*Final Draft – June 2015*

**REVISED CURRICULUM OF**

# MECHANICAL ENGINEERING DIPLOMA PROGRAM

**IN**

## MULTI POINT ENTRY & CREDIT SYSTEM

**PART-II**

**For the State of Meghalaya**

**National Institute of Technical Teachers' Training & Research**
Block – FC, Sector – III, Salt Lake City, Kolkata – 700 106

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## (Part-II)

# SCHEME OF STUDIES AND EVALUATION (MPECS) FOR DIPLOMA IN MECHANICAL ENGINEERING

## 1. FOUNDATION COURSES:

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assignment* | | Sessional | Viva | | |
| 1 | G101 | Communication Skill-I | | 2 | 0 | 2 | 70 | 15 | 15 | - | 25 | - | 125 | 3 |
| 2 | G102 | Communication Skill-II | G101 | 2 | 0 | 2 | 70 | 15 | 15 | - | 25 | - | 125 | 3 |
| 3 | G103 | Mathematics-I | | 4 | 1 | 0 | 70 | 15 | 15 | - | - | - | 100 | 5 |
| 4 | G104 | Mathematics-II | | 4 | 1 | 0 | 70 | 15 | 15 | - | - | - | 100 | 5 |
| 5 | G105 | Applied Mathematics | G103<br>G104 | 3 | 1 | 0 | 70 | 15 | 15 | - | - | - | 100 | 4 |
| 6 | G106 | Physics -I | | 2 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | - | 150 | 3 |
| 7 | G107 | Physics-II | G105 | 2 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | - | 150 | 3 |
| 8 | G108 | Chemistry - I | | 2 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | - | 150 | 3 |
| 9 | G109 | Chemistry - II | G107 | 2 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | - | 150 | 3 |
| TOTAL | | | | **23** | **3** | **12** | **630** | **135** | **135** | **100** | **150** | | **1150** | **32** |

*** The marks for assignment (15) should include five (5) marks for attendance.**

**2. HARD CORE COURSES:**

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assignment | | Sessional | Viva | | |
| 10 | G201 | Engineering Drawing-I | | 0 | 1 | 4 | - | - | - | 25 | 25 | - | 50 | 3 |
| 11 | G202 | Engineering Drawing-II | G201 | 0 | 1 | 4 | - | - | - | 25 | 25 | - | 50 | 3 |
| 12 | G203 | Workshop Practice-I | | 0 | 0 | 4 | - | - | - | - | 25 | 25 | 50 | 2 |
| 13 | G204 | Workshop Practice-II | G203 | 0 | 0 | 4 | - | - | - | - | 25 | 25 | 50 | 2 |
| 14 | G205A | Introduction to Information Technology | | 2 | 0 | 3 | 50 | 0 | 0 | 25 | 50 | - | 125 | 4 |
| | G205B | *Introduction to Computer Programming | | | | | | | | | | | | |
| 15 | G206A | Engineering Mechanics | | 3 | 0 | 2 | 70 | 15 | 15 | - | 25 | 25 | 150 | 4 |
| | G206B | *C-Programming | G205B | 3 | 0 | 2 | 50 | 0 | 0 | 50 | 50 | - | | |
| TOTAL | | | | **8** | **2** | **23** | **170** | **15** | **15** | **100** | **275** | **50** | **475** | **18** |

*G205B & G206B for CSE only

**Comment:** The above suggestions are as per sample path.

**3. SOFT CORE COURSES:** ***(Two to be taken, 301 and 302 are compulsory, any two from the rest)***

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assignment | | Sessional | Viva | | |
| 16 | G301 | Development of Life Skill-I | | 1 | 0 | 2 | - | - | - | - | 25 | 25 | 50 | 2 |
| 17 | G302 | Development of Life Skill-II | | 1 | 0 | 2 | - | - | - | - | 25 | 25 | 50 | 2 |
| 18 & 19 | G303 | Engineering Economics & Accountancy | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| | G304 | Entrepreneurship Development | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| | G305 | Principles of Management | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| | G306 | Organizational Behaviour | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| | G307 | Environmental Education | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| **TOTAL** | | | | **8** | **0** | **4** | **140** | **30** | **30** | **-** | **50** | **50** | **300** | **10** |

## 4. BASIC TECHNOLOGY COURSES:

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assign ment | | Sessional | Viva | | |
| 20 | ME 401 | **Thermal** Engineering-I | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| 21 | ME 402 | **Thermal** Engineering-II | ME401 | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | - | 150 | 4 |
| 22 | ME 403 | Fluid Mechanics | | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | - | 150 | 4 |
| 23 | ME 404 | Manufacturing Processes-I | ME404 | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| 24 | ME 405 | Manufacturing Processes-II | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| 25 | ME 406 | Theory of Machines | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| 26 | ME 407 | Mechanical Drawing | | 0 | 0 | 4 | - | - | - | 25 | 25 | - | 50 | 2 |
| 27 | ME 408 | Workshop Practice-III | | 0 | 0 | 4 | - | - | - | - | 25 | 25 | 50 | 2 |
| 28 | ME 409 | Workshop Practice-IV | | 0 | 0 | 4 | - | - | - | - | 25 | 25 | 50 | 2 |
| 29 | ME 410 | Fluid Machines | ME403 | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | - | 150 | 4 |
| 30 | ME 411 | Mechanics of Materials | | 3 | 0 | 2 | 70 | 15 | 15 | - | 25 | 25 | 150 | 4 |
| 31 | ME 412 | Elements of Electrical Engineering | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| **TOTAL** | | | | **27** | **0** | **20** | **630** | **135** | **135** | **100** | **200** | **50** | **1250** | **37** |

5. **APPLIED TECHNOLOGY COURSES :**

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assign ment | | Sessional | Viva | | |
| 32 | ME 501 | Machine Tools-I | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| 33 | ME 502 | Machine Tools-II | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| 34 | ME 503 | Mechanical Measurement | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| 35 | ME 504 | Automobile | ME401 ME402 | 3 | 0 | 2 | 70 | 15 | 15 | - | 25 | 25 | 150 | 4 |
| 36 | ME 505 | Production Management | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| 37 | ME 506 | Machine Design | ME411 | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | - | 150 | 4 |
| 38 | ME 507 | Plant Maintenance Engineering | | 3 | 0 | 0 | 70 | 15 | 15 | - | - | - | 100 | 3 |
| 39 | ME 508 | Workshop Practice-V | | 0 | 0 | 4 | - | - | - | - | 25 | 25 | 50 | 2 |
| 40 | ME 509 | Refrigeration and Air Conditioning | ME401 ME402 | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | - | 150 | 4 |
| 41 | ME 510 | Mechanical Estimation | | 2 | 0 | 2 | 70 | 15 | 15 | 0 | 25 | 25 | 125 | 3 |
| 42 | ME 511 | Professional Practices -I | | 0 | 0 | 2 | - | - | - | - | 50 | - | 50 | 1 |
| 43 | ME 512 | Professional Practices -II | | 0 | 0 | 2 | - | - | - | - | 50 | - | 50 | 1 |
| 44 | ME 513 | Professional Practices-III | | 0 | 0 | 3 | - | - | - | - | 50 | - | 50 | 2 |
| 45 | ME 514 | Professional Practices-IV | | 0 | 0 | 3 | - | - | - | - | 50 | - | 50 | 2 |
| 46 | ME 515 | Professional Practices-V | | 0 | 0 | 6 | - | - | - | - | 50 | - | 50 | 3 |
| 47 | ME 516 | Project | | 0 | 0 | 8 | - | - | - | - | 100 | 50 | 150 | 4 |
| **TOTAL** | | | | **26** | **0** | **36** | **610** | **120** | **120** | **100** | **500** | **75** | **1525** | **45** |

**6. ELECTIVE COURSES (Any TWO to be taken) :**

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assignment | | Sessional | Viva | | |
| 48 | ME 601 | Industrial Fluid Power | | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | 0 | 150 | 4 |
| | ME 602 | Nonconventional Sources of Energy | | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | 0 | 150 | 4 |
| | ME 603 | Mechatronics, | | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | 0 | 150 | 4 |
| | ME 604 | Power Plant Engineering | | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | 0 | 150 | 4 |
| 49 | ME 605 | Fabrication Technology | | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | 0 | 150 | 4 |
| | ME 606 | Tool Engineering | | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | 0 | 150 | 4 |
| | ME 607 | CAD/CAM | | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 25 | 0 | 150 | 4 |
| **TOTAL OF TWO COURSES** | | | | **6** | **0** | **4** | **140** | **30** | **30** | **50** | **50** | **0** | **300** | **8** |

Sl. 49 (ME 607) may be taken as elective - II (T-VI)

Sl. 48 (ME 602) may be taken as elective - I (T-V)

**SAMPLE PATH:** TERM - I

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hours / Week | | | Theory | | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assignment | Attendance | | Sessional | Viva-voce | | |
| 1 | G 101 | Communication Skill-I | | 2 | 0 | 2 | 70 | 15 | 10 | 5 | - | 25 | - | 125 | 3 |
| 2 | G 103 | Mathematics-I | | 4 | 1 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 5 |
| 3 | G 106 | Physics - I | | 2 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 3 |
| 4 | G 108 | Chemistry - I | | 2 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 3 |
| 5 | G 201 | Engineering Drawing – I | | 1 | 0 | 4 | - | - | - | - | 25 | 25 | - | 50 | 3 |
| 6 | G 203 | Workshop Practice - I | | 0 | 0 | 4 | - | - | - | - | - | 25 | 25 | 50 | 2 |
| 7 | G 205 A | Introduction to Information Technology | | 2 | 0 | 3 | 50 | 0 | 0 | 0 | 25 | 50 | - | 125 | 4 |
| TOTAL | | | | 13 | 1 | 17 | 330 | 60 | 40 | 20 | 75 | 200 | 25 | 750 | 23 |

Comments: Sl. 1 to 4 is based on observation of respective faculty.

Sl. 5 In Practical, 25 marks may be allotted for End exam.

Sl. 6 is as per decision of subject faculty.

**SAMPLE PATH:** TERM - II

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hours / Week | | | Theory | | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assignment | Attendance | | Sessional | Viva-voce | | |
| 1 | G 102 | Communication Skill-II | G101 | 2 | 0 | 2 | 70 | 15 | 10 | 5 | - | 25 | - | 125 | 3 |
| 2 | G 104 | Mathematics-II | G103 | 4 | 1 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 5 |
| 3 | G 107 | Physics - II | G106 | 2 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 3 |
| 4 | G 109 | Chemistry - II | G108 | 2 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 3 |
| 5 | G 202 | Engineering Drawing – I I | G201 | 1 | 0 | 4 | - | - | - | - | 25 | 25 | - | 50 | 3 |
| 6 | G 204 | Workshop Practice - II | G203 | 0 | 0 | 4 | - | - | - | - | - | 25 | 25 | 50 | 2 |
| 7 | G 206 A | Engineering Mechanics | | 3 | 0 | 2 | 70 | 15 | 10 | 5 | 0 | 50 | - | 150 | 4 |
| 8 | G 301 | Development of Life Skill-I | | 1 | 0 | 2 | - | - | - | - | - | 25 | 25 | 50 | 2 |
| 9 | | Professional Practices - I | | 0 | 0 | 2 | - | - | - | - | - | 50 | | 50 | 1 |
| TOTAL | | | | 15 | 1 | 20 | 350 | 75 | 50 | 25 | 75 | 250 | 50 | 875 | 26 |

Comments: Sl. 1,2,3,4,5,6,8,9, are acceptable.

Sl. 7. In Practical, End Exam may be removed and adjust the marks (25) in Progressive Assignment.

Sl. 5: End (P) marks may be allotted as indicated.

**SAMPLE PATH:** TERM - III

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hours / Week | | | Theory | | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assign ment | Attenda nce | | Sessional | Viva-voce | | |
| 1 | ME401 | Thermal Engineering - I | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 2 | ME403 | Fluid Mechanics | | 3 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 4 |
| 3 | ME404 | Manufacturing Processes- I | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 4 | ME406 | Theory of Machines | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 5 | G105 | Applied Mathematics | G103 G104 | 3 | 1 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 4 |
| 6 | G303 | Engineering Economics and Accountancy | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 7 | ME407 | Mechanical Drawing | | 0 | 0 | 4 | - | - | - | - | 25 | 25 | - | 50 | 2 |
| 8 | ME408 | Workshop Practice - III | | 0 | 0 | 4 | | | | | | 25 | 25 | 50 | 2 |
| 9 | G302 | Development of Life Skill - II | | 1 | 0 | 2 | | | | | | 25 | 25 | 50 | 2 |
| 10 | ME512 | Professional Practices - II | | 0 | 0 | 2 | - | - | - | - | - | 50 | - | 50 | 1 |
| TOTAL | | | | 19 | 1 | 16 | 420 | 90 | 60 | 30 | 25 | 175 | 50 | 850 | 27 |

Sl. No. 7:- End Exam for 25 marks may be allotted from sessinal.

**SAMPLE PATH:** TERM - IV

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hours / Week | | | Theory | | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assignment | Attendance | | Sessional | Viva-voce | | |
| 1 | ME410 | Fluid Machines | ME403 | 3 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 4 |
| 2 | ME402 | Thermal Engineering - II | ME401 | 3 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 4 |
| 3 | ME405 | Manufacturing Process - II | ME404 | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 4 | ME503 | Mechanical Measurement | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 5 | ME411 | Mechanics of Materials | | 3 | 0 | 2 | 70 | 15 | 10 | 5 | - | 25 | 25 | 150 | 4 |
| 6 | ME412 | Elements of Electrical Engineering | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | | | - | 100 | 3 |
| 7 | ME409 | Workshop Practice - IV | | 0 | 0 | 4 | - | - | - | - | - | 25 | 25 | 50 | 2 |
| 8 | ME513 | Professional Practices - III | | 0 | 0 | 3 | - | - | - | - | - | 50 | - | 50 | 2 |
| TOTAL | | | | 18 | 0 | 13 | 420 | 90 | 60 | 30 | 75 | 150 | 25 | 850 | 25 |

Sl.5: End Exam may be removed and may be Shifted.

**SAMPLE PATH:** TERM - V

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hours / Week | | | Theory | | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assignment | Attendance | | Sessional | Viva-voce | | |
| 1 | ME501 | Machine Tools - I | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 2 | ME504 | Automobile | | 3 | 0 | 2 | 70 | 15 | 10 | 5 | - | 25 | 25 | 150 | 4 |
| 3 | G304 | Entrepreneurship Development | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 4 | ME 601-604 | Elective-I | | 3 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 4 |
| 5 | ME 505 | Production Management | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 6 | ME506 | Machine Design | | 3 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 4 |
| 7 | ME508 | Workshop Practice - V | | 0 | 0 | 4 | - | - | - | - | - | 25 | 25 | 50 | 2 |
| 8 | ME514 | Professional Practices – IV* | | 0 | 0 | 3 | - | - | - | - | - | 50 | - | 50 | 2 |
| TOTAL | | | | 18 | 0 | 13 | 420 | 90 | 60 | 30 | 75 | 150 | 25 | 850 | 25 |

Sl.2: End Exam (P) may be removed and shifted to P.A (Viva).

**SAMPLE PATH:** TERM - VI

| Sl. No | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | | Total Marks | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-requisite | Contact Hours / Week | | | Theory | | | | Practical | | | | |
| | | | | L | T | P | End Exam | Progressive Assessment | | | End Exam | Progressive Assessment | | | |
| | | | | | | | | Class Test | Assignment | Attendance | | Sessional | Viva-voce | | |
| 1 | ME507 | Plant Maintenance Engineering | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 2 | ME509 | Refrigeration and Air Conditioning | ME401 ME402 | 3 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 4 |
| 3 | ME502 | Machine Tools - II | | 3 | 0 | 0 | 70 | 15 | 10 | 5 | - | - | - | 100 | 3 |
| 4 | ME510 | Mechanical Estimation | | 2 | 0 | 2 | 70 | 15 | 10 | 5 | - | 25 | - | 125 | 3 |
| 5 | ME 605-607 | Elective-II | | 3 | 0 | 2 | 70 | 15 | 10 | 5 | 25 | 25 | - | 150 | 4 |
| 6 | ME516 | Project | | 0 | 0 | 8 | - | - | - | - | - | 100 | 50 | 150 | 4 |
| 7 | ME515 | Professional Practices – V* | | 0 | 0 | 6 | - | - | - | - | - | 50 | - | 50 | 3 |
| TOTAL | | | | 14 | 0 | 20 | 330 | 60 | 40 | 20 | 100 | 250 | 50 | 825 | 24 |

Sl. 4: End exam (T) may changed as indicated above of end exam (P) may be removed and shifted to P.A as indicated.

# FOUNDATION COURSES

**APPLIED MATHEMATICS**

| L | T | P | **Curri. Ref. No.: G105** |
|---|---|---|---|
| 3 | 1 | 0 | |

***Total marks: 100***

Theory:
End Term Exam.:70

P.A:30

***Total Contact hrs.:***
Lecture:60

Tutorial:15

Practical: 0

Pre-requisite: G103, G104

Credit : 4

**RATIONAL**

Mathematics is an important tool to solve wide variety of engineering problems. Most of the technological processes in industry are described effectively by using mathematical framework. Mathematics has played an important role in the development of mechanical, civil, aeronautical and chemical engineering through its contribution to mechanics of rigid bodies, hydrodynamics, aero-dynamics and heat transfer etc. It has become of great interest to electrical engineers through its application to information theory, design of digital computer etc.

**AIM**

Through this syllabus we aim to give students a strong foundation in Matrix and Vector with their applications. We also aim to give detail idea of Numerical Integration, Numerical solution of Non-Linear Equation, Gauss Elimination method and Differential Equations with application problems.

| UNIT | TOPIC/SUB-TOPIC | Contact Hrs. | Total Marks. |
|---|---|---|---|
| 1.0 | **1.1 Numerical Solution of Algebraic Equations** | | |
| | (i)Bisection Method. | | |
| | (ii) Regula-falsi Method or method of false position | | |
| | (iii) Newton-Raphson Method. | **7** | **10** |
| | (iv) Problems on the above methods. | | |
| | **1.2 Numerical solution of simultaneous equations** | | |
| | **Containing 2 and 3 unknowns.** | | |
| | (i)Gauss elimination method. | | |
| | (ii)Iterative methods:-Gauss Seidal and Jacobi's method. | **7** | |
| 2.0 | **PARTIAL DIFFERENTIATION.** | | **10** |

| | | | |
|---|---|---|---|
| | (i)Introduction to functions of two or more variables.<br>(ii) Geometrical Interpretation of a Function of two variables.<br>(iii)Partial Derivatives.<br>(iv) Second Order Partial Derivative.<br>(v) Homogeneous function.<br>(v) Euler's Theorem.<br>(v) Problems | **8** | **10** |
| UNIT | TOPIC/SUB-TOPIC | Contact Hrs. | Total marks. |
| **3.0** | **Numerical Integration.**<br>(i)Introduction.<br>(ii) Formula for Trapezoidal Rule.<br>(iii) Geometrical Interpretation of Trapezoidal Rule.<br>(iv) Formula for Simpson's one-third Rule.<br>(v) ) Geometrical Interpretation of Simpson's one-third Rule.<br>(vi) Problems related to other physical systems. | 7 | 10 |
| **4.0** | **Differential Equations (ordinary)**<br>(i)Introduction.<br>(ii) Order and degree of a differential equation.<br>(iii) Formation of Differential Equations.<br>(iv) Solution of a Differential Equation.<br>(V)Differential equation of the first order and first degree.<br>(vI) Variables separable.<br>(v) Homogeneous Differential Equations.<br>(vi) Linear Differential Equations.<br>vii) Equations reducible to linear form.<br>(vii) Exact differential Equations.<br>(viii) Equations reducible to the exact form. | 21 | 20 |

(ix) Linear Differential Equations of second order with constant coefficients.

(x) Complete solution = Complementary Function Particular Integral.

(xi) Method of finding Particular Integral.

(xii) Applications of differential equations to civil engineering problems.

(xiii) Problems related to other physical systems.

| | | | |
|---|---|---|---|
| | | 10 | 10 |
| **5.0** | **Probability Distribution.** | | |

(i)Binomial distribution.

(ii)Poisson's distribution.

(iv)Normal distribution.

(v) Simple problems relating to production processes

| Total hours | Total marks |
|---|---|
| 60 | 70 |

**REFERENCE BOOKS**


(1) Integral Calculus by B.C.Das and B.N.Mukherjee.
(2) Diploma Engineering Mathematics (Volume-II) by B.K.Pal.
(3) Applied Mathematics-I by Dr.J.S.Bindra and K.S.Gill.
(4) Applied Mathematics-II by Dr.J.S.Bindra and K.S.Gill.
(5) Applied Mathematics-III by Dr.J.S.Bindra.
(6) Engineering Mathematics (Volume-I, Volume-II & Volume-III) By S.Arumugam, A.Thangapandi Issac and A.Somasundaram.

# SOFT CORE COURSES

## DEVELOPMENT OF LIFE SKILL -I

| *L* | *T* | *P* | ***Curri. Ref. No.: G301*** |
|---|---|---|---|
| *1* | *0* | *2* | |

***Total Contact hrs :*** ***Total marks: 50*** **Practical:**

*Theory: 15* *End Term Exam: 25*

*Tutorial: 0* *P.A : 25*

*Practical: 30*

**Credit : 2**

**Aim :-This subject is kept to**

- Conduct different session to improve students memory Power
- Conduct different session to improve time management skills
- Motivate student to face realistic problem with confidence and positive approach

**Objective: - This course will enable the students to:**

- Develop reading skills
- Use techniques of acquisition of information from various sources
- Draw the notes from the text for better learning.
- Apply the techniques of enhancing the memory power.
- Develop assertive skills.
- Prepare report on industrial visit.
- Apply techniques of effective time management.
- Set the goal for personal development.
- Enhance creativity skills.
- Develop good habits to overcome stress.
- Face problems with confidence

**DETAILED COURSE CONTENT**

**THEORY:**

| **UNIT** | **TOPIC/SUB-TOPIC** | **TOTAL HRS.** |
|---|---|---|
| Unit -1 | **Importance of DLS** | |
| | Introduction to subject, importance in present context ,application | **01** |
| Unit -2 | **Information Search** | |
| | Information source –Primary, secondary, tertiary Print and non – print, documentary, Electronic Information center, Library, | |

exhibition, Government Departments. Internet Information search
– Process of searching, collection of data –questionnaire, taking
Interview, observation method. **02**

Unit – 3 **Written communication**
Method of note taking
Report writing –Concept, types and format. **01**

Unit – 4 **Self Analysis**
Understanding self—
Attitude, aptitude, assertiveness, self esteem,
Confidence buildings. Concept of motivation. **02**

Unit – 5 **Self Development**
Stress Management –Concept, causes, effects and remedies to
Avoid / minimize stress.
Health Management – Importance, dietary guidelines and exercises.
Time management- Importance, Process of time planning, Urgent
Vs importance, Factors leading to time loss and ways to handle it,
Tips for effective time management.

Emotion-concept, Types, Controlling, Emotional intelligence,
Creativity-concept, Factors enhancing creativity
Goal setting-concept, Setting smart goal **06**

Unit – 6 **Study habits**
Ways to enhance memory and concentration.
Developing reading skill.
Organisation of knowledge,
Model and methods of learning. **03**

**SUGGESTED LEARNING RESOURCES**

**REFERENCE BOOKS**


1. Personality Development & Soft Skills - B. K. Mitra, Oxford University Press
2. Basic Managerial Skills for All - E.H. Mc Grath , S.J., Prentice Hall of India Pvt Ltd
3. Body Language - Allen Pease, Sudha Publications Pvt. Ltd.
4. Creativity and problem solving - Lowe and Phil, Kogan Page (I) P Ltd
5. Decision making & Problem Solving - Adair, J, Orient Longman
6. Develop Your Assertiveness - Bishop , Sue, Kogan Page India
7. Time management - Chakravarty, Ajanta, Rupa and Company
8. Life Skills Activities for Secondary Students with Special Needs - Darlene Mannix, Kindle Edition


**Internet Assistance:**

1) http://www.mindtools.com

2) http://www.stress.org

3) http://www.ethics.com

4) http://www.coopcomm.org/workbook.htm

5) http://www.mapfornonprofits.org/

6) http://www.learningmeditition.com http://bbc.co.uk/learning/courses/

7) http://eqi.org/

8) http://www.abacon.com/commstudies/interpersonal/indisclosure.html

9) http://www.mapnp.org/library/ethics/ethxgde.htm

10)http://www.mapnp.org/library/grp_cnfl/grp_cnfl.htm

11)http://members.aol.com/nonverbal2/diction1.htm

12)http://www.thomasarmstron.com/multiple_intelligences.htm

13)http://snow.utoronto.ca/Learn2/modules.html

14)http://www.quickmba.com/strategy/swot/

**Practical :**

**Suggested List of activities:**

- 1 Conduct Guest Lectures.
- Conduct Industrial visits.
- Conduct Seminar/Group Discussions.

**Suggested List of Assignments/Tutorial :**

**The Term Work Will Consist Of Following Assignments.**

1 Library search:-

Visit your Institute's Library and enlist the books available on the topic given by your teacher. Prepare a bibliography consisting name of the author, title of the book, publication and place of publication.

2 Enlist the magazines, periodicals and journals being available in your library.

Select any one of them and write down its content. **Choose a topic for presentation.**

3 Attend a seminar or a guest lecture, listen it carefully and note down the important points and prepare a report of the same.

4 Visit to any one place like historical/office/farms/development sites etc. and gather information through observation, print resources and interviewing the people.

5 Prepare your individual time table for a week –

(a) List down your daily activities.

(b) Decide priorities to be given according to the urgency and importance of the activities.

(c) Find out your time wasters and mention the corrective measures.

6 Keep a diary for your individual indicating- planning of time, daily transactions, collection of good thoughts, important data, etc

7 Find out the causes of your stress that leads tension or frustration .Provide the ways to Avoid them or to reduce them.

8 Undergo the demonstration on yoga and meditation and practice it. Write your own views, feeling and experiences on it.

**NOTE: -** THESE ARE THE **SUGGESTED ASSIGNMENT** FOR GUIDE LINES TO THE SUBJECT TEACHER. HOWEVER THE SUBJECT TEACHERS CAN SELECT, DESIGN ANY ASSIGNMENT RELEVANT TO THE TOPIC, KEEPING IN MIND THE OBJECTIVES OF THIS SUBJECT.

**DEVELOPMENT OF LIFE SKILL -II**

| *L* | *T* | *P* | ***Curri. Ref. No.: G302*** |
|---|---|---|---|
| *1* | *0* | *2* | |

***Total Contact hrs :*** ***Total marks: 50*** **Practical:**

*Theory: 15* *End Term Exam: 25*

*Tutorial: 0* *P.A : 25*

*Practical: 30*

**Credit : 2**

## Development of life skill-II

| UNITS | CONTENTS | Hours |
|---|---|---|
| **Unit1** | **Inter personal Relation**<br>Importance, Interpersonal conflicts, Resolution of conflicts, Developing effective interpersonal skills communication and conversational skills, Human Relation Skills (People Skills) | |
| **Unit 2** | **Problem Solving**<br>**I)Steps in Problem Solving(Who? What? Where? When? Why? How? How much?)**<br>1.Identify,understand and clarify the problem<br>2.Information gathering related to problem<br>3.Evaluate the evidence<br>4.Consider feasible options and their implications<br>5.Choose and implement the best alternative<br>6.Review<br>**II)Problem Solving Technique**<br>1.Trial and Error,2.Brain Storming3.Thinking outside the Box | |
| **Unit 3** | **Presentation Skills**<br>Concept ,Purpose of effective presentations,<br>***Components of Effective Presentations***:<br>Understanding the topic, selecting the right information, organizing the process interestingly,<br>Good attractive beginning, Summarising and concluding, adding impact to the ending, | |

| | | |
|---|---|---|
| | ***Use of audio visual aids*** OHP, LCD projector, White board,<br><br>***Non verbal communication***:<br>Posture, Gestures ,Eye contact and facial expression,<br>Voice and Language Volume, pitch, Inflection, Speed, Pause, Pronunciation,<br>Articulation, Language<br>Handling questions Respond, Answer, Check, Encourage, Return to presentation<br><br>***Evaluating the presentation*** Before the presentation, During the presentation,<br>After the presentation | |
| **Unit 4** | **Looking for a Job**<br>Identifying different sources announcing Job vacancies, Skim, scan and read advertisements in detail, write efficacious CVs, write covering letters to a company CVs, write Job Application Letters in response to advertisements and self-applications | 5 |
| **Unit 5** | **Job Interviews**<br>***Prepare for Interviews***:<br>Intelligently anticipating possible questions and framing appropriate answers, Do's and don'ts of an interview(both verbal and non verbal),<br><br>***Group Discussion:***<br>Use of Non verbal behavior in Group Discussion,<br>Appropriate use of language in group interaction,<br>Do's and don'ts for a successful Group Discussion | 10 |
| **Unit 6** | **Non verbal graphic communication**<br>Nonverbal codes: A .Kinesics ,.B .Proxemics,.C.Haptics.,D.Vocalics,.E.Physical appearance.,F..Chronemics,.G. Artifacts Aspects of Body Language | 6 |
| **Unit 7** | **Formal Written Skills:**<br><br>Memos, Emails, Netiquettes, Business correspondence Letter of enquiry, Letter of Placing Orders, Letter of Complaint | 6 |
| | **Total** | 48 |

| Sessional Activities | | |
|---|---|---|
| **Unit 1**<br><br>Interpersonal<br><br>Relation | Case Studies:<br>1.from books<br>2.from real life situations<br>3.from students' experiences<br>Group discussions on the above and step by step write of any one or more of these in the sessional copies | |
| **Unit II**<br><br>Problem Solving | Case Studies:<br>1.from books<br>2.from real life situations<br>3.from students' experiences<br>Group discussions on the above and step by step write of any one or more of these in the sessional copies | |
| **Unit III**<br><br>Presentation Skills | Prepare a Presentation (with the help of a Power point) on a Particular topic. The students may refer to the Sessional activity (sl.No.8) of the Computer Fundamental syllabus of Semester1. For engineering subject oriented technical topics the cooperation of a subject teacher may be sought. Attach hand out of PPT in the sessional copy | |
| **Unit IV**<br>Looking for a job | Write an effective CV and covering letter for it.<br>Write a Job Application letter in response to an advertisement and a Self-Application Letter for a job. | |
| **Unit V**<br>Job Interviews<br><br>&Group Discussions | Write down the anticipated possible questions for personal interview (HR)along with their appropriate responses<br><br>Face mock interviews. The cooperation of HR personnels of industries may be sought if possible<br>Videos of Mock Group Discussions and Interviews may be shown | |
| **Unit 7**<br>Formal Written Skills | Write a memo,<br>Write an effective official e-mail, write a letter of enquiry, letter of placing orders, letter of complaint | |
| | | |

## ENGINEERING ECONOMICS AND ACCOUNTANCY

| L | T | P | **Curri. Ref. No.: G 303** |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.: 45** **Total marks: 100** **Theory:**

Theory: 45 End Term Exam: 70

Tutorial: 0 P.A.: 30

Practical: 0

**Credit: 3**

### RATIONALE

The knowledge of Economics and Accountancy is needed by personal dealing with the cost of products of any kind related to quality and standards of production including its financial control. Engineers in general need to know the cost of the final products for marketing purposes. The knowledge of Economics as well as Accountancy is required by all people dealing in any business or enterprises.

This particular subject deals with the Basic Concepts of Economics, Factors of Production, Types of Industries, Market forms, Need of Economics Planning for overall development, Concept of Money, Unemployment causes and measures, Industrial Policy, Public Finance, Business Transactions and Accountancy, Maintenance of Cash and balances, Receipts and Expenditures Accounts, Final Accounts and Cost Concepts.

### DETAIL COURSE CONTENT

| UNITS | TOPICS/SUB-TOPICS | HOURS |
|---|---|---|
| 1. | **INTRODUCTION:**<br>1.1 Introduction to Economics and its Utility of Study<br>1.2 Importance of the study of economics. | 1 |
| 2. | **BASIC CONCEPTS OF ECONOMICS:**<br>2.1 Definition of Goods, Utility, Value, Price, Income, Capital<br>2.2 Classification of Goods, Human Wants-Classification and Types-Relation between Wealth and Capital<br>2.3 Consumer Behaviour: Basic Law of Demands and Supply<br>2.4 Concepts and measurement of elasticity of demand | 3 |
| 3. | **PRODUCTION:**<br>3.1 Meaning and Factors of Production<br>3.2 Land, Labour, Capital and Organisation – meaning and characteristics<br>3.3 Formation of Capital, Break Even Analysis, Break Even Chart its uses. | 3 |

| | | |
|---|---|---|
| 4. | **SCALE OF INDUSTRIES:**<br><br>4.1 Meaning of Small, Medium and Large Scale production<br>4.2 Advantages and Disadvantages of Small Scale and Large Scale Production | 2 |
| 5. | **MARKET FORMS:**<br><br>5.1 Meaning of Market-Forms of Market<br>5.2 Features of Perfect, Imperfect and Monopoly<br>5.3 Price Determination under Perfect Competition & monopoly | 3 |
| 6. | **ECONOMIC PLANNING :**<br><br>6.1 Basic features of underdeveloped Economy – Basic features of Indian Economy<br>6.2 Meaning, Objectives and Needs of Planning<br>6.3 Current Five Year Plan | 2 |
| 7. | **MONEY :**<br><br>7.1 Meaning and Function of Money<br>7.2 Introduction to the concepts of the value of Money | 2 |
| 8. | **UNEMPLOYMENT :**<br><br>8.1 Meaning, types and causes of Unemployment in India<br>8.2 Unemployment problems in India-Measures taken by the Government of India. | 2 |
| 9. | **INDUSTRIAL POLICY :**<br><br>9.1 Current Industrial Policy<br>9.2 Monopoly Restricted Trade Practices Act (MRTP), Foreign Exchange Management Act (FEMA), Competitions Act | 3 |
| 10. | **PUBLIC FINANCE :**<br><br>10.1 Meaning of Public Finance-Distinction Between Public and Private Finance<br>10.2 Sources of Public Revenue. | 2 |
| 11. | **BUSINESS TRANSCTIONS AND ACCOUNTANCY :**<br><br>11.1 Transactions and classifications, need and objectives of proper records including double entry system<br>11.2 Classification of accounts and its description (in respect of real accounts, personal accounts and nominal accounts)<br>11.3 Debit & credit concepts: Golden rules of Debit and Credit.<br>11.4 Objectives and Principals of Double Entry System of Book Keeping. | 5 |
| 12. | **BOOKS OF ACCOUNTS :**<br><br>12.1 Journal and Ledger, their subdivisions; posting from journals to ledger.<br>12.2 Balancing of Accounts | 2 |
| 13. | **CASH BOOK :**<br><br>13.1 Objectives of Cash Book (in respect of all kinds of Cash Transactions) | 2 |

| | | |
|---|---|---|
| | 13.2 Single Column, Double Column and Triple Column<br>13.3 Impress System of Petty Cash Book | |
| 14. | **TRIAL BALANCE :**<br><br>14.1 Objectives, Preparation – Errors and Rectification (In respect of Balance of Accounts for the Total period) | 2 |
| 15. | **FINAL ACCOUNTS :**<br><br>15.1 Steps of preparing accounts: Trading Accounts, Profit and Loss Accounts<br>15.2 Revenue and Depreciation Adjustment<br>15.3 Introduction to Balance Sheet | 5 |
| 16. | **CAPITAL & REVENUE EXPENDITURE DISTRIBUTION:**<br><br>16.1 Receipt and Payments<br>16.2 Income and Expenditure differences | 3 |
| 17. | **MENAING AND PURPOSE OF COSTING:**<br><br>17.1 Element of Cost Analysis and Classification of expenditure for Cost Accounts.<br>17.2 Cost Control: Prime Cost, Overhead Cost and Indirect Material and Tools | 3 |

**REFERENCE**


1. Elements of Economics by K. K. Dewett and J. D. Verma
2. An Introduction to Economics Theory by H. L. Ahuja
3. Double Entry Book Keeping by Mohan, Juneja, Chawla and Saxena
4. Double Entry System of Book Keeping by J. R. Batliboy

## ENTREPRENEURSHIP DEVELOPMENT

| L | T | P | *Curri. Ref. No.: G 304* |
|---|---|---|---|
| 3 | 0 | 0 | |

***Total Contact hrs.: 45*** ***Total marks: 100***

Theory: 45

Tutorial :0

Practical: 0

*Credit: 3*

*Theory:*
End Term Exam: 70

P.A.: 30

### RATIONALE

The course intends to provide the fundamental aspects of entrepreneurship as a means for self-employment and culminating in economic development of the country. It deals with basic issues like entrepreneurial characteristics and quality, governmental policy support and overall scenario along with opportunities and the facilities available for entrepreneurship development.

### AIM

- Introduction
- Forms of business organisation
- Small scale and ancillary industries
- System of distribution
- Sales organisation
- Pricing the product
- Introduction to import and export
- Business enquiries
- Project report
- Environment legislation

### DETAIL COURSE CONTENT

| UNIT | TOPIC / SUB-TOPIC | Lecture Hrs. |
|---|---|---|
| **1.0** | **INTRODUCTION** | **10** |
| | 1.1 Definition and functions of Entrepreneur, entrepreneurship quality, entrepreneurial spirit, need for entrepreneurship. | |
| | 1.2 Individual and social aspects of business – achievement motivation theory | |
| | 1.3 Social responsibilities of Entrepreneurs | |
| **2.0** | **FORMS OF BUSINESS ORGANISATION** | **4** |
| | 2.1 Types of company<br>2.2 Merits and demerits of different types | |
| | 2.2 Registration of small scale industries | |

2.4 Conglomeration.

**3.0 SMALL SCALE AND ANCILLARY INDUSTRIES 8**

3.1 Definition – scope with special reference to self employment.

3.2 Procedure to start small scale and Ancillary industries

3.3 Pattern on which the Scheme/Project may be prepared

3.4 Sources of finance - Bank, govt., and other financial institutions.

3.5 Selection of site for factory

3.6 Factors of selection

3.7 N.O.C. from different authorities, e.g., Pollution Control Board, Factories Directorate etc.

3.8 Trade License.

**4.0 SYSTEM OF DISTRIBUTION 1**

4.1 Wholesale Trade

4.2 Retail trade

**5.0 SALES ORGANISATION 3**

5.1 Market survey, marketing trends, knowledge of competitors, product selection & its basis.

5.2 Sales promotion

5.3 Advertisement

5.4 Public relations and selling skills

**6.0 PRICING THE PRODUCT 1**

6.1 Basic guidelines

**7.0 INTRODUCTION TO IMPORT AND EXPORT 6**

7.1 Procedures for export

7.2 Procedures for import

7.3 Technical collaboration – international trade

7.4 Business insurance

7.5 Rail and road transport

7.6 Forwarding formalities, FOR, FOB, CIF, etc.

**8.0 BUSINESS ENQUIRIES 4**

8.1 Enquiries: From SISI, DIC, SFC Dept. of Industrial Development Banks.

8.2 Offers and Quotations

8.3 Orders

**9.0 PROJECT REPORT 6**

9.1 Project Report on feasibility studies for small scale industries, proposal for finances from bank and other financial institutions for establishing new industries and its extension, obtaining License enlistment as supplier, different vetting organizations for Techno Economic feasibility report.

Breakeven analysis, Breakeven point.

**10.0 ENVIRONMENT LEGISLATION 2**

10.1 Air Pollution Act

10.2 Water Pollution Act

10.3 Smoke Nuisance Control Act

10.4 ISO: 14000, OSHA

**SUGGESTED LEARNING RESOURCES**
**REFERENCE BOOKS**


1. Entrepreneurship Development

   Prepared by CTSC Manila Publishers by Tata Mc Graw Hill Publishing Co. Ltd.

2. Small Enterprise Management Published by ISTE, Mysore
3. Motivation Published by ISTE, Mysore
4. S.S.M. in Environmental Engineering Published by ISTE, Mysore
5. Entrepreneurship New Venture Creations, Holt, Prentice Hall, India.
6. Essence of TQM by John Bank
7. Rathore, B.S. and J.S. Saini(ed), A Handbook of Entrepreneurship – Panchkula : Aapga, 1997
8. Jose Pauletal, Entrepreneurship Development, Mumbai : Himalaya Publishing House, 1996
9. Khanka, S.S., Entrepreneurship Development, New Delhi : S. Chand and Co., 2001
10. Nagarazan, R.S. and A.A. Arivalagar, TQM New Delhi : New Age International Publishers, 2005
11. Bhatia, R.C., Marketing Communication and Advertising, New Delhi : Galgotia Publishing Co., 2003
12. Sinha, J.C., and V.N. Mugali : A Textbook of Commerce, New Delhi : R. Chand and Co., 1994

## PRINCIPLES OF MANAGEMENT

| L | T | P | **Curri. Ref. No. G 305** |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.: 45** **Total marks: 100** **Theory:**

Theory: 45 End Term Exam: 70

Tutorial :0 P.A.: 30

Practical : 0

**Credit: 3**

### RATIONALE

Management is the integrated component of all areas of technological courses as recognized across the world. Technicians or supervisors coming out of the system hence need to study the basics components of the management relevant to them. Principals of management will enable them to apply basic knowledge of management in their field of work. Keeping with this in mind necessary content details of the course on Principles of Management has been developed. With the assumption that, it will develop some management foundation to the diploma students.

### AIM

- Framework of management
- Planning
- Organizing
- Staffing
- Directing
- Total quality management

### DETAIL COURSE CONTENT

| UNIT TOPIC / SUB-TOPIC | Lecture Hrs. |
|---|---|
| **1. FRAMEWORK OF MANAGEMENT** | **8** |
| 1.1 Nature of management | |
| 1.2 Development of management thoughts | |
| 1.3 Management and process skills | |
| **2.0 PLANNING** | **9** |
| 2.1 Fundamentals of planning | |
| 2.2 Planning premises and forecasting | |
| 2.3 Decision making | |
| 2.4 Mission and objective | |
| **3.0 ORGANIZING** | **10** |

3.1 Fundamentals of organizing

3.2 Design of organization structure

3.3 Forms of organization structure

3.4 Power and authority

3.5 Authority relationship

**4.0 STAFFING** **8**

4.1 Fundamentals of staffing

4.2 HR planning

4.3 Recruitment and selection

4.4 Training and development

4.5 Performance appraisal

**5.0 DIRECTING** **6**

5.1 Fundamentals of directing

5.2 Operational control techniques

5.3 Overall control technique

**6.0 TOTAL QUALITY MANAGEMENT** **4**

6.1 Concepts and definitions

6.2 Sages of quality gurus and their contributions

6.3 Basic tools of TQM

**SUGGESTED LEARNING RESOURCES:**

**REFERENCE BOOKS**


1. Principles of management, by: T.Ramasamy (Himalya publishing house)
2. Management by: S. P. Robins
3. Management principles by: Anil Bhat and Arya Kumar
4. Principles and practice of management by LM Prasad
5. Principles of management by LM Prasad
6. Essentials of Management / Joseph L. Massie / Prentice-Hall of India

## ORGANIZATIONAL BEHAVIOUR

| L | T | P | | |
|---|---|---|---|---|
| 3 | 0 | 0 | | **Curri. Ref. No.: G 306** |
| **Total Contact hrs.: 45** | | | **Total marks: 100** | **Theory:** |
| Theory: 45 | | | | End Term Exam: 70 |
| Tutorial :0 | | | | P.A.: 30 |
| Practical: 0 | | | | |

**Credit: 3**

### RATIONALE

Knowledge in behavioural principles in an organization is an important requirement because concepts such as work motivation, behavioural patterns of individuals as also those of group of individuals etc are intimately related to it. Organizational Behavioural principles, its scopes, applicability etc. are therefore important to know by the students irrespective of the branch of specialization. Based of the above facts following content details of the subject on Organizational Behaviour has been suggested.

### AIM

- Organization
- Motivation
- Developing good work habits
- Organizational culture
- Team building

### DETAIL COURSE CONTENT

| UNIT | TOPIC / SUB-TOPIC | Lecture Hrs. |
|---|---|---|
| **1.0** | **ORGANIZATION:** | **8** |
| | 1.1 Concept and Definition | |
| | 1.2 Structures (line, staff, functional divisional, matrix) | |
| **2.0** | **MOTIVATION :** | **10** |
| | 2.1 Principles of Motivation | |
| | 2.2 Aspects of Motivation | |
| | 2.3 Job motivation | |
| | 2.4 Theories of motivation (Maslow, Herzberg, Theory of X&Y of Mc. Gregar) | |
| **3.0** | **DEVELOPING GOOD WORK HABITS:** | **10** |
| | 3.1 Principles of habit formation | |

3.2 Attitude and values

3.3 Personality-

- Concepts
- Theories
- Personality and Behaviour

**4.0 ORGANIZATIONAL CULTURE: 8**

4.1 Concepts and its importance

4.2 Determinants of organizational culture

4.3 Rules & regulations

**5.0 TEAM BUILDING: 9**

5.1 Concepts Team and Group

5.2 Formation of Team building

**SUGGESTED LEARNING RESOURCES:**

**REFERENCE BOOKS**


1. Organisational Behaviour - An introductory Text by Huezynski A. & Bucheman C. (Prentice Hall of India)
2. Image of Organisation by Morgan G. (Sage)
3. Understanding Management by Linstoand S. (Sage)
4. Organizational Behaviour bu Robbins (Prentice Hall of India)
5. Understanding and Managing by Organizational Behavior — George & Jones
6. Organisational Behaviour by L.M. PRASAD, New Delhi, Sultan Chand & Sons
7. Essentials of Management by Koontz, Tata McGraw Hill

# ENVIRONMENTAL EDUCATION

| L | T | P | *Curri. Ref. No. G 307* |
|---|---|---|---|
| 3 | 0 | 0 | |

***Total Contact hrs.: 45***
Theory: 45

Tutorial : 0

Practical : 0

***Credit: 3***

***Total marks: 100***

**Theory:**

End Term Exam: 70

P.A.: 30

## RATIONALE

Management of Environmental Degradation as also its control using innovative technologies is of prime importance in the times we are living in. Since the days of the famed Rio Summit (1992) awareness about degradation of environment we live in an its management through participation of one and all has literally blossomed into a full fledged movement of universal importance. Technically qualified people, such as the Diploma Engineers, should not only be aware about new technologies to combat environmental degradation at their disposal but also various aspects of environment, ecology, bio-diversity, management, and legislation so that they can perform their jobs with a wider perspective and informed citizens. This course can be taken by all diploma students irrespective of their specializations.

## AIM

- Introduction
- Ecological aspects of environment
- Natural resources
- Global environmental issues
- Environmental pollution
- Clean technology
- Environmental legislation
- Environmental impact assessment

## DETAILED COURSE CONTENT

| UNIT | TOPIC / SUB-TOPIC | Lecture Hrs. |
|---|---|---|
| **1.0** | **INTRODUCTION** | **2** |
| | 1.1 Introduction | |
| | 1.2 Environment and its components | |
| | 1.3 Environment in India | |
| | 1.4 Public Awareness | |

**2.0 ECOLOGICAL ASPECTS OF ENVIRONMENT** **8**

2.1 Ecology

- Eco-system
- Factors affecting Eco-system

2.2 Bio-geochemical cycles

- Hydrological cycle
- Carbon cycle
- Oxygen cycle
- Nitrogen cycle
- Phosphorous cycle
- Sulphur cycle

2.3 Bio-diversity

2.4 Bio-diversity Index

**3.0 NATURAL RESOURCES** **5**

3.1 Definition of Natural Resources

3.2 Types of Natural Resources

3.3 Quality of life

3.4 Population & Environment

3.5 Water Resources

- Sources of Water

3.6 Water Demand

3.7 Forest as Natural Resource

- Forest and Environment
- Deforestation
- Afforestation
- Forest Conservation, its methods

3.8 Land

- Uses and abuses of waste and wet land

**4.0 GLOBAL ENVIRONMENTAL ISSUES** **9**

4.1 Introduction

4.2 Major Global Environmental Problems

4.3 Acid Rain

- Effects of Acid Rain

4.4 Depletion of Ozone Layer

- Effects of Ozone Layer Depletion

4.5 Measures against Global Warming

4.6 Green House Effect

**5.0 ENVIRONMENTAL POLLUTION 9**

5.1 Introduction

5.2 Water Pollution

- Characteristics of domestic waste water
- Principles of water treatment
- Water treatment plant (for few industries only- unit operations & unit processes - names only)

5.3 Air Pollution

- Types of air pollutants
- Sources of Air Pollution
- Effects of Air Pollutants

5.4 Noise Pollution

- Places of noise pollution
- Effect of noise pollution

**6.0 CLEAN TECHNOLOGY 6**

6.1 Introduction to Clean Technologies

6.2 Types of Energy Sources

- Conventional Energy sources
- Non-conventional sources of Energy

6.3 Types of Pesticides

6.4 Integrated Pest Management

**7.0 ENVIRONMENTAL LEGISLATION 3**

7.1 Introduction to Environmental Legislation

7.2 Introduction to Environmental Laws

**8.0 ENVIRONMENTAL IMPACT ASSESSMENT 3**

8.1 Introduction to Environmental Impact Assessment

8.2 Environmental Management (elements of ISO 14001)

8.3 Environmental ethics

**SUGGESTED IMPLEMENTATION STRATEGIES:**

The teachers are expected to teach the students as per the prescribed subject content. This subject does not have any practical but will have only demonstration and field visit as stated. The students will have to prepare report of the site visit.

**REFERENCE BOOKS**


1. Environmental Engineering by Pandya & Carny, Tata McGraw Hill, New Delhi
2. Introduction to Environmental Engineering and Science by Gilbert M. Masters Tata McGraw Hill, New Delhi
3. Waste Water Engineering – Treatment, Disposal & Reuse by Metcalf & Eddy Tata McGraw Hill, New Delhi
4. Environmental Engineering by Peavy, TMH International New York
5. Environmental Science by Aluwalia & Malhotra, Ane Books Pvt. Ltd, New Delhi
6. Text Book of Environment & Ecology by Sing, Sing & Malaviya, Acme Learning, New Delhi
7. Environmental Science & Ethics by Sing, Malaviya & Sing, Acme Learning, New Delhi
8. Environmental Chemistry by Samir K. Banerji, Prentice Hall of India, New Delhi
9. Study / training materials, references, reports etc. developed by Central Pollution Control Board, New Delhi as well as State Pollution Control Boards


(b) Others:

1. Text book mentioned in the references
2. Lab Manuals
3. OHP Transparencies
4. Video film on Environment

**SUGGESTED LIST OF DEMONSTRATIONS/FIELD VISIT**

- pH value of water sample.
- Hardness of water
- Calcium hardness
- Total Hardness
- Residual Chlorine to a given sample of water
- Turbidity
- B.O.D.
- C.O.D.

**Visits: Following visits shall be arranged by the teachers during the semester:**

- Water Treatment Plant
- Sewage Treatment Plant
- Maintenance work of water supply mains and sewage system

# BASIC TECHNOLOGY COURSES

# THERMAL ENGINEERING – I

| L | T | P | Curri. Ref. No.: ME401 |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.: 45** **Total marks: 100**
Theory: 45
Practical: 0

**Theory:**
End Term Exam: 70

P.A.: 30

***Total Credit: 3***

## RATIONALE

Amount of useful energy produced and spent is the most important factor by which a country's technical advancement is measured. Useful mechanical and electrical energy is produced from heat energy. It is of paramount importance to an engineer to know the basic principles by which heat energy can be converted into mechanical energy, which in turn can be converted into electrical energy.

Thermodynamics is the field of applied science which deals with the energy possessed by heated gases and vapours and the laws which govern the conversion of this energy into mechanical energy and vice versa. This is the fundamental subject for understanding the process of producing vast amount of mechanical energy from heat energy and therefore necessary to be learned by the engineering students. Understanding the working principles and features of the various machines and plants in which either such heated gas/vapours are produced or conversion of heat to mechanical energy takes place is of great importance.

## AIM

To have a clear understanding of the subject "Thermodynamics" and its importance for mechanical engineers. Students should know and understand the physical significance of first law and second law of thermodynamics. They should also learn about the thermodynamic properties of gases and steam which acts as the thermodynamic medium and how heat energy contained in the medium is converted to mechanical energy by passing through cyclic thermodynamic processes. Students will also learn the properties of steam, how steam is produced commercially in a boiler.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **INTRODUCTION :** | | **2** |

Importance of conversion of heat energy into mechanical energy and electrical energy; definition of Thermodynamics; concept of heat engines.

- Explain importance of study of Thermodynamics
  Give examples from every day life where heat energy is converted into mechanical energy and vice-versa.
- State the function of a heat engine.

## 2.0 FUNDAMENTALS OF THERMODYNAMICS : 6

2.1 Definition and understanding of terms:

Energy, work, power, law of conservation of energy, heat, units of heat, temperature, absolute temperature, pressure, absolute and gauge pressure, specific heat.

2.2 Thermodynamic system; closed, open and isolated systems; system boundary; properties of a thermodynamic system; concept of work and heat energy transfer to and from a system.

State relationship between: work and power, Centigrade and Fahrenheit scale of temperature, work and heat energy.

Distinguish between absolute pressure and gauge pressure.

- Understand a thermodynamic system
  Differentiate between a closed, open and isolated system.

## 3.0 PROPERTIES OF GASES 6

3.1 Gas as the working substance in a thermodynamic system; definition of gas and perfect (or ideal) gas; laws of perfect gases—Boyle's law, Charles's law and Gay-Lussac law with corresponding gas equations ; characteristic gas equation pv = mRT; problems.

3.2 Specific heat of gas; specific heat at constant volume and at constant pressure; work done by gas during expansion; internal energy; relation between two specific heats ($C_p - C_v = R/J$; $Cp/Cv = 1 + R/JCv$); simple problems.

- Define an ideal (or perfect) gas
- State three laws of perfect gases
- Write mathematical expression for the three gas laws
- Deduce characteristic equation of gas from the gas laws.
- Solve problems on gas laws
- Explain why Cp>Cv
- Prove Cp-Cv = R/J and Cp/Cv = 1 + R/JCv
- Solve problems on specific heats of gas.

## 4.0 LAWS OF THERMODYNAMICS 3

Thermal equilibrium; statement of Zeroth law; first law of thermodynamics; mechanical equivalent of heat; non flow energy equation (heat added = work done + rise in internal energy); second law of thermodynamics-statements; physical significance of second law.

Understand meaning of first and second law of thermodynamics.

- Justify that second law does not contradict first law.

## 5.0 THERMODYNAMIC PROCESSES OF PERFECT GASES: 6

5.1 Definition of thermodynamic (or non-flow) process; P - V diagram; constant volume, constant pressure, isothermal, adiabatic, polytropic and throttling processes.

5.2 Representing above processes in p-v diagram; estimation of pressure, volume, temperature, heat absorbed, work done, change of internal energy during above thermodynamic processes; simple problems.

- Understand on meaning of thermodynamic process
  Draw p-v diagrams for different thermodynamic processes
- Deduce formulae for work done by gas in
  (i) Constant pressure, (ii) isothermal and

  (iii) adiabatic expansion.
- Solve simple problems on thermodynamic processes.

## 6.0 ENTROPY OF GASES: 3

Concept of entropy; relation between heat and entropy; T-S diagram; change of entropy during different thermodynamic process (final expressions only, deduction not required) and their representation on T-S diagram.

- Write the mathematical expression for change of entropy
- Draw T-S diagram of various thermodynamic processes.

## 7.0 THERMODYNAMIC AIR CYCLES: 6

Definition of thermodynamic cycle; representation of a cycle in P-V diagram; work done in the cycle; reversible and irreversible cycle; working of an ideal engine; efficiency of a cycle; Carnot cycle in P-V and T-S diagram; expressions for work done and efficiency; simple problems on air cycles.

- Explain thermodynamic cycle
  Represent a cycle in the p-v diagram and identify the work done per cycle

  Draw a Carnot cycle in T-S diagram and work out their efficiency
- Solve problems on air cycles.

## 8.0 PROPERTIES OF STEAM: 6

8.1 Difference between gas and vapour; saturation temperature and pressure; sensible heat; latent heat; total heat; dryness fraction.

8.2 Wet steam; dry saturated steam; superheated steam; degree of superheat

8.3 Use of steam table; Mollier's diagram; calculation of total heat; specific volume and internal energy of steam; solve problems.

Understand the terms : sensible heat, latent heat, total heat; dryness and wetness fraction.

- Use steam table and solve problems.

9.0 **STEAM BOILER:** **7**

9.1 Function of steam boiler; fire tube & water tube boilers; working principle of Cochran, Lancashire, Locomotive, Babcock and Wilcox, Stirling boilers.

9.2 Constructional features and uses of important boiler parts like shell, grate, drum, tubes, furnace, mountings, accessories.

9.3 Fuels; burning equipment; feed water treatment

9.4 Boiler performance; boiler efficiency

Understand the difference between fire tube and water tube boilers.

Explain working principles of various types of boilers with help of sketches

State use and importance of various parts and systems of a boiler.

***Note :*** *Arrangement should be made to show the running of a boiler to the students during tenure of this course or during normal industrial visits.*

**REFERENCE BOOKS**


1. V. P. Vasandani & D. S. Kumar ***Heat Engineering*** Metropolitan Book Co (P) Ltd.
2. R. S. Khurmi ***A text book of Engineering Thermodynamics*** – S. Chand & Co. Ltd.
3. B. K. Sarker ***Thermal Engineering*** TMH
4. P. L. Ballaney ***Thermal Engineering*** Khanna Publishers
5. K. C. Pal ***Heat Power*** Orient Longman
6. P. K. Nag ***Engineering Thermodynamics*** Tata McGraw Hill, New Delhi, 2008
7. R. S. Khurmi & Gupta ***Refrigeration and Air Conditioning***
8. Domkundwar, Kothandarman and Domkundwar ***A Course in Thermal Engineering*** Dhanpat Rai Publishing Company New Delhi
9. Mahesh M. Rathore ***Thermal Engineering*** Tata McGraw Hill Education Private Ltd.
10. R. Rudramoorthy ***Thermal Engineering*** Tata McGraw Hill Published New Delhi, 2003
11. R. K. Rajput ***Thermodynamics*** Laxmi Publications, New Delhi, 2007
12. M. M. Rathore ***Essential Engineering Thermodynamics*** Dhanpat Rai Publishing Co, New Delhi, 2005
13. S. L. Somasundaram ***Thermal Engineering*** New Age International (P) Ltd.
14. J. S. Rajadurai ***Thermodynamics and Thermal Engineering*** New Age (I), New Delhi

# THERMAL ENGINEERING - II

| L | T | P | **Curri. Ref. No: ME 402** |
|---|---|---|---|
| 3 | 0 | 2 | |

**Total Contact hrs.: 75**
Theory: 45
Practical: 30

**Total marks: 150**

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

PA.: 25

**Prerequisite: ME401**
***Total Credit: 4***

## RATIONALE

Amount of useful energy produced and spent is the most important factor by which a country's technical advancement is measured. Useful mechanical and electrical energy is produced from heat energy. It is of paramount importance to an engineer to know the basic principles by which heat energy can be converted into mechanical energy which in turn can be converted into electrical energy.

Thermodynamics is the field of applied science which deals with the energy possessed by heated gases and vapours and the laws which govern the conversion of this energy into mechanical energy and vice versa. This is the fundamental subject for understanding the process of producing vast amount of mechanical energy from heat energy and therefore necessary to be learned by the engineering students. Understanding the working principles and features of the various machines and plants in which either such heated gas/vapours are produced or conversion of heat to mechanical energy takes place is of great importance to a mechanical engineer.

| UNIT | TOPIC / SUB-TOPIC | Periods |
|---|---|---|
| **1.0** | **STEAM ENGINE** | **4** |
| 1.1 | Importance of steam engine in ushering industrial Revolution. | |
| 1.2 | Classification of steam engines; important parts/ Components and their functions. | |
| 1.3 | Working principle of a single cylinder double acting engine. | |
| 1.4 | Indicator diagram; mean effective pressure; diagram factor; indicated horse power; mechanical efficiency and thermal efficiency. | |

**2.0 STEAM TURBINE** **10**

2.1 Function and use of steam turbines

2.2 Working principle; difference between steam engine and steam turbine.

2.3 Classification : impulse and reaction; simple and compound; single and multistage.

2.4 Constructional parts : Shaft (rotor), casing, nozzles, blades, diaphragm, glands.

2.5 Velocity diagram of a turbine – work done on a moving blade, blade efficiency, stage efficiency.

2.6 Simple impulse turbine; analysis of a single stage impulse turbine; maximum efficiency conditions; simple problems.

2.7 Reaction turbine; degree of reaction; maximum efficiency conditions.

2.8 Compounding : velocity compounded, pressure compounded; multistage turbine.

**3.0 STEAM CONDENSER** **6**

3.1 Function of a steam condenser; elements of a condensing plant.

3.2 Classification : jet condensers, surface condensers.

3.3 Condenser vacuum; vacuum efficiency; condenser efficiency; simple problems.

**4.0 INTERNAL COMBUSTION (IC) ENGINE** **10**

4.1 Function and use of IC engines;

4.2 Classification of IC engines; working principle of 2-stroke and 4-stroke cycles IC engines; SI. engine and CI engine; Otto cycle; Diesel cycle.

4.3 Construction of an IC engine - cylinder block, cylinder head, piston, piston ring, connecting rod, crank shaft, crank case, valve mechanism, manifold.

4.3 Accessories : Carburator, ignition system, fuel injection system, cooling system, exhaust system, lubrication system.

4.5 Firing order of multi cylinder engine

4.6 Fuels; additives; knocking; compression ratio; octave rating; cetane rating.

4.7 Governing of S. I. And C.I. engines.

4.8 Super-changing and turbo-changing of IC engine.

**5.0 GAS TURBINE** **8**

5.1 Function and use of gas turbines

5.2 Principle of operation; closed cycle and open cycle; constant pressure and constant volume gas turbine.

5.3 Constructional components : Compressor, combustion chamber, turbine.

**6.0 STEAM POWER PLANT** **7**

Definition; type and size of a power plant; essential equipment of a steam power plant; coal handling system; pulverized coal firing system; ash handling and disposal system; cooling towers; principles and factors of a power plant design; site selection; plant layout.

**NOTE :** Arrangement may be made for the students to make an industrial visit to a power plant.

**7.0 PRACTICAL**

**30**

7.1 Study of C.I. engine and to drawing the valve timing diagram

7.2 Determination of power, efficiency and fuel consumption of a C.I. engine

7.3 Study of a S.I. engine and to draw its valve setting diagram

7.4 Determination of power, efficiency and fuel consumption of a S.I. engine

7.5 Determination of calorific value of an engine fuel by Bomb Calorimeter

7.6 Calculation of fuel consumption and heat balance of an I.C. engine.

7.7 Study of cut section of steam engine, steam turbine, gas turbine.

**REFERENCE BOOKS**


1. V. P. Vasandani & D. S. Kumar ***Heat Engineering*** Metropolitan Book Co (P) Ltd.
2. R. S. Khurmi ***A text book of Engineering Thermodynamics*** – S. Chand & Co. Ltd.
3. B. K. Sarker ***Thermal Engineering*** TMH
4. P. L. Ballaney ***Thermal Engineering*** Khanna Publishers
5. A. S. Sarao ***Thermal Engineering***
6. K. C. Pal ***Heat Power*** Orient Longman
7. P. K. Nag ***Engineering Thermodynamics*** Tata McGraw Hill, New Delhi, 2008
8. A. Basu ***Thermal Engineering***
9. R. S. Khurmi & Gupta ***Refrigeration and Air Conditioning***
10. Manohar Prassad ***Refrigeration and Air Conditioning***
11. Domkundwar, Kothandarman and Domkundwar ***A Course in Thermal Engineering*** Dhanpat Rai Publishing Company New Delhi
12. Mahesh M. Rathore ***Thermal Engineering*** Tata McGraw Hill Education Private Ltd.
13. R. Rudramoorthy ***Thermal Engineering*** Tata McGraw Hill Published New Delhi, 2003
14. R. K. Rajput ***Thermodynamics*** Laxmi Publications, New Delhi, 2007
15. M. M. Rathore ***Essential Engineering Thermodynamics*** Dhanpat Rai Publishing Co, New Delhi, 2005
16. S. L. Somasundaram ***Thermal Engineering*** New Age International (P) Ltd.

# FLUID MECHANICS

| L | T | P | | |
|---|---|---|---|---|
| 3 | 0 | 2 | | |

**Curri Ref. No: ME403**

**Total Contact hrs.:75** **Total marks: 150**

Theory: 45

Practical: 30

**Credit: 4**

**Theory:**

End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A: 25

## RATIONALE

Though in majority of cases we use solids as engineering materials, use or application of fluids (i.e. liquids and gases) in engineering field is also numerous and of great importance.

A number of materials (elements and compounds) are available in fluid forms only, viz. air, water petroleum products, steam, mercury etc. Many metals are extracted from ores by pyrometallurgical process in liquid form only. Water is a liquid and is involved in all spheres of human activity, ranging from daily needs to irrigation, generation of power, water transportation, cooling agent in chemical & metallurgical processes and innumerable other applications. Heat Engines utilise fluid medium for conversion of heat energy to useful mechanical energy or for generation of electrical energy in power plants.

It is, therefore, necessary to study the physical properties and characteristics of fluids as a distinct group of materials, which have very important use and application in a wide range of fields of engineering and in mechanical engineering in particular.

## AIM

To understand the properties and characteristics of fluids (mainly liquid) particularly in relation to handling and using fluids in engineering fields, like : physical properties of a liquid, pressure exerted by a liquid, property of buoyancy, energy of flowing fluid, characteristics of fluid flow in a pipe or open channel and measurement of flow of liquid.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

### 1.0 FLUID AND PROPERTIES OF FLUID 3

Definition and classification of fluid; definition of fluid mechanics and hydraulics; specific weight; density; compressibility; viscosity; surface tension.

- Define fluid, liquid, fluid mechanics, hydraulics.

Express relationship between specific weight and density.

Demonstrate by simple experiments viscosity and surface tension of a liquid.

## 2.0 PRESSURE AND ITS MESUREMENT 8

2.1 Intensity of pressure; pressure head; Pascal's Law; hydraulic press; atmospheric pressure; barometer; absolute pressure and gauge pressure; pressure measuring devices; manometer; pressure gauges bourdon tube and diaphragm type.

2.2 Total pressure on plane and curved surface one face of which is submerged in liquid; centre of pressure.

- Define pressure head at a point in a liquid
  State in which machines Pascal's law is utilized to multiply forces
- Measure atmospheric pressure using a barometer
- Solve simple problems of pressure measurements by using manometer.

Draw and explain working principle of a bourdon tube pressure gauge.

- Define total pressure (hydrostatic force)
- Calculate total pressure in a vertical surface
- Solve problems on total pressure on surfaces
- Deduce the expression for centre of pressure
- Solve simple problems involving centre of pressure

## 3.0 EQUILIBRIUM OF FLOATING BODIES 8

Archimedes' principle; buoyancy and principle of floatation; hydrometer for measurement of specific weight of liquids; centre of buoyancy and metacentre; conditions of equilibrium of floating bodies; determination of metacentric height (analytical method).

- Understand Archimedes' principle
- State a few practical applications of Archimedes' principle
- Define buoyancy
  Show relationship between Archimedes' principle and principle of floatation
- Demonstrate use of a hydrometer

State the conditions of equilibrium of a floating body and corresponding relationship of CG and metacentre of the body.

- Solve problems of floating bodies

Solve simple problems concerning metacentre of Floating Bodies.

## 4.0 FLOW OF FLUID 8

Definition of hydrokinematics and hydrodynamics; types of fluid flow : steady and unsteady, uniform and non-uniform, laminar and turbulant; rate of flow and their units; continuity equation of flow; potential energy of a flowing liquid; total head; Bernoulli's theorem (statement and proof)

- Define hydrokinematics and hydrodynamics
- State different types of fluid flow

- Solve problems on rate of liquid flow
- Write expressions for different heads of fluid flow
- Prove Bernoulli's theorem
- Solve simple problems on Bernoulli's equation

**5.0 FLOW THROUGH PIPES** **10**

5.1 Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Dancy's equation of head loss; Reynold's number and its effect on pipe friction; syphons;

- Define hydraulic gradient

Solve simple problems of pipe losses using Chezy's and Darcy's equation.

- Define Reynold's number
- Identify practical uses of syphon.

5.2 Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings.

- Deduce expression of head loss for each of the cases
- Solve problems.

**6.0 OPEN CHANNEL FLOW** **4**

Definition of open channel; Chezy's formula; definition and classification of weirs; co-efficient of discharge; flow over rectangular notch and triangular notch.
Identify a few cases of open channel flow in everyday life.
Deduce formulae for flow over rectangular and triangular notch

- Solve simple problems of open channel flow

**7.0 FLOW MEASUREMENT** **4**

Working principle and use of venturimeter, orificemeter, pitot tube, rectangular weir and triangular weir (V-notch).
Draw and explain working principle of different flow measuring devices.

- Solve simple problems of flow measurement.

**8.0 PRACTICAL** **30**

8.1 To determine specific gravity of different liquids

(like kerosine, mobile oil, aqueous solution of HCL, water) by use of an hydrometer.

8.2 Measurement of Buoyancy

8.2.1 Prove Archimede's Principle by using a balance
8.2.2 Determine volume of an odd shaped object

8.3 Measurement of Pressure and Velocity

8.3.1 Calculate atmospheric pressure using a barometer

8.3.2 Show that pressure head of a liquid increases linearly with depth using (i) piezometric tube, (ii) double column manometer and (iii) differential manometer.

8.3.3 Calibrate a pressure gauge by using different columns of water contained in a flexible PE tube.

8.3.4 To determine the velocity distribution in a pipeline and calculate average velocity using a pitot tube.

8.4 Verify Bernouli's theorem

8.5 Determine Darcy's friction factor "f " in pipe flow from

the formula $h_f = f\,(L/D)\,V^2/2g$

8.6 Find out the co-efficient of discharge for a

(i) Rectangular notch

(ii) V-notch

8.7 Flow Measuring Devices

8.7.1 Find out the co-efficient of a venturimeter (i.e. calibrate a venturimeter)

8.7.2 Find out the value of the co-efficient of discharge for an orifice meter

**REFERENCE BOOKS**


1. Modi & Seth ***Hydraulics & Hydraulic Machines*** Standard Book.
2. A. K. Jain ***Fluid Mechanics*** Khanna Publishers.
3. Jagadish Lal ***Hydraulics and Fluid Mechanics*** Metropolitan Book
4. B. Majumdar ***Fluid Mechanics with Laboratory Manual*** PHI Learning Private Limited
5. R. S. Khurmi ***Fluid Mechanics***
6. Ramamartham ***Fluid Mechanics & Hydraulic Machines***
7. NPTEL Lecture material on Fluid Mechanics

# MANUFACTURING PROCESS - I

| L | T | P | Curri. Ref. No: ME404 |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.:45** **Total marks: 100** **Theory:**

Theory: 45

Practical: 0

End Term Exam: 70

P.A.: 30

**Credit: 3**

## RATIONALE

Manufacturing is the backbone of any industrial nation. The level of manufacturing activity is directly related to the economic health of a country. Generally, the higher the level of manufacturing activity in a country, the higher is the standard of living of is people. Manufacturing is generally a complex activity, involving people who have a broad range of disciplines and skills and a wide variety of machinery, equipment, and tooling with various levels of automation, including computers, robots, and material handling equipment.

## AIM

To develop basic concepts of different manufacturing processes mechanical properties of metals and alloys, manufacturing iron and steel, carbon steels, ally steels, non ferrous alloys, and working principles of heat treatment of steels and castings.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **INTRODUCTION TO MANUFACTURING PROCESS** | | **1** |

A brief history of Manufacturing processes, Different types of Manufacturing processes, Functions of manufacturing process, Factors influencing in selection of manufacturing process, State the factors for selection of manufacturing processes.

**2.0 MECHANICAL PROPERTIES OF METAL AND ALLOYS 1**

Importance mechanical properties in manufacturing, Hardness, Toughness, Ductility, yield strength etc., define Hardness, Toughness, Ductility etc.

**3.0 MANUFACTURING OF IRON AND STEEL 1**

Blast furnace operation, Production of Pig iron, Cast iron and wrought iron.

- Distinguish between Pig iron, Cast iron
- State the sequence of Blast furnace operation

**4.0 CARBON STEELS** **3**

Composition and their relative importance in manufacturing, composition of dead mild steel, low, medium high carbon steel and their respective properties, specific use of mild steel, medium carbon and high carbon steel, standard designation as per Indian Standard.

- State the composition of different types of carbon steel
  Identify the user of mild steel, medium carbon and high carbon steel

  Represent the designation of carbon steel as per Indian Standard.

**5.0 ALLOY STEELS** **3**

Different kind of alloy steels and their elements and Impurities, Properties developed or influenced by alloying elements and effects of different alloying elements, specific use of alloy steels, method of designating alloy steels

- List some of the alloy steel with their compositions
- State the method of designating alloy steels

**6.0 NON FERROUS ALLOYS** **6**

6.1 Common types of non-ferrous alloys

Muntz metal, Babbit metal, Phosphor Bronze, Gun metal, German Silver and Aluminum Bronze, Properties and uses of alloys.

List some of the non-ferrous alloys, with their composite

- Identify the factor influences on the properties of alloys.

6.2 Bearing metal

Composition and their desirable qualities, White metal, Copper bare alloys and aluminum alloys, Properties and their specific uses.

- List some of the bearing metal with their composition.
- Identify factors influences on the properties of alloys

**7.0 METALLURGY AND MANUFACTURING** **10**

7.1 Introduction to Metallurgy

Definition, importance of Metallurgy in manufacturing.

State the relevance of microstructure of metal in Manufacturing.

7.2 Microstructure of Metals

- Crystalline structure and grain formation.
  Pearlite, Ferrite, Cementite, Ledeburite and their specific properties.

Micro structure of wrought Iron, Grey Cast Iron, Carbon Steels and White Cast Iron.

- Define microstructure of metals
- Explain different types of microstructure of metals

7.3 Equilibrium diagram (E.D.) of alloys

- Definition
- Importance of E.D. in Manufacturing
- The Iron carbon phase diagram
- Phase diagrams for Eutectic journey Alloys
- Phase diagram for Paratactic Transformation
- Define phase diagram of an alloy
  Explain the importance of phase diagram in manufacturing.

7.4 Transformation of Austenite

- Isothermal Cooling
- Isothermal decomposition of Austenite
- Define isothermal cooling
  Explain the importance of irothermal cooling in manufacturing

## 8. HEAT TREATMENT OF STEEL 10

8.1 Introduction

- Definition
- Importance related to Manufacturing
- Examples of heat treated parts
- Define Heat Treatment of Steel
  Explain the important Heat Treatment Process In Manufacturing.

8.2 Different heat treatment processes of carbon steel

Annealing: Types, Methods and specific use. Description of the process with the help of phase diagram.

Normalising : Methods and specific use. Description of the process with the help of phase diagram.

Hardening : Methods and specific use. Description of the process with the help of phase diagram.

Tempering : Methods and specific use. Description of the process with the help of phase diagram.

Define Annealing, Normalizing, Hardening and Tempering.

Describe Annealing, Normalizing, Hardness and Tempering with their specific use.

8.3 Case hardening process

- Carburising - Principle, purpose and uses.
- Nitriding - Principle, purpose and uses.
- Cyaniding - Principle, purpose and uses.
- Define carburising, nitriding and cyanidia
  Describe carburising, Nitridising, and cyarriding With their specific use.

8.4 Surface hardening process

- Flame hardening - Principle, purpose and uses.
- Induction hardening - Principle, purpose and uses.
- State different types of surface hardening processes
  Describe Flame Hardening, Induction Hardening with specific use.

**9.0 CASTING 10**

Specific use

9.1 Melting of metal and types of furnaces
9.2 Casting processes – Sand casting, Pressure Die Casting,Centrifugal casting etc.
9.3 Fettling and Cleaning of Casting.
9.4 Defects in casting and their remedies.
9.4.1 Non Destructive Testing
Visual, Sound, Ultra Sound, X-ray, Magnetization, and Liquid penetration.

9.5 Safety precautions required in casting.

- State specific use of casting
- State the different procedural steps in casting
- Identify the defects in casting

**REFERENCE BOOKS**


1. R. K. Jain ***Manufacturing Process.***
2. L. Doyle ***Manufacturing Process and Materials for Engineers.***
3. H. V. Johnson ***Manufacturing Process.***
4. B. H. Amstead, Phillipe. F. Ostwald & Myron L. Begeman ***Manufacturing Process*** John Wiley & Sons.
5. J. S. Campbell ***Principles of Manufacturing Materials and Processes*** Tata Mc.Graw Hill Publishing Company.
6. George E. Dieter ***Mechanical Metallurgy*** Mc. Graw - Hill International Book Company.
7. Donal S. Clark and Wilbur R. ***Varney Physical Metallurgy for Engineers***

   - Affiliated East – West Press Private Limited.
8. B. S. Raghuwanshi ***A Course in Workshop Technology Vol. I and II***

   - Dhanpat Rai & Sons.
9. John A. Schey **Introduction to Manufacturing Process**

   Mc. Graw Hill Book Company.
10. P. N. Rao ***Manufacturing Technology : Foundry, Forming and Welding***

    - Tata Mc. Graw - Hill Publishing Company Limited.
11. Serope Kalpakjan ***Manufacturing Engineering and Technology***

    - Addison Wesley Publishing Company.

# MANUFACTURING PROCESSES - II

| L | T | P | Curri. Ref. No: ME405 |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.: 45** **Total marks: 100** **Theory:**
Theory: 45 End Term Exam: 70
Practical: 0 I.A.: 30

**Prerequisite: ME404**
***Total Credit: 3***

## RATIONALE

Manufacturing is the backbone of any industrial nation. The level of manufacturing activity is directly related to the economic health of a country. Generally, the higher the level of manufacturing activity in a country, the higher is the standard of living of is people. Manufacturing is generally a complex activity, involving people who have a broad range of disciplines and skills and a wide variety of machinery, equipment, and tooling with various levels of automation, including computers, robots, and material handling equipment.

## AIM

To develop basic concepts and working principles of different fabrication processes, welding, forging and non conventional machining

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

**1.0 GENERAL INTRODUCTION** **1**

Examples of Manufactured products, selection of Manufacturing Processes, selection of materials.

**2.0 INTRODUCTION TO FABRICATION PROCESSES** **2**

2.1 Mechanical joining : Bolts, screws and Rivets
2.2 Adhesive bonding : Epoxy resins
2.3 Welding, brazing and soldering
Identify the factors that affects the choosing of a particular method of fabrication.

**3.0 BRAZING, BRAZE WELDING AND SOLDERING** **4**

3.1 Brazing – Process description specification of equipment

Definition, fluxes used in brazing, properties of filler metal.

- State the difference between brazing and welding

- Identify the filler materials used in brazing
- Explain silver brazing.

3.2 Braze welding

Definition, necessity, design of joint

- Compare blaze and braze welding
- Define braze welding

3.3 Soldering -– Process description specification of equipment

Definition, joint design, types of fluxes, filler metals.

- State the typical applications of soldering
- Distinguish between brazing and soldering

3.4 Safety precaution

4.0 GAS WELDING AND CUTTING **4**

4.1 Types of Gas welding, oxy-acetylene welding, principle of operation, process, and equipment, flame types and safety with specification

- State the operation sequence of oxy-acetylene Processes.

State different types of applications of oxy-acetylene welding.

4.2 Flame cutting

Operation, equipment, safety, techniques.

- List the different types of cutting processes
- List the conditions that affect the quality of the cut.

**5.0 ELECTRICITY AND WELDING** **4**

Principle, arc welding equipment, electrodes,

5.1 Manual metal arc welding
5.2 Carbon arc welding
5.3 Tungsten inert gas welding
5.4 Submerged arc welding

Distinguish between arc and gas welding processes from the point of view of heat concentration, temperature, care of operation and running cost.

Explain reasons for choosing TIG for welding aluminium.

State the parameters that control the weld quality in manual metal arc welding

5.5 Testing of welded joints
5.6 Quality control
5.7 Safety practice

## 6.0 FORGING AND OTHER MECHANICAL WORKS 8

Introduction to metal working processes, nature of plastic deformation, hot working and cold working.

6.1 Rolling

Principle, rolling stand arrangement, roll passes, breakdown passes, roll pass sequences.

Distinguish between cold rolling and hot rolling in terms of process and product.

- Explain the principle of rolling with a new sketch

6.2 Forging

Forging operation, smith forging, drop forging, press forging machine forging, forging design, drop forging die design.

Distinguish between open and closed die forging processes

- List the advantages of forging of metals
- Explain the operations that are normally employed in forging.
- Safety practice

## 7.0 NON-CONVENTIONAL MACHINING 8

Basic processes, applications, advantages and disadvantages and economics of the following process:
Chemical Machining, Electrochemical Machining, Electro Discharge Machining (EDM), Laser Beam Machining, Electron Beam Machining, Water Jet Machining, Abrasive Jet Machining.

- List the reasons for development of unconventional machining processes.
- Explain the difference between chemical and electrochemical machining
- Explain how EDM is capable of producing complex shapes.

## 8.0 PLASTICS AND THEIR PROCESSING 7

8.1 Introduction, types of plastics

8.2 Types of plastic, plastic processing, moulding, reinforcing Thermoforming, casting, laminating and formed plastics, fastening and machining plastic.

- State the raw materials for processing plastic into products
- List several products that can be made by thermoforming
- Describe advantages of cold forming of plastics over other processing methods.

## 9.0 ADVANCED MANUFACTURING TECHNOLOGIES 7

Basic concepts about the following

9.1 Industrial computerization and automation
9.2 Group Technology and flexible manufacturing systems
9.3 CAD / CAM / CIM

9.3 Robotics
- Sate the reasons for industrial automation
- Define a robot.

**REFERENCE BOOKS**


1. R. K. Jain ***Manufacturing Process***.
2. L. Doyle ***Manufacturing Process and Materials for Engineers***.
3. H. V. Johnson ***Manufacturing Process***.
4. B. H. Amstead, Phillipe. F. Ostwald & Myron L. Begeman Manufacturing ***Process*** John Wiley & Sons.
5. J. S. Campbell ***Principles of Manufacturing Materials and Processes*** Tata Mc. Graw – Hill Publishing Company.
6. George E. Dieter ***Mechanical Metallurgy*** Mc. Graw - Hill International Book Company.
7. Donal S. Clark and Wilbur R. Varney ***Physical Metallurgy for Engineers*** Affiliated East – West Press Private Limited.
8. B. S. Raghuwanshi ***A Course in Workshop Technology Vol. I and II*** Dhanpat Rai & Sons.
9. John A. Schey ***Introduction to Manufacturing Process*** Mc. Graw – Hill Book Company.
10. P. N. Rao ***Manufacturing Technology : Foundry, Forming and Welding*** Tata Mc. Graw - Hill Publishing Company Limited.
11. Serope Kalpakjan ***Manufacturing Engineering and Technology*** Addison Wesley Publishing Company.

# THEORY OF MACHINES

| L | T | P | | |
|---|---|---|---|---|
| 3 | 0 | 0 | | **Curri. Ref.No: ME406** |
| **Total Contact hrs.:45** Theory: 45 | | | **Total marks: 100** | **Theory:** End Term Exam: 70 |
| Practical: 0 | | | | P.A.: 30 |
| **Pre requisite: G206A** Credit: 3 | | | | |

## RATIONALE

Mechanical Engineering is primarily related with design, manufacture & use of various types of machines which receives input energy in some available form and convents if to do a particular kind of useful work at the output. Each machine consists of a large number of static parts and connected moving parts or subassemblies called mechanisms. There exists a large number of different kinds of mechanisms. Each of these mechanisms can generate a particular type of output motion with some other kind of input motion. Theory of Machines is basically study of such different types of mechanisms. Any machine utilizes one or many such mechanisms to obtain desired kind of motions in different parts of that machine. It is, therefore, necessary to study and understand functions of different types of mechanisms for design, manufacture and use of various machines.

## AIM

To study and understand different types of mechanisms with respect to their functions, functional relationship between different components, relationship between the input and output motions and their design features.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

### 1.0 MECHANISM 6

Definition of machine, mechanism and kinematics; types of motions; link; kinematic pair; kinematic chain; inversion; four-bar linkage; slider crank mechanism; crank and slotted lever quick return mechanism.

- Understand meaning of the terms – machine, mechanism and kinematics
- Identify with examples various types of motions of a part of a machine
- Define a link
- Show examples of kinematic pairs from everyday used equipment / machines.
- Demonstrate graphically that a three pin-jointed links is a rigid frame.
- Draw and determine motions of the joints of a 4 bar linkage.
- Deduce the expression for time ratio of cutting stroke to return stroke of a quick return mechanism.

## 2.0 BELT, ROPE AND CHAIN DRIVE 9

2.1 Flat belt & pulley drive; velocity ratio; effect of belt thickness and slip on velocity ratio; length of belt for open or crossed belt condition; power transmission by belt drive; belt material and safe strength; belt creep and tensioning; idler pulley; belts connecting non parallel shafts; applications.

2.2 V-belts and pulleys – advantages and disadvantages; specification of a V-belt; applications.

2.3 Use of wire-ropes; construction of wire ropes.

2.4 Chain & sprocket drive; advantage and specific uses of chain drives; constructional features of roller chain and sprocket; simplex and duplex chain & sprocket; applications.

- Compare advantages and disadvantages of use of flat belt, V-belt and chain drives.
- Express velocity ratio considering belt thickness as well as slip.
- Calculate length of belt for an open belt drive
  Explain the limitations of driving non-parallel shafts by a flat belt.

- Specify a V-belt.
- State specific use of wire ropes
- Explain how chain tensioning is achieved
- Solve simple problems.

## 3.0 GEAR DRIVE 12

Toothed wheel classifications of gears with respect to relative disposition of their axes (spur, helical, herringbone, rack & pinion, bevel, worm & wheel) leading terms and definitions pertaining to a gear tooth; velocity ratio and centre distance for simple or compound gear trains; epicyclic gear train; concept of gear box; selection of a gear box from manufacturers' catalogue; applications.

- Identify different types of gears
- Select different types of gears depending on relative disposition of gear axes
- Draw a gear tooth and label the various leading terms (addendum, dedendum, pcd., circular pitch, tooth thickness, face with, whole depth etc.)
- Calculate velocity ratio and centre distance of a gear train.
- Deduce the expression for velocity ratio of an epicyclic gear train
- Select suitable gear box from manufacturer's catalogue.

## 4.0 FLYWHEEL AND GOVERNOR 4

4.1 Fluctuation of turning moment and energy of a prime-mover; function of a flywheel; calculation of size of a flywheel; simple problems; hoop stress in a rotating flywheel.

4.2 Functions of a governor; Watts, Porter and Hartnell governors – description and functions.

- Explain the function of a flywheel
- Deduce the expression for moment of Inertia of a fly wheel in terms of maximum fluctuation of energy and speed.
- Deduce the expression of hoof stress in a rotating flywheel.

- Solve simple problems
- Understand functions of a governor

## 5.0 BALANCING 3

Effect of imbalance in a rotary shaft; static balancing and dynamic balancing; balancing of one or several revolving masses in a shaft.

- Explain effects of imbalance in a rotating body
- Differentiate between static and dynamic balancing
  Understand method of balancing several masses revolving in different planes

- Solve simple problems of balancing.

## 6.0 CAMS 5

Types of cams and cam followers; time displacement diagram for follower motion; drawing a rotating cam profile from a given displacement diagram for knife edge, flat and roller type follower; applications.

- Understand function of a cam and cam follower
- List different types of cams and cam followers
- Identify working of cams in different machines
- Design a plate cam to displace a roller cam-follower as per a given time-displacement diagram for the follower motion. Effect cam profile correction for the roller follower.

## 7.0 BRAKES, CLUTCHES AND DYNAMOMETER 6

7.1 Functions of brakes; types – block or shoe, band; calculation of braking torque; simple problems; brake shoe materials; applications.

7.2 Function of clutches; types – friction (plate, conical), toothed; estimation of friction torque (formula only no derivation); applications.

7.3 Function of dynamometers; absorption dynamometers: pony brake & rope brake type

- Explain functions of a brake, clutch and dynamometer
- Differentiate between the functions of a brake and a clutch
  List possible reasons for non functioning of a brake or a clutch and remedies thereof.
- Identify shortcomings of a pony brake dynamometer.

**REFERENCE BOOKS**


1. Thomas Bevan ***The Theory of Machines*** CBS Publishers & Distributors
2. A. Shariff and N. A. Shariff ***Theory of Machines*** Dhanpat Rai & Sons
3. Jagdish Lal ***Theory of Machines and Mechanism***
4. P. L. Ballany ***Theory of Machines*** Khanna Publishers.
5. J. S. Rao, R. V. Dukkipatti ***Mechanism and Machine Theory***
6. Dr. R. K. Bansal ***A Text Book of Theory of Machines***

## MECHANICAL DRAWING

| L | T | P | Curri. Ref. No: ME407 |
|---|---|---|---|
| 0 | 0 | 4 | |

**Total Contact hrs.: 60** **Total marks: 50** **Practical:**

Theory: 0

Practical: 60

End Term Exam: 25

P.A: 25

**Credit: 2**

### RATIONALE

For learning and practicing mechanical engineering use of mechanical drawing is most essential. With the advent of computers, knowledge of Computer-Aided Drawing making has become a must in industries. Thus knowledge and practice of mechanical engineering in the CAD environment is a must for a mechanical engineer.

### AIM

Students will be able to understand and produce drawings of various mechanical components and devices and should be conversant with CAD operation.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

**1.0 INTRODUCTION** **6**

1.1 Specification of Standard Mechanical Components

a) Hexagonal bolts and nuts :

Precision and semi precision bolts (IS : 1364 – 1967), hexagonal bolts (IS : 3640 – 1967), square bolts, screws and nuts (IS : 2585 – 1963), hexagonal socket head cap screws (IS: 2269-1967), slotted counter-slink head screws (IS : 1365 - 1968), slotted cheese head screws (IS: 1366-1968), STUDS (IS: 1862-1975), slotted and costle – nuts (IS : 2232-1967).

(b) Washers – plain washers (IS : 2016-1967)

(c) Keys – Taper keys and key ways (IS : 2292-1974)

(d) Splines ( IS : 2327)

(e) Miscellaneous pins – cylindrical pins (IS : 2393-1980) taper pins ( IS : 6688 – 1972)

(f) Circlips – external and internal

(g) Rivets ( IS : 2155)

(h) Oil Seals – rotary shaft oil seals (IS : 5129), O-rings

(i) Ball bearings

Select a standard machine component from IS codes or design hand books to use in machine drawing.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

1.2 Limits, Tolerances and Fits (IS : 919 Part I and II)

(i) Limit system – Tolerance, limits, deviation, allowance, basic size, design size,

(ii) Tolerances – Fundamental tolerances, fundamental deviation, method of placing limit dimensions.

(iii) Fits – Clearance fit, transition fit, interference fit, hole basis system, shaft basis system, tolerance grades.

Calculate the values of clearance / interference, hole tolerance and shaft tolerance with given basic size for common assemblies like H7 / g6, H7/m6, H8 / u7.

1.3 Surface Roughness

(a) Introduction – actual profile, reference profile, datum profile, mean profile, peak-to-valley height, mean roughness index, surface roughness number

(b) Use of machining symbols in production drawings

(c) Indication of surface roughness

Indication of special surface roughness characteristics, indication of machining allowance, indication of surface roughness, symbols on drawings, method of indicating surface roughness on a given component.

- Show how the roughness is indicated on a component for

(a) surface to be obtained by any production method

(b) surface to be obtained without removal of material.

**2.0 ISOMETRIC DRAWINGS OF MACHINE PARTS 6**

**3.0 ASSEMBLY DRAWING AND DETAILED DRAWING OF MACHINES 8**

(i) I.C. Engine piston, petrol engine connecting rod.
(ii) Revolving, centre, square tool post
(iii) Hydraulic cylinder
(iv) Crane hook
(v) Spindle assembly

Prepare the assembly drawing and the part drawings providing necessary tolerances, fits, between mating parts and surface finishes.

**4.0 KEYS AND COTTERS 4**

4.1 Keys and Splines

- Draw different forms of keys in position

4.2 Cotter joint, kunckle joint, Universal joint

- Draw the three principal views (with local section, if necessary) of the assembly of above joints.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **5.0** | **SHAFT COUPLING** | **4** | |

5.1 Rigid coupling, Flange Coupling, and Muff Coupling

5.2 Non-rigid or Flexible coupling :

Pin-bush coupling, Universal Coupling or Hooke's joint.

Draw the three principal views of the coupling (with local Section if necessary).

**6.0 BEARINGS (ANY ONE) 4**

6.1 Foot step bearing, bracket

6.2 Ball bearing mounted on a shaft

Draw the principal views of foot step bearing and plummer block (with local sections if necessary)

**7.0 STRUCTURAL DRAWING 10**

Drawings of riveted structure with the following types of riveted joints single riveted, double riveted (chain, Zig-gag), lap joint, butt joint.

Draw two views of a riveted joint with given rivet diameter and plate thickness.

7.1 Drawing of welded structures with following types of welds and their symbols fillet, square butt, single V butt, double V butt, single U- butt, double U-butt, single level butt, double level butt, single J-butt, double J-butt, stud, bead,

sealing run, plug or slot, backing strip, spot, seam, meshed seam, stitch, meshed stitch, projection, flash, belt resistance.

Draw sketches of a given fabricated by welding showing welding symbols on the assembled drawing of the component (IS: 813 – 1961).

**8.0 PULLEY** **4**

8.1 Assembly of Fast and Loose pulley

8.2 Cone Pulley : (a) Front view-full in section

(b) Side view-half in section from the left.

- Draw the principal views of pulley (with local section if necessary).

**9.0 PIPE DRAWINGS** **6**

9.1 Pipe joints – Cast iron flanged joint, spigot and socket joint, hydraulic joint, expansion joint, union joint, coupler or socket

9.2 Pipe fittings and tubing

9.3 Pipe threads : straight, tapered

9.4 Pipe drawings – a) Scale layout b) diagrammatic layout

**10.0 COMPUTER AIDED DRAFTING** **8**

Use of AutoCAD or any other drafting package to make simple engineering drawings. The use of commands will enable the student to do the following activities

(i) Making of simple drawing
(ii) Editing of existing drawing
(iii) Dimensioning, drawing section lines and hatched sections.
(iv) Writing text on drawings
(v) Display of drawings
(vi) Making different settings of drawings related to scale, units, co-ordinate system.

**REFERENCE BOOKS AND STANDARDS**

1. Thomas E. French, Charles J. Vireck, Robert J. Foster :

Engineering Drawing and Graphic Technology – Mc Graw Hill Inc.

2. Gerard G. S. Volland : Modern Engineering Graphic & Design

- CBS Publishers & Distributors.

3. M. Bhattacharyya and S. Pal : Fundamentals of Engineering Drawing

- CBS Publishers & Distributors, Delhi.

3. Subrata Pal and Madhusudan Bhattacharyya :
Mechanical Engineering Drawing – Arnold Associates, Calcutta.

5. K. L. Narayana, P. Kannaiah, K. Venkata Reddy : Production Drawing

- New Age International (P) Ltd., Publishers, New Delhi.

6. R. B. Gupta : A Text Book of Engineering Drawing

- Satya Prakashan, New Delhi.

7. R. B. Gupta : A Text Book of Machine Drawing
- Satya Prakashan, New Delhi.

8. N. D. Bhatt and V. M. Panchal :

Engineering Drawing – Charotar Publishing House, Anand, Gujrat.

9. V. Lakshminarayan, M. L. Mathur and R. S. Vaishwanar :

Machine Drawing – Jain Brothers.

10. N. D. Bhatt : Machine Drawing – Charotar Book Stall

11. R. K. Dhawan : A Text Book of Machine Drawing – S. Chand & Company Ltd.

12. IS : 4897 – 1986 Bureau of Indian Standards.

13. IS : 919 (Part I & II) : 1993 Bureau of Indian Standards.

14. IS : 1364 – 1967 Bureau of Indian Standards
15. IS : 3640 - 167 Bureau of Indian Standards
16. IS : 2585 – 1963 Bureau of Indian Standards
17. IS : 2269 – 1967 Bureau of Indian Standards
18. IS : 1365 – 1968 Bureau of Indian Standards
19. IS : 1366 – 1968 Bureau of Indian Standards
20. IS : 1862 – 1975 Bureau of Indian Standards
21. IS : 2232 – 1967 Bureau of Indian Standards
22. IS : 2016 – 1967 Bureau of Indian Standards
23. IS : 2292 – 1974 Bureau of Indian Standards
24. IS : 2327 - 1993 Bureau of Indian Standards
25. IS : 2393 – 1980 Bureau of Indian Standards
26. IS : 6688 – 1972 Bureau of Indian Standards
27. IS : 2155 - 1982 Bureau of Indian Standards
28. IS : 5129 - 1987 Bureau of Indian Standards
29. IS: 919 (Part I and II) Bureau of Indian Standards
30. IS : 813 – 1961 Bureau of Indian Standards.

## WORKSHOP PRACTICE - III

| L | T | P | **Curri. Ref. No: ME408** |
|---|---|---|---|
| 0 | 0 | 4 | |

**Total Contact hrs.: 60** **Total marks: 50** **Practical:**

Theory: 0

Practical: 60

End Term Exam: 25

P.A:25

***Credit: 2***

### RATIONALE

The wealth of a community is measured by the variety and quality of the articles it possesses for its use and consumption. All the materials we posses are made from substances which is the first place are won from the earth, or from nature. Our property depends upon our ability to convert these raw materials into useful articles for consumption, and to distribute these articles equitably amongst the various members of our community. The production of our engineering workshops from an important part of our general industrial scheme since a large proportion of our industries is of an engineering nature. Our ability, therefore, to maintain a high standard of skill in our engineering workshops is an important factor.

### AIM

To use and describe the tools, materials and working principles of various processes for pattern making shops, foundry shops, and electric shops.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| 1.0 | **Pattern Making shop** | | **5** |

1.1 Shop Talk
Safety and precaution measures

1.1.1 Introduction to pattern making

- Role of pattern making and its importance.

1.1.2 Use and description of different pattern making tools.

1.1.2.1 Planning tools

Block Plane, Rabbet Plane, Router Plane, Circular Plane, Plough Plane, Core box,Draw knife etc.

1.1.2.2 Sawing tool
Coping saw, Bow saw.

1.1.2.3 Marking and layout tools
Contraction scale of shrinkage rule, Dividers, calipers

1.1.2.4 Miscellaneous requirements

- Pinch dogs, files and other tools.

1.1.3 Pattern making materials and factors effecting in selection of pattern materials.

Wood : types and desirable properties, Plaster : types and desirable properties, Plastic : types and desirable properties, Wax.

1.1.4 Types of patterns

Solid or single piece pattern, two piece or split pattern, multiple pattern, match plate pattern, gated pattern, skeleton pattern, sweep pattern, cope and drag pattern

1.1.5 Types of core boxes
Half core box, dump core box, split core box, right and left hand core box

1.1.6 Design consideration in pattern

Allowance, selection of parties & line, material, Selection, desirable surface finish.

1.1.7 Pattern making allowance

Shrinkage allowance, machining allowance, draft allowance, shake or draft allowance, Distortion allowance, Camber

1.1.8 Colour coating for pattern and core boxes

Representation of different types of surfaces by different colours.

1.2 Pattern shop practice **15**

1.2.1 Marking of solid pattern of simple machine parts
1.2.2 Marking of a pattern using fillet core prints and flange
1.2.3 Marking of a pattern on wood turning lathe machine

1.3 **Test and Viva – Voce.** **3**

**2.0 FOUNDRY** **5**

2.1 Shop talk- Safety and precaution measures

2.1.1 Introduction to foundry and it's importance

2.1.2 Tools and equipment

Hand tools, containers, mechanical tools, sand testing and conditioning tools, metal melting equipment, fettling and finishing equipment.

2.1.2.1 Hand tools

- Shovel, Hand riddle, Rammers, Strike off bar, Vent ware, Trowels, slicks, liffers or cleaners,Draw spike, Mallet.

2.1.2.2 Containers

Moulding boxes or flasks, ladles, crucibles

2.1.3 Moulding materials and moulding process

2.1.3.1 Types of mould materials and factors influencing their selection.

Metals, non – metals.

2.1.3.2 Types of moulding sands

Natural sands, Selica sands

2.1.3.3 Characteristics of moulding sand

- Rafractoriness, Permeability, Flowability, Adhesiveness, cohesiveness, Collapsibility.

2.1.3.4 Terminology of foundry sands

Green sand, dry sand, facing sand, parting sand, floor, black or baking sand.

2.1.3.5 Types of moulding machines
Jar or jolt machines, squeezer machine, jolt-squeezer machine, diaphragm moulding machine.

2.1.3.6 Functions of Runner, riser, cleaner and vent wire.

2.1.4 Furnaces used in foundry

Pit furnace, Tilting furnace, Cupola, Blower,Burner

2.1.5 Charging a furnace, melting and pouring both ferrous and non-ferrous metals.

2.1.6 Dry repairing and finish of a mould

2.1.7 Cleaning of casting.

2.2 FOUNDRY SHOP PRACTICE 12

2.2.1 Preparation of moulding sand

2.2.2 Practice on Green Sand Moulding with simple solid pattern with one box.

2.2.3 Practice on Green Sand Moulding with drag and cope by skin dry method.

2.2.4 Preparation of core sand and making a simple core

2.2.5 Practice on core fitted moulds like flanges, brackets pulleys etc.

2.2.6 Preparing a mould with a pattern made in the pattern shop.

2.2.7 Casting of the model as prepared from the pattern shop.

2.3 **Test and Viva – Voce.** 3

**3.0 ELECTRIC SHOP** **4**

3.1 Shop Talk- Safety and precaution measures

3.1.1 Introduction to Electric shop

Functions in Workshop technology, importance

3.1.2 Knowledge about safety precautions

- Rules for protection against electric shock
- What to do for a victim of electric shock
- Fire extinguisher.

3.1.3 Common conductors and insulators used for electrical engineering practice.

3.1.4 Common measuring instruments and methods.
Safety, accuracy, meters, multi-meters, digital meters etc.

3.1.5 Various types of electrical fittings used for domestic wiring: Surface and conceal

- Knowledge about wiring regulation
- Wiring of terminals and plugs.

3.1.6 Study of Three Phase Induction Motor : Reversing of direction for single and three phase Motors and starters

3.1.7 Earthing materials and procedures.

3.1.8 Testing of new and old installation and identification of live and neutral conductors.

3.2 Shop practice 10

3.2.1 Making of a bore conductor joint and soldering of the same.

3.2.2 Wiring with single core P.V.C. Cable.

3.2.3 Wiring of Twin Core Cable through main switch, pouser plug points etc.

3.2.4 Testing of the installation of small workshop wiring/house wiring with some faults.

4.0 **Test and Viva – Voce.** **3**

**REFERENCE BOOKS**


1. P.L.Jain : Principles of Foundry Technology Tata McGraw Hill Publishing Company Limited
2. S.K. Hajra Choudhury ***Workshop Technology Vol 1 &2*** Media Promoters of Publishers
3. , O.P. Khanna***Workshop Technology*** Dhanpat Rai & Sons Publications
4. Chapman ***Workshop Technology Parts 1 & 2*** 4th Edition, Viva Books P. Ltd., New Delhi
5. Kenyon Pitman ***Basic Fabrication & Welding*** Pitman Pub. Ltd.
6. P.N.Rao ***Manufacturing Technology*** Tata Macgraw Hill

## WORKSHOP PRACTICE - IV

| L | T | P | **Curri. Ref. No: ME409** |
|---|---|---|---|
| 0 | 0 | 4 | |

**Total Contact hrs.: 60** **Total marks: 50** **Practical:**

Theory: 0

Practical: 60

End Term Exam: 25

P.A: 25

**Pre requisite: nil**
**Credit: 2**

### RATIONALE

The wealth of a community is measured by the variety and quality of the articles it possesses for its use and consumption. All the materials we posses are made from substances which is the first place are won from the earth, or from nature. Our property depends upon our ability to convert these raw materials into useful articles for consumption, and to distribute these articles equitably amongst the various members of our community. The production of our engineering workshops from an important part of our general industrial scheme since a large proportion of our industries are of an engineering nature. Our ability, therefore, to maintain a high standard of skill in our engineering workshops is an important factor.

### AIM

To develop basic concept and skill in machining, operations on lathe, planner, shaper and various welding operations.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **MACHINE SHOP** | | **8** |

1.1 Shop Talk

1.1.1 Introduction to Machine Shop

Role of machine shop and it's importance in Manufacturing, difference between machine and machine tool, discussion on different types of machine.

1.1.2 Safety precautions to be observed in machine shop

Safety measures in construction work, Protection in storage and manual handling of material, causes and common sources of accident, common precautions against electric shocks, damages and fires etc.

1.1.3 Study of a centre lathe

Types of lathe, parts of the lathe, lathe accessories lathe turning, thread cutting, specifications of a lathe, running and routine maintenance of a centre lathe

1.1.4 Study of a single point cutting tool

Classification of cutting tool, materials of cutting tool, various angles of cutting tool, nomenclature of cutting tool.

1.1.5 Study of planner, shaper and slotter.

1.1.5.1 Functions of planning machine

Planner tools, cutting speed feed and depth of cut.

1.1.5.2 Functions of shaper

Shaper tools, cutting speeds and speeds.

1.1.5.3 Functions of a slotting machine

Slotter tools, cutting speed, feed and depth of cut.

1.1.6 Demonstration of job and test setting on a shaper, planner and slotter.

1.1.7 Adjustment of stroke length and study of quick return mechanism of a shaper and planner.

1.1.8 Study of Capstan and Turret.

Introduction to semi-automatic lathe, functions of capstan and turret lathe.

1.1.9 Study of a CNC Lathe

1.2 **Machine shop practice** **21**

1.2.1 Tool grinding practice on M. S. square bar

1.2.2 Job setting for centering, facing and counter boring on a 3-jaw and a 4-jaw chuck.

1.2.3 Practical on plain turning, step turning and taper turning process using 4-jaw chuck and tail stock.

1.2.4 Practical on knurling, chamfering, drilling and parting off operations.

1.2.5 Practical on external and internal thread cutting on a capstan lathe.

1.2.6 Practical on Horizontal, Vertical and Angular surface and slot cutting using shaping machine.

1.3 Uses of Portable Hand machine: Portable Saw Mills

**2.0 WELDING SHOP:** **8**

2.1 Shop Talk

2.1.1 Introduction to welding processes

2.1.2 Gas welding processes

2.1.2.1 Oxy-acetylene welding

- Relative advantages over other processes
- Methods of welding

- Composition of the Gas.

2.1.2.2 Metal Inert Gas welding (MIG).

Relative advantages over other processes stating specific applications.

- Methods of MIG welding
- Composition of shielder & gases

2.1.3 Arc welding processes

2.1.3.1 Types of arc welding processes

2.1.3.2 arc welding principle

2.1.3.3 Setting of various parameters for welding

2.1.3.4 Arc welding equipment

Electrode holder, welding Helmet, Safety goggles, welder's chipping hammer, Earthing clamps, Hand gloves Approus and sleeves, wire brush.

2.2 **Welding shop practice** **20**

2.1.1 Leftward and Right ward welding
2.1.2 Buts-joints practice on M.S. sheet at horizontal Position by gas welding.
2.2.3 Arc welding practice on M.S. flat bar, 4-6 mmthick both left and right ward for hand balancing.

2.2.4 Making a double Vee-Butt joint on M.S. flat of 6 mm thick with minimum 2 runs on each side by Arc welding.
2.2.5 Making Tee Fillet – joint on flat position using M.S. flat of 4 mm. thick by arc welding.
2.2.6 Making small grill or window frame etc. by Arc welding.

**3.0 Test and Viva – Voce.** **3**

**REFERENCE BOOKS**


1. Machinist – Trade Practicals (1st year and 2nd year), Central Instructional Media Institute, Madras, Directorate General of Employment & Training, Ministry of Labour, Govt. of India.
2. **Turner** – Trade practical (1st year and 2nd year), Central Instructional Media Institute, Madras Directorate of Employment & training, Ministry of Labour, Govt. of India.
3. S. K. Hazra Choudhury and A. K. Hazra Choudhury **Elements of Workshop Technology Vol. I & II** Media Promoters & Publishers Pvt. Ltd.
4. R. N. Dutta **Machine Tools Vol. I,** S. Charel & Company Ltd.
5. B. S. Raghu Wanshi **A course in Workshop Technology Vol. I & II** Dhanpat Rai & Sons.
6. O.P. Khanna***Workshop Technology*** Dhanpat Rai & Sons Publications
7. Chapman ***Workshop Technology Parts 1 & 2*** 4th Edition, Viva Books P. Ltd., New Delhi
8. Kenyon Pitman ***Basic Fabrication & Welding*** Pitman Pub. Ltd. P.N.Rao ***Manufacturing Technology*** Tata Macgraw Hill

# FLUID MACHINES

| L | T | P | Curri. Ref. No: ME 410 |
|---|---|---|---|
| 3 | 0 | 2 | |

**Total Contact hrs.: 75**
Theory: 45
Practical: 30

**Total marks: 150**

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A.: 25

**Prerequisite: ME403**
***Total Credit: 4***

## RATIONALE

Importance of fluids (i.e. liquids and gases) in mechanical engineering cannot be overstressed, and has been explained under the course named " Fluid Mechanics". Water is the most important liquid which is widely used by mankind starting from agriculture for production of food to various industrial as well as household purposes. pressurised oil is used for transmitting power to various production machines as well as mechanised system. However, actual use of or action by various liquids like water & oil can be realised by a group of machines called fluid machines. It is, therefore, essential that mechanical engineers should be well conversant with design, operation and use of these hydraulic machines.

## AIM

Students to have a good working knowledge and skill about the principle of working, constructional features, uses and normal maintenance problems pertaining to common water hydraulic machines and oil hydraulic system.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **IMPACT OF FLUID JET :** | | **4** |

Force exerted by fluid jet on a stationary and moving flat plate and curved plate. Derive the expression for the force of a fluid jet on a stationary or moving plate. Deduce the expression for force of a fluid jet impinging on a curved plate.

- Solve simple problems on force of fluid jets.

**2.0 WATER TURBINES : 12**

2.1 Classification of turbines :

(a) impulse or velocity turbine,

(b) pressure or reaction turbine.

2.2 Impulse turbine (Pelton wheel); principle of operation; velocity diagram and work done; efficiencies of an impulse turbine; simple problems.

2.3 Reaction turbine classifications: redial flow, axial or parallel flow, mixed flow; difference between impulse and reaction turbines.

2.4 Inward flow reaction turbine (Francis turbine); velocity diagram and work done.

2.5 Axial flow reaction turbine (Kaplan turbine); work done.

2.6 efficiencies of a reaction turbine : hydraulic, mechanical & overall efficiency; simple problems.

Understand working principle of (i) impulse turbine and (ii) reaction turbine.

- Draw velocity diagrams for different turbines.
- Solve problems regarding turbine efficiencies.
- Distinguish between various turbine efficiencies
- Compare between a Francis and Kaplan turbine

**3.0 PUMPS 2**

Various types of pumps, their principle of operation and uses : reciprocating pump, centrifugal pump, axial flow pump, jet pump.

- Explain operational principle of a reciprocating and a centrifugal pump.
- Compare applications of different types of pumps.

**4.0 RECIPROCATING PUMPS : 6**

4.1 Types of reciprocating pumps; constructional details and parts of a reciprocating pump; discharge capacity; power required to drive a reciprocating pump.

4.2 Advantages and disadvantages of a reciprocating pump; normal problems of a reciprocating pumps; effect of air vessel in the line.

- Explain constructional features of a reciprocating pump.
- State usual problems faced in a reciprocating pump.
- Describe the specific advantages and disadvantages of a reciprocating pump.

**5.0 CENTRIFUGAL PUMPS : 10**

5.1 Constructional details and parts of a centrifugal pump; single stage and multistage pumps; applications of centrifugal pump.

5.2 Work done by a centrifugal pump; efficiency of a centrifugal pump; power required to drive a centrifugal pump; simple problems

5.3 Priming; suction head; delivery head; characteristic curves; normal problems in a centrifugal pump; cavitation.

- Draw and label various parts of a centrifugal pump
- Explain importance of characteristic curve of a centrifugal pump.
- Solve problem conserning work done, power requirement and efficiency of centrifugal pumps
- Explain need for priming.

**6.0 AUXILIARY FLUID MACHINES : 6**

6.1 Principle of operation and constructional details of hydraulic ram; and hydraulic press; mechanical advantage of a press.

6.2 Air compressor classification; constructional features and use of: reciprocating compressor-single stage and multi stage, rotary compressor, centrifugal blower.

- Understand working principle of a hydraulic ram
  Explain the basic principle involved and utility of a hydraulic press.
- State the need of compressed air
  Identify commonness of different types of compressors with different types of water pumps.

**7.0 OIL HYDRAULICS : 5**

7.1 Definition of oil hydraulic system; various components and uses of an oil hydraulic system: pump, storage tank, filter, flow and pressure control valve, direction control valve, hydraulic cylinder, accumulator, pipes & fittings; symbol used for these components.

7.2 Principle of operation of rotary positive displacement pumps: gear pump, vane pump, variable delivery piston pumps; pressure range of hydraulic systems

7.3 Constructional features of a double acting hydraulic cylinder.

7.4 Hydraulic circuit drawing for a few typical applications like holding a job, hydraulic press etc.

- Explain operation of different types of oil pumps
- Draw sketch of a hydraulic cylinder and label it
  State the function of different components in a hydraulic system
- Draw hydraulic circuits for specific needs.

## 8.0 FLUID MACHINES LABORATORY: 30

### 8.1 SUGGESTED LIST OF EXPERIMENTS/ DEMONSTRATIONS

1. **Performance study of a centrifugal pump**
2. Performance study of reaction turbine
3. Performance study of pelton turbine
4. Study of submerged axi-symmetric jet
5. Demonstration of the actual working of reciprocating pump
6. Demonstration the actual working of centrifugal pump
7. Study of the model of Francis turbine
8. Demonstration of the actual working of hydraulic ram
9. Study of the models of gear pump, vane pump and piston pump
10. Study of the pressure limiting valve, direction control valve, flow control valve, pipe fittings

11.Study hydraulic system of any machine, draw the hydraulic circuit and operate the system.

**REFERENCE BOOKS**


1. Jagadish Lal ***Hydraulic Machines*** Metropolitan Book
2. TTTI, Madras TMH ***Hydraulics and Hydraulic Machinery***
3. R. S. Khurmi ***Hydraulics and Hydraulic MachinesS***. Chand & Co. (Pvt.) Ltd.
4. S. R. Majumder **Oil Hydraulics** TMH

5, Dr. R. K. Bansal ***A Text Book of Fluid Mechanics and Hydraulic Machines***

# MECHANICS OF MATERIALS

| L | T | P | | |
|---|---|---|---|---|
| 3 | 0 | 2 | | **Curri. Ref. No.: ME411** |

**Total Contact hrs.:75**
Theory: 45

Practical: 30

**Pre requisite: G205**
**Credit: 4**

**Total marks: 150**

**Theory:**

End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A : 25

## RATIONALE

Mechanics of Materials deals with the internal behaviour of variously loaded solid bodies, such as; shafts, bars, beams, plates, and columns, as well as structures and machines that are assemblies of these components. Mechanics of materials focuses primarily on mechanical properties of materials, analysis of stress, strain and evaluation of deformations. The subjects like structural analysis, design of structures as well as machines are based on adequate knowledge and understanding of Mechanics of Materials. Therefore, it is an important basic subject for Diploma students in Civil and Mechanical Engineering.

## AIM

The aim of the subject Mechanics of Materials is to develop background preparation of students for taking up Engineering subjects like Theory and Design of Structures, Design of Machines mostly through the followings:

- Describe the Mechanical properties of important Engineering materials
- Determine stresses, strains and deformations in elastic bodies of different shapes under different loading conditions for engineering applications.
- Determine load carrying capacity of different types of members.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **INTRODUCTION** | **3** | |
| | 1.1 Scope of the subject:<br>Uses of structures, Importance of knowledge of: stress, strain, and deformation in a structure, permissible stresses in a material, Safety and Economy. Contents and importance of the subject. | | |
| | 1.2 Engineering Materials:<br>Elastic material, linearly elastic material, ductile material, brittle material, composite material, isotropic material, orthotropic material<br>(Definition, examples, and application).<br>• Identify different engineering materials in specific application. | | |
| **2.0** | **STRESS AND STRAIN:** | **12** | |
| | 2.1 Introduction:<br>Definitions of stress; types of stress-tensile, compressive and shear | | |

2.2 Stress-strain Diagram:

Principle of tensile testing in Universal Testing Machine, Dimensions of a tensile test specimen, tensile test, elastic limit, elastic range, proportional limit, point of fracture, plastic range, strain hardening, ultimate stress, necking, ductility, yield strength, 0.2% proof stress, allowable stress of ductile and brittle materials, factor of safety.

- Identify the different parts of universal Testing Machine.
- Draw the sketch of a tensile test specimen.
- Draw the stress strain diagram for mild steel and indicate the different parts of the curve.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

2.3 Stress-strain Relations :

Hooke's law, Young's modulus, Shear modulus of rigidity, Poisson's ratio, generalized Hooke's law for two dimensional stress, relation among the elastic constants for an isotropic material.

- Distinguish among different elastic constants for a material

2.4 Stresses, strains, and Deformations of Axially Loaded Members :

Bars of varying section, taper rod, bars of composite section, rod and tube connected by bolted joint, temperature stresses.

- Solve simple problems on determination of stresses and shortening of axially loaded members.

2.5 Principal Stresses and Strains :

Plane stress - definition and expressions; stresses on inclined planes; Principal Stresses (no theoretical derivation) - principal planes, maximum or major principal stress, minimum or minor principal stress, maximum shear stress; Mohr's Circle – construction and interpretation.

- Determine principal stresses in an element with given stresses or at a point of a loaded member using standard formulae and indicate the same with the help of a Mohr's Circle (sketch only).

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **3.0** | **ANALYSIS OF BEAMS:** | **12** | |

3.1 Beam : definition, types of beams – Simply supported and cantilever beams, propped cantilever, fixed-ended and continuous beams.

- Identify different types of beams and loading conditions.
- Determine the support reactions and draw the free body diagram of a determinate beam.

3.2 Shearing force and Bending Moment in Beams :

Sign conventions and relationships among load, shearing force and bending moment.

3.3 Shear Force and Bending Moment Diagrams :

Cantilever beam with concentrated and uniformly distributed load, simply supported beam with uniformly distributed and varying loads.

- Draw the shear force and bending moment diagrams of a beam with given loads on it.

**4.0 SIMPLE BENDING OF BEAMS : 6**

4.1 Centroid of an area, moment of inertia of beam cross-sections, parallel axis theorem, principal moments of inertia

4.2 Assumptions in simple bending, neutral surface, neutral axis determination of bending stresses in beams with simple cross sections and standard sections used in industry.

- Determine the moment of inertia, section modulus and moment of resistance of a beam cross-section.
- Determine the bending stresses in a beam under pure bending.

**5.0 TORSION 6**

5.1 Basic assumptions for pure torsion, torsion of circular shafts (hollow and solid, no proof) – polar moment of inertia, torsional shearing stress, angle of twist, torsional rigidity.

- Determine the maximum shear stress and angle of twist in shafts transmitting given torque.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

5.2 Applications: Horse power transmitted by a shaft, Torque transmitted by a flange coupling and corresponding forces acting on coupling bolts, formula for stiffness of closed coil helical spring (no proof).

- Apply the torsion formula in determination of (a) safe power transmitted by a flange coupling (b) stiffness of helical springs.

**6.0 SLOPE AND DEFLECTION OF BEAMS: 6**

6.1 Introduction : Shape and nature of elastic curve (deflection curve). Importance of slope and deflection.

6.2 Expressions for slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load. Principle of superposition for deflection and rotation.

- Determine the slope and deflection at a point of beams under given loads and supports conditions.
- Solve problems of propped cantilevers from superposition of deflection at the prop.

**PRACTICAL :** 30 Hours

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **8.0** | **SHEAR TEST:** | **3** | |
| | 8.1 Determination of Shear Modulus (Modulus of Rigidity) of a soft material | | |
| **9.0** | **TENSILE TEST** | **3** | |
| | 9.1 Determination of Young's Modulus of a material in a tensile testing machine. | | |
| **10.0** | **HARDNESS TEST:** | **3** | |
| | 10.1 Determination of hardness of a material by a Brinell or Rockwell testing machine. | | |
| **11.0** | **IMPACT TEST:** | **3** | |
| | 11.1 Testing of Cast Iron (C.I.) and Mild Steel (M. S.) test pieces by Impact testing machine. | | |

**12.0 FATIGUE TEST: 3**

12.1 Testing of a Mild Steel (M. S.) test piece for fatigue.

**13.0 DEFLECTION OF BEAMS 3**

13.1 Central Deflections (with the help of a dial gauge) of simple supported beam models (e.g., M. S. flat) with concentrated loads at the middle.

13.2 Determination of Young's Modulus (E) for the material of a beam model by load deflection method.

**14.0 VIVA - VOCE: 12**

**REFERENCE BOOKS :**


1. S. P. Timoshenko, D. H. Young ***Elements of Strength of materials*** Affiliated East – West Press Private Limited.

2. R. K. Bansal ***Engineering Mechanics and Strength of materials*** Laxmi Publications, New Delhi

3. Surendra Singh ***Strength of Materials*** Vikas Publishing House Pvt. Ltd.

4. Ferdinand L. Singer ***Strength of materials*** Harper & Row and John Weatherbill.

4. William A. Nash **Strength of MaterialsTheory and Problems** Shaum's Outline Series, Mc. Graw Hill. Inc.

**5.** R.S. Khurmi ***Strength of Materials***

**6.** Sadhu Singh **Strength of Materials** Khanna Publishers, New Delhi.

S. Ramamrutham **Engineering Mechanics & Strength of Materials** Dhanpat Rai Publishing Co., New Delhi.

7.. D.R. Malhotra and H.C. Gupta ***Strength of Materials*** Satya Prakashan, New Delhi.

8. B. K. Sarkar **Strength of Materials Through Problems** Allied Publishers Limited, New Delhi.

# APPLIED TECHNOLOGY COURSES

# MACHINE TOOLS – I

| L | T | P | Curri. Ref. No: ME501 |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.: 45**
Theory: 45
Practical: 0

**Total marks: 100**

**Theory:**
End Term Exam: 70

P.A.: 30

***Total Credit: 3***

## RATIONALE

Metal cutting is by far the most versatile and most used process for giving final shape to most of the engineering materials, to be used either as finished products or as parts for making machines, which will produce finished goods and services. All such metal cutting operations are performed by a host of machines called Machine Tools. Different types of machine tools are used for performing different metal cutting operations for giving different shapes to machined items. No engineering production unit can be imagined without any machine tool.

In other words, knowledge of design & use of machine tools is of vital importance to a mechanical engineer.

## AIM

After study of the subject Machine Tools (distributed over two courses viz. Machine tools I and II), a diploma mechanical engineer should have a clear conception about metal cutting process, its importance and about the uses and operations of all basic types of machine tools normally used in industry.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| 1.0 | **DEFINITION OF MACHINE TOOLS; METAL CUTTING OPERATION** | | 4 |

- A brief history of machine tools
- Define a machine tool
- Understand metal cutting process
- List various surfaces and profiles that can be machined in machine tools.

**2.0 BASIC MACHINE TOOLS AND THEIR OPERATIONS** **4**

Lathe drilling machine, shaper, planer, slotter, broaching machine, milling machine, boring machine, grinding machine, gear hobbing machine

- List out various operations that can be done in each individual machine tool
- Identify the cutting motions and feed motions for each of above operations.

## 3.0 METAL CUTTING AND CUTTING TOOLS 12

3.1 Metal cutting by chip forming process; orthogonal and oblique cutting; mechanics of chip formation; cutting forces in orthogonal and oblique cutting; cutting velocity; power and work done in cutting.

3.2 Single point and multi point tool; cutting tool nomenclature; types of chips and factors affecting them; chip breakers.

3.3 Cutting speed, feed and depth of cut; factors determining speed, feed and depth of cut; cutting tool materials; range of speed and feed for different combinations of metals and tool materials.

3.4 Tool wear; friction and heat in cutting; factors affecting tool life; cutting fluids : purposes, types and properties.

- Distinguish between orthogonal and oblique cutting
- Explain mechanics of chip formation
- Demonstrate relationship between cutting & feed forces with friction and normal force at rake surface of a turning tool
- Draw views of a turning tool and show nomenclature and angles of the tool
- List optimum cutting speed range for various job-tool material pair.
- Explain how cutting fluid enhances tool life

## 4.0 DRIVES AND MECHANISMS IN MACHINE TOOLS 6

4.1 Machine tool motions : Cutting motion, feed motion, auxiliary motions (loading, unloading, clamping, tool approach & withdrawal, indexing, swivelling etc.); source of power; individual vs. group drive; mechanisms for convertion of rotation to translation & vice-versa.

4.2 Kinematic structures of machine tools; speed and torque relationship; requirement of multiple spindle speeds; cone pulley drive; all geared drive; clutched drive.

- Compare individual vs. group drive

Explain through sketches mechanism to convert rotation to translation

Draw kinematic diagrams for simple operations like turning, parting, drilling.

## 5.0 LATHE 9

5.1 Operations; classification; specifications

5.2 Parts of a lathe machine : bed, head stock, tail stock, carriage, tool post, drive, speed changing mechanism, all geared head stock, feed drive, apron mechanism.

5.3 Accessories & Attachments : Centres, catch plate and carriers, chucks, face plate, angle plate, mandrel, steady rest, follower rest, taper turning attachment.

5.4 Different tools and their uses.

- Write detailed specification of a centre lathe
- Identify various parts and attachments of a lathe and explain their functions
- Determine various operations and corresponding tools by which different finish machined objects may be made in a lathe.

**6.0 DRILLING MACHINE 4**

6.1 Operations; classification; specifications

6.2 Parts of a pillar drill : pillar, table, drill, drive mechanism; grouped spindle pillar drill.

6.3 Parts of a radial drill : column, arm, head, screw, elevating screw, drive mechanism.

6.4 Drill bits and reamer; trepanning tools; recommended cutting speed and feed; drilling jigs.

- Explain feed motion mechanism of a drilling machine
- Compare functions of a pillar drill and a radial drill
- Sketch drilling jigs for specific jobs
  List various operations that can be performed in a drilling machine.

**7.0 SPHAPER, PLANER, SLOTTER & BROACHING MACHINE 6**

7.1 Operations and specifications
7.2 Parts and drive mechanism of shaper, planer, slotter and broaching machine.

7.3 Quick return mechanism and feeding mechanism of shaper and planer.

7.4 Tools used

- List various operations which can be performed in shaper, planer, slotter and broaching machine.
- Draw and analyze quick return mechanism of a shaper
- Sketch various broaching operations
- Compare between a shaper, planer and slotter
- Draw cross sectional view of a planer and label various parts.
- Find out the similarity of shaping, planing, slotting and broaching operation
- Identify uniqueness of broaching from shaping/ planing/slotting operation
- Explain through sketch how feed motion is given in a Shaper and planer.

**REFERENCE BOOKS**


1. G. Thirupati Reddy ***Metal cutting & Machine Tools*** Scitech Publications (India) Pvt. Ltd. 2006

3 S. K. Basu and D. K. Pal ***Design of Machine Tools*** Oxford & IBH Publishing Co. Pvt. Ltd.

3. S. K. Hajra Choudhury, S. K. Bose, A. K. Hazra Choudhury ***Elements of Workshop Technology Vol. : II*** Media Promoters & Publishers Pvt. Ltd.

4. W. A. J. Chapman ***Workshop Technology, Part 1 & 2*** ELBS.

5. H. Gerling ***All about Machine Tools*** New Age International (P) Ltd.

6. Gopal Chandra Sen and Amitabha Bhattacharyya ***Principles of Machine Tools*** New Central Book Agency

**7.** G. Kuppuswamy ***Principles of Metal Cutting*** Universities Press

**8. NPTEL lecture on machine tools**

## MACHINE TOOLS – II

| L | T | P | Curri. Ref. No: ME 502 |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.: 45** **Total marks: 100** **Theory:**
Theory: 45 End Term Exam: 70

Tutorial: 0 I.A.: 30

**Prerequisite: ME501**

***Total Credit: 3***

### RATIONALE

Metal cutting is by far the most versatile and most used process for giving final shape to most of the engineering materials, to be used either as finished products or as parts for making machines, which will produce finished goods and services. All such metal cutting operations are performed by a host of machines called Machine Tools. Different types of machine tools are used for performing different metal cutting operations for giving different shapes to machined items. No engineering production unit can be imagined without any machine tool.

In other words, knowledge of design & use of machine tools is of vital importance to a mechanical engineer.

### AIM

After study of the subject Machine Tools (distributed over two courses viz. Machine tools I and II), a diploma mechanical engineer should have a clear conception about metal cutting process, its importance and about the uses and operations of all basic types of machine tools normally used in industry.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

**1.0 MILLING MACHINE : 8**

1.1 Operations; classifications; specifications

1.2 Constructional features and parts of a horizontal and vertical milling machine

1.3 Different milling cutters (slab, side and face, angular, form relieved, end mill, face mill) and their uses; gang milling operation.

- Understand various milling operations
- Classify different types of milling machine
  Sketch an universal milling machine and label various parts
- Explain uses of different milling tools

**2.0 BORING MACHINE : 5**

2.1 Horizontal and vertical boring machine; specifications.
2.2 Constructional features for horizontal and vertical boring machine.
2.3 Boring bar; boring heads; tools for boring bar
2.4 Various operations performed in boring machine.

- Explain specific use of boring machines
- Specify a horizontal boring machine
- State range of accuracies expected from boring Machines
  Draw a boring bar, boring head and tools used for boring bar.

**3.0 GRINDING MACHINE: 7**

3.1 Grinding operation; comparison with other metal cutting operations.

3.1 Classification and specification of grinding machines (cylindrical, surface, tool & cutter, centreless)
3.1 Constructional features of different types of grinding machines
3.4 Construction of grinding wheel ; different abrasive and bond materials; wheel classification; different wheel shapes; wheel dressing.

- Explain grinding process
  Explain specific applications where grinding operation is used

- Specify different types of grinding machines
- Classify different grinding machine by use
- Specify a grinding wheel
  Show how a grinding wheel is fixed in a grinding machine

  State the precautions to be observed during grinding operation.

**4.0 GEAR HOBBING MACHINE : 6**

4.1 Generation vs. form cutting method of gear cutting.
4.2 Constructional features and principle of operation of a hobbing machine.
4.3 Hob cutters

- Explain generation process
- Compare between a generated and formed gear
- Understand operating principle of a hobbing machine

**5.0 CAPSTAN & TURRET LATHE : 6**

5.1 Characteristic features of a capstan or turret lathe; specialised use of these machines.

5.2 Machine parts and accessories; head stock, chucks, collet chucks, turret head, stops and trips, work supports, bar stops and centering toolsCompare between a capstan and turret lathe

- Sketch a turret head
- List various accessories and their uses of a capstan lathe

**6.0 AUTOMATIC MACHINES 6**

6.1 Concept of automatic machining; utility of an automatic turning machine.

6.2 Features of a single spindle automatic turning machine: feed and chucking, turret indexing, turning attachment, thread cutting attachment, drilling attachment, chip conveyor, magazine feed.

- List various attributes of automatic machining
- Explain features of a single spindle automatic turning machine
- List a few products / job which can be done in a single spindle automat.

**7.0 NUMERICAL CONTROL (NC) MACHINES : 7**

7.1 Introduction to numerical control machine : NC, CNC and DNC.

7.2 Principles of numerical control; operation of NC system : point to point, continuous path / contour system.

7.3 Constructional details of a CNC machine : axis identification, slide ways, spindle mounting, drive units, position transducers.

7.4 Input media (punched cards, magnetic tapes, punched tape); decimal or binary coding; card, magnetic tape, punched card reader; operation procedure : planning, part programming, tape/card preparation, verification, production.

- Understand the basic concept of a NC machine
- Define the term numerical control
- Differentiate between NC, CNC and DNC
  Explain through sketch the operation of NC system for machining a profile
- Explain the function of position transducer.

7.5 CNC programming for a simple job with facing, step turning and taper turning operations

**REFERENCE BOOKS :**


1. W. A.J. Chapman ***Workshop technology*** Part 2 & 3 - ELBS

2. S. K. Basu and D. K. Pal ***Design of Machine Tools*** Oxford & IBH Publishing Co. Pvt. Ltd.

3. S. K. Hajra Choudhury, S. K. Bose, A. K. Hajra Choudhury ***Elements of Workshop Technology Vol II*** Media Promoters & Publishers Pvt. Ltd.

4. B. S. Pabla and M. Adithan ***CNC Machines*** New Age International (P) Ltd.


*1. Students should be conversant and be able to operate all types machine tools available in the workshop of the respective institute.*

*2. Operation of the machines not available in the institute should be shown to the students during factory visits which is a mandatory part of mechanical engineering curriculum.*

# MECHANICAL MEASUREMENT

| L | T | P | **Curri. Ref. No: ME 503** |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.: 45** **Total marks: 100** **Theory:**
Theory: 45 End Term Exam: 70

Tutorial: 0 I.A.: 30

**Prerequisite: Nil**

***Total Credit: 3***

## RATIONALE

The Mechanical measurement is primarily concerned with methods of measurement based on agreed units and standards. The practice of mechanical measurement involves precise measurements requiring the use of apparatus and equipment to permit the degree of accuracy required to be obtained. In the broader sense the subject is not limited to length measurement but is also concerned with the industrial inspection and its various techniques. Thus technicians working in inspection, production and maintenance units should be thorough in this subject.

**AIM:** The students will be exposed to the instruments and methods of their use in linear measurement, machine tool metrology, gear and screw thread measurement.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| 1.0 | **INTRODUCTION** | | **4** |
| | 4.1 A brief history of mechanical measurement ,definition of metrology, need of inspection | | |
| | 1.2 Measuring instruments – measuring range, sensitivity, scale interval, discrimination, hysteresis, response time, repeatability, bias, inaccuracy, precision and accuracy, magnification, calibration, uncertainty of measurement. | | |
| | 1.3 Types of errors – controllable errors, random errors | | |
| | 1.4 General care of measuring instruments | | |
| | 1.5 Standardization and standardising organizations- ISO, ISA, IEC, OIML, NPL | | |
| | • Describe the characteristic of measuring instruments for a particular measurement application. | | |

- List the name of different national and international standardizing organizations.

2.0 LINEAR MEASUREMENT **7**

2.1 Construction use and care of instruments for non-precision linear measurement : steel rule, calipers, surface plate, angle plate, V-block, straight edges.

2.2 Construction use and care of instruments for precision measurement : vernier instruments, vernier height gauge, micrometers, inside micrometer calipers.

2.3 Slip gauges : Indian standards on slip gauges, standard terminology, wringing and enforced adhesion, measuring faces, grades of slip gauges, sets of gauges, selecting slip gauges for required dimension, calibration of slip gauges.

2.4 Comparators – Characteristics, uses, working principles of different types of comparators : mechanical, mechanical optical, electrical and electronic, pneumatic, fluid displacement comparator.

- Identify the required measuring instrument for a particular linear measurement application.
- Describe care and use of different measuring instruments.

**3.0 ANGULAR MEASUREMENT 7**

3.1 Construction and use of instruments for angular measurement – vernier and optical level protractor, sine bars, sine table, angle gauges, spirit level, clinometers.

3.2 Optical instruments for angular measurement – auto-collimator, microptic auto-collimator, constant deviation prism.

3.3 Circular division – dividing heads and circular tables, circular division by polygon, angle gauge dividing head.

- Describe the construction and use of different instruments for angular measurement.

**4.0 MEASUREMENT OF FORM AND POSITION 7**

4.1 Surface roughness standard form of representation, checking surface, roughness (introduction)

4.2 Use of straight edges and surface plate "Wedge" Method, "Level" Method

4.3 Squareness Testing by Try square, dial gauge, Optical square

4.4 Testing of parallelism with scribing block, clock indicator

4.5 Use of dial gauge for squareness of hole axes.

4.6 Test for roundness and concentricity

4.7 Checking the relative position of holes (jig plate fitted with drill bushes) Define the terms related to measurement of form and position.

Describe the method of determining the quality related to form and position.

**5.0 MACHINE TOOL METROLOGY 7**

5.1 Need for machine tool metrology

5.2 Tests for level of installation of machine in horizontal and vertical planes

5.3 Tests for the true running of the main spindle and its axial movements

5.4 Test for flatness of machine bed for straightness and parallelism of bed ways for bearing surfaces

5.5 Test for squareness

5.6 Tests for parallelism of spindle axis to guide ways for

bearing surfaces

- Describe he common tests related to machine tools metrology.

**6.0 MEASUREMENT OF SCREW THREADS AND GEARS 6**

6.1 Measurement of screw threads – Introduction, measurement of external and core diameters, measurement of flank diameter, testing the lead, testing of thread angle and thread profile. Testing of threads with gauges.

6.2 Measurement of gears (spur) – Introduction, measurement of the tooth thickness, measurement of the pitch, chordal measurement over several teeth, testing of alignment of teeth, testing of concentricity, shape of tooth and pitch

- Describe the methods of measurement of different quantity related to screw thread geometry.
- Describe the methods of measurement of quantities relates to gear geometry.

**7.0 MEASUREMENT EXAMPLES 7**

7.1 Measuring the diameter of a spigot (using slip gauges)

7.2 Checking the size of a groove, dovetail slides, gauginglarge bores with point gauge and by four ball method.

7.3 Small bore measurement with 2 spheres and 3 spheres

7.4 Measuring a Taper plug gauge, Tape Ring gauge, internal and external template radius.

- Describe the method of measurement and list instruments required for a measurement job.

Note: All the relevant instruments and their applications should be demonstrated to the students in the lecture class.

**REFERENCE BOOKS**


1. R. K. Jain ***Engineering Metrology*** Khanna Publishers

2, D. S. Kumar ***Mechanical Measurements and Control Engineering*** Metropolitan Book Co. Pvt. Ltd.

3.I.C. Gupta ***Engineering Metrology*** Dhanpat Rai & Sons, New Delhi

4.Greeve J. and Wilson F. : 'Handbook of Industrial Metrology' - Prentice Hall Publishers, New Delhi

5. Manish J.Kadam ***Metrology and Quality Control*** Everest Publishing House

# AUTOMOBILE ENGINEERING

| L | T | P | **Curri. Ref. No: ME 504** |
|---|---|---|---|
| 3 | 0 | 2 | |

**Total Contact hrs.: 75** **Total marks: 150**

Theory: 45

**Practical:** 30

**Prerequisite: ME 401,ME402**

***Total Credit: 4***

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

P,A

Sessional : 25

Viva : 25

**RATIONALE**

The automobile is one of the principal transport system. Their manufacture maintenance gives a major scope for employment. The technicians who pass out from technical institutes many of them go to automobile companies for production or servicing of vehicles. Moreover, many entrepreneurs go for servicing of automobiles or trading of auto components. Thus the automobile engineering is an important subject to be in the regular curriculum of the technicians.

**AIM**

Students will be exposed to construction, function, and working principle of engines, lubrication system, cooling system, electrical system and the power train of different types of automobile vehicles.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **INTRODUCTION** | | **2** |
| | 1.1 Definition of automobile | | |
| | 1.2 Different types of chassis layouts - front engine driving the near wheels, transverse engine driving the front wheels, rear engine driving the rear wheels, four wheel drive. | | |
| **2.0** | **ENGINE** | | **6** |
| | 1.1 Classification of internal combustion engine<br>Compression ignition, spark ignition. | | |
| | 2.2 Petrol engine – working principle and application of four stroke petrol engine | | |
| | 2.3 Diesel engine-working principle and application of four stroke engine and two stroke engine. | | |

2.4 Combustion – exhaust emissions : hydrocarbons, carbon monoxide, oxides of nitrogen; emission control approaches : modification of engine design, modification of fuel, exhaust gas treatment; detonation, pre-ignition, valve timing diagram.

**3.0 FUEL SYSTEM 5**

3.1 Characteristics of fuels for automobile engines

3.2 Carburation and air fuel ratios – factors affecting carburation : temperature, time, quality, engine design; air fuel ratios.

3.3 Fuel supply system – petrol engines : tank, fuel, lines, filters, mechanical fuel pump, electric fuel pump, petrol injection system; diesel engines : methods of fuel injection, injector types, fuel injection pump, primary and secondary fuel filters. Governing system; mechanical, pneumatic and hydraulic.

**4.0 COOLING SYSTEM 3**

4.1 Comparison among different types of cooling systems : water cooling, air cooling.
4.2 Parts of air cooling and water cooling systems.
4.3 Anti-freeze mixtures – characteristics and examples

- Describe the air cooling and water cooling system
- List few examples of anti-freeze mixtures.

**5.0 LUBRICATION SYSTEM 4**

5.1 Purpose of lubrication and parts of engine that require lubrication.

5.2 Lubricating oil – function of lubricating oil, properties of lubricating oil.

5.3 Principles of different types of lubrication system - petroil, splash, semi-pressure, pressure, wet-sump, dry sump.

5.4 Parts of lubrication system – oil sump, oil pump, oil relief valve, oil filter, oil dip stick, oil pressure indicating light, oil pressure gauge.

- Explain the necessity of lubrication of engine
  Explain the principles of different types of lubrication system.
- Describe the parts of lubrication system.

**6.0 POWER TRAIN 6**

6.1 Transmission – Elements of power transmission from crank shaft to rear axle

6.2 Clutch – functions of clutch, working principles of different types of clutch : cone, inverted cone, single plate, multiplate, diaphragm, automatic.

6.3 Gear boxes – construction and working principles of different types of gear boxes : sliding, constant mesh, syncromesh, epicycle, automatic; gear box lubrication.

6.4 Propeller shaft – functions, construction,

6.5 Universal joints-working principles of different types of universal joints.

6.6 Differential – purpose, principle, construction

6.7 Drive systems – front wheel drive, four wheel drive

6.8 Rear axles – forces on near axles

**7.0 BRAKING SYSTEM 4**

7.1 Principle of broking and requirements of brake.

7.2 Construction and working principle of different types of brakes - drum brakes, disc brakes, mechanical brakes, hydraulic brakes,

**8.0 SUSPENSION SYSTEMS 5**

8.1 Functions of suspension system and characteristics of a good suspension system.

8.2 Working principles of different suspension systems.

8.3 Working principle of different types of suspension springs : leaf, coil, torsion, air, rubber, hydroelastic.

8.4 Dampers – purpose, function, types

8.5 Wheels and tires.

**9.0 STEERING SYSTEMS 4**

9.1 Functions and requirements of a steering system.

9.2 Arrangement of steering system

- steering wheel, steering column, steering shaft, drop arm, drag link.

9.3 Types of steering gears – worm and sector, rack and pinion, reciprocating ball, warm and roller, cam and lever, screw and nut.

9.4 Wheel alignment : camber, caster, king pin inclination, toe-in, toe-out drawing turns, wheel alignment-setting.

Describe the function and construction of different Types of steering systems.

**10.0 ELECTRICAL SYSTEMS 6**

10.1 Battery – types, principle of battery charging, capacity, methods of charging.

10.2 Dynamo and alternator – purpose, parts, principle of working.

10.3 Ignition system – parts of ignition circuit, magneto ignition system.
10.4 Starting system – purpose, circuit, and construction.
10.5 lighting and auxiliary equipment - Lighting circuit, components of lighting system, components operated by electricity, head lamp, electric horn wind screen wiper.

- Describe the different elements of automotive electrical system.

**PRACTICAL:** 30 hours

**11.0 AUTOMOBILE ENGINEERING LABORATORY 30**

11.1 Introduction, demonstration and use of various tools, instruments and equipment used in auto shop

11.2 Study of automobile chassis with respect to layout, location and function of various major visible components

11.3 Study of automobile engine

11.4 Study of automobile gear box

11.5 Overhauling of clutch and gear assembly

11.6 Overhauling of units of breaking system

11.7 Overhauling of fuel pump

11.8 Overhauling carburetor

11.9 Servicing air filter/air cleaner

11.10 Phasing and calibration of fuel injection pump

11.11 Charging of battery and measuring call voltage, specific gravity of electrolyte

11.12 Checking wheel alignment

11.13 Measuring compression pressure of an engine

11.14 Cleaning of fuel tank and fuel lines

11.15 Nozzle testing and its adjustment

11.16 Overhauling water pump

11.17 Testing of ignition system of engine

11.18 Overhauling of gear box of a vehicle

11.19 Overhauling of lubricating pump.

11.20 Driving practice of a motor vehicle for 6 hours

*NOTE:*

1. *Students should perform the experiments 11.1, 11.2 & 11.3 and any five from the rest*
2. *The experiments should be chosen in such a manner that they cover manor sub assemblies of an automobile*
3. *Students should work in a group the size of which should not be more than ten*

**REFERENCE BOOKS**


1. Dr Kirpal Singh ***Automobile Engineering I & II*** Standard Publishers Distributors
2. R. B.Gupta ***Automobile Engineering*** Satya Prakashan
3. C. P.Nakra ***Automobile Engineering***
4. Joseph Heitmer ***Automotive machinery*** CBS Publishers
5. W. H. Course ***Automotive Engine*** McGraw Hill
6. W. H. Course ***Automotive Transmission & Power Train*** McGraw Hill

# PRODUCTION MANAGEMENT

| L | T | P | **Curri. Ref. No: M505** |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.:45** **Total marks: 100** **Theory:**
Theory: 45 End Term Exam: 70

Tutorial: 0 P.A.: 30

**Prerequisite: Nil**

***Total Credit: 3***

## RATIONALE

Main objective of Mechanical Engineering and Technology is to produce goods and services for benefit of mankind. Resources like material, men and machines are absolutely essential for any production activity. However, to make such a production system operable and self sustaining, questions like "how", "how-much", "when" etc. needs to be properly answered. How a particular production should be made by using which process in what machine etc. is the subject matter of " production technology". Answers to host of other questions like how much quantity to be produced, when to be produced and similar questions pertaining to various factors of production like availability of raw materials, product quality, material handling, productivity, optimum utilisation of resources etc. are also of vital importance for viability of the production system. All these aspects of production system are the subject matter of "Production Management", and hence important for study by the mechanical engineers.

## AIM

A fresh mechanical diploma engineer will be conversant with the concept of production system and management and its ramifications in the area of plant location and layout, material handling, demand forecasting, production planning and control measures, product inspection and quality control, raw materials management, work study, principles of mass production and operations research.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **PRODUCTION & PRODUCTION MANAGEMENT** | | **2** |
| | 1.1 Meaning of the terms : production and production management; factors of production; production system; productivity; types of production : mass, batch, job-shop, projects. | | |

1.2 Objectives of production management; scope of production management.

Understand concepts of : production system, factors of production, production management, productivity.

Compare between mass, batch, job-shop and projects types of production.

## 2.0 PLANT LOCATION, LAYOUT AND MATERIALS HANDLING 7

2.1 Factors affecting plant location; necessity of plant layout; process and product layout; work station design; procedural steps for making a plant layout; undertake plant layout exercise.

2.2 functions and principles of material handling; different types of material handling equipment like crane, hoist, conveyor, truck & trolley, lift and elevator, chute, vibratory feeder, pneumatic conveying, robot etc.; selection criteria of material handling equipment.

Solve problems on plant location selection based on cost comparison and rate of return (ROR) considerations.

Draw work station layout for different machines in a machine shop.

- Sketch different roof structures of a factory.
  Understand specific uses of different material handling equipment.

## 3.0 SALES FORECASTING 4

Concept and purpose of forecasting; forecasting techniques : historic, sales force, trend line, market survey; simple average; moving average; weighted moving average.

- Explain necessity of forecasting.
  Solve problems of forecasting by moving average and weighted moving average techniques.

  Identify the characteristics of moving average over simple average.

## 4.0 PRODUCTION PLANNING & CONTROL 8

4.1 Concept of process planning; process planning procedure : selection of process, materials, jigs & fixtures, tools & gauges, standard set up and process timings; economic batch quantity.

4.2 Concept of scheduling; scheduling techniques : master schedule, perpetual scheduling (load analysis sheet and Gantt load chant).

4.3 Concept and procedure for : dispatching, routing, progress control.

- Understand various process planning procedures

Deduce the mathematical formula for economic batch quantity and solve problems

- Prepare load analysis sheet and Gantt load chant

**5.0 INSPECTION AND QUALITY CONTROL 6**

5.1 Purpose of inspection; types of inspection : moving, fixed, key-point, final.

5.2 Difference between inspection and quality control; benefits of quality control; basic concepts of statistical quality control (SQC); sampling inspection; C-control chart and simple problems.

- Explain the need for inspection
- Compare between various types of inspection
- State benefits for quality control
- Understand concept of SQC
  Write expression for C-control chart and solve simple problems

**6.0 MATERIALS MANAGEMENT AND 8**

**INVENTORY CONTROL**

6.1 Functions and objectives of materials management; objective and functions of purchase department.

6.2 Methods and steps in purchasing : purchase requisition, floating enquiry, tender or quotation, comparative statement, acceptance of quotation, earnest money, security deposit, purchase order.

6.3 Objectives and functions of stores management; location and layout of stores; receipt and issue of materials.

6.4 Store records; stores ledger, bin cards; physical verification of stores; codification of stores; ABC analysis.

8.1 Meaning and classification of inventory; objective of inventory control; economic order quantity (EOQ)- assumptions and deuctions

- State functions and objectives of : materials management, purchase department, stores management.
- Draw typical layout of a large store
- Design : requision slip, store ledger.
- Explain store codification system
- Justify use of ABC analysis in a store
- Explain various steps of purchasing
- Deduce the EOQ formula

**7.0 WORK STUDY** **6**

7.1 Concept and objectives of work study; method study procedure : flow process chart, flow diagram.

7.2 Purpose of time and motion study; therbligs; time study data by stop watch; calculation of standard time (considering performance rating factor and various allowances).

- State the purpose of work study
  Explain flow process chart and flow diagram procedures of method study by drawing suitable sketches.

- List ten therbligs
- Break-up an activity into its therbligs
- Explain the purpose of time and motion study.

8.0 Fundamentals of PERT & CPM **4**

**REFERENCE BOOKS**


1. B. Kumar ***Industrial Engineering*** Khanna Publishers
2. O.P. Khanna ***Industrial Engineering and Management*** Dhanpat Rai & Sons
3. K. C. Jain and L. N. Agarwal ***Production Planning Control and Industrial Management*** Khanna Publishers
4. C.K. Mustafi ***Operations Research Methods and Practice*** New Age International
5. Elwood S. Buffa and Rakesh K. Sarin ***Modern Production/Operation Management*** John Wiley & Sons
6. N. G. Nair ***Production and Operation Management*** Tata McGraw-Hill Publishing Company Limited New Delhi

# MACHINE DESIGN

| L | T | P | Curri. Ref. No: ME 506 |
|---|---|---|---|
| 3 | 0 | 2 | |

**Total Contact hrs.: 75**
Theory: 45
Practical: 30

**Total marks: 150**

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A.: 25

**Prerequisite: M411**
***Total Credit: 4***

## RATIONALE

Design is the formulation of a plan, a scheme, or a method to translate a need into a satisfactorily functioning device that satisfies the original need. Machine design is art of planning or devising new or improved machines to accomplish specific purposes. All engineering courses are tools in the process of design. The idea of design is helpful in the specification and selection of machine components in any activity of an industrial organization. Hence all students should acquaint with machine design to be a successful engineer technician.

## AIM

The student should be acquainted with the methods of calculation to attempt to predict the stress of deformation in the part in order that it may safely carry the loads, which will be imposed upon it, and that it may last for the expected life of the machine. Consideration should be given not only to the cost of design, manufacture, sale, and installation, but also to the cost of servicing.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **INTRODUCTION TO MACHINE DESIGN** | | **6** |

1.1 Definition of machine design, phases of design process, design considerations.

1.2 Introduction to Indian Standards, IS codes related to preferred numbers (IS : 1076) and standard sizes.

1.3 Limits and Fits and Tolerances – Basic Hole System, Basic Shaft System, reading of tables from IS 919, 2709; Use in engineering drawing, selection of standard limits and fits from Indian Standard, Surface roughness.

1.4 Indian Standard on Steels, their physical properties (IS : 1570)

1.5 Types of load, ideas of stress concentration, factor of safety

- Describe the different phases of design process.

- Collect information on preferred numbers, material properties from relevant codes and hand books.
- Use limits, fits and tolerances in machine design

**2.0 SCREW THREADS AND JOINTS 10**

2.1 Design of screwed joints; Internal stresses due to screwing up forces, stresses due to external forces, stresses due to combined load, design of bolts or studs for cylinder cover, bolts of uniform strength, design of nut, bolted joints under eccentric loading.

2.2 Power Screw : Force analysis of power screw, design of power screw and nut.

2.3 Drawing of screwed joints and power screws.

- To design and draw a screwed joint given the loading on the joint.
- To design a power screw for a given load.

3.0 **SHAFTS AND SHAFT COUPLING 15**

3.1 Design of shafts on the basis of strength and rigidity - solid shaft, hollow shaft.

3.2 Design of axles.

3.3 Design of shafts subjected to

a) fluctuating loads
b) axial load in addition to combined
c) torsion and bending load.

3.4 Design shaft and shaft coupling for a specified duty.

**4.0 BEARINGS 8**

4.1 Simple loaded shafts mounted on bearings, calculations (shaft diameter and bearing loads)

4.2 Types of bearings, bearing materials, bearing lubrication ( IS : 10260, IS 11473)

4.3 Design and drawing of journal bearing (simple type)

4.4 Rolling Contact Bearing – types, standard dimensions and designations of bearings, selection of rolling element bearing from catalogues / handbooks.

4.5 Design and drawing of shaft mounted on anti-friction bearings.

- To design journal bearing for given load
- Select rolling contact bearing for given loading

**5.0 DRIVES 8**

5.1 Pulleys – design of hub rims, arm, key and key ways

5.2 Drawing on related problems on pulleys

5.3 Spur Gears – calculation of number of teeth, gear ratio, forces acting between gear wheels, selection of gear dimensions.

5.4 Drawing of simple gear drives and pulley drives

- Design gear drive for given power and speed
- Design pulley for given power, speed and angle of contact.

**6.0 PIPE JOINTS 8**

6.1 Pipes and cylinders subjected to internal pressure-calculations of internal diameter and thickness

6.2 Pipe joint - design

6.3 Drawing pipe joints with different fittings.

- To design pipe joint under given internal pressure and pipe material.

## 7.0 RIVETED JOINTS AND WELDED JOINTS 10

7.1 Riveted joints – Design of a riveted joint : Single riveted lap joint, double riveted lap joint, triple riveted lap joint; efficiency of riveted joint; drawing of riveted joints.

- Determine the design parameters (rivet size, type of joint and joint efficiency etc.) if the thicknesses and working stresses of plates are given.
- Draw the riveted joints showing all design parameters.

7.2 Welded joints – design of welded joints for static loads: strength of butt joints, strength of fillet joints, fillet welts in tee joints.

- Determine the welt size given thickness, width of plates, working stresses and loading condition.

## 8.0 COMPUTER AIDED DRAFTING 10

Use of Auto Cad or any other drafting package to make assembly and detailed drawings any of the above topics.
To draw simple production drawings using CAD package.

**NOTE:** Students will draw detail and assembly drawings, from design drawing or from given problems considering the assembly difficulties, manufacturing requirements, material, standard parts, standard fits and tolerance. They are to use design calculation only to check the dimensions of the relevant parts.

## REFERENCE BOOKS


1. P. C. Sharma and D. K. Aggarwal ***Machine Design*** S. K. Kataria & Sons, Delhi

2. R. L. Khurmi and J. K. Gupta ***Machine Design*** Eurasia Publishing House Ltd.

3. R. B. Gupta ***Machine Design*** Satya Prakashan, New Delhi

4. J. E. Shigley and Charles R. Mischke ***Mechanical Engineering Design*** Mc Graw-Hill Book Company.

5. N. C. Pandya and C. S. Shah ***Elements of Machine Design*** Charotar Publishing House, Anand.

6. Allen S. Hall, Alfred R. Holowenko and Herman G. Laughlin ***Schaum's Outline of theory and Problems of Machine Design*** Mc Graw – Hill Book Company.

7. Sham Tickoo, Santosh Tickoo and Renu Muthoo ***Auto CAD – 14 For Windows Bible*** Galgotia Publications Pvt. Ltd.

8. M. F. Spotts ***Design of Machine Elements*** Prentice Hall of India Limited

9. Aaron D. Deutschman, Walter J. Michels and Charles E. Wilson ***Machine Design : Theory and Practice*** Macmillan Publishing Co.Inc

10. S. G. Kulkarni ***Machine Design*** Tata McGraw-Hill Publishing Company Limited

11. S. N. Trikha ***Machine Design Exercises*** Khanna Publishers

12. IS : 1076 (Part 1 and 2) : 1985 Bureau of Indian Standards

13. IS : 919 (Part 1 and 2) : 1993 Bureau of Indian Standards

14. IS : 10260 (Part 1, 2, 3) : 1982 Bureau of Indian Standards

1. IS : 14478 : 1997 Bureau of Indian Standards

# PLANT MAINTENANCE ENGINEERING

| L | T | P | **Curri. Ref. No: M 507** |
|---|---|---|---|
| 3 | 0 | 0 | |

**Total Contact hrs.: 45**
Theory: 45

Tutorial: 0

**Practical:** 0

**Total marks:** 100

**Theory:**
End Term Exam: 70

P.A.: 30

**Prerequisite: Nil**

***Total Credit: 3***

## RATIONALE

Maintenance is an important and integral part of the factory organization. Maintenance means up-keeping of the equipment to ensure their reliability, accuracy, durability and availability of equipment needed to achieve desired production target. It is necessary to keep machinery, buildings and equipment in good operating conditions all the time. No definite all purpose maintenance procedure can be recommended or prescribed in general. It varies from plant to plant, depending on the size, politics, technology and prevailing condition of an individual concern. Technicians working on any type of concern should be acquainted with the basic principles of maintenance.

## AIM

The students will be exposed to installation and maintenance of different types of machinery, and the common tools and materials required for these activities.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

**1.0 INTRODUCTION** **3**

1.1 Definition and objectives of maintenance.

1.2 Fundamental of reliability,bath-tub curve ,hazard models,MTTF, maintainability and avaibility

1.3 Tools and equipment for installation and maintenance work

- List the objectives of maintenance
- Describe the use fits and tolerance in maintenance work
- List the tools and equipment required in maintenance work

**2.0 GENERAL INSTALLATION PROCEDURE OF ENGINE** **5**

**OR MACHINE**

4.2 Location, layout and positioning of machine

4.3 Foundation : dynamic and static loads, ground condition, vibration consideration, foundation bolts, excavation, template, concrete mixing, pouring, levelling and alignment.

4.4 Grouting, fitting of parts and fittings, final levelling and test runs.

- Describe the steps of installation of an engine or machine.

**3.0 POWER TRANSMISSION DEVICES 8**

3.1 Key and keyway – dismantling of keyed joint, assembly of keyed joints.

3.2 Plain bearing – assembly of plain bearings, bush repairing.

3.3 Antifriction bearing – selection of bearing, mounting dismantling of anti-friction bearing.

3.4 Coupling – Assembly of couplings, coupling defects and repair.

3.5 Clutches – defects and repair

3.6 Belt drives – belt joining methods, installation, maintenance.

3.7 Chain drive – defects and repair of chain, erection of chain and sprocket drive.

3.8 Gears – Assembly of gears, gear tooth failure, maintenance, gear inspection, errors.

- Describe the methods of assembly and repair of common power transmission elements.

**4.0 SEALS, PACKING AND GASKETS 3**

4.1 Types of seals – static seal (gasket), dynamic seals, labyrinth seals, packings.

4.2 Application – seals in bearing, packing and seals for pumps, seals and packing for steam turbine, packings in pipe fittings.
Describe different types of seals and their applications.

**5.0 LUBRICATION 3**

5.1 Functions of lubrication.

5.2 Properties of lubricants and selection of lubricant.

5.3 Modes of lubrication – boundary, fluid film, mixed.

5.4 Types of lubricating systems – hand, dip, wick, splash, circulating.

5.5 Lubricating instructions.

- Describe the functions and properties of lubricants. Describe different types of lubricating system with their application.

**6.0 ELECTRIC MOTORS 5**

6.1 Types of motors – A. C. motors, D. C. motors.

6.2 Selection and installation of motors.

6.3 Maintenance of motor – bearing, slip rings and brushes and commutator.

6.4 Operational problems on A. C. motor - causes andremedies.

- Describe the process of selection of a motor and its installation.
- Identify the proper causes and remedies for operational problems of motor.

**7.0 INTERNAL COMBUSTION ENGINE 10**

7.1 Diesel engine – foundation, erection.

7.2 Maintenance of main parts of diesel engine - cylinder head, cylinder block and cylinder liner, piston and piston ring, crank shaft and main bearing, fuel oil injector.

7.3 Operational troubles of a diesel engine.

7.4 Maintenance of petrol engine parts.

7.5 Trouble – shooting of a petrol engine

- Describe the maintenance procedure of the main components of diesel engine
- Describe the maintenance of petrol engine

**8.0 MAINTENANCE PLANNING 8**

8.1 Definition, advantage and limitation of types of Maintenance - scheduled, predictive, preventive, breakdown.

8.2 General organization of maintenance.

8.3 Maintenance planning – planning and scheduling : controlling, repair, cycle, repair complecity, equipment history card, master schedule card, work report; controlling; maintenance and reliability.

8.4 Spare parts management – spare parts planning : codification of spares, preservation of past data, practice to use standard spares, effective purchase procedures; classification of spare parts.

**RECOMMENDED BOOKS**


1. H. P. Garg ***Industrial Maintenance*** S. Chand & Company Ltd.
2. R. K. Jain ***Plant Maintenance Engineering***
3. Nayak ***Maintenance Engineering***
4. A. R. Basu, P G Goswami, T. P. ***Mukherjee Installation Maintenance Servicing*** M. Dutta & Co., Calcutta.
5. S. N. Bhattacharyya ***Installation Servicing and Maintenance*** S. Chand & Company Ltd.
6 .L.S. Srinath ***Introduction to Reliability Engineering*** East West Publication

## WORKSHOP PRACTICE - V

| L | T | P | | |
|---|---|---|---|---|
| 0 | 0 | 4 | | **Curri. Ref. No:M 508** |
| **Total Contact hrs.: 60** | | **Total marks: 50** | **Practical:** | |
| Theory: 0 | | | P.A : 50 | |
| Practical: 60 | | | | |
| **Credit: 2** | | | | |

**RATIONALE**

The wealth of a community of measured by the variety and quality of the articles, it possesses for its use and consumption. All the materials we posses are made from substances which is the first place are won-from the earth, or from nature. Our property depends upon our ability to convert these raw materials into useful articles for consumption, and to distribute these articles equitably amongst the various members of our community. The production of our engineering workshops from an important part of our general industrial scheme since a large proportion of our industries is of an engineering nature. Our ability, therefore, to maintain a high standard of skill in our engineering workshops is an important factor

**AIM**

To develop basic concepts and working principles of various processes of lathe machines, milling machine milling cutters, drilling machines and various types of measuring instrument.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.** | **MACHINE SHOP** | | **30** |
| | 1.1 Shop Talk | | |
| | 1.1.1 Description of the various methods of taper lurning with demonstration on a centre lathe. | | |
| | 1.1.2 Description of the various job holding devices pike face plate, angle plate, collet, seady rent, follower rest of a cente lathe. | | |
| | 1.1.3 Description of the cutting of L.H. threads, in multiple start threads with demonstration. | | |
| | 1.1.4 Study of turret & capsta lathe, common tools and attachments used on turret/capstan lathe, and demonstration of making some simple parts using various tools. Specification of a capstan/turret lathe. | | |
| | 1.1.5 Study of various types of milling machines, functions of different components and accessories and their core and maintenance. Specification of a milling machine. | | |
| | 1.1.6 Study of different types of milling cutters, their specification and method of cutter sharpening. | | |

1.1.7 Demonstration of job and tool setting on a milling machine. Operating the controls, job holding and supporting devices, use of gear tooth vernier.

1.1.8 Study of radial drilling machine, their specification and uses

1.1.9 Demonstration of boring and reaming, operations of a single point H.S.S. cutting tool. Discussions about specific uses of these operation.

1.1.10 Study of a cylindrical grinder, etc. specific uses and demonstration of operation. Selection of grinding wheel fora job.

- State the methods of taper turning on a centre lathe
- State the types of job holding devices used in a centre lathe
- Specify a milling machine
- Demonstrate different indexing operations

1.2 Shop practice

1.2.1 Facing operation by holding a job in a four jaw chuck

1.2.2 Plain turning operation through setting a graduated collar on a cross-slide.

1.2.3 Step turning by using a R.H. knife tool, Aligning lathe centres by visual alignment, aligning lathe centre using tail stock graduation, aligning lathe centres using trial cut method, aligning lathe centres using test bar & dial indicator

1.2.4 Right hand (R.H.) left hand (L.H.) square and V-thread cutting (external and internal) including drilling and boring.

1.2.5 Preparation flat, inclined surface, slots, key way on a M. S. / C.I. in milling machine.

1.2.6 Making of spur gear of a given D. P. on CI/MS blank on a milling machine.

1.3 Tests and Viva-Voce

## 2.0 ADVANCED FITTING SHOP 30

2.1 Shop Talk :

2.1.1 Vernier caliper graduations and reading of vernier caliper and measurement of drilled angles.

2.1.2 Standard tapers, special purpose files and constructional features of a micrometer.

2.1.3 Description and use of slip gauges, sin bar and centre gauges.

2.1.4 Demonstration and use of dial test indicator

2.1.5 Running and routine maintenance of tools and machineries, breakdown maintenance of machines

2.2 Shop Practice

2.2.1 Selection and determination of slip gauges for different sizes.
2.2.2 Determination of taper using sine bar and step Gauges.
2.2.3 Determination of internal dovetail angle using rotters and slip gauges.
2.2.4 Measurement of effective diameter and minor diameter of a screw thread.
2.2.5 Calculation of internal and external diameter using rollers and slip gauges.

**REFERENCE BOOKS**

1. Fitter – Trade practical (1st year and 2nd year), Central Instructional Media Institute, Madras, Directorate General of Employment & Training, Ministry of Labour, Govt. of India.

2. Machinist – Trade practical (1st year and 2nd year), Central Instructional Media Institute, Madras, Directorate General of Employment & Training, Ministry of Labour, Govt. of India.

## REFRIGERATION AND AIR CONDITIONING

| L | T | P | **Curri. Ref. No: ME 509** |
|---|---|---|---|
| 3 | 0 | 2 | |

**Total Contact hrs.: 75** **Total marks: 150**

Theory: 45

**Practical:** 30

**Prerequisite: ME 401,ME402**

***Total Credit: 4***

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A: 25

### RATIONALE

Refrigeration is the process of cooling below surrounding temperature. It has numerous applications spanning from air conditioning to industrial refrigeration for chemical, pharmaceutical, petrochemical plants, including food preservation and many special applications in manufacturing and construction industries.

Air-conditioning dos not necessarily means cooling only. It means treatment and supply of air after controlling its temperatures, humidity and cleanliness for human comfort.

The field of application for Refrigeration and Air conditioning in growing rapidly. But with the steady increase in energy cost and the threat perception of diminishing reserves of conventional fuel, the subject of Refrigeration & Air Conditioning becomes more specialized and energy effective day by day. Therefore, the students who would like to pursue their industrial career in this widening field, should undertake this electric course.

### AIM

After study of this subject a diploma mechanical engineer should have a clear understanding about the diverse field of application of Refrigeration & Air Conditioning, and sufficient knowledge about the equipment used and the processes involved in their operation.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| 1.0 | **APPLICATIONS OF REFRIGERATION & AIR CONDITIONING.** | | **4** |
| | 1.1 Definitions and relationship of "Refrigeration" and "Air-conditioning". | | |

1.2 Major uses of Air-conditioning : buildings, industrial air conditioning, ventilation, room air conditioners, vehicle.

1.3 Major uses of refrigeration : cold storage, food preservation, and distribution, food processing, chemical processes, desalting of sea-water, special applications.

- Understand the relationship between refrigeration and air-conditioning
- Develop a comprehensive idea about applications of refrigeration and air-conditioning in various fields.

## 2.0 THERMAL PRINCIPLES 3

Definition and concept of : enthalpy, heat transfer by conduction, convection and radiation, heat exchangers, evaporation.

- Define and explain the concepts of: enthalpy, heat transfer, conduction, convection, radiation, evaporation, latent heat etc.
- Explain function of heat exchangers.

## 3.0 VAPOUR COMPRESSION SYSTEM 8

3.1 Concept of vapour compression system; flow diagram and pressure - enthalpy diagram; Co-efficient of performance (COP);

3.2 Classification and nomenclature of refrigerants; properties of common refrigerants.

3.3 Use working principle and constructional features of component equipment: compressors, condensers of evaporators (water cooled, air-cooled), expansion valve (thermostatic and electric).

- Explain the working principle of a vapour compression refrigeration system.
- Draw a flow diagram of a vapour compression cycle and explain function of each component,
- Understand the pressure-enthalpy diagram for a vapour compression system
- Define COP and express it in enthalpy terms of the refrigerant
- Solve simple problems of a refrigeration system.
- Explain through sketches constructional features and use of various component equipment like compressors, condensers, evaporators and expansion valve.

## 4.0 VAPOUR ABSORPTION SYSTEM 4

Principle of absorption system; the absorption cycle; comparison between absorption and compression system.

- Draw flow diagram of an absorption refrigeration system and explain the working principle
- Compare between absorption and compression refrigeration system

**5.0 PSYCHROMETRICS 4**

5.1 Definition ; definition of terms : saturation line, dew point, relative humidity ratio specific humidity, dry and wet bulb temperature.

5.2 Psychrometric chart and use of such charts.

- Use psychrometric charts
- Understand various terms like : dew point, relative humidity, specific humidity, dry and wet bulb temperature.

6.0 **COMFORT CONDITIONS & LOAD CALCULATIONS 6**

6.1 Factors governing human comfort; comfort standard, related to temperature, humidity, air velocity and ventilation (air change).

6.2 Components of heating load; procedure for heating load calculation (no derivation); components of cooling load; procedure for cooling load calculation (no derivation).

- Memorize the comfort standards related o range of temperature, humidity, air velocity and air change.

**7. AIR CONDITIONING SYSTEM 10**

7.1 Concept of an air-conditioning system; single zone system; outdoor air control; multiple zone system.

7.2 Air distribution system; duct size design, centrifugal fan (blown) and their characteristics

7.3 Water heaters; room heaters (water and electric); water and refrigerant piping.

7.4 Constructional details and working of a room air conditioner; cooling coil; desert cooler.

7.5 Air-conditioning controls; various control systems, function of various control components like : two way and three way valves, dampers, pressure regulators, thermostats, humidistates etc.

8 Maintainability aspects of refrigeration and air conditioning systems 6

**PRACTICAL:** 30 hours

**9. REFRIGERATION & AIRCONDITIONING LABORATORY 30**

8.1 To study a vapour compression refrigeration unit and identify all components.

8.2 To bring out a room air conditioner from its casing, study the unit and identify all components.

8.3 To determine relative humidity using dry and wet bulb temperature.

8.4 To determine the Co-efficient of Performance (COP) of an air conditioning unit.

8.5 To determine cycle efficiency of an air conditioning plant.

8.6 To determine capacity and efficiency of a compressor.

8.7 To evacuate a closed space by a vacuum pump and to measure the degree of vacuum created.

*Note: At least 5 experiments to be conducted by each batch of students. One batch should not consist of more than 10 students.*

**REFERENCE BOOKS**


1. Stoecker and Jones ***Refrigeration & Air Conditioning*** McGraw Hill international edition.
2. C. P. Arora ***Refrigeration and Air Conditioning*** TMH
3. Manohar Prasad ***Refrigeration and Air Conditioning*** New Age International (P) Ltd.
4. P. L. Ballaney ***Refrigeration and Air Conditioning*** Khanna Publishers.
5. NPTEL lecture materials on ***Refrigeration and Air Conditionin***

# MECHANICAL ESTIMATION

| L | T | P | **Curri. Ref. No: ME 510** |
|---|---|---|---|
| 2 | 0 | 2 | |

**Total Contact hrs.: 60**
Theory: 30

Tutorial: 0

**Practical:** 30

***Total Credit: 3***

**Total marks:** 150

**Theory:**
End Term Exam: 70

P.A : 30

**Practical**

**Sessional : 25**

**Viva : 25**

## RATIONALE

Estimation is an art of finding the cost, which is likely to be incurred on the manufacture of an article, before it is actually manufactured. In all organizations, before starting actual production or filling up the tenders, estimation is done. The technicians working in big organigations this estimation is limited to estimate department. In small industrial organisations the technicians have to supervise number of activities as there are no separate department for each activity. Hence they have to make estimate frequently. Hence, every technician should study this subject.

## AIM

The students should be exposed to the basic methods of calculating material, time, labor required for different applications in different manufacturing shops to produce an item.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| 1.0 | ESTIMATION AND COSTING | | **5** |
| | 1.1 Estimating – definition, functions, constituents of estimate. | | |
| | 1.2 Elements of cost – materials, labour, expenses | | |
| | 1.3 Components of cost – prime cost, factory cost, office cost, total cost. | | |
| | 1.4 Indirect expenses – factory expenses, administrative expenses. | | |
| | 1.5 Methods of wage payment | | |
| | Identify different types of costs and expenses. Distinguish among different methods of wage payment. | | |
| 2.0 | ESTIMATION OF WEIGHTS AND MATERIALS | | **5** |
| | 2.1 Forms of materials : casting, forgings, bar or billets; different cross section. | | |
| | 2.2 Procedural steps for calculating material cost of a product. | | |

2.3 Centroids and areas of plane figures, volumes and surface areas of solids.

**3.0 ESTIMATION IN MACHINE SHOP 5**

3.1 Time considerations during machining : job set up, tool set up, inspection of job, fatigue allowance.

3.2 Terms related to machining : cutting speed, feed, depth of cut.

3.3 Lathe operations : turning, knurling, facing, drilling, boring, reaming, threading, tapping.

3.4 Milling operations : Cutting operation, facing operation.

3.5 Grinding operations : surface grinding, cylindrical grinding.

3.6 Shaping and planing : shaping operation, planing operation.

- Calculate machining time, machining cost of machined items.

**4.0 ESTIMATION IN SHEET METAL SHOP 15**

4.1 Common operations and processes in sheet metal shop.

4.2 Common sheet metal joints.

4.3 Calculation of blank size, blank lay-outs, estimation of time in different processes and capacity of press

for sheet metal work.

4.4 Practice exercise : window frame, funnel, open and covered tanks, cylindrical tank, tables, racks, mouldbox, chimney etc.(any five).

- Estimate material, required time, cost of sheet metal items.

**5.0 ESTIMATION IN FORGING SHOP 5**

5.1 Common forging operations

5.2 Estimation of net weight, and estimation of losses :long loss, scale loss, sprue loss.

5.3 Estimation of time : heating the job, performing forging operation.

- Estimate the material requirement and cost of operation for a forged item.

6.0 ESTIMATION IN WELDING SHOP **5**

6.1 Estimation of welding cost : preparation cost, cost of material, labour cost, finishing cost, on cost.

6.2 Estimation of gas cutting cost: cutting cost, finishing cost, on cost

6.3 Estimation of electric welding cost :
Material cost, labour cost, power charges,

Finishing cost, on-cost.

- Estimate the different component costs for welding and cutting and the total cost for an fabricated item.

**7.0 ESTIMATION IN PATTERN MAKING AND FOUNDRY SHOP 5**

7.1 Estimation of pattern cost : direct material cost, direct labour cost, overheads.

7.2 Estimation of foundry shop: material cot, labour cot, on-cost,

**8.0 PRACTICE EXERCISE : 10**

Estimation of the following items using the procedures related to different shops.

a) Stools, book case, chest drawers, packing box, surface plate, flange coupling, face plate, pulley bracket, stepped pulley, foot step bearing block (any four).

b) Bracket, flanged coupling, pulley, cone clutch, piston, solid, bush bearing, air valve CI blocks, wall box, disc, piston rod (any five)

**9.0 PROJECT PLANNING: 5**

Market surveying, project capacity, selection of site, design and drawing, material requirement, operation planing, machine loading, sub-contract consideration, equipment requirement, organizational layout and staff requirement, material handling, budgeting.

- Describe the different steps in project planning.

**REFERENCE BOOKS**


1. D. Kannappan, A.G. Augustine and D. Paranthaman ***Mechanical Estimating and Costing*** Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. T. R. Banga and S.C. Sharma ***Mechanical Estimating and Costing*** Khanna Publishers, Delhi.
3. J. S. Charaya and G. S. Narang ***A Text Book of Estimating and Costing (Mechanical)***
4. C. K. Singh and M. I. Khan ***Mechanical Costing & Estimation*** Standard Publishers Distributors, New Delhi.
5. O. P. Khanna ***A Text Book of Mechanical Estimating and Costing*** Dhanpat Rai & Sons.
6. S. C. Jain ***Mechanical Estimating and Costing*** Dhanpat Rai & Sons.
7. T. P. Mukherjee and P. G. Goswami ***Estimating and Costing*** M. Datta & Co., Calcutta.
8. B. P. Sinha ***Mechanical Estimating and Costing*** Tata McGraw Hill Publishing Company Limited, New Delhi.

## PROFESSINAL PRACTICE I

| L | T | P | | |
|---|---|---|---|---|
| 0 | 0 | 2 | | |
| **Total Contact hrs.: 30** | | | **Total marks: 50** | **Practical:** |
| Theory: 0 | | | | P.A : 50 |
| Practical: 30 | | | | |
| **Credit: 1** | | | | |

**Curri. Ref. No: ME 511**

### RATIONAL

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

### AIM

The Student will be able to:

- Acquire information from different sources.
- Prepare notes for given topic.
- Present given topic in a seminar.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture.

### Activities

**Industrial Visits:**

Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form part of the term work.

Visits to **any two** of the following:

- Nearby Petrol Pump.(fuel, oil, product specifications)
- Automobile Service Station (Observation of Components / aggregates)
- Engineering Workshop(Layout, Machines)
- Dairy Plant / Water Treatment Plant

Lectures by Professional / Industrial Expert / Student Seminars based on information search to be organized from any THREE of the following areas:

- Pollution control.

- Non destructive testing.
- Acoustics.
- Illumination / Lighting system.
- Fire Fighting / Safety Precautions and First aids.
- Computer Networking and Security.
- Topics related to Social Awareness such as - Traffic Control System, Career opportunities, Communication in Industry, Yoga Meditation, Aids awareness and health awareness.

**Group Discussion:**

The students should discuss in a group of six to eight students and write a brief report on the same as a part of term work. Two topics for group discussions may be selected by the faculty members. Some of the suggested topics are -

i) Sports

ii) Current news items

iii) Discipline and House Keeping

iv) Current topics related to mechanical engineering field.

**Student Activities:**

The students in a group of 3 to 4 will perform any one of the following activities ( others similar activities may be considered Activity :

i) Collect and study IS code for Engineering Drawing..

ii) Collecting information from Market: Nomenclatures and specifications of engineering materials.

iii) Specifications of Lubricants.

iv) Draw orthographic projections of a given simple machine element using and CAD software

## PROFESSINAL PRACTICE II

| L | T | P | Curri. Ref. No: ME 512 |
|---|---|---|---|
| 0 | 0 | 2 | |

**Total Contact hrs.: 30** **Total marks: 50** **Practical:**

Theory: 0

P.A : 50

Practical: 30

**Credit: 1**

**RATIONAL**

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

**AIM**

Student will be able to:

- Acquire information from different sources.
- Prepare notes for given topic.
- Present given topic in a seminar.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture

**Contents**

**Activities**

- **Industrial Visits**

Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work.

**TWO** industrial visits may be arranged in the following areas / industries:

i. Manufacturing organizations for observing various manufacturing processes including heat treatment
ii. Material testing laboratories in industries or reputed organizations
iii. Auto workshop / Garage
iv. Plastic material processing unit
v. SateTransport workshop / City transport workshop

Lectures by Professional / Industrial Expert be organized from **ANY THREE** of the following areas:

i. Use of a plastics in automobiles.
ii. Nonferrous Metals and alloys for engineering applications
iii. Surface Treatment Processes like electroplating, powder coating etc.
iv. Selection of electric motors.

v. Computer aided drafting.
vi. Industrial hygiene.
vii. Composite Materials.
viii. Heat treatment processes.
ix. Ceramics
x. Safety Engineering and Waste elimination

**Individual Assignments:**

**Any two** from the list suggested

a) Process sequence of any two machine components.
b) Write material specifications for any two composite jobs.
c) Collection of samples of different plastic material or cutting tools with properties, specifications and applications.
d) Preparing models using development of surfaces.
e) Assignments on bending moment, sheer forces, deflection of beams and torsion chapters of strength of material.
f) Select different materials with specifications for at least 10 different machine components and list the important material properties desirable.
g) Select 5 different carbon steels and alloy steels used in mechanical engineering applications and specify heat treatment processes employed for improving the properties. Also give brief description of the heat treatment processes.
h) List the various properties and applications of following materials - a. Ceramics b. fiber reinforcement plastics

i) thermo plastic plastics d. thermo setting plastics

j) rubbers.

OR

Conduct **ANY ONE** of the following activities through active participation of students and write report

i. Rally for energy conservation / tree plantation.
ii. Survey for local social problems such as mal nutrition, unemployment, cleanliness, illiteracy etc.
iii. Conduct aptitude , general knowledge test , IQ test
iv. Arrange **any one** training in the following areas :
a) Yoga. B) Use of firefighting equipment and First aid
Maintenance of Domestic appliances.

**Modular courses (Optional):**

A course module should be designed in the following areas for max. 12 hrs. Batch size - min. 15 students.

Course may be organized internally or with the help of external organizations.

a) Forging Technology.
b) CAD-CAM related software.
c) Welding techniques.
d) Personality development.
e) Entrepreneurship development.

**3-D Design using software**

Computer screen, coordinate system and planes, definition of HP,VP, reference planes How to create them in $2^{nd}/3^{rd}$ environment. Selection of drawing site & scale. Commands of creation of Line, coordinate points, Axis, Poly lines, square, rectangle, polygon, sp line, circles, ellipse, text, move, copy, offset, Mirror, Rotate, Trison, Extend, Break, Chamfer, Fillet,Curves, Constraints fit tangency, perpendicularity, dimensioning Line convention, material conventions and lettering.

The Student should draw - different orthographic Views (including sections), Auxiliary views according to first/ Third angle method of projection. (Minimum two sheets, each containing two problems) after learning the contents as above.

## PROFESSINAL PRACTICE III

| L | T | P | Curri. Ref. No: ME 513 |
|---|---|---|---|
| 0 | 0 | 3 | |

**Total Contact hrs.: 45** **Total marks: 50** **Practical:**

Theory: 0

P.A : 50

Practical: 45

**Credit: 2**

**RATIONAL**

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

**AIM**

Student will be able to:

- Acquire information from different sources
- Prepare notes for given topic
- Present given topic in a seminar
- Interact with peers to share thoughts
- Prepare a report on industrial visit, expert lecture

**Contents**

**Activities**

**Industrial Visits**

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. The industrial visits may be arranged in the following areas / industries: Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant.

vi)Machine shop having CNC machines.

vii)ST workshop / Auto service station

viii) City water supply pumping station

ix) Manufacturing unit to observe finishing and super finishing processes.

**Lectures by Professional / Industrial Expert lectures to be organized from any two of the following areas:**

Interview Techniques.

Modern Boilers - Provisions in IBR

Applications of Sensors and Transducers

Alternate fuels - CNG / LPG , Biodiesel, Ethanol, hydrogen

Piping technology

**Information Search:**

Information search can be done through manufacturer's catalogue, websites, magazines, books etc. and submit a report **any one** topic.

Following topics are suggested:

v) Engine lubricants & additives

vi)Automotive gaskets and sealants

vii)Engine coolants and additives

viii)Two and Four wheeler carburetor.

ix)Power steering

x)Filters

xi)Different drives/Transmission systems in two wheelers.

xii)Types of bearings - applications and suppliers.

xiii) Heat Exchangers

xiv)Maintenance procedure for solar equipment.

Tools holder on general purpose machines and drilling machines.

**Seminar:**

Seminar topic shall be related to the subjects of fourth semester. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time - 10 minutes)

Mini Project / Activities: (any one)

a) Prepare one model out of card board paper / acrylic / wood / thermocol / metal such as : i) Elliptical Trammel ii) Pantograph iii) Coupling iv) Cams and Followers v) Geneva mechanism
b) Dismantling of assembly (e.g. jig / fixtures, tool post, valves etc.) Take measurement and prepare drawings / sketches of different parts.
c) Make a small decorative water fountain unit.
d) Toy making with simple operating mechanisms.

## PROFESSINAL PRACTICE IV

| L | T | P | Curri. Ref. No: ME 514 |
|---|---|---|---|
| 0 | 0 | 3 | |

**Total Contact hrs.: 45** **Total marks: 50** **Practical:**

Theory: 0

P.A : 50

Practical: 45

**Credit: 2**

### RATIONAL

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

### AIM

- Student will be able to:
- Acquire information from different sources.
- Prepare notes for given topic.
- Present given topic in a seminar.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture

### Contents

**Activities**

### Industrial Visits

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work.(2 visits) Following are the suggested types of Industries/ Fields –

i. Automobile manufacturing / auto component manufacturing units to observe the working of SPM
ii. Refrigeration and air conditioning manufacturing / servicing units / industries / workshops
iii. Automobile service stations for four wheelers
iv. Co-ordinate measuring machine to observe its construction working specifications and applications.
v. Auto Engine Testing unit to gather details regarding the testing procedures/parameters etc.
vi. Wheel Balancing unit for light and / or heavy motor vehicles.
vii. Food processing unit.
viii. Textile industry machinery manufacturing / servicing units.
ix. Hydro electric and Thermal power plants.

x. Automotive Research Association of India, Pune, Central Iinstitute of Road Transport, Pune, Vehicle Research and Development establishment , Ahmednagar.
xi. Engine testing, exhaust gas analysis and vehicle testing
xii. PWD workshop.
xiii. Safety museum at Central Labour Institute, Sion, Mumbai

**The Guest Lecture/s**

From field/industry experts, professionals to be arranged (2 Hrs duration), minimum 4 nos. from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of Term work

a) Electronic fuel injection systems
b) Exhaust gas analysis.
c) Vehicle testing.
d) Transducer application in automobiles.
e) Environmental pollution & control.
f) Vehicle aerodynamics & design.
g) Earth moving machines.
h) Automobile pollution, norms of pollution control.
i) Biotechnology
j) Nanotechnology
k) Rapid prototyping
l) Programmable logic controllers
m) TQM
n) MPFI
o) Hybrid motor vehicles
p) Packaging technology
q) Appropriate technology
r) Six sigma systems
s) LPG / CNG conversion kit.

**Group Discussion:**

The students should discuss in group of six to eight students and write a brief report on the same, as a part of term work. The topic of group discussions may be selected by the faculty members. Some of the suggested topics are **(any one) –**

i. CNG versus LPG as a fuel.
ii. Petrol versus Diesel as a fuel for cars.
iii. Trends in automobile market.
iv. Load shading and remedial measures.
v. Rain water harvesting.
vi. Trends in refrigeration Technology.
vii. Disaster management.
viii. Safety in day to day life.
ix. Energy Saving in Institute.
**x.** Nano technology.

**Seminar: (any 2 topics)**

Seminar topic should be related to the subjects of fifth semester / topics from guest lectures. Students shall submit a report of at least 10 pages and deliver a seminar (Presentation time - 10 minutes for a group of 2 students)

**Mini Projects: (in a group of 4-5 students)**

1. Design / drawing of simple jigs, fixtures
2. Thermocouple based temperature controller.
3. Pump on / off timer
4. Models of jigs / fixtures
5. Layout design of SSI units / factory / workshop of the institute
6. 

**Models of material handling route systems**

OR

**Modular Course on any one of the suggested or alike relevant topic be undertaken by a group of students (Min 10):**

a) LPG/CNG conversion of vehicles b) Advance features in CAD - CAM c) basics of PLC programming d) die design e) JIT techniques f) Nontraditional manufacturing methods g) jigs and fixture design h) 3D Modeling I) finite element method j) Mechatronics k) Advanced computer programming l) maintenance of home appliances m) value stream mapping
n) Piping technology

**Student Activities** - Students in a group of 3 to 4 shall perform **ANY TWO** of the following activities (Other similar activities may be considered) and write a report as a part of term work.

**Activities:-**

1. Collection of data regarding loan facilities or other facilities available through different organizations / banks to budding entrepreneurs
2. Survey and interviews of successful entrepreneurs in nearby areas
3. Survey of opportunities available in thrust areas identified by Government or DIC.
4. Measuring Screw thread parameters on floating carriage dial micrometre and select the optimum diameter of wire.
5. Survey of data regarding different types of pumps with specifications from manufacturers catalogue, local markets, end users (any other engineering products may be considered for survey)
6. Survey of farm implements used by farmers

Text Books:

| Name of Authors | Titles of the Book | Edition | Name of the Publisher |
|---|---|---|---|
| Mark Ratner and Daniel Ratner | ***Nanotechnology*** | | Pearson Educatuion, New Delhi |
| YoramKorem | ***Computer Control of Manufactring System*** | | Mcgraw Hill Publication |
| Sunil Chopra, Peter Meindl | ***Supply Chain Management*** | | Pearson Educatuion, New Delhi |

## PROFESSINAL PRACTICE V

| L | T | P | Curri. Ref. No: ME 515 |
|---|---|---|---|
| 0 | 0 | 6 | |

**Total Contact hrs.: 90** **Total marks: 50** **Practical:**

Theory: 0

P.A : 50

Practical: 90

**Credit: 3**

**Aim**

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

**Objective**

Student will be able to:

- Acquire information from different sources.
- Prepare notes for given topic.
- Present given topic in a seminar.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture.

**Pre-Requisite:- Nil**

**Activities**

**Industrial Visits**

Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work.

**Two** industrial visits may be arranged in the following areas / industries to observe - Material Handling System, quality control charts / production record / layout flow systems / Facilities / Hydraulic & pneumatic systems / Working of Boilers and steam engineering applications.

i) Auto / Electronic equipment manufacturing industry.
ii) Cement / Sugar / Chemical / Textile / Steel rolling mills / extrusion industries.
iii) Material handling in mines or ports.
iv) Earth Moving Equipment Maintenance Shop.

Lectures by Professional / Industrial Expert be organized from any of the following areas (four lectures of two hour duration) student shall submit the report on each lecture:

a) Battery and its charging system b) Electronic ignition system c) Micro-processor based instrumentation in Automobiles d) Earth moving machines. e) Tractors f) Excavators. g) Fork lift truck. h) Road- roller. i) Automated Guided Vehicles (AGV) j) Career opportunities in Service stations, Marketing, Surveyor, Insurance, R&D, call centers, CAD, NDT, Railways, Defense, Aeronautics, Marine, Software development, Information Technology k) Continuing education / Open university Programs, l) Air compressor technology 2) Tribological Aspects in automobiles / machine tools

**Group Discussion: (Two topics)**

The students shall discuss in group of six to eight students and write a brief report on the same as a part of term work. The topic for group discussions may be selected by the faculty members. Some of the suggested topics are

i) Solar Vehicles / Electric Vehicles.
ii) Auto Vehicles - Comparison.
iii) Two stroke versus four stroke engines
iv) Recycling of plastics and other waste material
v) Attributes of product design
vi) Creativity and innovativeness
vii) Energy conservation in institutes
viii) Value engineering
ix) Revolution in communication technology

ix) Pneumatic tools and equipments

**Student Activities:**

**The students in a group of 3 to 4 will perform ANY THREE of the following activities (other similar activities to be considered), and write a report as a part of term work.**

**Activity:**

i) Collecting internal communication forms.
ii) Collecting Failure data for automobile / machines / equipments.

iii) Study of Hydraulic system for any one application like - dumpers, Earth moving equipment, Auto service station.

v) Survey of oils used for hydraulic circuits - specifications, properties, costs, manufacturers names etc.
vi) Study any one type of CNC machining center and prepare report on tooling and tool holding devices

Vii) Using finite element method analyse stresses in a cantilever beam. Write all the steps involved with brief description.

vii) For a given job write a sequence of operations performed by automated manufacturing system. Draw a block diagram of control system to perform above operations

ix) Survey of types of bearings involving information about construction working principles, mounting, lubrication, materials, advantages, limitations and cost.

x) Prepare a trouble shooting chart for any refrigeration system and suggest remedial measures to avoid failures

xi) For a drilling or milling operations on a simple machine component, draw a jig or fixtures showing various features like locating clamping, fool proofing etc.

xii) Compare non-traditional methods on the basis of working principles, accuracy, MRR, Applications and limitations

a) EBM b) PAM C) AJM d) WJM

Xii) For a given job involving 3 to 4 operations suggest to prepare a report

**Seminar:-**

Seminar on any advanced technical topic to be presented by individual student in a batch of 20 students. A separate topic be selected by an individual student.

## PROJECTS

| L | T | P | Curri. Ref. No: ME 516 |
|---|---|---|---|
| 0 | 0 | 8 | |

**Total Contact hrs.: 120** **Total marks:** 150 **Practical:**

Theory: 0

P.A: 150

Tutorial: 0

**Practical:** 120

***Total Credit: 4***

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **2.0** | **LEVELLING, ALIGNMENT AND TESTING OF ANY ONE OF THE FOLLOWING MACHINES:** | | **15** |
| | 2.1 Drilling Machine | | |
| | 2.2 Centre Lathe | | |
| | 2.3 Shaping Machine | | |
| | 2.4 Dismantling and assembling of machine parts, study of relevent transmission of motion , power generation & mechnism | | |
| **3.0** | **PROJECT JOB(Fabricate/Manufacture one or more from the following or similar type of equipment/accessories)** | | **45** |
| | 2.1 Gear puller | | |
| | 2.2 Machine vice(simple) | | |
| | 2.3 Jigs and fixtures for drilling works | | |
| | 2.4 Agricultural implements | | |
| | 2.5 Centrifugal pump(small) | | |
| | 2.6 Double acting hand pump | | |
| | 2.7 Screw jack | | |
| | 2.8 Hand shearing machine | | |
| | 2.9 Hand blower (small) | | |
| **3.0** | **PROJECT TYPE JOB (produce any one from following list)** | | **30** |
| | 3.1 Cast iron main switch outer casing | | |
| | 3.2 Cast iron base plate for vice stand | | |
| | 3.3 Stepped motor pulley | | |
| **4.0** | **PROJECT TYPE JOB (produce any one from following list)** | | **30** |
| | 4.1 Window grills | | |
| | 4.2 Iron door and window frame | | |
| | 4.3 Steel furniture | | |

4.4 Iron structural fabrications

## 5.0 VIVA VOCE

***NOTE :*** *The project work as indicated above will involve students to work in different shops depending on the nature of the job. All the jobs indicated above are not of the same difficulty level nor they will require the same time for completion. The number of jobs to be assigned to a student or a group of students will be decided by the teacher concerned to ensure a uniform standard as far as practicable on the basis of available facilities.*

# INDUSTRIAL FLUID POWER

# INDUSTRIAL FLUID POWER

| L | T | P | **Curri. Ref. No: ME601** |
|---|---|---|---|
| 3 | 0 | 2 | |

**Total Contact hrs.: 75**
Theory: 45

**Practical:** 30

***Total Credit: 4***

**Total marks: 150**

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A: 25

## RATIONAL

Use of oil hydraulics systems and pneumatic systems all fields of engineering as clean source of motive power and low cost automation with the use of pneumatic systems.

## AIM

The students should be able to identify various hydraulic and pneumatic components, know working principles and detect fault in hydraulic and pneumatic circuits.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.** | **Introduction to fluid power and its applications** | | **2** |
| **2.** | **Classification of fluid power** | | **2** |
| **3.** | **Energy and power in Hydraulic Systems** | | **3** |
| | Application of Pascal's law, Conservation of energy, the continuity equation, hydraulic horse power, Bernoulli's equation, energy, power and flow rate in the SI Metric System. | | |
| **4.** | **The source of hydraulic power: Pumps** | | **6** |
| | Pumping theory, pump classification – Gear, vane, piston, pump performance, pump noise, pump selection. | | |
| **5.** | **Linear Actuator (Hydraulic Cylinder)** | | **4** |

Overall operating features, cylinder mountings and mechanical linkages, cylinder force, velocity and power, cylinder cushions, mechanics of hydraulic cylinder loadings, telescopic cylinder.

**6. Rotary Actuator (Hydraulic Motor) 2**

Classification: Gear, Vane, Piston; hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance.

**7. Valves and other control components in hydraulic systems 6**

Direction control valves, pressure control valves, flow control valves, cartridge valves, pressure and temperature switches, hydraulic accumulators, pressure intensifiers, servo valves.

**8. Hydraulic Conductors and Fittings 2**

Conductor sizing, pressure ratings of conductors, steel pipes, steel tubing, plastic tubing, flexible hoses, quick disconnect couplings, metric size tubing.

**9. Hydraulic Circuits and Applications 5**

Symbols of hydraulic components, single acting and double acting hydraulic circuits, hydraulic circuits – hydraulic press, traverse and feed circuit applied to machine tool

**10. Components of Pneumatic Systems 5**

Properties of air, the perfect gas laws, compressors, fluid conditioners, air control valves, pneumatic actuators.

**11. Pneumatics: Circuit and Applications 5**

Symbols of pneumatic components, Pneumatic circuits with air pressure losses in pipelines, simple multicylinder circuits, application of pneumatic systems.

**12 Troubleshooting aspects of hydraulic and pneumatic circuits. 3**

**PRACTICALS 30**

1. Study operating principle of Gear pump,Vane pump,Piston pump
2. Study operating principle of two stage reciprocating compressor
3. Assemble and study different types of hydraulic circuits
4. Assemble and study different types of pneumatic circuits
5. Draw and study the hydraulic circuits of various types of machine tools and laboratory equipments
6. Fault diagnosis of hydraulic and pneumatic circuits

**REFERENCE BOOKS**


1. Authony Esposito***Fluid power with applications,*** Prentice Hall International , Inc
2. S.R. Majumdar ***Oil Hydraulics,*** Tata Mc Graw Hill
3. S.R. Majumdar ***Pneumatic System: Principles and Maintenance,*** Tata Mc Graw Hill
4. D.D. Banks, D.S.Banks***Industrial Hydraulics***, Prentice Hall
5. A.B.Goodwin ***Power Hydraulics,*** B.I. Publications
6. Chris Stacey ***Practical Pneumatics,*** Arnold Publications

## NON CONVENTIOAL SOURCES OF ENERGY

**Curri. Ref. No: ME602**

| L | T | **P** |
|---|---|---|
| 3 | 0 | **2** |

**Total Contact hrs.: 75**
**Theory: 45**

**Practical: 30**

***Total Credit: 4***

**Total marks: 150**

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A: 25

**RATIONAL**

Knowledge of basics of energy conversion, conservation, sources of nonconventional energy audit and waste heat energy recovery techniques are essential to combat day to day activities of mankind.

**AIM**

Students should be able to develop awareness for effective utilization of alternative energy sources, identify different components of solar energy and wind energy devices, identify and analyze biomass plant, identify and apply energy conservation techniques for commonly used power absorbing and generating devices, **a**pply principles of energy conservation and energy management techniques

| **UNIT** | **TOPIC/SUB-TOPIC** | **Hrs.** | **Total hrs.** |
|---|---|---|---|
| **1**. | Introduction to Energy Sources-Major sources of energy,Renewable and Non-renewable, Primary and secondary energy sources, Energy Scenario:Prospects of alternate energy sources, Need of Non conventional energy sources. | **2** | **10** |

**2. Solar Energy-**Principle of conversion of solar energy into heat and electricity**,**Solar Radiation: Solar Radiations at earth's surface ,Solar Radiation Geometry: Declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle**,** Applications of Solar energy: - Construction and working of typical flat plate collector and solar concentrating collectors and their applications,Advantages and limitations

- Space heating and cooling.
- Photovoltaic electric conversion.
- Solar distillation, Solar cooking and furnace.
- Solar pumping and Green House.

Agriculture and Industrial process heat.

(no derivations and numericals)

3.**Wind Energy** **8**

Basic Principle of wind energy conversion.

Power in wind, Available wind power formulation, Power coefficient, Maximum power

Main considerations in selecting a site for wind mills.

Advantages and limitations of wind energy conversion.

Classification of wind mills

Construction and working of horizontal and vertical axis wind mills, their comparison

Main applications of wind energy for power generation and pumping.

**4**.**Energy from Biomass** **8**

Common species recommended for biomass.

Methods for obtaining energy from biomass

Thermal classification of biomass

a)Gasified, b) Fixed bed and fluidized

Application of gasifier

Biodiesel production and application

Agriculture waste as a biomass

Biomass digester

Comparison of Biomass with conventional fuels

**5. Energy Conservation & Management** **6**

Global and Indian energy market

Energy scenario in various sectors and Indian economy

Need and importance of energy conservation and management

Concept of Payback period, Return on investment (ROI), Life cycle cost, Sankey diagrams, specific energy consumption.

6.**Energy Conservation Techniques** **8**

Distribution of energy consumption

Principles of energy conservation.

Energy audit

Types of audit

Methods of energy conservation

Cogeneration and its application

Combined cycle system

Concept of energy management

Study of different energy management techniques like

Analysis of input

Reuse and recycling of waste

Energy education

- Conservative technique and energy audit

**7. Economic approach of Energy Conservation** **3**

Costing of utilities like steam, compressed air, electricity and water.

Ways of improving boiler efficiency

Thermal insulation, Critical thickness of insulation

Waste heat recovery systems, their applications, criteria for installing unit.

An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.

**8. PRACTICAL**
**30**

- To perform an experiment on solar flat plate collector used for water heating.
- To study construction and working of photo voltaic cell.
- To study construction, working and maintenance of solar cooker.
- Visit to plant of solar heating system for hotel/hostel/railway station etc.
- To study construction and working of horizontal axis wind mill or to visit a nearest wind farm.
- To visit a biomass/ biogas plant of municipal waste or elsewhere.
- Perform energy audit for workshop/Office/Home/SSI unit.
- Study of various waste heat recovery devices.

**REFERENCE BOOKS**


| | | |
|---|---|---|
| Dr B.H.Khan | ***Non conventional energy Resources*** | Tata McGraw Hill |
| G. D. Rai | ***Non conventional energy sources*** | Khanna publication |
| S. P. Sukhatme | ***Solar energy*** | Tata McGraw Hill |
| H. P. Garg | ***Solar energy*** | Tata McGraw Hill |
| Arrora | ***Power plant engineering*** | Dhanpat Rai & co. |
| Domkundwar | | |
| P.H. Henderson | ***India- The energy sector*** | University Press |
| D. A. Ray | ***Industrial energy conservation*** | Pergaman Press |
| W. C. Turner | ***Energy management handbook*** | Wiley Press |
| K. M. Mittal | ***Non-conventional energy source*** | - |

## MECHATRONICS

**Curri. Ref. No: ME603**

| L | T | P |
|---|---|---|
| 3 | 0 | 2 |

**Total Contact hrs.: 75** **Total marks: 150**

Theory: 45

**Practical:** 30

***Total Credit: 4***

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A: 25

**RATIONAL**

The integration of electronics engineering, electrical engineering, computer technology and control engineering with mechanical engineering as a part in the design, manufacture and maintenance of wide range of engineering products and processes. To study the systems used in automation.

**AIM**

Students should be able to identify various input and output devices in an automated system,understand and draw ladder diagrams,write simple programs for PLCs,interpret and use operations manual of a PLC manufacturer,use simulation software provided with the PLC,understand interfacing of input and output devices.

**Pre-Requisite:**

- Knowledge of mathematical topics like calculus, Differential equations, Probability and Statistics.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| | | | **11** |

**1. Introduction to sensors, Transducers and Actuators** -Principle, working and applications of-Limit switches, proximity switches like inductive, capacitive and optical (deflecting and through beam type), Thumb wheel switches magnetic reed switches, optical encoders-displacement measurement, rotary, incremental, opto-couplers.
Actuator – solenoids – on-off applications, latching, triggering ,types of relays – solid state ,types of motors – DC motors, DC brushless motors, AC motors, stepper motors, servo motors

**11**

2. **8085 Microprocessor-**Architecture, Pin configuration, working of microprocessor, and applications,introduction to ICs used for interfacing such as – Programmable peripheral devices, USART, memory, keyboard, display – LCD, LED, I/O device, ADC, DAC etc.

**8051 Microcontroller-**Architecture, Pin configuration, working of microcontroller, Applications Comparison of microprocessor and microcontroller, advantages and disadvantages. **11**

**3. Programmable Logic Controller (PLC)-**

Introduction, PLC definition, PLC block diagram, Difference between relay panel and PLC, power supply, input/output modules (analog, digital) concepts of sink/source, set/reset, latch/unlatch, advantages and disadvantages, installation, troubleshooting and maintenance.

**4. Selection of a PLC Programming equipment, Programming formats 6**

Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method, Basic PLC functions,Register basics, timer functions, counter functions,

Intermediate functions – Arithmetic functions, number comparison and number conversion functions,

Data handling functions – SKIP, Master control relay, Jump, Move, Block move, table to register and register to table move functions. FIFO and LIFO functions, File Arithmetic and Logic function.

**5.ONS and CLR functions and their applications 6**

PLC digital bit functions and applications,sequencer functions and cascading of sequencers,

PLC matrix functions,Discrete and analog operation of PLC, Networking of PLCs,PLC auxiliary commands and functions, Online, offline, stop/run modes of operations, uploading/downloading between PLC and PC, Introduction to SCADA and DCS.

**6.PRACTICAL 30**

- Identification of various sensors and transducer used in automated systems
- Interpretation of circuits in automation.
- Use of simulation software for PLCs
- Preparation of ladder diagrams
- Testing of interfacing ICs

Term work shall consist of detailed report on the following experiments:

- Identification and demonstration of different sensors and actuators.
- Demonstration of the working of various digital to analog and analog to digital converters.
- Development of ladder diagram, programming using PLC for
    a) Measurement of speed of a motor

b) Motor start and stop by using to different sensors
c) Simulation of a pedestrian traffic controller
d) Simulation of four road junction traffic controller
e) Lift/elevator control
f) Washing machine control
g) Tank level control
h) Soft drink vending machine control

- Trace, interpret and demonstrate working of at least two electro pneumatic systems.

Trace, interpret and demonstrate working of at least two electro hydraulic systems

**REFERENCE BOOKS:**


| | | |
|---|---|---|
| Bolton W. | ***Mechatronics- Electronics control systems in Mechanical and Electrical Engineering*** | Pearson Education Ltd. |
| Histand B.H. and Alciatore D.G | ***Introduction to Mechatronics and Measurement systems*** | Tata McGraw Hill Publishing |
| John W. Webb and Ronald Reis | ***Programmable Logic Controllers*** | Prentice Hall of India |
| NIIT | ***Programmable Logic Control – Principle and Applications*** | Prentice Hall of India |
| Kolk R.A and Shetty D. | ***Mechatronics systems design*** | Vikas Publishing, New Delhi. |
| Mahalik N.P | ***Mechatronics principles, concepts and applications*** | Tata McGraw Hill Publishing |

# POWER PLANT ENGINEERING

| L | T | P | Curri. Ref. No: ME604 |
|---|---|---|---|
| 3 | 0 | 2 | |

**Total Contact hrs.: 75** **Total marks: 150**
Theory: 45

**Practical:** 30

***Total Credit: 4***

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A: 25

## RATIONALE

Cheap and abundant supply of electrical power generated by steam power plants, nuclear power plants, I.C. engine power plants and hydro-electric power plants is the key factor in the economical development and process of country. Since the power turns the wheels of industry and railway, lifts the water for irrigation and drinking, illuminates and operates commercial and domestic appliances. Hence per capita consumption of electric power is regarded as an index of living standard.

Power plant engineering covers application of thermodynamics, heat transfer, fluid mechanics and nuclear physics. Young engineers & technicians are required to study design, installation, operation and maintenance of power plant components for better energy efficiency and the least pollution effect upon the environment.

## AIM

Students should be able to
Understand thermodynamic applications of power cycles.
Understand basic components of different types of power plant.
Analyse performance of power plant equipment of optimizing their efficiency.
Understand governing and control systems of various power plant.
Understand and analyse problems pertaining to pollution control, waste disposal and safety regulation in different types of power plant.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **INTRODUCTION** | | **4** |
| 1.1 | Sources of energy. | | |
| 1.2 | Concept of power plants. | | |
| 1.3 | Types of power plants. | | |

1.4 Energy conversion in various power plant such as thermal, diesel. & nuclear power plants.
1.5 Central and captive power plants.
1.6 National grid.
1.7 Basic elements of various power plants (Steam power plant, diesel engine power plant, Gas turbine power plant.)
1.8 Technical data of basic elements of different power plants and over all specifications of power plant.

**2.0 STEAM POWER PLANT CYCLES 4**

2.1 Parameters of power cycles such as thermal efficiency, work ratio, mean effective pressure, specific steam consumption.
2.2 Carnot cycle for gas and vapour as working fluid.
2.3 Simple Rankine cycle.
2.4 Methods of improving Rankine cycle efficiency.
2.5 Reheat cycle and Regenerative cycle.

**3.0 STEAM GENERATING UNIT 5**

3.1 Schematic diagram of Modern thermal power plant.
3.2 Various circuits of modern thermal power point.
3.3 High pressure boilers such as Lamount boiler, Benson boiler, Loeffler boiler, Schmidt Hartman boiler.
3.4 Super heaters, Air pre heaters.
3.5 Boiler furnaces.
3.6 Pulverised fuel system.
3.7 Different types of draft system in Boilers.
3.8 Parameters related to power plant performance.

**4.0 STEAM PRIMEMOVERS 4**

4.1 Concept of prime mover, Steam turbine.
4.2 Governing of steam turbine.
4.3 Starting and stopping procedure of steam turbine.
4.4 Performance of steam turbine.

**5.0 STEAM CONDENSERS AND COOLING TOWERS 3**

5.1 Working principle of surface condenser.
5.2 Parameters for condenser performance.
5.3 Purpose and working of cooling towers.

**6.0 STEAM POWER STATION CONTROLS 3**

6.1 Effect of load variation in steam plant.
6.2 Area control system and Centralized control system.
6.3 Basic elements & requirement of control system.
6.4 Compressed air control system and electrical control system.
6.5 Various control parameters and instruments used in modern station control room.

6.6 Feed water control system in modern power station.
6.7 Steam temperature control.
6.8 Purpose of various record maintained in steam power plant.

**7.0 DIESEL ENGINE POWER PLANT 4**

7.1 Application of I.C engine.
7.2 Advantages and disadvantages of diesel engine as a prime mover.
7.3 Essential elements of diesel power plant and their function.
7.4 Explanation of various systems of diesel power plant.

**8.0 GAS TURBINE POWER PLANT 5**

8.1 Concept of Brayton cycle.
8.2 Advantages of gas turbine over diesel engine as a prime mover.
8.3 Methods of improving performance of gas turbine plant.
8.4 Important components of gas turbine power plant and their functions.
8.5 Essential auxiliaries of gas turbine power plant.
8.6 Governing system.
8.7 Fuel supply system of gas turbine plant.

**9.0 NUCLEAR POWER PLANT 5**

9.1 Basic nuclear physics fundamentals.
9.2 Nuclear fuels.
9.3 Basic elements of a nuclear reactor.
9.4 Classification of nuclear reactor.
9.5 Schematic diagrams and working and comparison of Pressurized water reactor, Boiling water reactor, CANDU type reactor.
9.6 Criteria for location of nuclear power plant.
9.7 Comparison of nuclear plant with steam power plant.
9.8 Units of radiation.
9.9 Safe dose of radiation recommended by physicists.
9.10 Effect of radiation.
9.11 Disposal of nuclear waste.
9.12 Technical details of nuclear power plants in India.

**10.0 HYDEL POWER PLANT 5**

10.1 Purpose of multi-purpose hydro project.
10.2 Advantages and disadvantages of hydro power station considering the economic factor.
10.3 Basic elements of hydro power plant.
10.4 Classification of Hydro-electric power plant.
10.5 Water turbine used in Hydro power plant.
10.6 Factors for selecting hydraulic turbines.
10.7 Auxiliaries attached with Hydro-power plant.
10.8 Governing of water turbine.
10.9 Stages of starting and stopping of turbine of hydro-electric power station.

**11.0 POWER PLANT ECONOMICS 3**

11.1 Cost of power.
11.2 Economics of power generation and distribution.
11.3 Economics in plant selection.

**12.0 PRACTICALS : 30**

1) Study of basic elements of various power plants.
2) Study of high pressure boilers.
3) Study of Boiler furnaces.
4) Study of coal and ash handling system of modern thermal power station.
5) Study of governing systems of steam turbine.
6) Study of control systems of steam power plant.
7) Study of diesel power plant.
8) Study of gas-turbine power plant.
9) Study of nuclear reactors.
10) Study of nuclear power plant.
11) Study of hydro-power plant.
12) Field visit reports (Compulsory)

**REFERENCE BOOKS**


| | | | |
|---|---|---|---|
| *1.* | *S.C. Arora*<br>*S. Domkundwar* | ***A course in power plant engineering*** | *Dhanpatrai& sons, N. Delhi.* |
| *2.* | *F. T. Morse* | ***Power plant engineering*** | *Attiliated East – West press, New Delhi.* |
| *3.* | *H. B. Keswani* | ***Power plant engineering*** | *STD Book House, Delhi.* |
| *4.* | *P. C. Sharma* | ***Power plant engineering*** | -- |
| *5.* | *Mahesh Verma* | ***Power plant engineering*** | *Metro Book, New Delhi.* |
| *6.* | *M. M. Wakil* | ***Power plant engineering*** | *Mc Graw Hill Publication.* |
| *7.* | *G. D. Rai* | ***Power plant engineering*** | -- |
| *8.* | *Lofftness* | ***Nuclear power plant*** | *D. Van Nostrand Co. Inc N. York* |
| *9.* | *Course material in power plant engineering (D. L. Mode)* | ***LRDC Gujrat*** | -- |

## FABRICATION TECHLOLOGY

| L | T | P | **Curri. Ref. No: ME605** |
|---|---|---|---|
| 3 | 0 | 2 | |

**Total Contact hrs.: 75** **Total marks: 150**

Theory: 45

**Practical:** 30

***Total Credit: 4***

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A: 25

**RATIONALE**

The rapid industrial development and growth of Chemical industries, Fertilizer industries, ship building, Mechanical fabrication & Electronics needs fabrication for one or another reason. This has grown and developed fabrication industries.

This curriculum will help the students to achieve know now required by fabrication industries. Students aspiring for self employment will find ample (immense) opportunities in this area of metal fabrication work, fabrication requirements, fabrications consumables, testing, etc

**AIM**

The student will be able to

know various materials and consumables used in welding.
interpret fabrication drawings.
understand advance welding and cutting processes.
know various inspection & testing methods.
understand various surface finishing & coating methods.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|
| **1.0** | **INTRODUCTION** | | **6** |
| | 1.1 Fabrication technology-Importance, and areas of fabrications. | | |
| | 1.2 Distinguish between fabrication work and manufacturing process. | | |

1.3 Fabrication processes-types, features, merits and demerits, and applications.
1.4 Fabrication materials-types, their standards (BIS, JIS, EN, ASME, ASTM, etc..) their methods of designations, properties, applications (for coded non coded practices) and selection criteria.
1.5 Consumables-types: classification: features; standards their codes, designation method; applications and selection criteria.
1.6 Weldability-concept, meaning, definition and factors affecting it and its importance.
1.7 Power source-classification, advantages, limitations, features, applications & selection criteria. (Introductory).

**2.0 FBRICATION DRAWING INTERPRETATION 4**

2.1 Welding symbols & their different standards. (Including BIS/ASME etc.)
2.2 Piping symbol & their different standards (including BIS/ASME etc.)
2.3 Structural drawing- features & interpretation.
2.4 Process equipment drawings-features & interpretation.

**3.0 ADVANCE WELDING AND CUTTING PROCESSES 10**

3.1 Advance welding processes-types, definitions, working, principle, power source, tools, equipments, consumables, applications and selection criteria. (This includes MMAW, SAW, MIG, FCAW, TIG, RESISTANCE, PLASMA, LASER, BEAM, ELECTRON BEAM, UNDER WATER, and other in trend.)
3.2 Cutting processes-types, working, features, applications and selection criteria.

**4.0 EDGE PREPARATION 4**

4.1 Edge preparation-need and advantages, types, methods & applications.
4.2 Types of welded joint, their applications.
4.3 Equipments/machines used for edge preparation, their working & features.
4.4 Set up, fit up and alignment of pressure vessels.

**5.0 INSPECTION, TESTING AND QUALITY CONTROL 8**

5.1 Common weld defects, their causes and remedies;

5.2 Codes used in fabrication work (such as ASME, TEMA, BIS, etc.)-importance, use
5.3 Weld quality-concept, meaning, definition, importance and factors affecting it.
5.4 Modes of inspection of weld work.
5.5 Testing methods-types, features, standards, working, applications & selection criteria.
5.6 Quality control for fabrication work-need, importance, approach & advantages.
5.7 Third party inspection- concept, need, and agencies.

**6.0 WELDING METALLURGY 5**

6.1 Welding Metallurgy & its analysis.
6.2 Preheating-need, method, application.
6.3 Post heating-need, method, application.
6.4 Post weld heat treatment-need, methods, applications, and selection criteria.
6.5 Welding heat flow diagram-concept, importance, applications.
6.6 Thermal distortion-concept, meaning, definition, causes, effect and types.
6.7 Methods and equipments used to control thermal distortion.
6.8 Methods of relieving thermal stresses.

**7.0 SURFACE FINISHING AND COATING 5**

7.1 Surface finishing on weld part-need, importance, methods & procedure.
7.2 Surface coating-need, benefits, methods and procedures.

**8.0 WELDING SAFETY 3**

8.1 Need.
8.2 Precautions and measures.
8.3 Safety norms for welding applications.

**9. PRACTICALS** **30**

1. Demonstration on Welding equipments and consumables

2. Preparation of using one complex job each arc, gas & spot welding.

   This includes & process.

   a) Selection of process & process parameters
   b) Selection of consumables.
   c) Edge preparation if applicable.
   d) Process.
   e) Post process treatments.
   f) Inspection and testing.

3. Report writing/presentation on advance welding processes by each student

4. Case study on weldment

5. Industrial visit, report writing and presentation. This should focus on product range, welding & testing methods used, surface treatments used & other fabrication aspects. (This is part of term work.)

**REFERANCE BOOKS**


1. Kenyon Pitman- ***Basic Fabrication & Welding,*** Pitman Pub. Ltd.
2. F.J.M. Smith- ***Basic Fabrication & Welding***, Longman Group Ltd.
3. Hazra & Choudhuri- ***Workshop Technology Vol. 1 & 2,*** Media Promoters & Publications
4. O.P. Khanna- ***Welding Technology,*** Dhanpat Rai & Sons
5. P.N.Rao- ***Manufacturing Technology,*** Tata McGraw Hill
6. DE Garmo et al- ***Materials & Processes in Manufacturing –*** Wiley

## TOOL ENGINEERING

**Curri. Ref. No: ME606**

| L | T | P |
|---|---|---|
| 3 | 0 | 2 |

**Total Contact hrs.: 75**
Theory: 45

**Practical:** 30

***Total Credit: 4***

**Total marks: 150**

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A: 25

**RATIONAL**

To impart, concepts, principles & procedures of tool engineering to achieve highest productivity and perform duties as a technician in tool room, shop floor, quality control & assist tool Engineer in design of tools and production processes.

**AIM**

The students should be able to select cutting tools and its material using data book and manufacturer's catalogue, estimate tool wear and tool life ,use press tools and dies effectively, design strip layout for given component ,decide appropriate cutting fluid for machining process improvement.

| UNIT | TOPIC/SUB-TOPIC | Hrs. | Total hrs. |
|---|---|---|---|

**1.Metal Cutting** **20**

Mechanics of Metal cutting: requirements of tools, cutting forces - types of chips, chip thickness ratio, shear angle - simple numericals only, types of metal cutting process - orthogonal, oblique and form cutting. Cutting fluids - types, characteristics and applications.

Tool wear, Types of wear, Tool life - Tool life equations.

Machinability - definition, factors affecting machinability, machinability index.

Tool materials: Types, characteristics, applications. Heat treatment of tool steels, Specification of carbide tips, Types of ceramic coatings.

Cutting Tool Geometry: Single point cutting tool, drills, reamers, milling cutters.

**2.Press Tools** **20**

Presses: Types, Specification.

Types of dies and construction: Simple Die, Compound Die, Progressive Die, Combination Die.

Punch & die mountings, pilots, strippers, misfeed detectors, Pressure Pads, Knock outs, stock guide, Feed-Stop, guide bush, guide pins.

Die Design Fundamentals: Die Operations- blanking, piercing, shearing, cropping, notching, lancing, coining, embossing, stamping, curling, drawing, bending, forming.

Die set, Die shoe, Die area, Calculation of clearances on die and punch for blanking and piercing dies, Strip layout, Calculation of material utilization factor.

Forming Dies: Bending: methods, Bending Dies, bend allowance, spring back, spanking, bending pressure, pressure pads, development of blank length.

Drawing: operations, Metal flow during drawing.

Calculation of Drawing blank size, variables affecting metal flow during drawing, single action and double action dies, combination dies.

**3.Fundamentals of Other Tools** **5**

Constructional features of - Pressure Die casting dies, metal extrusion dies, injection molding dies, forging dies, plastic extrusion dies.

**4.PRACTICALS**

**30**

1. Report on Visit to press shop for study of presses.
2. Sketches of Combination Die, Progressive Die, Compound die, Inverted Die, Drawing Die, Bending Die.
3. Drawing of strip layout of simple component (Different component for every student) , and calculation of material utilization factor.
4. Sketches of Injection Moulding die, Pressure die-casting die, forging die.
5. Two assignments on calculation of Cutting forces and shear angle based on Merchant's circle.
6. One assignment each on development of blank length for bending operation and single strokedrawing operation.
7. One assignment on designation of carbide tools.

8. Sketches of different types of cutting tools showing details of tool angles.
9. One assignment on types of Punches and pilots, strippers
10. Design of blanking die - Drawing sheets showing assembly & details.

**REFERENCE BOOKS**


| | | |
|---|---|---|
| Donaldson Anglin | ***Tool Design*** | Tata Mc Graw Hill |
| P. C. Sharma | ***A Text Book OF Production Engineering*** | S Chand & Co. |
| H. M. T. | ***Production Technology*** | Tata Mc Graw Hill |
| R. K. Jain | ***Production Technology*** | Khanna Publishers |
| A.S.T.M.E. | ***Fundamental of tool design.*** | Prentice-Hall of India. |
| M.H.A. Kempster | ***Introduction to Jig and Tool Design*** | Viva publ. |
| P. H. Joshi | ***Jigs and Fixtures*** | Tata Mc Graw Hill |
| P. H. Joshi | ***Press Tools*** | Tata Mc Graw Hill |

# CAD/CAM

**Curri. Ref. No: ME607**

| L | T | P |
|---|---|---|
| 3 | 0 | 2 |

**Total Contact hrs.: 75**
Theory: 45

**Practical:** 30

***Total Credit: 4***

**Total marks: 150**

**Theory:**
End Term Exam: 70

P.A.: 30

**Practical:**

End Term Exam: 25

P.A: 25

## RATIONALE

The use of computers for various activities in the industry gave new dimensions to design and manufacturing to meet the challenges of global competition. The field of Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) has widened the scope of traditional design and manufacturing. In order to be competitive in the global economy, it is imperative that all the manufacturing industries adopt CAD/CAM. Thus we need to train the manpower on CAD/CAM technology for the necessity of the present day industries.

## AIM

To develop basic understanding of CAD/CAM technology and its applications to design and manufacturing.

| UNIT | *TOPIC/SUB-TOPIC* | HRS. | TOTAL HRS. |
|---|---|---|---|
| **1.0** | **INTRODUCTION** | | **5** |
| | **Introduction to CAD/CAM** | | |
| | Computers in manufacturing | | |
| | Product cycle. CAD/CAM hardware. | | |
| **2.0** | Computer Aided Design (CAD) | | **10** |
| | Requirement of geometric models, solid | | |
| | Modeling: Primitives, Boolean operations | | |
| | free formed surfaces. | | |

| | | |
|---|---|---|
| **3.0** | **Introduction to computer** | **15** |
| | Numerical Control- The beginning of CAM<br>Introduction to NC, CNC, DNC, Advantages<br>Of CNC over NC, Basic components of a<br>CNC system, Motion Control system: Point to<br>Point, straight line, continuous path, Economics<br>of CNC control system | |
| **4.0** | **Part Programming** | **10** |
| | Fundamentals, Manual part programming<br>Preparatory codes, Miscellaneous codes<br>Word address programming, programming<br>format. Computer Aided Part Programming. | |
| **5.0** | **Automation** | **5** |
| | Basic elements of automated systems level of<br>Automation, CAD/CAM automation.<br>Flexible Manufacturing Systems: FMS equipment<br>FMS applications, Introduction to CIM,<br>Introduction to CIM | |

**PRACTICAL** **30**

1. Two assignments on CAD for 2D drafting using any software.
2. Two assignments on CAD for 3D modelling using any software.
3. Manufacturing on turning and one milling component on CNC machine.
4. Four assignments on part programming using sub-routines, do loops for turning and milling.
5. Report writing on visit to industry having CNC machine.

**REFERENCE BOOKS**


1. Mikell P. Groover and Zimmers, Jr.***CAD/CAM: Computer Aided Design and Computer Aided Manufacturing*** Practice Hall of India.
2. P. N. Rao ***CAD/CAM Principles and Applications*** Tata McGraw Hill.
3. Radha Krishna P. &Subramaniam ***CAD/CAM/CIM*** Willey Eastern Limited.
4. Lalit Narayan, M. Rao, ***Computer Aided design and manufacturing*** Prentice Hall of India.