deogiri Institute of Engg. & Mgmt. Studies ★ Chhatrapati Sambhajinagar ★

Chairman, BoS
Mechanical Engg.