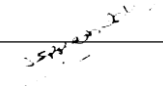# YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING
## B.E. Regular (MECHANICAL ENGINEERING)
## SCHEME OF EXAMINATION

| SI.No. | Sub Code | Subject | CONTACT HOURS | | | | Credits | % Weightage | | | | ESE Duration |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | | MSE- I | MSE- II | TA | ESE | |
| **VII SEMESTER** | | | | | | | | | | | | |
| 1 | GE403 | Industrial Management | 3 | 0 | 0 | 3 | 3 | 15 | 15 | 10 | 60 | 3 Hours |
| 2 | | Professional Elective - 1 | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hours |
| 3 | | Professional Elective - 2 | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hours |
| 4 | | Professional Elective - 3 | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hours |
| 5 | | Professional Elective - 3-Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| 6 | FE-II | Free Elective-2 | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hours |
| 7 | ME433 | Project Phase-1 | 0 | 0 | 4 | 4 | 4 | | | 40 | 60 | |
| 8 | ME434 | Training | 0 | 0 | 0 | 0 | 3 | | | 100 | | |
| | | **Total** | **19** | **0** | **6** | **25** | **27** | | | | | |

| SI.No. | Sub Code | Subject | CONTACT HOURS | | | | Credits | % Weightage | | | | ESE Duration |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | | MSE- I | MSE- II | TA | ESE | |
| **VIII SEMESTER** | | | | | | | | | | | | |
| 1 | ME435 | Automation In Production | 3 | 1 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hours |
| 2 | ME436 | Automation In Production Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| 3 | ME475 | Optimisation Techniques | 3 | 1 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hours |
| 4 | | Professional Elective - 4 | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hours |
| 5 | | Professional Elective - 4-Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| 6 | | Professional Elective - 5 | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hours |
| 8 | ME472 | Comprehensive Viva Voce | 0 | 0 | 0 | 0 | 3 | | | 40 | 60 | |
| 9 | ME 473 | Project Phase-2 | 0 | 0 | 6 | 6 | 6 | | | 40 | 60 | |
| | ME 474 | Extra Curricular / Competative Exm. | 0 | 0 | 0 | 0 | 2 | | | 100 | | |
| | | **Total** | **14** | **2** | **10** | **26** | **29** | | | | | |
| | | **Final Total** | **109** | **10** | **49** | **168** | **157** | | | | | |

## FREE ELECTIVES-II

| Sub Code | Subject | | | | | Credits | MSE- I | MSE- II | TA | ESE | ESE Duration |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EL412 | FE2:Electrical Energy Audit and Safety | 4 | 0 | 0 | | 4 | 15 | 15 | 10 | 60 | |
| EL413 | FE2:Utilisation of Electrical Energy | 4 | 0 | 0 | | 4 | 15 | 15 | 10 | 60 | |
| CV418 | FE II : Elements of Earthquake Engineering | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| CV419 | FE II : Air Pollution & Solid Waste Management | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ET411 | FE2 : Soft Computing | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hrs |
| ET412 | FE2 : Industrial Instrumentation | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hrs |
| EE411 | FE 2 :Fuzzy Logic & Neural Network | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| EE429 | FE 2 :Basic of Analog and Digital Communication Systems | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| CT411 | FE2:Multimedia and Animation | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 100 |
| CT412 | FE2:Current Trends and Technologies | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 100 |
| IT408 | FE2: Applications of Computer Networking | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | 3 Hrs |

## PROFESSIONAL ELECTIVES

| Sub Code | Subject | | | | | Credits | MSE- I | MSE- II | TA | ESE | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ME401 | PE 1: Tool Design | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME402 | PE 1: Material Handling Systems | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME403 | PE 1: Refrigeration & Air Conditioning | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME404 | PE 1: Engineering Of Plastics | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME405 | PE 1: Project Evaluation & Management | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME406 | PE 1: Finite Element Methods | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME408 | PE 2 : Synthesis Of Mechanism | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME409 | PE 2 :Finance & Cost Management | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME410 | PE 2 :Renewable Energy System | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME411 | PE 2 :Artificial Intelligence | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| ME412 | PE 2 :Maintainance Management | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |

| Chairperson | | Date of Release | May 2013 | Applicable for |
|---|---|---|---|---|
| Dean (Acad. Matt.) | | Version | 1.03 | AY 2013-14 Onwards |

| Sl.No. | Sub Code | Subject | CONTACT HOURS | | | | Credits | % Weightage | | | | ESE Duration |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | Total | | MSE-I | MSE-II | TA | ESE | |
| | ME415 | PE 3 :Vibration | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME416 | PE 3 :Vibration Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| | ME417 | PE 3 :Cim | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME418 | PE 3 :Cim Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| | ME419 | PE 3 :I.C. Engines | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME420 | PE 3 :I.C. Engines Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| | ME437 | PE 4 :Industrial Fluid Power | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME438 | PE 4 :Industrial Fluid Power Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| | ME439 | PE 4 :Cnc & Robotics | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME440 | PE 4 :Cnc & Robotics Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| | ME441 | PE 4 :Vehicle Engineering | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME442 | PE 4 :Vehicle Engineering Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| | ME443 | PE 4 :Mis | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME444 | PE 4 :Mis Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| | ME445 | PE 4 :Mechatronics | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME446 | PE 4 :Mechatronics Lab. | 0 | 0 | 2 | 2 | 1 | | | 40 | 60 | |
| | ME451 | PE 5 :Stress Analysis | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME452 | PE 5 :Design of Experiments and Taguchi Methods | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME453 | PE 5 :Value Engg. | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME454 | PE 5 :Lean Sigma | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME455 | PE 5 :Product Design And Development | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME456 | PE 5 :Advanced Manufacturing Techniques | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME457 | PE 5 :Power Plant Engineering | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME458 | PE 5 :Machine Tool Design | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME459 | PE 5 :Industrial Safety | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |
| | ME460 | PE 5 :Advance Welding Techniques | 4 | 0 | 0 | 4 | 4 | 15 | 15 | 10 | 60 | |

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|---|---|---|---|---|
| Dean (Acad. Matt.) | | Version | 1.03 | AY 2013-14 Onwards |

| GE403/GE801 | INDUSTRIAL MANAGEMENT | | | L= 4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|---|---|
| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | | ESE Duration |
| | 15 | 15 | 10 | 60 | 100 | | 3 Hrs |

**Objectives**: **This subject helps student to understand the Functions of management, Marketing Management, Personnel Management, Plant Management, Inventory Control and Finance Management in the organization. [a,d,f,g,i,k]**

**UNIT-1:** Principles of management

Concepts of management, development of scientific management, Taylor Principles Fayol, functions of management such as planning, decision making, organizing, communication, controlling, span of control. [a,d,f,g,i,k]

[8 Hours]

**UNIT-2:** Personnel & Human Resource Management

Concept and evolution of personnel management and HRM, Difference between PM and HRM. Functions of HRM Concept of HRD. HR Planning, Concept, Objective, Importance, and Process. Recruitment: Meaning, process, Recruitment Agencies, selection process, test, and types of test, interview and types of interview. Training and Development. [a,d,f,g,i,k]

[7 Hours]

**UNIT-3:** Plant Management

Definition & scope ,Plant location, plant layout, types of maintenance such as break down, predictive & preventive maintenance, stores management, industrial safety, causes & cost of accidents, safety programs, production planning & control, job, batch & process type of product    [a,d,f,g,i,k,l,m]

[8 Hours]

**UNIT-4**: Marketing Management

 Definition & scope, selling & modem concepts of marketing, market research, rural marketing, Customer Behaviors, marketing strategies, product launching,  product life cycle, sales promotion, pricing, channels of distribution, Advertising,  market segmentation, marketing mix, positioning, targeting        [a,d,f,g,i,k]

[8 Hours]

**UNIT-5:** Material Management

 Definition & scope, Importance of Materials Management, Classification, Codification, Forecasting, and Necessity of Inventory & it's  control   [a,d,f,g,i,k,l,m]
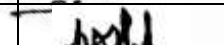
(7 Hours)
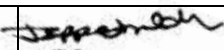
**UNIT-6**: Financial management

 Definition & Functions of Finance department, Sources of finance ,financing organizations, types of capital, elements of costs & allocations of indirect expenses, cost control, break even analysis, budgets & budgetary control, equipment replacement policy, make or buy analysis, balance sheet, ratio analysis, profit & loss statement. [a,d,f,g,i,k,m]

[7 Hours]

| Text books: | | | | |
|---|---|---|---|---|
| 1 | Industrial Management | 1st Edition 1997 ISBN:81-219-1480-9 | I.K. Chopde & A.M. Sheikh | S.Chand & Company Ltd. |
| 2 | Financial management | 1st Edition 2000 ISBN:     8186985158 ISBN-13:    9788186985151 | S.C. Kuchhal | Chaitanya Publishing House, Allahabad |
| 3 | Principles & Practice of Management | 6th Edition 2001 | Dr.L.M.Prasad | S.Chand & Company Ltd. |
| 4 | Essentials of Management | 1st Edition 2006 ISBN: 9780070620308 | Harold Koontz,  Heniz Weihrich | McGraw-Hill. |

| Reference books: | | | | |
|---|---|---|---|---|
| 1 | Principles & Practice of Management | 6<sup>th</sup> Edition 2000 | T.N. Chabra | Dhanpat Rai & Sons, New Delhi |
| 2 | Principles of marketing management | 11thEdition 2005 ISBN13: 9780131469181 | Philip Kotler | Prentice Hall |
| 3 | Management & Entreprenurship | 1<sup>st</sup> Edition 2009  ISBN-13:019-806190-8 | Kanishla Bedi | Oxford University Press |

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|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME401/ME701 | **Tool Design** | | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration | |
|---|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs | |

## OBJECTIVES

To learn the mechanism of metal cutting and the design of metal cutting tools. Also to understand various press working operations along with tools to dies design.

### Unit1                                                                                   [8 Hrs]

Design of single Point Cutting Tool ,Theory of metal Cutting Introduction, Mechanics of chip formation, Cutting tool materials, Single point cutting tool, Designation of cutting tools, ASA system, Importance of Tool angles, Orthogonal rake system, Classification of cutting tools, Types of chips, determination of shear angle, velocity relationship, force relations, Merchant's Theory, Cutting power, Energy consideration in metal cutting, Tool wear, Tool life, Tool life criteria, variable affecting tool life, Machineability

[a,b, c, d, e, f, g, h, l, j ,k, l, m]

### Unit2                                                                                   [8hrs]

Form tools- Introduction, Types, design of form tools. Drills- Introduction, Types, Geometry, Design of drill. Milling cutters - Introduction, Types, Geometry, and Design of milling cutters.

[ a, b, c, d,  f, g, h, l,  j, k, l, m]

### Unit3                                                                                   [10hrs]

Press tool Design

Introduction, Press operations - Blanking, piercing, Notching, Perforating, Trimming, Shaving, Slitting, Lancing, Nibbling, Bending, Drawing, Squeezing. Press working equipment - Classification, Rating of a press, Press tool Equipment, arrangement of guide posts.  Press selection, press working

Terminology, Working of a cutting die, Types of dies - Simple dies, inverted die, Compound dies, combination dies, progressive dies, Transfer dies, multiple dies Principle of metal cutting, strip layout, clearance, angular clearance, clearance after considering elastic recovery, cutting forces, method of reducing cutting forces, Die block, Die block thickness, Die opening, Fastening of die block, back up plate, Punch, Methods of holding punches, Strippers.  Stoppers, Stock stop, Stock guide, Knockouts, Pilots. Blanking & Piercing die design - Single & progressive dies.

[ a, b, c, d, e, f, g, h, i, j ,k, l, m]

### Unit4                                                                                   [ 10hrs]

Bending Forming & Drawing dies Bending methods - Bending Terminology, V- Bending, Air bending, bottoming dies, spring back & its prevention.  Design Principles - Bend radius, Bend allowance, Spanking, width of die opening, Bending pressure. Metal flow during drawing, Design, Design consideration - Radius of draw die, Punch radius, Draw clearance, Drawing speed, Calculating blank size, Number of draws, Drawing pressure, Blank holding pressure.

[ a, b, c, d, f, g, h, l, j, k, l, m]

### Unit5                                                                                   [7 Hrs]

Forging Die Design:  Introduction, Classification of forging dies, Single impression dies, Multiple Impression dies.  Forging design factors - Draft, fillet & corner radius, parting line, shrinkage & die wear, mismatch, finish allowances, webs & ribs Preliminary forging operation - fullering, edging, bending, drawing, flattering, blacking finishing, cutoff.  Die design for machine forging - determination of stock size in closed & open die forging.  Tools for flash trimming & hole piercing, materials & manufacture of forging dies.
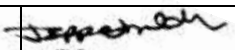
[ a, b, c, d, f, g, h,  i , j ,k, l, m]

### Unit6                                                                                   [10 Hrs]

Design of jigs & fixture: -   Introduction, locating & clamping - principle of location, principle of pin location, locating devices, radial or angular location, V - location, bush location. Design principle for location purpose, principle for clamping purposes, clamping devices, design principles common to jigs & fixtures. Drilling Jigs: - Design principles, drill bushes, design principles for drill bushings, Types of drilling jigs - Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig . Jig feet. Milling Fixtures: - Essential features of a milling fixtures, milling machine vice, Design principles for milling fixtures, Indexing jig & fixtures, Automatic clamping Devices.
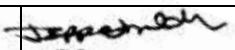
[ a, b, c, d,  e, f, g, h, i , j, k, l, m]

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME401/ME701 | Tool Design | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

.**Reference books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | "Tool design" | 2001 | Donaldson | TATA Mc-Graw Hill. |
| 2 | "Fundamentals of Tool design | 1988 | ASTME, | TATA Mc-Graw Hill. |
| 3 | "Fundamentals of Tool design" | 1962 | Pollock, | Reston Publishing Company |
| 4 | , "Fundamentals of Tool design" | 1971 | Kempster | Hall of India Pvt. Ltd |
| 5 | Computer aided fixture design | -- | Rong , Yeming | Marcel Dekker |

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|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME402/ME702 | **Material Handling System** | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

### OBJECTIVES

To develop the awareness about principles and practices of material handling equipments. Study the different components design and applications of material handling devices.

**Unit1** [8 Hrs]

Types of intraplant transporting facility, principles of material handling and classification of material handling equipments, selection of material handling equipment, hoisting equipment, screw type, hydraulic and pneumatic conveyors, general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications. Introduction to control of hoisting equipments. **[ a, b,  c, d, e, g,  h, k]**

**Unit 2** [10 Hrs]

Component selection and design Flexible hoisting appliances like ropes and chains, welded load chains, roller chains, selection of chains, hemp rope and steel wire rope, selection of ropes, rope reeving arrangement and pulley blocks   fastening of chains and ropes, different types of load suspension appliances, fixed and movable pulleys, different types of pulley systems, multiple pulley systems. Chain  and  ropes heaves and sprockets. **[a, b, c, d, e, f, g]**

**Unit 3** [7 Hrs]

Load handling attachments, standard forged hook, hook weights, hook bearings, cross piece and casing of hook, crane grab for unit and piece loads, carrier beams and clamps, load platforms and side dump buckets, Electromagnetic lifting system, grabbing attachments for loose materials, crane attachments for handling liquid materials. [**a, b, c, d, e, f, i, j**]

**Unit 4** [10 Hrs]

Arresting gear, ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thrusters operated, controlled brakes, shoe brakes, Electro-Hydraulic thrusters safety handles, load operated constant force and variable force brakes, Rope drum design and assembly, design of guides and column, [a, **b, c, d, e, i, j,k**]

**Unit 5** [8 Hrs]

Different drives of hoisting gears like individual and common motor drive for several mechanisms, travelling gear, travelling mechanisms for moving trolleys and cranes on runway rails, mechanisms for trackless, rubber-tyre and crawler cranes, motor propelled trolley hoists and trolleys, rails and travelling wheels, slewing, jib and lifting gears. Operation of hoisting gear during transient motion, selecting the motor rating and determining braking torque for hoisting mechanisms, selecting the motor rating and determining braking torque for travelling mechanisms, slewing mechanisms, jib and lifting mechanisms. (Elementary treatment is expected) **[a, b, c, d, e, fj, k]**
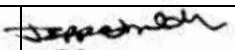
**Unit 6** [7 Hrs]

Cranes with rotary pillar, cranes with a fixed post, jib cranes with trolley, portal cranes with luffmg boom, cantilever cranes, cage elevators, safety devices of elevators, belt and chain conveyors and their power calculations, vibrating and oscillating conveyors, pneumatic and hydraulic conveyors, screw conveyors, hoppers, gates and feeders. Introduction to AGV's as new material handling device, use of robot for material handling. **[a, b, c, d, e j, k]**

| **Text books:** | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Materials Handling Equipment- | 1964 | N. Rudenko , | Envee Publishers, New Dehli |
| 2 | Materials Handling Equipment- | 1968 | M.P. Alexandrov. | Mir publications |

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME403/ME703 | Refrigeration and Air Conditioning | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To familiarize with terminologies associated with refrigeration and Air conditioning. To understand principle of Refrigeration and Air conditioning systems. To understand basic and applied psychrometry. To understand air conditioning load calculations and duct design. To understand energy conservations and management

**[a, b, c, e, i ,k, l, m ]**

**Unit 1**                                                                                          **[7 Hrs]**

**PSYCHROMETRY:** Introduction, psychometric properties of air, psychometric chart, psychometric processes bypass factor, apparatus dew point temperature.

HUMAN COMFORT: **Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart**

[a, b, c, e, i ,k, l, m ]

**Unit 2**                                                                                          **[8 Hrs]**

**ADVANCED PSYCHROMETRY:** Application of psychrometry to various air-conditioning systems. RSHF, GSHF, ESHF, air washers, air coolers.

HEAT LOAD CALCULATIONS: **Data collection for load calculation. Various components of heat load estimate.  Methods of cooling load calculation. Demonstration of air conditioning systems to students.**

[a, b, c, e, i ,k, l, m ]

**Unit 3**

**[ 7 Hrs]**

**AIR TRANSMISSION & DISTRIBUTION:**

**Principle of air distribution, types of grills & diffusers & their selection criteria, air alteration, types of air filters, distribution of air through ducts, pressure losses in ducts, methods of duct design, duct friction chart, air conditioning controls.**

[a, b, c, e, i ,k, l, m ]

Unit 4                                                                                          [8 Hrs.]

**REFRIGERATION:** Introduction, Definition,  Applications.

Study of simple vapour compression refrigeration system.

Analysis of simple vapour compression refrigeration system, effect of sub cooling, superheating, polytropic compression & pressure drops on the performance of the system. Demonstration of performance of VCRS to students.

**[a, b, c, e, i ,k, l, m ]**

**Unit 5**                                                                                          **[8 Hrs]**

 **MULTISTAGE VAPOUR COMPRESSION REFRIGERATION SYSTEMS:**

Multiple compressor & multiple evaporator systems, cascade refrigeration systems. Study of equipments such as compressors, evaporators, expansion devices & controls defrosting methods (types & principle only). Testing & charging of refrigeration systems. Demonstration of  above equipments to students.

**REFEGERANTS:**

Nomenclature of refrigerants, refrigerant properties, mixture refrigerants, global warming potential & Ozone depletion potential, Montreal & Kyoto protocol, alternate refrigerants.

**[a, b, c, e, i ,k, l, m ]**

**Unit 6.**

**[7 Hrs]**

**STUDY OF VAPOUR ABSORPTION REFRIGERATION SYSTEM:**

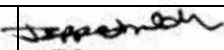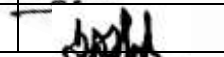Introduction Ammonia-Water, Lithium bromide-water systems, three fluid refrigerators.

**OTHER REFRIGERATION TECHNIQUES:**

Air cycle refrigeration, Applications in air refrigeration systems, Vortex tube, and thermoelectric refrigeration.

CRYOGENICS:

Introduction, Application of cryogenics, Joule- Thomson coefficient, inversion curve, methods of liquefaction of air
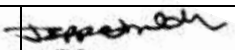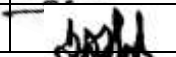
**[a, b, c, e, i ,k, l, m ]**

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME403/ME703 | Refrigeration and Air Conditioning | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**Text books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Refrigeration & Air-conditioning | 2005 | R.S. Khurmi & J.K. Gupta | Eurasia Publishing House |
| 2 | Refrigeration & Air-conditioning | 2005 | Dr. P.L. Ballany | Khanna |
| 3 | Refrigeration & Air-conditioning | 2000 | Dr.C.P. Arora | Tata McGraw-Hill Education |
| 4 | Refrigeration & Air-conditioning | 2007 | Dr. Manohar | New Age International |
| 5 | Refrigeration & Air-conditioning | 2007 | S.V. Domkundwar | Dhanpat Rai Company (P) Ltd |

**REFERENCE BOOKS:**

| | | | | |
|---|---|---|---|---|
| 1 | Refrigeration & Air-conditioning | 1986 | Stocker & Jones | McGraw-Hill |
| 2 | Principle of Refrigeration & Air-conditioning | 1997 | Roy J.Dossat | Prentice Hall |
| 3 | ASHRAE hand books | 2003 | | ASHRAE |
| 4 | Air conditioning Principles & System. Energy approach | 1989 | E.G. Pita | Wiley |
| 6 | Basic Refrigeration& Air-conditioning | 2005 | P.N. Ananthnarayanan | Tata McGraw-Hill Education |

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|---|---|---|---|---|
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| ME404/ME704 | Engineering of Plastics | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**OBJECTIVES**

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.(a,b,d,e,j,k.l.m)

**Unit 1**                                                                                    **[7 Hrs]**
Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Disadvantages.**[a,k,l,m ]**

**Unit 2**                                                                                    **[7 Hrs]**
Extrusion -  Blow Molding – Casting – Thermo Forming – Rotomolding Study of molds **[a,b,j,k,l,m]**

**Unit 3**                                                                                    **[8 Hrs]**
Compression and Transfer Molding - Injection Molding- study of compression and injection molding moulds **[a,b,k,l]**

**Unit 4**                                                                                    **[8 Hrs]**
General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics - Mechanical Fasteners - Thermal bonding - Press Fitting. Testing of plastic **[a,b,k,l]**
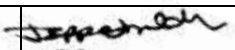
**Unit 5**                                                                                    **[8 Hrs]**
Fibers - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics. Open Mould Processes, Bag Molding, Compression Molding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Molding - Application of PMC's. **[a,b,d,e,k,l]**

**Unit 6**                                                                                    **[7 Hrs]**
Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques - Plasma Spray,Chemical and Physical Vapor Deposition of Matrix on Fibers - Liquid State Fabrication Methods - Infiltration - Squeeze Casting - Rheo Casting - Compocasting - Application of MMCS. **[a,b,d,e,k,l]**

.**Reference books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Product Design and Process Engineering | 1995. | Harold Belofsky, | Hanser Publishers, |
| 2 | High Performance Polymers | 1991 | Bera, E and Moet | Hanser Publishers, |
| 3 | Plastics Extrusion technology | 1988 | F.Hensen, | |
| 4 | Injection Moulding Machines | 1983 | F.ohannaber | Hanser Publishers, |
| 5 | Polymer extrusion | 1990 | C.Rauwendaal, | Hanser Publishers, |
| 6 | Blow Moulding Handbook | 1989 | D.V.Rosatao, | Hanser Publishers, |
| 7 | Modern Plastics Moulding | | E.B Seamour, | John Wiley. |
| 8 | Plastics Moulding | 1952 | John Dalmonte, | John Wiley. |
| 9 | Machining of Plastics | 1981 | Akira Kobyashi, | Mc-Graw Hill. |
| 10 | Composite Materials science and Engineering | 1998 | Krishan K.Chawla | Springer-Verlag, 1987. |

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|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME405/ME705 | Project Evaluation & Management | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economical feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.

**Unit1** [7 hrs]
**Project Identification** considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty.[ **a,b,c,d,e,h,l,j,k**]

**Unit 2** [7 hrs]
**Technical feasibility** : Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation: [ **a,b,c,d, ,h,l,j,k,l,m**]

**Unit 3** [9 hrs]
**Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Break even point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.    [**a,b,d,e,h,l,j,k**]

**Unit 4** [7 hrs]
**Project Planning and Control:** Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating [ **a,b,c,d,,h,l,j,k,l,m**]
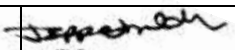
**Unit 5** [7 hrs]
**Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital [**a,b,c,d,e, f, h,l,j,k,l,m**]

**Unit 6** [8 hrs]
Initial review, performance analysis , ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environmental & social aspects. [**a,b,c,d,e, f, h,l,j,k,l,m**]

| .Reference books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Projects | Seventh edition 2007 | Prasanna chandra | Tata mc graw Hill publishing company Ltd. |
| 2 | CPM & PERT | | L. S. Srinath | East West publisher |
| 3 | Projects | 1963 | P.K. Joy | Macmillon |
| 4 | Engineering Economy | Fifth edition | H. G Thuesen, W J Fabricky, G,J, Thuersen | Prentice-Hall |
| 5 | Finance series 'Project management' , Vol-I1 and Vol-III | 2009 | ICFAI | ICFAI,Press Hyderabad |
| 6 | Finance Management | Sixth edition 2010 | M.Y.Khan | Tata McGraw hill |
| 7 | Financial Management | Fourth edition | Chandra, Prasanna | Tata McGraw-Hill Education, 1997 |
| 8 | Engineering Economics | Eighth edition | G. J. Thuesen, Wolter J. Fabrycky | Prentice Hall, 1993 |

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|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME406/ME706 | FINITE ELEMENT METHOD | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

### Unit 1 [7 hrs]

Fundamentals of stress & strain, stress & strain components, stress strain relationship, Elastic constants, plane stress, plane strain., differential equation of equilibrium, compatibility equations, boundary conditions, Saint Venant's principle.
**[a,b,c,d,j,k]**

### Unit 2 [7 hrs]

Fundamental concepts of FEM -' Historical background, Scope of FEM in Engg. Applications, Principle of minimum potential energy. Concept of Virtual work. Raleigh-Ritz method. FEM analysis procedure. Mathematical understanding required for FEM, Matrix algebra & operations, Eigen values & Eigen vectors. Methods for solution of simultaneous equations. like Gauss elimination. Matrix decomposition method.
Concept of discritization of body into elements. degrees of freedom, bandwidth, Basic types of 2-D & 3-D elements, displacement models, convergence requirements, shape function. Programming for above matrices.
**[a,b,c,d,e,j,k]**

### Unit 3 [8 hrs]

Finite element modeling and analysis of one dimensional problems:
Finite element modeling & analysis using Bar & Beam element -stiffness matrix, assembly, boundary conditions, load vector, temperature effects.
Two dimensional plane trusses-Local & Global coordinate system, element stiffness matrix, assembly, boundary conditions, load vector, force & stress calculations. Programming for simple bar and beam elements**.**
**[ a, b, c, d, e, i, j, k]**

### Unit 4 [8 hrs]

Two dimensional problems using CST & LST -formulation of CST & LST elements, elemental stiffness matrix, assembly, boundary conditions, load vector. stress calculation. Temperature effect .
Axi-symmetric solids subjected to axi-symmetric loading -axi-symmetric formulation using CST ring, element, stiffness matrix, boundary conditions, load vector, calculation of stresses. Programming for simple 2-D problems using CST and LST elements.
**[ a, b, c, d, e, h, k]**
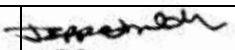
### Unit 5 [7 hrs]

Introduction to Isoperimetric & Higher order elements. Introduction to Numerical Integration.
Introduction to dynamic analysis, formulation of mass matrix for one-dimensional bar element, free vibration analysis using one-dimensional bar element.
Torsion of prismatic bars using triangular elements. Programming for these elements.
**[ e, g, h i, j, k]**

### Unit 6 [8 hrs]

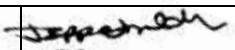Application of commercial software for simple machine elements and interpretation of results..
**[h i, j, k]**

| Chairperson | *[signature]* | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | *[signature]* | Version | 1.00 | |

| ME406/ME706 | FINITE ELEMENT METHOD | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**Text books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Introduction to Finite Elements in Engineering | 4th edition 2011 | Chandrupatla T.R; Belegundu AD | Pearson Education |
| 2 | Theory of Elasticity | 2nd edition 1951 | Timoshenko S.P | Tata McGraw-Hill Education |
| 3 | Concept and applications of Finite element Analysis | 2nd edition revised, 2010 | Cook RD | I. K. International Pvt Ltd |
| 4 | The Finite Element Method -A basic introduction for engineers | 2nd edition | Griffiths D. W; Nethercot D.A | BSP Professional, 1983 |
| 5 | Finite element methods | 6th edition, 2005 | O. C. Zienkiewicz, Richard Lawrence Taylor, Perumal Nithiarasu, J. Z. Zhu | Butterworth-Heinemann |
| 6 | Applied elasicity | -- | Chi The Wang | Amazon |
| 7 | Finite to Infinite | -- | -- | Infinite seris |

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|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME408/ME801 | Synthesis Of Mechanism | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To make the students understand various types of mechanisms and criterion used in their selection. To give detailed knowledge of type, number and dimensional synthesis of mechanisms. To introduce various graphical and analytical methods so as to enable students to design the mechanisms to meet kinematic needs. Introducing various optimization techniques for synthesis.

**Unit 1**                                                                                          **[7 hrs]**
**Introduction to kinematics, types of mechanism, kinematics synthesis, science of relative motion, tasks of kinematic synthesis with practical applications, Degree of freedom, class-I, class-II chain, Harding's notation, Grashof criterion, Grubler's criterion.** [a,b,c,e,l]

**Unit 2**                                                                                          **[8 hrs]**
Introduction to position generation problem, concept of pole, two &three position generation synthesis, pole triangle, Relationship between moving & fixed pivots, Four position generation, opposite pole quadrilateral, center point &circle point curve, Burmester's point. Matrix method for position generation problem, rotation matrix, displacement matrix. **[a, b, c,e,l ]**

**Unit 3**                                                                                          **[7 hrs]**
Introduction to function generation problem, co-ordination of input-output link motion, relative pole technique, inversion technique, overlay technique, graphical synthesis of quick return mechanisms for optimum transmission angle. Types of errors, accuracy points, cheby sher's spacing, frudenstein's equation with problems.**[a,b,c,e,l]**

**Unit 4**                                                                                          **[8 hrs]**
Introduction to path generation problem, synthesis for path generation with and without prescribed timing using graphical method. Coupler curves, cognate linkages, Robert's law of cognate linkages.
Complex number method for path generation problem 3 precision points.     **.[a,b,c,e,l]**

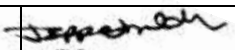**Unit 5**                                                                                          **[7 hrs]**
Synthesis for infinitesimally separated position, concept of polode and centrod, Euler's savery equation, inflection circle, Bobbilier and Hartman's construction.**[a,b,c,e,l]**

**Unit 6**                                                                                          **[8 hrs]**
Optimal synthesis of planer mechanisms, powell's search method, least square method, penalty function. Introduction to spatial mechanisms, D-H notations, introduction to kinematic analysis of robot arm.
**.[a,b,c,e,l]**

| .Reference books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Applied linkage synthesis | Fifth edition | Tao D.C. | New York, NY, |
| 2 | Advanced mechanism design | 1984 | Erdman A.G.; Sandor G.N | Prentice-Hall, 1984 |
| 3 | Kinematics and mechanism design | Third edition 2010 | Sue C.H; Radchiffe C.W | |

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|---|---|---|---|---|
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| ME409/ME802 | Financial & Cost Management | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

**Unit 1** [7 Hrs]

**Business Finance:**

Need for finance, sources of finance (fixed and working capital), equity and preference shares, deposits from public, debentures, bonds, term loans, financial institutions in India, Financial statements and their analysis. **[a, c, d, e, f, g, h, i ,j ,l, ]**

**Unit 2** [7 Hrs]

**Concept of Cost:**

Concept of cost, classification of cost, direct and indirect , fixed and variable , semi variable, product and period, controllable and uncontrollable costs, opportunity costs , sunk cost, joint cost, prime cost, factory cost, cost of production, selling and distribution cost, administrative cost, cost of sales. **[a, c, d, e, f, g, h, i ,j ,l, ]**

**Unit 3** [7 Hrs]

**Cost ascertainment and cost reduction:**

Concept of overhead, collection of overheads, allocation and appointment, absorption of overheads, absorption rates, under – over absorption , cost centers, cost units, cost statement sheet.
Areas of cost reduction, techniques, productivity**[a, c, d, e, f, g, h, i ,j ,l, ]**

**Unit 4** [8 Hrs]

**Costing System:**

Job costing, contract costing, cost plus contracts, batch costing, process costing, simple process costing, normal abnormal losses and gains, waste, scrap & spoilage, joint & byproducts, operating costing. **[a, c, d, e, f, g, h, i ,j ,l, ]**

**Unit 5** [8 Hrs]

**Cost Planning and Control:**

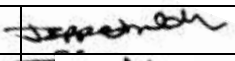Concept of budgeting, advantages and limitations, budgetary control, key factors, fixed and flexible budget.
Standard costing, selling of standards, variance analysis. **[a, c, d, e, f, g, h, i ,j ,l, ]**

**Unit 6** [8 Hrs]

**Decision Making:**

Marginal costing, break even analysis, cost volume, profit analysis, application of costing to various decisions like make or buy, add or drop products, cost or process further, operate or shut down, replace or retain. **[a, c, d, e, f, g, h, i ,j ,l, ]**

| .Reference books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Principles and Practice of Cost Accounting | Fifth edition | N.K.Prasad | Pearson Education |
| 2 | Cost Accounting | | Jawahar Lal | |
| 3 | Management Accountancy | Third edition2010 | J. Batty | Tata Mc Graw Hill |
| 4 | Financial Management | | Khan and Jain | |
| 5 | Financial Management | 2007 | Prasanna Chandra | Tata Mc Graw Hill |
| 6 | Engineering Economy | 1973 | Paul Degarmo | Macmillan, 1973 |
| 7 | Cost Accounting | 2008 | B.K.Bhar | Academic publishers |
| 8 | Costing and finance managment | 2012 | Mrunalini Naik | Thakur publications |

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|---|---|---|---|---|
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| ME410/ME803 | Renewable Energy System | | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To realize understand the importance of various renewable energy sources in this era of energy crisis. To study the theory of conversation of various renewable energy such thermal, electrical, etc. Apply thermodynamics cycles to above systems. To study Magneto Hydrodynamic systems. **[a, b, c, e, i ,l, m ]**

### Unit 1 [8 hrs]

Solar Energy: Introduction, solar constant, spectral distribution of solar radiation, beam & diffuse radiation, measurement of solar radiation and measuring instruments. Solar radiation geometry, solar angles, estimation of average solar radiation, radiation as tilted surface, tilt factors **[a, b, c, e, i ,l, m ]**

### Unit 2 [7 hrs]

Solar flat plate collectors: Types of collectors, liquid flat plate collectors, solar air heaters, transmissivity of glass cove(system, collector efficiency, analysis of flat plate collector, fin efficiency, collector efficiency factor and heat removal factor, selective surfaces, evacuated   collectors, novel designs of collector.
**[a, b, c, e, i , l, m ]**

### Unit 3 [8 hrs]

Concentrating collectors: line focusing, point focusing and non focusing type, central receiver concept of power generations compound parabolic collector, comparison of flat & concentrating collectors. Applications of solar energy to water heating, space heating, space cooling, drying refrigeration, distillation, pumping. Solar furnaces, solar cookers, solar thermal electric conversion, solar photo- voltaics Solar energy storage, sensible, latent and  thermochemical storage, solar pond **[a, b, c, e, i , l, m ]**

### Unit 4 [7 hrs]

Biogas: - Introduction, bio gas generation, fixed dome & floating drum biogas plants their constructional details, raw material for biogas production, factors affecting generation of biogas and methods of maintaining biogas, production, digester design considerations, fuel properties of biogas and utilisation of biogas biomass :- Introduction, methods of obtaining energy from biomass, Incineration, thermal gasification, classification of gasifiers & constructional details chemistry of gasification fuel properties, applications of gasifiers.
**[a, b, c, e, i ,l, m ]**
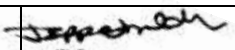
### Unit 5 [8 hrs]

**Wind and Ocean energy: -**Power in wind, forces on blades, wind energy: Basic principle of wind energy conversion site selection consideration wind data and energy estimation, basic components of WECS Classification of WEC systems, savonius and darrieus rotars applications of wind energy.
**Ocean energy**: Introduction: - ocean thermal electric conversion open and closed cycle of OTEC, hybrid cycle, energy from tides basic principles of tidal power & components of tidal power plants, single & double basin arrangement estimation of tidal power and energy. Energy from ocean waves -energy availability, wave energy conversion devices. **[a, b, c, e, i , l, m ]**

### UNIT 6 [7 hrs]

Geothermal and MHD power generation :
Geothermal energy: Introduction, classification of geothermal systems vapour dominated, liquid dominated system, total flow concept, petrothermal systems, magma resources, applications of geothermal operational & environmental problems. Magneto Hydro Dynamic power generation: Introduction principles of MHD power generation, MHD open and closed systems, power output from MHD generators, design problems of MHD generation, gas conductivity, seeding  **[a, b, c, e, i , l, m ]**

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| ME410/ME803 | Renewable Energy System | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |
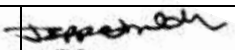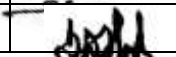
**Text books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Energy Technology | 3rd edition | Parulekar & Rao | Khanna Publishers |
| 2 | Non Conventional Energy Sources | | G D Rai | Standard Publishers Distributors |
| **Reference book** | | | | |
| 1 | Solar Energy | 3rd edition | S.P. Sukhatme | Tata McGraw-Hill Education, |
| 2 | Solar Energy | 3rd edition, 2006 | John A. Duffie, William A. Beckman | Wiley |
| 3 | Solar energy engineering | 2007 | Jui Sheng Hsieh | Prentice-Hall, |

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME411/ME804 | Artificial Intelligence | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To learn about the automation of machines tools making the system intelligent. Understanding the different techniques used for implementation of artificial intelligence.

**Unit 1**                                                                                                   **[7 hrs]**
Human and machine intelligence, Artificial Intelligence (AI), Programming in AI environment,. Natural Language processing (NLP) Architecture of an Expert system, Knowledge base, inference engine forward and backward chaining, Selection of inference mechanism. **[a, b, c, d]**

**Unit 2**                                                                                                   **[7 hrs]**
Introduction, to Rule Based System, Conflict Resolution, Advantages and Drawbacks of Rule Based Systems Clausal Form Logic; Rule Base Verification, Refinement and Validation  **[a, b, c, d, j ]**

**Unit 3**                                                                                                   **[9 hrs]**
Creating Knowledge Base, Knowledge Engineer and Domain Expert, Phases of Knowledge Engineering, Tools for Knowledge Engineering  **[a, b, c, d, e, j, k  ]**

**Unit 4**                                                                                                   **[7 hrs]**
Neural network applications, artificial neural network models, NN applications in Cellular manufacturing and other areas of mechanical Engg. **[a, b c, i, j, k ]**
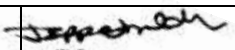
**Unit 5**                                                                                                   **[7 hrs]**
Fundamentals of OOP (Object oriented programming), creating structures and objects, object operations, invoking procedures, programming applications, Object oriented expert systems.  **[a, b,  i , j, k ]**

**Unit 6**                                                                                                   **[8 hrs]**
Semantic nets, ruled systems for semantic nets, certainty factors, automated learning;      **[a, b, e, i, j,  k  ]**

.**Reference books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Designing Knowledge Based System | 1985 | Addis, T.R | Prentice Hall |
| 2 | Principles of Artificial Intelligence and Expert Systems Development | 1988. | Rolston, D.W | McGraw Hill |
| 3 | Handbook of Expert Systems in Manufacturing | 1991 | Maus, R. and Keyes | McGraw Hill |
| 4 | A comprehensive guide to artificial intelligence and expert systems | 1990 | Robert Levine | McGraw-Hill, 1990 |
| 5 | Artificial Intelligence | 1991 | Elain Rich | McGraw-Hill, 1991 |
| 6 | Rule based expert systems | 1990 | Sasikumar, Ramani | |
| 7 | Design for Knowledge Based Systems | 1978 | Graham Winstanley | Galgotia Publications |
| 8 | Artificial Neural Networks | 1992 | Zurada | West, 1992 |
| 9 | Neural Networks and Fuzzy Logic | | V.B. Rao and H.V. Rao, "C<sup>++</sup> : | BPB Publications |

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
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| ME412/ME805 | Maintenance Management | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

The student will be able to (1) understand the maintenance function, its importance and types.(2)  organize the maintenance department.,(3)  analyze the failure of a machine ,(4) estimate repair and maintenance cost,(5) plan the condition monitoring program for a machine and to understand the maintenance needs of basic electrical and mechanical devices.

**Unit I**                                                                                              **[8 Hrs]**

Objectives, scope, structure of maintenance organization and operating policies to  guide  management, policies with respect to work allocation, work force, intra and inter plant relation, material, finance and control. Concept of life cycle maintenance ,optimization of total maintenance, analysis of productivity ,Reliability ,Maintainability, and Availability, **[a, b, d, h, j ,l ,m]**

**Unit II**                                                                                             **[7 Hrs]**

Maintenance policies, Preventive maintenance program, corrective maintenance guidelines, replacement policies-cyclic replacement, group replacement, standbys, economics of  machine replacement, TPM,RCM and CMMS. **[a,  d, m ]**

**Unit III**                                                                                           **[7 Hrs]**

Failure analysis:

General practice, failure classification , data collection, failure pattern recognition ,determination of replacement period, time between preventive maintenance checks. Use of various modern techniques to monitor the condition of machine to facilitate maintenance  **[a, b, d, e, k ,m ]**

**Unit IV**                                                                                           **[8 Hrs]**

Work measurement for maintenance:

Need for Work measurement ,various techniques for work measurement of  direct and indirect labour. Work force requirement, location and size. **[b, d, m ]**

**Unit V**                                                                                             **[8 Hrs]**

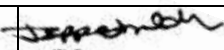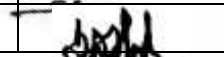Control and estimation of maintenance cost:

Job classification, various estimating techniques and its use.

Maintenance manual, plant performance improvement, Maintenance training program, Maintenance control indices and factor affecting them .Lubrication system-need ,design and implementation. **[a, d, m ]**

**Unit VI**                                                                                           **[7 Hrs]**

Maintenance of various mechanical and electrical equipments. **[d, i, m ]**

| .Reference books: | | | | |
|---|---|---|---|---|
| **S.N.** | **Title of the book** | **Edition (Year of publication)** | **Author(s)** | **Publisher** |
| 1 | Maintenance engineering handbooks | 2008 | Mobley and Higgins | Mc-graw Hill |
| 2 | Guide to Complete Maintenance | 1988. | Rolston, D.W | Heintzelment |
| 3 | Maintainability and maintenance management | 1991 | J. Patton | Maus, R. and Keyes |
| 4 | Operation research in Maintenance | -- | Jarding | -- |
| 5 | Introduction to reliability and maintainability Engineering. | -- | Thomos Ebelling | Mc-graw Hill |
| 6 | Advanced operations management | | R.P.Mohanty and S.G.Deshmukh | Pearson Education |
| 7 | Maintenance engineering and management | | R.C.Mishra and K.Pathak | PHI Publications |
| 8 | Industrial Maintenance management | | S.K.Shrivastava | S.Chand |

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| ME415/ME808 | Vibrations | L=4 | T=0 | P=0 | Credits=4 |
|-------------|-----------|-----|-----|-----|-----------|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|-------------------|-------|--------|----|----|-------|--------------|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To develop in students fundamentals knowledge of vibrations. To familiarize with energy methods for multi degree freedom systems. To impart, knowledge of vibration of continuous systems and applications of factor in vibration analysis. To impart knowledge of use of FFT in vibration analysis for condition monitoring purpose.

**Unit 1** [7 hrs]
Free body diagram, free & forced vibration, un damped and damped single degree of freedom systems subjected to harmonic and other periodic excitations. Impulse response, convolution integral and response to arbitrary excitation. Vibration isolation and transmissibility. Solution using laplace transform, Runga kutta method, structural damping.**[a, b, l ]**

**Unit 2** [7 hrs]
Energy method applied to multi degree freedom system. Lagranges equation. Generalized mass formulation of mass , damping and stiffness matrix and its numerical solutions . Vibration absorber, conservative and non conservative systems. Geared rotor system, Influence Coefficients and flexibility matrix of bending vibration of beam and multi-disc rotor. Mode shapes and orthogonality principle.
.**[a, b, l ]**

**Unit 3** [8 hrs]
Numerical techniques for M.d.o.f. systems. Matrix iteration method. Holzer's method for torsional vibration. Dunkeleys method for critical speed determination of multi disc rotor. Rayleigh quotient sweeping matrix method for determination of all the natural frequencies and mode shapes. Rayleigh Rit method. Modal matrix and expansion theorem. Free and forced response by modal analysis. .**[a, b, l ]**

**Unit 4** [8 hrs]
Vibration of continuous system. Axial vibration of rod, bending vibration of beam and torsional vibration of shaft. Hamiltons principle and derivation of equation of motion, Rayleigh quotient. Modal co-ordinates and modal forces. Free and forced response through modal analysis.**[a, b, l ]**
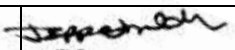
**Unit 5** [8 hrs]
Vibration pickup, seismometers, accelerometer, proximity probe spectrum analyzer, FET & DFT (DiscreteFT), torsional, Vibration measurement, Digital vibration measurement, philosophy of vibration. condition monitoring. .**[a, b, m]**

**Unit 6** [7 hrs]
Introduction to Finite element method in vibration of continuous system. Natural frequencies and mode shape computation for simple rod and beam problem.    **[a, b, m]**
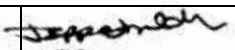
.**Reference books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|------|-------------------|-------------------------------|-----------|-----------|
| 1 | Theory of vibration | 2001 | Thomson W.T | Prentice hall |
| 2 | Elements of vibration analysis | 1986 | Meirovitch L | McGraw-Hill Science/Engineering/Math; 2 Sub edition (January 1, 1986) |
| 3 | Mechanical vibration | 1984 | Rao J.S.;Gupta K | Wiley Eastern, c1984 |
| 4 | Theory of vibrations | 1983 | Morse TSE; Hinkle | New Delhi: CBS Publishers, 1983. |
| 5 | Advanced theory of vibration | 1992 | Rao J.S | Wiley, 1992 |
| 6 | Vibration condition Monitoring of Machines | 2000 | Rao J.S | Alpha Science International Limited, 2000 |
| 7 | Random vibration | | Gandall & Mark | |

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| ME416/ME809 | Vibration Laboratory | | L=0 | T=0 | P=2 | Credits=1 |
|---|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 40 | 60 | 100 | |

**List of Practical**

1. To determine transmissibility of single degree freedom system using load cells and exciter.
   **[a, b, l ]**
2. To Study the Transverse Vibrations of Cantilever Beam and to determine the frequency or period of Vibration (oscillation) theoretically and actually by experiment.
   **[a, b, l ]**

3. To determine natural frequency of Torsional vibration of geared system.
   **[a, b, l ]**
4. To Study the forced vibration of equivalent spring mass System.
   **[a, b, l ]**

5. Study and determination of modes shapes for two degree and three degree freedom systems.

   **[a, b, l ]**

6. To Study the Free Vibration of two rotor and three rotor System and to determine the natural frequency of vibration theoretically & experimentally.
   **[a, b, l ]**

7. To verify the Dunkerley's Rule.
   **[a, b, l ]**

8. Determination of Whirling of shaft.
   **[a, b, l ]**

9. To study the effect of damping on natural frequency and plot frequency response curves at various damping coefficient.
   **[a, b, l]**
10. To determine vibration parameters ( Amplitude Velocity acceleration for machines using FFT)
    **[a, b, m]**

11. To diagnose faults in simple machines like pumps motor gearbox using FFT.
    **[a, b, m ]**

12. To remove dynamic unbalance using FFT.
    **[a, b, m ]**

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| ME417/ME810 | Computer Integrated Manufacturing | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**OBJECTIVES**

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

**Unit 1**                                                                                                              **[7 hrs]**

Concept and scope of CIM, components of CIM, benefits, limitations.Basics of computer graphics NC basics, NC words, Manual part programming (NC part programming) Punch Tape, Tape Format CNC , DNC, APT programming Adaptive control, application. Tooling for CNC machine. **[a, b, d ]**

**Unit 2**                                                                                                              **[7 hrs]**

Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT. Part families , classification and coding , Production flow analysis , Machine cell design , Benefits **[a, k ,l ]**

**Unit 3**                                                                                                              **[8 hrs]**

Introduction & Components of FMS , Application work stations , Computer control and functions , Planning, scheduling and control of FMS , Scheduling , Knowledge based scheduling , Hierarchy of computer control , Supervisory computer Manufacturing data systems , data flow , CAD/CAM considerations , Planning FMS database **[b, d, k ]**

**Unit 4**                                                                                                              **[8 hrs]**

Industrial robotics Robot anatomy, Robot control, accuracy, repeatability, End Effectors Sensor, Introduction to robot programming, Robot application (Material handling processing assembly and inspection) introduction to robot Kinematics. **[d, h,l ]**
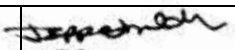
**Unit 5**                                                                                                             **[10 hrs]**

Process Planning in the Manufacturing cycle , Process Planning and Production Planning  Process Planning and Concurrent Engineering, CAPP, Variant process planning , Generative approach , Forward and Backward planning, Input format, Logical Design of a Process Planning , Implementation considerations ,manufacturing system components, Automated material handling systems, AS/RS, general considerations , selection, evaluation and control . Inspection and Quality control, CAQC, CMM types, working, applications Expert process planning  **[a, b, d ]**

**Unit 6**                                                                                                              **[5 hrs]**
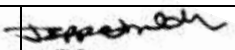
Totally integrated process planning systems, Integration of CNC robotics for CIM, Agile manufacturing, Nano Manufacturing. Simulation **[a, h, k  ]**

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| ME417/ME810 | Computer Integrated Manufacturing | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

.**Reference books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Systems Approach to Computer Integrated Design and Manufacturing | 1996 | Nanua Singh | John Wiley & Sons, 1996. |
| 2 | Automation, Production Systems and Computer Integrated Manufacturing | 2002 | Groover M.P | Prentice-Hall of India Pvt. Ltd., New Delhi, 2002 |
| 3 | Handbook of Flexible Manufacturing Systems | 1991 | Jha, N.K | Academic Press Inc., 1991 |
| 4 | Group Technology in Engineering Industry | 1979 | Burbidge, J.L | Mechanical Engineering pub. London, 1979. |
| 5 | G.T Planning and Operation, in The automated factory-HandBook: Technology and Management | 1991 | Askin, R.G. and Vakharia, A.J | Cleland, D.I. and Bidananda, B (Eds), TAB Books, NY, 1991. |
| 6 | Cellular Manufacturing Systems | | Irani, S.A | Hand Book |
| 7 | Planning, design and analysis of cellular manufacturing systems | 1995 | Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds) | Elsevier |
| 8 | Principles of Process Planning | 1995 | Gideon Halevi and Roland D. Weill | A logical approach, Chapman & Hall, |

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| ME418/ME811 | Computer Integrated Manufacturing Laboratory | L=0 | T=0 | P=2 | Credits=1 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 40 | 60 | 100 | |

**List of Practical**

1. Study of CIM. **[a, e, k]**

2. Study of CAD systems  **[a, b,  c  ]**

3. Numerical control – Fundamental & Application  **[a, b, k  ]**

4. CNC- Lathe – Features, Specification, & Part Program. **[a, b, ,l ]**

5. CNC- Milling – Features, Specification, & Part Program. **[a, b, ,l ]**

6. Group Technology. **[a, b, e ]**

7. FMS & CIM. **[a, b, e  ]**

8. Computer Aided Process Planning. **[a, b, d  ]**

9. Manual Part Programming. **[a, b, ,l ]**

10. APT Part Programming. **[a, e ,l ]**

11. Robots Fundamental and Applications **[a, b, ,l ]**

12. AGVS- Fundamental and applications  **[a, b, l ]**

13. CNC Lathe – Programming , Simulation & Actual Machining of Part.
( Thread Cutting , Facing , Turning , Grooving etc. ) **[a, b, ,l ]**

14. CNC Milling – Programming , Simulation & Actual Machining of Part.
(Profile Cutting , Various Interpolation , Pocketing , Mirroring etc. ) **[a, b, l ]**

15. Programming , Simulation of Robot. **[a, b, e  ]**

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| ME419/ME812 | I.C.Engines | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To understand basic working cycles, types and development of I.C. Engines. To study the various systems related to I.C. Engines. To understand testing and performance of Engines. To study fuels, combustion, pollution and its control of engines. **[a, b, c, e, i ,l, m ]**

**UNIT 1**                                                                                                    **[7 HRS]**

Historical Perspective, Engines classification, Working cycles and operation, P-V, Valve Timing diagrams, Engine components and their material .Engine cycle Energy Balance, various losses in the engine like Frictional losses, blow by losses, pumping loss etc. Engine system: Air supply, Fuel supply, lubrication systems, cooling systems and their importance. **[a, b, c, e, i , l, m ]**

**UNIT 2**                                                                                                    **[8 HRS]**

I.C.Engines fuel and its desirable properties. Requirements of S.I and C.I. Engine fuel
Rating of I.C. engine fuels, Other fuel like CNG, LPG, Alcohols,
Air pollution from I.C.Engines and their control using EGR, Catalytic converters, particulate traps. **[a, b, d, e, i , l, m ]**

**Unit 3**                                                                                                    **[8 HRS]**

Fuel supply systems for S. I. Engine: A-F mixture requirements, Basic principle, Simple Carburetor and systems like main metering, choke, idle, acceleration pump. Operating difficulties for carburetors. Petrol Injection SPFI., MPFI, Direct Gasoline Injection, Ignition system & components for S.I.Engine - Battery, Magneto & Electronic. **[a, b, c, e, i , l, m ]**

**Unit 4**                                                                                                    **[7 hrs]**

Combustion in S. I. Engine: Stages of combustion with p-θ diagram. Factors affecting various stages of combustion. Abnormal combustion Pre ignition, Detonation and Knocking. HUCR, S.I.Engine combustion chamber. **[a, b, c, e, i , l, m ]**

**Unit 5**                                                                                                    **[7 HRS]**
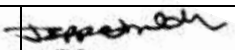
Fuel supply systems for C.I.Engine: Requirements of an ideal FI system, Types of Injection, Fuel injection pumps, fuel injectors and nozzles.
Combustion in C. I. Engines. Stages of combustion with p-θ diagram, Factors affecting various stages of combustion. Abnormal combustion Diesel Knock,
Supercharging and turbo charging in engine. **[a, b, c, e, i , l, m ]**

**Unit 6**                                                                                                    **[8hrs]**

Engine performance Parameters. MEP, Torque ,speed, power, Specific fuel consumption and various efficiencies., Air measurement, Excess air and Volumetric efficiency, Measurement and Testing  of friction power ,indicated power, Brake power, Fuel consumption, Air consumption, etc. Heat balance sheet calculation.  **[a, b, c, e, i , l, m ]**

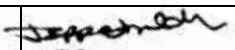| .Reference books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Internal Combustion Engine Fundamentals | 1988 | John B. Heywood | McGraw-Hill |
| 2 | Internal Combustion Engines and Air pollution | 1973 | Edward F. Obert | |
| 3 | Internal Combustion Engines | 2007 | M. C. Mathur, R.D. Sharma. | McGraw-Hill |
| 4 | Internal Combustion Engines | 2007 | V. Ganesan | McGraw-Hill |
| 5 | Internal Combustion Engines | 2010 | V. M. Domkundwar | Dhanpat Rai & Co |
| 6 | Internal Combustion Engines | 2012 | R.K.Rajput | Laxmi publications (P) Ltd. |

**Regular: - 7th Semester     Elective-III Practical     PTDC: - 7th Semester**

| Chairperson | [signature] | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
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| ME420/ME813 | I.C.Engines Laboratory | L=0 | T=0 | P=2 | Credits=1 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 40 | 60 | 100 | |

**List of Practical**

1. Study and demonstration of working of 2-S & 4-S Engines. **[a, b, c, e, i ,k, l, m ]**
2. Study and demonstration of Lubrication & Cooling systems. **[a, b, c, e, i ,k, l, m ]**
3. Study of fuel systems for S.I. engines.**[a, b, c, e, i , k, l, m ]**
4. Study of fuel systems for C.I. engines. **[a, b, c, e, i , k, l, m ]**
5. Determination of Air: Fuel ratio for Petrol Engine. **[a, b, c, e, i , k, l, m ]**
6. Determination of Air: Fuel ratio for Diesel Engine.**[a, b, c, e, i , k, l, m ]**
7. Determination of BP/FP/IP of Engine. **[a, b, c, e, i , k, l, m ]**
8. Heat balance sheet calculation. **[a, b, c, e, i , k, l, m ]**
9. Visit to Automobile Industry/ workshop. **[a, b, c, e, i , k,  l, m ]**

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| ME433ME828 | Project Phase-I | | L=0 | T=0 | P=4 | Credits=4 |
|---|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | |
|---|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 100 | **Internal Evaluation** |
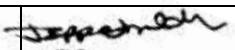
## OBJECTIVES

The objective is to prepare the student to examine any design or process or phenomenon fron all angles.This will encourage and develop the process of independent thinking and team working in them and expose them to the needs of industry and society

The group of students (not more than 4) will work under the guidance of the faculty member on the project work .It is expected to carry out literature survey for their project work and finalized the methodology and schedule of project.

Each student from the project batch shall present [(1<sup>st</sup> Preliminary and 2<sup>nd</sup> Progress)  using audio visuals, aids] the seminar of about 10 to 15 minute duration on their project methodology. Seminar delivery will be followed by question – answer session. The batch of the students shall also require to submit a progress report of minimum 3 pages before 2<sup>nd</sup> seminar .The seminar committee (minimum 3 members) shall be constituted for the purpose of evaluating seminar.

**[a,b,c,d,e,f,g,h,I,j,k,l,m]**

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| Dean (Acad. Matters) | | Version | 1.00 | |

| ME434/ME829 | Training | | L=0 | T=0 | P=0 | Credits=3 |
|---|---|---|---|---|---|---|

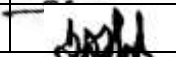| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | |
|---|---|---|---|---|---|---|
| | 0 | 0 | 100 | 0 | 100 | Internal evaluation |
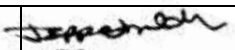
**OBJECTIVES**

To work in an industry for understanding-
1. Nature of work **[a, b, d, f ,g, h, j, k l ]**
2. Different machines used **[a, b, d, f ,g, h, j, k l ]**
3. Different technologies used**[a, b, d, f ,g, h, j, k l ]**
4. Work culture**[a, b, d, f ,g, h, j, k l ]**
5. Various problems exists in Industry. **[a, b, d, f ,g, h, j, k l ]**

+

**TRAINING:** The student shall undergo training in an industry for minimum period of one month duration during summer vacation after completion of 6<sup>th</sup> Semester. They will be required to prepare and submit a comprehensive report on the training undergone by them. They will have to submit a certification of completion of training from the industry at the time of joining 7<sup>th</sup> Semester. They will have to face or undergo a viva-voce by a committee of teachers during 7<sup>th</sup> semester.

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| ME429/ME824 | Total Quality Management | L=3 | T=1 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

The course aims to build an overall capability to understand Quality and its relevance in today's dynamic market. Various Quality Improvement tools and technique shall be introduced and practiced  so as to develop skills and knowledge to function as a good quality professional in the Engineering  Profession.

**Unit 1** [7 hrs]
Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering  **[d, f, g, h, l, j, m ]**

**Unit 2** [7 hrs]
Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards. **[c, f, g, h, j, l ]**

**Unit 3** [8 hrs]
Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA -YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design  **[d, e, l ]**

**Unit 4** [8 hrs]
Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes **[a, e, m ]**
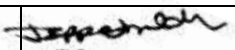
**Unit 5** [8 hrs]
Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling, **[ b, c, m ]**

**Unit 6** [7 hrs]
Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing **[b,  h, k , l ]**

.**Reference books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Total Quality Management for Engineers | 1991 | Mohamed Zairi | Woodhead Publishing Limited 1991 |
| 2 | Production and Operations mangament - Total Quality and Responsiveness | 1995 | Harvid Noori and Russel | McGraw-Hill Inc, 1995 |
| 3 | Managing for Total Quality | 1998 | N.Logothetis | Prentice Hall of India Pvt .Ltd,1998 |
| 4 | The Essence of Total Quality Management | 1995 | John Bank | Prentice Hall of India Pvt.Ltd., 1995. |
| 5 | Introduction to Statistical Quality Control | 1991 | Douglus C. Montgomery | 2nd Edition, John Wiley and Sons, 1991. |
| 6 | Statistical Quality Control | 1984 | Grant E.L and Leavensworth | McGraw-Hill, 1984. |

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
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| ME430/ME825 | Reliability Engineering | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**OBJECTIVES**
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few  well understood basic principles to find its solution.

**Unit 1**                                                                                                [7hrs]
 Fundamental concepts:-
Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability, **[a, c, d, e, f, g, h, i ,j ,l, ]**

**Unit 2**                                                                                                [8hrs]
 Probability theory:-
Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications. **[a, c, d, e, f, g, h, i ,j ,l, ]**

**Unit 3**                                                                                                [7hrs]
System reliability and modeling:
Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation. **[a, c, d, e, f, g, h, i ,j ,l, ]**

**Unit 4**                                                                                                [8hrs]
 Maintainability and Availability:
Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation. **[a, c, d, e, f, g, h, i ,j ,l, ]**

**Unit 5**                                                                                                [7hrs]
 System reliability Analysis:
Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing. **[a, c, d, e, f, g, h, i ,j ,l, ]**

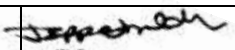**Unit 6**                                                                                                [8hrs]
Strength based reliability:
Safety factor, safety margin, Stress strength interaction,  Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads. **[a, c, d, e, f, g, h, i ,j ,l, ]**

| . .**Reference books:** | | | | |
|---|---|---|---|---|
| **S.N.** | **Title of the book** | **Edition (Year of publication)** | **Author(s)** | **Publisher** |
| 1 | Concepts of Reliability Engg | 1985 | L.S. Srinath | Affiliated East-Wast Press (P) Ltd |
| 2 | Reliability Engineering | 1983 | A.K. Govil | Tata McGraw-Hill Publishing Co. Ltd |
| 3 | Reliability Engineering | 1984 | E. Balagurusmy | Tata McGraw-Hill Publishing Co. Ltd |
| 4 | Engineering Reliability | 1980 | B.S. Dhillion, C. Singh | John Wiley & Sons |
| 5 | Probabilistic, Reliability | 1968 | M.L. Shooman | McGraw-Hill Book Co., |
| 6 | Practical Reliability Engg | 1985 | Patric D.T.O'connor | Heyden and sons ltd. |
| 7 | Reliability in Engineering Design | 1977 | K.C. Kapur, L.R. Lamberson | John-Wiley and sons. |
| 8 | Reliability Engineering, Theory and Practice | Third Edition, 1999 | A.Birolini | Springer, |

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| ME435/ME830 | Automation In Production systems | L=3 | T=1 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**OBJECTIVES**

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

**Unit 1**          **[7 hrs]**

Automation- Definition, types, reasons for automating, arguments for and against automation. Types of production, functions in manufacturing, Organization and information processing in manufacturing.

Automated Flow 'Lines- Methods of workpart transport, Transfer mechanisms, Buffer storage. Analysis of flow lines- General terminology and analysis, analysis of transfer lines without storage, partial automation, automated flow lines with storage buffers, manual assembly lines. Line Balancing Problem, Methods of line balancing. Automated Assembly Systems- Types, parts delivery system **[a, b, h ]**

**Unit 2**          **[8 hrs]**

Numerical Control Production Systems- Basic concepts, coordinate system and machine motion- Types of NC systems- Point to point, straight cut and continuous path. Machine control unit and other components, Tape and tape readers.

NC part programming- Punched tape and tape formats, NC words, methods of part programming, manual part programming: APT programming, Direct numerical control. Computer numerical control. Adaptive control. Applications and economics of NC. **[a, b, k ]**

**Unit 3**          **[8 hrs]**

Industrial Robotics- Introduction, robot anatomy, robot control systems, accuracy and repeatability and other specifications, end effectors, sensors, introduction to robot programming, safety monitoring.

Robot applications- Characteristics of robot applications, work cell layout, robot applications in material handling, processing, assembly and inspection. **[a, h, l ]**

**Unit 4**          **[7 hrs]**

Automated material handling & storage-Conveyor systems : Roller conveyer , Skate wheel conveyer, Belt conveyers, Chain conveyers, Slat conveyers , Overhead trolley conveyers , Infloor towline conveyers, Cart on track conveyers . Automated Guided Vehicle Systems -

Types: - Driverless trains, AGVS pallet trucks, AGVS unit-load carriers. Vehicle guidance & Routing, Traffic control & safety, System management, Analysis of AGVS systems, AGVS applications.

Automated Storage & Retrieval System -

Types :- Unit load AS/RS , mini load AS/RS , man on board AS/RS , automated item retrieval system, deep lane AS/RS -Basic components & special features of AS/RS , Carousel storage systems , Work in process storage, quantitative analysis. **[a, c, l ]**
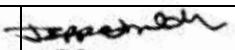
**Unit 5**          **[7 hrs]**

Automated inspection & Group technology:- Automated inspection principles & methods -100% automated inspection, off -line & on -line inspection, distributed inspection & final inspection; Sensor technologies for automated inspection , coordinate measuring machines contruction , operation & benefits; Machine vision - image aquisition & digitization, image processing & analysis, interpretation,

machine vision applications; Other optical inspection methods -Scanning laser systems , linear allay devices, optical tringulation techniques. Introduction to Group Technology. **[a, d, k  ]**

**Unit 6**          **[7 hrs]**

Computer aided manufacturing -Manufacturing planning, manufacturing control ; Computer integrated manufacturing ;

Flexible manufacturing systems -Components, Types of systems, FMS layout configuration computer functions, data files, system reports, FMS benefits.

Computer aided process planning: Retrieval CAPP systems, generative CAPP systems, benefits of CAPP . Shop floor control.  Computer Process Control. **[a, c, d  ]**

| ME435/ME830 | Automation In Production systems | L=3 | T=1 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |
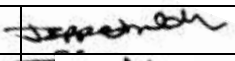
**Text books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Automation, production System & CIMS | Third edition (2007) | M P, Groover PHI | Prentice Hall |
| 2 | CAD/CAM | Fifth edition (2008) | Zimmers & Groover PIII | Pearson Education India |
| **Reference Books:** | | | | |
| 1 | Numerical Control And Computer Aided Manufacturing | 13th edition (2007) | Rao, N K Tiwari, T K Kundra | Tata McGraw-Hill Education |
| 2 | Computer Control of Manufacturing Systems | 2005 | Koren | Mcgraw Hill |

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|---|---|---|---|---|
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| ME436/ME831 | **Automation In Production Laboratory** | **L=0** | **T=0** | **P=2** | **Credits=1** |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 40 | 60 | 100 | |
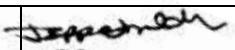
**Practicals:**
1) Performance, Simulation on CNC lathe (atleast two Complex Geometric) **[ b, k ,m ]**
2) Performance, Simulation on CNC milling (atleast two Complex Geometries) **[a, d, m ]**
3) Practice Programming on Manual Part Program **[a, b, m ]**
4) Practice Programming on APT **[a, b, m ]**
5) Case Study on Automated System of any Industry. **[a, b, k ]**
6) Performance/ Practical on Robot. **[a, b, k ]**
7) Part Coding and Group Technology **[a, d, h ]**
8) Study of FMS**[a, b, c ]**
9) Study of Automated material handling **[a, b, e ]**
10) Study of Automated inspection **[a, d, h ]**

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| ME475 / ME720 | Optimization Techniques | L=3 | T=1 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course

**Unit 1** **[7 hrs]**

Introduction of operation research. LP Formulations, Graphical method for solving LP's with 2 variables, Simplex method, Duality theory in linear programming and applications, Integer linear programming, dual simplex method.

**[ a, b, c, d, e, f, g, h, i, k, l, m ]**

**Unit 2** **[7 hrs]**

Transportation model, Assignment model.

/FCFS, M/M/S : N/FCFS.∞ /FCFS,M/M/1 : N/FCFS, M/M/S : ∞Queuing Models : Essential features of queuing systems, operating characteristics of queuing system, probability distribution in queuing systems, classification of queuing models, solution of queuing M/M/1 **[ a, b, d, e, f, g, h, i, k, l, m ]**

**Unit 3** **[8 hrs]**

Dynamic Programming: Basic Concepts, Bellman's optimality principles, Dynamics programming approach in decision making problems, optimal subdivision problem.

Sequencing Models: Sequencing problem, Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines. **[ a, b, c, d, e, f, g, h, i, j, k, l, m ]**

**Unit 4** **[8 hrs]**

Project Management: PERT and CPM : Project management origin and use of PERT, origin and use of CPM, Applications of PERT and CPM, Project Network, Diagram representation, Critical path calculation by network analysis and critical path method (CPM), Determination of floats, Construction of time chart and resource labeling, Project cost curve and crashing in project management, Project Evaluation and review Technique

**[ a, b, c, d, e, f, g, h, i, k, l, m ]**

**Unit 5** **[7 hrs]**

Replacement Models and Economic Equivalence: Concept of equivalence interest rate, present worth, economic evaluation of alternatives, group replacement models. Simulation model.
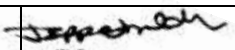
**[ a, b, c, d, e, f, g, h, i, k, l, m ]**

**Unit 6**

**[8 hrs]**

Inventory Models: Introduction to the inventory problem, Deterministic Models, The classical EOQ (Economic Order Quantity) model, Inventory models with deterministic demand (no shortage & shortage allowed), Inventory models with probabilistic demand, multi item deterministic models. **[ a, b, c, d, e, f, g, h, i, j, k, l, m ]**

| **Text books:** | | | | |
|---|---|---|---|---|
| **S.N.** | **Title of the book** | **Edition (Year of publication)** | **Author(s)** | **Publisher** |
| 1 | Introduction to Operation Research, Computer Oriented Algorithmic approach | 2007 | Gillet B.E | Tata McGraw Hill Publising Co. Ltd. New Delhi. |
| 2 | Operations Research | Third edition 2008 | P.K. Gupta & D.S. Hira | S.Chand & Co. |
| 3 | Operations Research: Theory and Applications | Second edition 2002 | J.K. Sharma | Mac Millan |
| 4 | Operations Research | 2006 | S.C. Sharma | Discovery Publishing House |
| 5 | Optimization Theory and Application | Second edition 2010 | S.S. Rao | Halsted Press |
| 6 | Operations Research - An Introduction | Ninth Edition 2010 | Tata Hamdy | Prentice Hall of India Pvt. Ltd., New Delhi. |

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|---|---|---|---|---|
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| ME437/ME832 | INDUSTRIAL FLUID POWER | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration | |
|---|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs | |

## OBJECTIVES

To realize and understand the importance of industrial fluid power systems in the world of automation and power transmission. To introduce simple fluid power systems and apply fluid principles to it. To study various basic components of fluid systems. Understanding the language and graphic symbols associated with fluid power systems. To study various fluids for hydraulic systems and various accessories such as filters, accumulators, etc. to design and analyze practical fluid power systems.

**Unit 1** [8 hrs]

**Fluid power systems:** Components, advantages, applications in the field of M/c tools, material handling, hydraulic presses, mobile & stationary machines, clamping & indexing devices etc. **Transmission of power at static & dynamic states**. Pascal's Law, continuity equations,

**Types of Hydraulic fluid** petroleum based, synthetic & water based. Properties of fluids. Selection of fluids, additives, effect of temperature & pressure on hydraulic fluids.

**Seals**, sealing materials, selection of seals.

**Filters**, strainers, sources of contamination of fluid & its control.

JIC symbols/ISO Symbols for hydraulic & pneumatic circuits. **[ a, e, k, l, m]**

**Unit 2** [7 hrs]

**Pumps:** Types, classification, principle of working & constructional details of vane pump, gear pumps, radial & axial plunger pumps, power and efficiency calculations, characteristic Curves, selection of pumps for hydraulic power transmission.

**Accumulators & Intensifiers**: Types & functions of accumulators & intensifiers, applications, selection & design procedure. **[e, k, l, m]**

**Unit 3** [8 hrs]

**Control Of Fluid Power:** Necessity of pressure control directional control, flow control valves,

**Pressure Control Valves**: Principle of pressure control valves, direct operated, pilot operated, relief valves, pressure reducing valve, sequence valve & methods of actuation of valves.

**Flow Control Valves:** Principle of operation, pressure compensated, temperature Compensated flow control valves, meter in & meter out flow control circuits, bleed off circuits.

**Direction Control Valves:** Check valves, types of D.C. valves:- Two way two position, four way three position, four way two position valves, open center, close center, tandem center valves, method of actuation of valves, manually operated, solenoid operated, pilot operated etc **[ a, e, k, l]**

**Unit 4** [7 hrs]

**Actuators:** Linear & Rotary actuators.

**Hydraulic motors:** Types, vane, gear piston, radial piston.

Theoretical torque, power & flow rate hydraulic motor performance.

**Hydraulic Cylinders:** Types of cylinder & mountings, calculations of piston velocity, thrust under static & dynamic applications. Design consideration for cylinders. **[ a, e, k, l]**

**Unit 5** [7 hrs]

**Design Of Hydraulic Circuits**:

Meter in meter out circuits. Pressure control for cylinders, Flow divider circuits, etc. Introduction to **Fluidics**. Circuit illustrating use of pressure reducing valves, sequencing valve, counter balance valves, unloading valves with the use of electrical controls, accumulators etc. Hydraulic circuit analysis.

Maintenance, trouble shooting & safety precautions of Hydraulic Circuits.

Hoses & Pipes: Types, materials, pressure drop in hoses/pipes, valves and fittings.
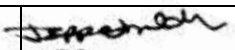
Hydraulic piping connections. **[ a, b, c, e, l, m]**

**Unit 6** [8 hrs]

**Pneumatics: Introduction** to pneumatic power sources, e.g. reciprocating & rotary compressors, roots-blower etc. **Comparison** of pneumatics with Hydraulic power transmission. **Air preparation units**, filters, regulators & lubricators. **Actuators**, linear, single & double acting, rotary actuators, air motors, **Pressure Regulating Valves**, **Directional Control Valves** two way, three way & four way valves, solenoid operated, push button; & lever control valves. **Flow Control Valves**. Check valves methods of actuation, mechanical, pneumatic & electrical etc.
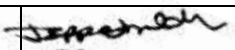
**Pneumatic circuits** for industrial applications & automation. **[ a, b, c, e, l, m]**

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| ME437/ME832 | INDUSTRIAL FLUID POWER | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**Text books:**

| Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|
| **Introduction to Fluid Power** | 2002 | James L Johnson | **Delmar Thomson Learning** |
| Fluid Power With Applications | 6th | Anthony Esposito | PEARSON Prentice Hall |
| Industrial Hydraulics | 3rd or above | J.J. Pipenger & T. G. Hicks | McGraw Hill Co. |
| Pneumatic Systems: Principles and Maintenance | 16th (2006) | S. R. Majumdar | Tata McGraw-Hill Education |
| **Reference Books:** | | | |
| Power pneumatics | (2007) | Michael J. Pinches | Prentice Hall |
| Vickers manuals on Industrial Hydraulics | 3rd edition or above | Vickers | Vickers, 1996 |
| Hydraulics & Pneumatics | 4th edition | Harry L. Stewart | Industrial Press |
| Fluid Power Design Handbook | 3rd edition | Franklin D. Yeaple | Marcel Dekker, 1996 |

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|---|---|---|---|---|
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| ME438/ME833 | INDUSTRIAL FLUID POWER Laboratory | L=0 | T=0 | P=2 | Credits=1 |
|---|---|---|---|---|---|

| **Evaluation Scheme** | **MSE-I** | **MSE-II** | **TA** | **ESE** | **Total** | **ESE Duration** |
|---|---|---|---|---|---|---|
| | **0** | **0** | **40** | **60** | **100** | |
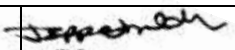
**Practical**: - Minimum eight practical to be conducted /studied
**Note: Demonstrations shall be carried out on Hydraulic and Pneumatic Kit**
1) Study of JIC/ISO symbols for Hydraulics and Pneumatics
2) Demonstration of hydraulic pumps used in hydraulic systems
3) Demonstration of Actuators used in Fluid Power systems
4) Demonstration of various valves used in Fluid Power systems
5) Demonstration of accumulators and Intensifiers used in Fluid Power systems
6) Demonstration of different flow control methods used in Fluid Power systems
7) Demonstration of various hydraulic circuits ( three to four applications)
8) Demonstration of various industrial hydraulic circuits (another three to four applications)
9) Demonstration of FRL unit used in pneumatic systems.
10) Demonstration of valves used in pneumatic systems.
11) Demonstration of industrial pneumatic circuits (three to four app.)
12) Study of hydraulic fluids used in hydraulic systems
13) Study of hydraulic seals used in Fluid Power systems
14) Study of Contamination Control of Hydraulic Fluids.
15) Design report of a hydraulic or pneumatic system using manufacturer's catalogue

**All the above project will satisfy [a, c, l, m]**

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| ME439/ME834 | CNC and Robotics | | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

### OBJECTIVES

To understand the need and process of automation in industry. Study the Computer Numerically Controlled machines and Robots, their components, functions, functions, programming and applications.

**Unit 1** **[7 hrs]**
Concepts of NC, CNC, DNC. Classification of CNC machines, MCU architecture and functionality, Machine configurations, Types of control, CNC controller's characteristics, Interpolators. **[a, d, h, l, j]**

**Unit 2** **[8 hrs]**
Qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, of CNC Machines.
Programming CNC machines, Part print analysis and Process planning, Advanced Programming features , Canned cycles. APT part programming CAD/CAM, Parametric Programming.**[a, b, c, d, e, h, l, j, k ,l ,m]**

**Unit 3** **[8 hrs]**
Manual part programming for CNC turning, milling and machining center. Wire EDM machines. Computer assisted part programming techniques, Conversational and Graphics based software, Solid  based part programming. Freeform surface machining. Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM. **.[a, b, c, d, e, h, l, j, k ,l ,m]**

**Unit 4** **[7 hrs]**
Robotics, Basic concepts , Robot configurations , Basic robot motions , Types of drives , Applications
Transformations and kinematics, Vector operations, Translational transformations and Rotational transformations , Properties of transformation matrices,
Homogeneous transformations and Manipulator, Forward solution, Inverse solution, Introduction to robot dynamics.
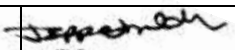Controls, Control system concepts, Analysis, control of joints, Adaptive and optimal control. **[a, b, c, d, e, h, l, j, k ,l ,m]**

**Unit 5** **[8 hrs]**
End effectors, Classification, Mechanical, Magnetic, Vacuum, and Adhesive, Drive systems, Force analysis and Gripper design**.**
Robot programming, Methods, Languages ,Computer control and Robot Software – Programming Languages, Robot application (Assembly, inspection, material handling, processing) **[a, b, c, d, e, h, l, j, k ,l ,m]**

**Unit 6** **[7 hrs]**
Sensory devices, Non optical and optical position sensors, Velocity and Acceleration, Range, Proximity, touch, Slip, Force, Torque. Machine vision, Image components , Representation , Hardware , Picture coding , Object recognition and categorisation Integration of Robots with CNC machines for CIM. **[a, b, c, d, e, h, l, j, k ,l ,m]**
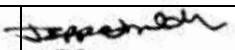
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|---|---|---|---|---|
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| ME439/ME834 | CNC and Robotics | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**Text books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Robot Engineering An Intergrated approach | 2004 | Klafter R.D., Chmielewski T.A. and Negin M | Springer |

**Reference :**

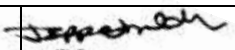| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | CNC Technology and Programming | 2003 | Krar, S., and Gill | Industrial Press Inc |
| 2 | An Introduction to CNC Machining | 1991 | Gibbs, D. | Industrial Press |
| 3 | Computer Numerical Control Concepts and Programming | 1991 | Seames, W.S. | Thomson Learning EMEA, Limited |
| 4 | Computer Numerical Control for Machining | 1993 | Lynch, M | McGraw-Hill |
| 5 | Computer Control of Manufacturing Systems | 2005 | Koren Y | Tata McGraw-Hill Education |
| 6 | Robotics control, sensing, vision, and intelligence | 2004 | Fu K.S., Gonzalez R.C., and Lee C.S.G. | Tata McGraw-Hill Education |
| 7 | Robotics Technology and Flexible Automation | 2001 | Deb S.R | Tata McGraw-Hill Education |
| 8 | Introduction to Robotics Mechanics and Control | 2008 | Craig J.J | Pearson Education India |

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|---|---|---|---|---|
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| ME440/ME835 | CNC and Robotics Laboratory | L=0 | T=0 | P=2 | Credits=1 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration | |
|---|---|---|---|---|---|---|---|
| | 0 | 0 | 40 | 60 | 100 | | |
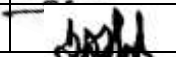
**List of Practical**

1) Demonstration on Automation through development in NC machines. **[a, b ,e ,i, j, k]**
2) Numerical control – Fundamental & Application. **[a, b , d, e ,i, j, k]**
3) Manual Part Programming. **[a, b ,e ,i, j, k, l, m]**
4) APT Part Programming. **[a, b ,e ,i, j, k, l, m]**
5) CNC- Lathe – Features, Specification, & Part Program. **[a, b ,e ,i, j, k, l, m]**
6) CNC Lathe – Programming, Simulation & Actual Machining of Part.
   **[a, b ,e ,i, j, k, l, m]** (Thread Cutting, Facing, Turning, Grooving etc. ) **[a, b ,e ,i, j, k, l, m]**
7) CNC- Milling – Features, Specification, & Part Program. **[a, b ,e ,i, j, k, l, m]**
8) CNC Milling – Programming, Simulation & Actual Machining of Part. **[a, b ,e ,i, j, k, l, m]**
   (Profile Cutting, Various Interpolation, Pocketing, Mirroring etc.)
9) Robots Fundamental and configurations. **[a, b , d, e ,i, j, k]**
10) Robots Applications **[a, b ,e ,i, j, k, l, m]**
11) Programming, Simulation of Robot. **[a, b ,e ,i, j, k, l, m]**
12) Problems on Robot kinematics **[a, b ,e ,i, j, k, l, m]**

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|---|---|---|---|---|
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| ME441/ME836 | Vehicle Engineering | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**OBJECTIVES**

The main objective of the syllabus to understand basic knowledge about Automobile systems which are used in the regular vehicle. The modernization in automobile is also included to understand recent trend in the field.

**UNIT-1**:                                                                                                    **[8 hrs]**

Introduction, Automobile history and development and classification. Vehicles layout.

Engine construction and working of 2 stroke and 4-stroke cycle.

Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic)

Engine cooling and lubrication systems., **[ a ,b , i , l, m ]**

**UNIT-2**:                                                                                                    **[8 hrs]**

Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch.

Gear box: Necessity of gear box, working principle, Classification: Sliding mesh, constant mesh, synchromesh, synchromesh and Transfer case gear box, Gear Selector mechanism, lubrication and control.

Introduction to Automatic Transmission **[ a ,b , k, l, m ]**

**UNIT-3**:                                                                                                    **[8 hrs]**

Transmission system:  Propeller shaft, Universal joint, constant velocity joint, Hotchkiss drive, torque tube drive.

Differential - Need and working. Differential lock.

Rear Axles and Front Axles

Wheel and Tyres : tyres specification, factors affecting tyre performance. **[ a ,b , k, l, m ]**

**UNIT-4**:                                                                                                    **[8 hrs]**

Steering systems, principle of steering, Steering linkages, steering geometry and wheel alignment, steering gear box and its types, Drum and Disc brakes, Comparison

Brakes   - Need, types : Mechanical, hydraulic (Master and wheel cylinder), Air brakes.

Suspension systems – Function, conventional and Independent suspension System, Telescopic shock absorber.

**[ a ,b , k, l, m ]**

**UNIT-5**:                                                                                                    **[8 hrs]**
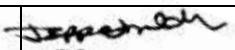
Electrical systems: Battery construction. Specification. Operation and maintenance of Batteries.

Alternator, starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator, wiper.

Automobile air-conditioning,

Panel board instruments

Overhauling, Engine tune up **[ a ,b , d,  l, m ]**

**UNIT-6**:                                                                                                    **[8 hrs]**

Resistance to vehicle motion: Air, Road and gradient resistance and power calculation.

 Recent Advances in automobiles such as ABS, Power Steering, Collision avoidance, Navigational aids etc

**[ a ,b , d, ,l, m ]**

| **Reference books:** | | | | |
|---|---|---|---|---|
| S.N. | Title of Book | Edition | Authors | Publication |
| 1 | Automotive Technology | | H.M.Sethi | Tata McgraHill |
| 2 | Automobile Engineering-I & II | First Edition - 2010 | P.S.Gill | S.K.Kataria & sons |
| 3 | Automotive Mechanics | | Joseph Heitner | |
| 4 | Motor Vehicle Technology | | J.A. Dolan | |
| 5 | Automotive Engines | | W.H. Crouse | |

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|---|---|---|---|---|
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| ME442/ME837 | Vehicle Engineering Laboratory | L=0 | T=0 | P=2 | Credits=1 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 40 | 60 | 100 | |
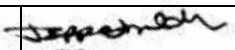
**List of Practical**: Minimum eight practical to be conducted

1.  Study and demonstration of four wheeler chassis layout. Two-wheel & four-wheel drive layouts.
2.  Study and demonstration of 2S & 4S Engine Working
3.  Study and demonstration of working of single plate/Multiplayer/Diaphragm automobile clutch.
4.  Study and demonstration of synchromesh gearbox.
5.  Study and demonstration of final drive and differential.
6.  Study and demonstration of working Hydraulic braking system.
7.  Study and demonstration of front wheel steering geometry and steering mechanism.
8.  Study and demonstration of suspension system of a four-wheeler.
9.  Study and demonstration of battery, electrical charging system.
10. Study and demonstration of electrical starting system
11. Study and demonstration of Electric horn, Brake light and side indicator
12. Visit to workshop to study and demonstration of wheel balancing.
13. Visit to servicing station for study of vehicle maintenance, repairs and report

For all the above practical's **[ a ,c, d, e,  i k, l, m ]**

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013- |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | 14 Onwards |

| ME443/ME838 | Management Information Systems | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To focus on the integration of computer systems with the overall goals set by an organization. To learn the development and management of information technology tools for assisting executives and the general workforce in performing any tasks related to the processing of information MIS and business systems are especially useful in the collation of business data and the production of reports to be used as tools for decision making.

### Unit 1 [7 hrs]
Introduction to MIS;
System & Its components, System Concepts, system control, Types of systems, Date & Information, Nature and scope, Character Function & Applications, system life cycle design. **[a, b, c, e]**

### UNIT 2
**[7 hrs]**
System Analysis: System planning, Information Gathering, Structure Analysis tools, Feasibility Study, cost/benefit analysis. **[a ,b, c, e,  h, i, j, k]**

### UNIT 3 [7 hrs]
System Design: Stages of system Design, Input/output & form design, Database Design, Design Documentation.
**[a, b, h, i, j, k ]**

### UNIT 4 [7 hrs]
SYSTEM IMPLEMENTATION & EVALUATION :
System testing, Implementation Detailed evaluation, System maintenance. **[a, b, i, j, k ]**

### UNIT 5 [7 hrs]
DECISION SUPPORT SYSTEM :
Concepts & Philosophy of DSS, Deterministic System, Artificial Intelligence(AI), knowledge Based Expert system(KBES). **[a, b, i, j, k ]**

### UNIT 6 [7 hrs]
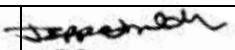MIS TOOLS & PACKAGES/AREAS OF MIS
    ERP(Enterprise Resource Planning)
    SCM(Supply Chain arrangement)
    CRM(Customer Relation ship Management.)
    Concept of data ware housing and data mining. **[a, e,  f, g, h ]**

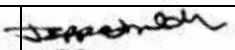| Reference books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | MIS | 2002 | WS Jawadekar | Tata McGraw-Hill |
| 2 | MIS | 2006 | D. P. Goyal | Macmillan |
| 3 | System Analysis and Design | 1985 | Elias M. Awad | R.D. Irwin |
| 4 | System Analysis and Design | 2004 | Donald Yeales. | Financial Times Prentice Hall |

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|---|---|---|---|---|
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| ME444/ME839 | Management Information Systems Laboratory | L=0 | T=0 | P=2 | Credits=1 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 40 | 60 | 100 | |

**PRACTICALS :**
1. Inventory control, **[a ,b, c, e,  h, i, j, k]**
2. MRP, **[a ,b, c, e,  h, i, j, k]**
3. Office Automation by using: MS-Access **[a ,b, c, e,  h, i, j, k]**
4. Visual Basic, **[a ,b, c, e,  h, i, j, k]**
5.  Oracle or any other database Languages. **[a ,b, c, e,  h, i, j, k]**

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|---|---|---|---|---|
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| ME445/ME840 | Mechatronics | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

Develop the ability to understand the working of various electronically and computer control devices. This will help to bridge the existing gap between machines, Automation and Computer control system

**Unit 1**                                                                 **[7 hrs]**

Introduction, sensors, actuators, modeling of systems. Recent trend of designing machine units along with electronic circuits for operation and supervision of mechanisms. Techniques of interfacing mechanical devices with computer hardware. **[a, b, c, d, e, i, l ]**

**Unit 2**                                                                 **[8 hrs]**

Basic principles ,working and specific  applications of armature and field controlled D.C. Motors, Variable voltage and variable frequency control of 3 phase and single phase Induction motors, speed control of synchronous motors, Different types of stepper motors-Constriction ,working and application. Position control of stepper motors.
**[a, b, d, e, i, l ]**

**Unit 3**                                                                 **[8 hrs]**

Common and commercial I.Cs used for amplification, timing and digital indication.
Different types of actuators, working of synchro-transmitter and receiver set, Pressure to current (P/I ) and I/P conversion. Electrical and hydraulic servomotors.
Design of solenoid plungers and pressure and force amplification devices. **[a, b, d, e, i, l ]**

**Unit 4**                                                                 **[7 hrs]**

Add-on cards for sampling and actuation, 4-20 mA ports, AD-DA conversion, Peripheral interface organization, general layout of data bus and data transfer through serial and parallel modes of communication, schemes of computer networking and hierarchy in supervisory control. **[a, b, d, e, i, l ]**
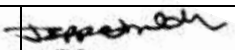
**Unit 5**                                                                 **[8 hrs]**

Study of various integrated systems by using block diagrams.  Study of systems used in Ink Jet Printers, Photo copying, Washing Machines, IC Engine fuel injection system etc **[ a, b, c, d, e, i, l , m ]**

**Unit 6**                                                                 **[7 hrs]**

 General philosophy of Artificial Neural Network simulations, Fuzzy logic for operation and control of mechatronic systems. **[a, b, d, e, i, l , m ]**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| | **Text books:** | | | |
| 1 | Introduction to Mechatronics and Measurement Systems | 2007 | Michael B.Histand and David G. Alciatore | Tata McGraw-Hill Education |
| 2 | Mechatronics | 2007 | Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ., | Chapman and Hall, 1991 |
| 3 | Microprocessor Architecture, Programming and Applications | 2002 | Ramesh.S, Gaonkar | Prentice Hall |
| 4 | Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics | 1996 | Lawrence J.Kamm | John Wiley and Sons |
| 5 | Introduction to Microprocessors for Engineers and Scientists | 2004, | Ghosh, P.K. and Sridhar | PHI Learning Pvt. Ltd. |

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|---|---|---|---|---|
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| ME446/ME841 | Mechatronics laboratory | L=0 | T=0 | P=2 | Credits=1 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 40 | 60 | 100 | |
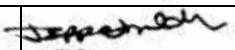
**List of Practical (Minimum 10 Experiments)**

1. Verification of P, P+I, P+D, P+I+D control actions.
2. Demonstration on XY position control systems.
3. Demonstration on linear conveyor control system.
4. Demonstration on rotary table positioning systems.
5. Demonstration on different switches and relays.
6. Analysis of control system using software like MATLAB/SIMULINK or equivalent.
7. Development of ladder diagram/programming PLC for level control, position control or any other mechanical engineering application.
8. Demonstration on A/D and D/A converters.
9. Demonstration on Flip Flops and Timers.
10. Demonstration on Application of Op – Amp circuits.
11. Demonstration on Data acquisition system.
12. Demonstration on Microcontrollers.

**For all the above practical's [a, b, d, e, i, I , m ]**

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|---|---|---|---|---|
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| ME451/ME846 | STRESS ANALYSIS | L=3 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles of stress analysis.

**Unit 1** [7 hrs]

Two Dimensional Problems in. Cartesian Coordinate system -Fundamentals of stress & strain, stress-strain relationship, Elastic constant, plane stress, plane strain., differential equation of equilibrium Boundary conditions, Saint Venant's principle, compatibility equation. **[ a ,b , e, l ]**

**Unit 2** [7 hrs]

Airys stress function. Stress analysis of cantilever subjected to concentrated load at its end and simply supported beam subjected to uniformly distributed load.
Two dimensional problems in polar coordinate systems -General equations of equilibrium in polar coordinate compatibility equation. **[ a ,b , e, l ]**

**Unit 3** [7 hrs]

Stress distribution about symmetric. axis, stress analysis of cylinder subjected to internal & external pressure, Pure bending of curved beams, effect of hole on the stress distribution in plates, Stress analysis of rotating circular disk. **[ a ,b , e, l ]**

**Unit 4** [8 hrs]

Introduction to various methods of stress analysis like grid techniques, brittle coating method, Moire fringe method etc.
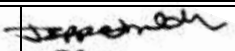Two Dimensional Photo elasticity - Introduction to basic optics related to photo elasticity, stress optic law, plane & circular polariscope arrangements, diffusion and lens type polariscope .Effect of stressed model in plane & circular polariscope, Isoclinic & Isochromatics, stress trajectories, calibration of photo elastic material (determination of fringe constant). Various photoelastic materials and their properties, Casting of photo elastic models, Tardy's and other compensation technique. Separation techniques like, shear difference, oblique incidence & electrical analogy. **[ a ,b , e, l ]**

**Unit 5** [8 hrs]

Strain gage technique for stress & strain analysis -Introduction to electrical resistance strain gages, gage . factor, bridge circuit, bridge balance, output voltage of Wheatstone bridge, balancing of bridge, temperature compensation, various bridge configurations, bonding of strain gages to the specimen, determination of principle strains & stresses using strain rosettes. Environmental effects on performance of strain gages, Strain gages response to dynamic strains, Effect of lead wires. Introduction to Strain measurement on rotating components, Static & Dynamic Strain Measurement introduction to semiconductor gages, high temperature strain gages & self-temperature compensated gages. Introduction to Commercial strain indicators. **[ a ,b , e, l ]**

**Unit 6** [7 hrs]

Introduction to fatigue and fracture mechanics. **[ a ,b , e, l ]**

| Text books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Theory of Elasticity | 2<sup>nd</sup> edition | Timoshenko S.P; | Tata McGraw-Hill Education, 1951 |
| 2 | Experimental Stress Analysis | 3<sup>rd</sup> edition | Dally ;Riley | McGraw-Hill, 1991 |
| 3 | Experimental Stress Analysis | 1982 | Ray T.K. | S. Chand, |
| 4 | Experimental Stress Analysis | 1984 | Srinath L.S | Tata McGraw-Hill Publishing Company Limited, 1984 |
| 5 | Vol - I and Vol – II."Theory of photoelasticity | 2009 | Max Mark Frocht | Pergamon Press, 1969 |
| 6 | Applied elasicity | -- | Chi The Wang | Amazon |

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|---|---|---|---|---|
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| ME452/ME847 | Design of Experiments and Taguchi methods | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**OBJECTIVES**

The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.

**Unit 1**                                                                                                          **[7 Hrs]**
Frequency Distribution & Histograms, Probability & its Distribution, Measures of Central Tendency & Distribution, Presentation of Statistical Data. Importance and significance of statistics in an engineering industry.
[ **a,f,h,i,l** ]

**Unit 2**                                                                                                          **[8 Hrs]**
Confidence intervals, Hypothesis Testing, Correlation, Liner & Multiple Repression Analysis, Signification Testing, Introduction to minitab.**[ b, e, m ]**

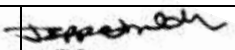**Unit 3**                                                                                                          **[7 Hrs]**
Full & fractional factorial experiments, analysis of variance, Latin squares, response surface methology,
 **[ c, k , l ]**

**Unit 4**                                                                                                          **[7 Hrs]**
Group Method of Data Handling, shainin variable search technique, Regression equation in matrix form.
**[j, m ]**

**Unit 5**                                                                                                          **[8 Hrs]**
Taguchi techniques, concept of six sigma, DoE and six sigma, Six sigma implementation. **[ b, d, g,j, l ]**

**Unit 6**                                                                                                          **[8 Hrs]**
Industrial application of Taguchi technique, orthogonal arrays, OA selection, DoE with Taguchi and comparison with conventional DoE. **[ b, l  ]**

| Text books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Experimental Design | 1950 | Cochran & Cox | Wiley, |
| 2 | Taguchi Techniques in Quality Engineering | 2<sup>nd</sup> edition | Phillip J. Ross | McGraw-Hill, 1996 |
| 3 | Statistical Analysis for Engineers and Scientist | 2010 | Barnes | McGraw-Hill, 1994 |
| 4 | Introduction to Probability and Statistics | 4<sup>th</sup> edition 2003 | Milton | McGraw-Hill, |
| 5 | Engineering Statistics | 2<sup>nd</sup> edition | Bowker & Liberman | Prentice-Hall, 1972 |

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME453/ME848 | Value Engineering | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To learn about the philosophy of VA/VE, its importance to present day industrial and consumer product design. ,Study the various steps involved in systematic implementation of VA/VE.

**Unit 1** [7 hrs]

Introduction to Value Engineering (V.E.) and Value Analysis, Quantitative definition of Value, Use Value and Prestige Value, Estimation of product quality/performance, Types of Functions. [ e, g, l]

**Unit 2** [7 hrs]

Life Cycle of a Product, Product life cycle Management, Methodology of V.E., [f, h, m ]

**Unit 3** [8 hrs]

Relationship between Use Functions and Esteem Functions in product design, Functional Cost and Functional Worth, Effect of value improvement on profitability, Aims of VE systematic Approach [c, i, l]

**Unit 4** [8 hrs]

Introduction to V.E. Job plan / Functional Approach to Value Improvement, Various phases and techniques of the job plan [ a, j, m ]
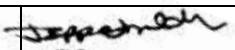
**Unit 5** [8 hrs]

Factors governing project selection, Life Cycle Costing for managing the Total Value, Concepts in LCC, Present Value concept, Annuity concept, Net Present Value, Pay Back period, Internal rate of return on investment (IRR), Examples and illustrations. [ b, k, l ]

**Unit 6** [7 hrs]

Creative thinking and creative judgment, False material, labor and overhead saving, System Reliability, Reliability

elements in series and parallel, Decision matrix, Estimation of weights and efficiencies, Sensitivity analysis, Utility functions, Fast diagramming, Critical path of functions, DARSIRI method of value analysis, Purchase price analysis.

[a, c, d, m ]

| Reference Books | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Value Engineering | 1962 | L.D.Miles | Materials Management International, |
| 2 | Getting more at less cost | 1995 | Jagannathan | Tata McGraw-Hill Publishing Company Limited, |
| 3 | Value Engineering | | Tufly | |
| 4 | Value Engineering | 3<sup>rd</sup> edition | Donald Parker | |
| 5 | Value Engineering | 4<sup>th</sup> edition 1984 | Zimmerman | City of Tulsa, 1984 |

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|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME454/ME849 | Lean Sigma | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

The course aims to develop a broad understanding of Lean/Six Sigma principles. It focuses on build capability to implement Lean/Six Sigma initiatives in manufacturing as well as service operations will also help the capability to operate with awareness of Lean/Six Sigma at the enterprise level.

**UNIT 1**                                                                                          **[8 hrs]**
Business process, Quality management, Need and significance of LS, COQ, COPQ, LS implementation, LS culture, Team roles and function, benefits. **[ c, d, f, i, j, l ]**

**UNIT 2**                                                                                          **[8 hrs]**
Six sigma essentials, SS tools, DMAIC methodology, case studies and applications.**[ a, b, e, k, m]**

**UNIT 3**                                                                                          **[8 hrs]**
Statistical applications and methods using Minitab Software, cases and problems.**[a, b, k, l]**

**UNIT 4**                                                                                          **[7 hrs]**
Process capability, Gage R & R,MSA, ANOVA,HYPOTHESIS testing, DOE, process characterization.
**[b, g, k, l]**

**UNIT 5**                                                                                          **[7 hrs]**
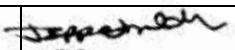Lean manufacturing concepts, Lean means speed, efficiency, waste time and cost reduction.
Lean Tools and Techniques-VSM,7 waste,5S,Kanban,Poka-yoke,Kaizen,TPM,SMED,Pull vs Push, JIT, single piece flow. **[a, c, h, k, m]**

**UNIT 6**
Design for Six Sigma, (DFSS)- need and significance, DMADV methodology, DFSS tools, Product and process optimization, innovations, TRIZ, case studies and applications.**[a, b, e, k, m ]**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| **Test Books** : | | | | |
| 1 | Getting started in Six-sigma | | Michel C Thomset | John Wiley and Sons |
| 2 | Six Sigma for every one | | George Eclees | John Wiley and Sons |
| 3 | Transactinal Six sigma nad Lean servicing | | Betsi Harris Ehrlich | St.Lucie Press |
| 4 | Six sigma for small business | | Greg Brue | Ep- Entrepreneur press |
| **5** | Six sigma for Quality and productivity promotion | 2003 | Sung H. | Park Asian Productivity organization |
| **Reference Books** | | | | |
| 1 | Six sigma and Beyond- Vol I to VII | | D. S Stamalatis | St. lucie Press |
| 2 | Demystifying Six Sigma | 2003 | Alan Lasson | AMCON( American management Association ) |
| 3 | The Six sigma Way | 2003 | P.Pande R Nenman & R.Cavanagh | Mc GraHill |
| 4 | Lean Production Simplified: A plain- Language Guide to the World's Most powerful Production System | 2002 | Dennis, Pascal | New York: Productivity Press, ISBN: 1563272628 |
| 5 | Lean Six sima | | Michel L George | Mc GraHill |
| 6 | Design for Six Sigma | | Kai Yang,Basen El-Haik | Mc GraHill |
| 7 | Design for Lean Six sigma | | | |

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME455/ME850 | PRODUCT DESIGN AND DEVELOPMENT | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To understand the Product Life Cycle. Study different design techniques, product development phases, process selection, material selection and costs associated with PDD.**[a,b,c,d,k,l]**

**Unit 1**                                                                                                                          **[7 hrs]**
Importance of product design, types of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods. **[a, c, d,  k ]**

**Unit 2**                                                                                                                          **[7 hrs]**
Material selection – Importance, classification, material performance characteristic, Selection criteria, Ashby Material selection chart, other constrain effect. **[a, e,  k ]**

**Unit 3**                                                                                                                          **[8 hrs]**
Process selection – Impotence types of manufacturing processes and their classification, sources of information, selection criteria, Material and Process selection Methods- Expert systems, Computer Database Approach, Performance indices, decision matrix, AHP and fuzzy approach, introduction to material and process selection software **[a, c, d, l ]**

**Unit 4**                                                                                                                          **[8 hrs]**
Benchmarking, integrated product design and development, DFM, DFA, DFX, Early supplier involvement, robust design, QFD and concurrent engineering. Introduction to green design.
**[a, c, d, l ]**

**Unit 5**                                                                                                                          **[8 hrs]**
Mathematics of Time Value of Money, Cost Comparison, Depreciation, Taxes, Inflation, Profitability of Investment and Investment Decision Analysis Sensitivity Analysis. Methods of Cost Estimates. Industrial Engineering Approach, Parametric Approach, Introduction to Assembly Modelling, Top-Down and Bottom-Up Approaches of AM, Mating Conditions, Representation Schemes, Generations of Assembly Sequences
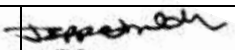**[a, b, c, d, k ]**

**Unit 6**                                                                                                                          **[7 hrs]**
Product Development Cycle and Importance of Prototyping, Types of Prototypes, Principle and Advantages & Different Type of Generative Manufacturing Process, Viz, Stereolithography, FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Considerations
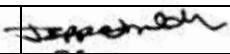**[a, c, k ]**

| Text books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Fourth Eye (Excellence through Creativity | 1992. | KHANDWALLA P.N.; | Wheeler Publishing, Allahabad, |
| 2 | Product Design and Manufacturing | 4<sup>th</sup> edition, 2007 | A. K. Chitale and R. C. Gupta | PHI  Pvt. Ltd., 2002 , |
| 3 | Engineering Design | 4<sup>th</sup> edition 2008 | Dieter George E | McGraw Hill Pub. Company |

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|---|---|---|---|---|
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| ME455/ME850 | PRODUCT DESIGN AND DEVELOPMENT | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**Reference Books:**

| | | | | |
|---|---|---|---|---|
| 1 | Product Design and Development | 2003 | Ulirich Karl T. and Eppinger Steven D | McGraw Hill Pub. Company |
| 2 | Handbook of Product Design for Manufacturing | 1986 | Bralla, James G. | McGraw Hill Pub. Company |
| 3 | I.P.R. Bulletins | | | TIFAC, New Delhi, |
| 4 | Creativity and innovation | 2008 | Harry Nystrom | John Wiley & Sons, 1979. |
| 5 | Managing technological innovation | 4th edition | Brain Twiss | Pitman Publishing Ltd |
| 6 | New Product Planning | | Harry B.Watton | Prentice Hall Inc. |
| 7 | Techniques in Reverse engineering and new product development. | | Kevin Otto and Kristin wood. | Pearson Education |

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|---|---|---|---|---|
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| **ME456/ME851** | **Advanced Manufacturing Techniques** | **L=4** | **T=0** | **P=0** | **Credits=4** |
|---|---|---|---|---|---|

| **Evaluation Scheme** | **MSE-I** | **MSE-II** | **TA** | **ESE** | **Total** | **ESE Duration** |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

### OBJECTIVES

To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

**Unit 1**                                                             **[7 hrs]**
**Non-traditional machines process:** Need, classification & historical development. Abrasive machine and finishing operations, high speed grinding, creep feed grinding, belt grinding, hot and cold machining. **[ a, b, c, d, f, g, h, I, j, k, l, m ]**

**Unit 2**                                                             **[8 hrs]**
 **Abrasive Jet Machine:** Mechanics of AJM. Process parameter and characteristics ultrasonic machining mechanics, process parameter & control, effect of USM on materials, water jet machining.     **[ a, b, c, d, e, f, g, h, i, j, k, l, m ]**

**Unit 3**                                                             **[9 hrs]**
**Electro – chemical machining:** Electrochemistry of ECM, tool design, effect of variable on performance chemical milling, Chemical Engraving, Photo chemical machining,  EC grinding, Electric discharge machining, machine surface finish & machining accuracy, electron beam. Laser beam and plasma arc machining **[ a, b, d, e, h, I, k, l, m ]**

**Unit 4**                                                             **[6hrs]**
**High energy rate forming process.** Burnishing, dallising and other miscellaneous forming and finishing processes, electroforming.     Thermoform High velocity forming, Vacuum forming, **[ a, b, d, e, f, g, h, I, j, k, l, m ]**
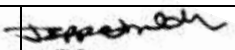
**Unit 5**                                                             **[8 hrs]**
**Unconventional welding techniques**, laser, electron beam, plasma arc, atomic hydrogen, submerged arc, explosive welding techniques, electro slag welding and casting.    **[ a, b, d, e, f, g, h, I, j, k, l, m ]**

**Unit 6**                                                             **[7 hrs]**
Adhesive bonding, solid phase welding, technique such as ultrasonic welding, friction welding, recent development in welding, comparative analysis, economics and applications of nontraditional processes for machining, welding and forming.   **[ a, b, c, d, e, f, g, h, I, j, k, l, m ]**

| **Reference Books:** | | | | |
|---|---|---|---|---|
| **S.N.** | **Title of the book** | **Edition (Year of publication)** | **Author(s)** | **Publisher** |
| 1 | Manufacturing Science | 2007 | A. Ghosh & A. Mallik. | Ellis Horwood, 1986 |
| 2 | Non Traditional Machining | 2005 | P.C. Paonoey & H. S. Shan. | Tata McGraw-Hill Education, 1980 |
| **3** | New Technology | | A Bhattacharya | |
| **4** | Advance machining process | | V.K.Jain | Allied publisher |

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|---|---|---|---|---|
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| ME457/ME852 | Power Plant Engineering | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To understand the conventional processes of power generations. To study the basic systems of the various conventional power plant. To understand the analysis of load calculations and measuring systems of power plant.

**Unit 1** [7 Hrs]

**THERMAL POWER PLANT- I**

Introduction to thermal power plants and power plant layouts.

Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling.

Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers, water treatment, Waste Disposal-Present practices, environmental hazards and other social aspects.**[ a, c,  i, k, l, m ]**

**Unit 2** [8 Hrs]

**THERMAL POWER PLANT- II**

Gas Turbine Power Plant: -Introduction, power plant layouts, Open cycle, close cycle power plants. Various components and systems. Methods to improve efficiency. Reheat and Regeneration cycle and their combinations

Diesel Electric Power Plant: - Introduction, Outline, type of engines, different components, performance, plant layout.

Comparison with other power plant. Introduction to captive power plant.(To study the practical aspect ot power plant,the visit to nearby power plant shall be arrange for the students) **.[ a, c,  i, k, l, m ]**

**Unit 3** [7 Hrs]

**HYDROELECTRIC POWER PLANT.**

Hydrology: - Rainfall, Runoff, Hydro graph, flow duration curve, mass curve.

Hydroelectric power plant: - Site selection, classification of hydroelectric power plant, general arrangement, details of different components, turbine selection, models & model testing, governing.

Comparison with other power plant. **.[ a, c,  i, k, l, m ]**

**Unit 4** [8 Hrs]

**POWER PLANT ECONOMICS**

Load Analysis - Fluctuating Load on power plants, Load curves, various terms & definition, peak load, effect of fluctuating load.

Economic Analysis: - Cost of electric energy, load division, and. Tariff methods for Electrical Energy. **.**

**[ a, c, d,  k, l, m ]**

**Unit 5** [8 Hrs]

**NUCLEAR POWER PLANT**

Introduction to Nuclear Engineering, Global scenario, prominent installations worldwide, present & proposed nuclear plant in India.

Nuclear Reactors: - Types of reactors, PWR, BWR, CANDU, Gas cooled, liquid metal cooled, Breeder reactor.

Operational requirements and difficulties, site selection for location of a nuclear power station Nuclear Waste Disposal-Present practices, environmental hazards and other social aspects.

Comparison with other power plant. **.[ a, c,  i, k, l, m ]**

**Unit 6** [7 Hrs]

COMBINED OPERATION OF DIFFERENT POWER PLANTS

Combined operation: - Need division, combination of different plant & their coordination, advantages.
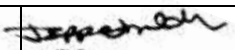
NON CONVENTIONAL POWER GENERATION SYSTEMS

Introduction to Non Conventional power Generation Systems

Geo-Thermal Power Plant, Tidal Power Plant, Wind Power Plant, Solar Power Plant

Global scenario, prominent installations worldwide present & proposed plant locations. **.**

**[ a, c,  i, k, l, m ]**

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME457/ME852 | Power Plant Engineering | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |
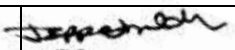
**.Text books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Power Plant Engineering | 2002 | Domkundwar. | Dhanpat Rai & Co. |

**.Reference books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Power Plant Engineering | 2007 | Vopal & Slortzki | |
| 2 | Power Plant Engineering | 1984 | M.M. Wakil | TATA Mc-Graw Hill. |
| 3 | Power Plant Engineering | 2008 | P. K. Nag | TATA Mc-Graw Hill. |
| 4 | Power Plant Engineering | 2005 | R. K. Rajput | TATA Mc-Graw Hill. |

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|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME458/ME853 | Machine Tool Design | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

### OBJECTIVES

**UNIT 1**                                                                                         **[7Hrs]**

Introduction to Machine tool drives & Mechanisms, Working & auxiliary motions in machine tools, Parameters defining the working motions of a machine tool; Machine tool drives, Hydraulic Transmission & its elements, Mecll.'U1ical Transmission & its elements, General requirements of machine tool design, layout of machine tool. **[a, c, l, m ]**

**UNIT 2**                                                                                         **[8 Hrs]**

Regulation of speed & feed rates - Aim of speed & feed regulation, Stepped regulation of speed -Various laws of stepped regulation, Selection of range ratio, Standard values of Geometric progression Ratio & guidelines for selecting proper value, break up of speed steps; Structure diagrams & their analysis, Speed classification. Design of feed box, machine tool drives using multiple speed motors, Special cases of gear box design -speed box with overlapping speed steps, speed box with a combined structure, speed box Wit11 broken geometric progression, General recommendation for developing the Gearing diagram, determining the Number of teethes of gears, Classification of speed & feed boxes. Electromechanical system of Regulation, Friction, Pressure and Ball Variation, Epicyclic Drive **[a,  c, e,  k, l, m ]**

UNIT 3                                                                                             [7Hrs]

Machine Tool Structure - Functions of machine tool structures & their requirements, Design criteria for machine tool structures, Materials of machine tool structures, Static &Dynamic stiffness, Profiles of machine tool structures, Factors affecting stiffness of machine tool structures & methods of improving it; Basic design procedure of machine tool structures -design for strength, design for stiffness. Design of Beds, Column, housings, Bases & Tables, Cross Rails, Arms, Saddles, Carriages, Rams. **[a,  c, e,  k, l, m ]**

**UNIT 4**                                                                                         **[8Hrs]**

Design of Guide ways & Power Screws - Functions & types of guide ways, Design of Sideways - Shapes, materials, methods of adjusting clearances. Design Criteria & Calculations for sideways, Design for wear resistance, Design for stiffness. Guide ways operating under liquid friction conditions -Hydrodynamic & Hydrostatic sideways, Design of Aerostatic sideways, Design of Antifriction Guide ways, Combination guide ways, protecting devices for sideways.
Design of Power Screws -Sliding friction power screws, Rolling friction Power Screws. **[a,  c, e,  k, l, m ]**

**UNIT 5**                                                                                         **[7Hrs]**

Design of Spindles & Spindle Supports Functions of spindle unit & requirements, Materials of spindles, design calculations of spindles – Deflection of spindle axis due to bending, deflection of spindle axis due to compliance of spindle supports, optimum spacing between spindle supports deflection due to compliance of the Tapered Joint permissible deflection & design for stiffness. Antifriction bearings -Preloading of antifriction bearing. Sliding bearings - Sleeve bearings, hydrodynamic journal bearing, and air -lubricated bearings.
**[a,  c, e,  k, l, m ]**

**UNIT 6**                                                                                         **[8Hrs]**
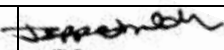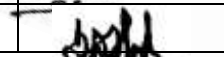
Testing & Control of Machine Tools
a) Testing: Objects and procedure for Acceptance Test, Instrumentation for acceptance, Accuracy of machine tools, and accuracy of work pieces.
b) Control systems: Electrical control, push button control, directional control relays, electrical brakes, automation in feed mechanism
c) Hydraulic control: positional control, power pack for lubrication system in hydraulic drive.
d) Control system for gear sliding and feed mechanism ( open loop or close loop) for NC/CNC machine using stepper motor or DC motor. **[a,  c, d, e,  k, l, m ]**
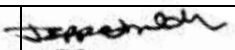
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.

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|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME458/ME853 | Machine Tool Design | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**Text books:**

| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
|---|---|---|---|---|
| 1 | Machine Tool Design | 2007 | N. K. Mehata | Tata McGraw-Hill, 1984 |
| 2 | Principles of Machine Tools | 2011 | Gopal Chandra Sen, Amitabha Bhattacharyya | New central book agency |
| 3 | Design Of Machine Tools | 5th edition 2008 | Basu, Pal | Oxford and IBH Publishing, 2008 |
| 4 | Principles of Machine tools | | Sen and Bhattacharya | New central book agency |

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|---|---|---|---|---|
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| ME459/ME854 | INDUSTRIAL SAFETY | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

**OBJECTIVES**

To understand the need and importance of safety. Study different types of accidents and its preventions. Also study the various safety equipments and their applications.

**Unit 1**                                                                                    **[7Hrs]**
**Introduction**
Introduction to occupational safety & health, need for occupational safety, Safety Organization, Safety Policy, Safety Committee, Safety Officer, Medical Officer, Labour welfare Officer, Safety manual, Disaster management plan, Government & other autonomous occupational safety & health organizations. Introduction to OHSAS 18000.**[ a, b, c, e, f, h, d ]**

**Unit 2**                                                                                    **[8Hrs]**
**Occupational Accidents**
Accident, causes of accident, cost of accident, unsafe conditions, unsafe actions, unsafe personal factors, Accident causations models, accident reporting, accident investigation & analysis, Application of remedial measures, result monitoring, Personal Protective Equipments( ppe), Types of ppe, legal provisions of accident reporting, safety performance measurement, Frequency Rate, Severity Rate, Incidence Rate, Introduction to IS:3786.[a,b,c,d,e,f,g]

**Unit 3**                                                                                    **[7Hrs]**
**Risk Identification & Risk management**
Plant safety inspection, Job safety analysis, Hazards identification & Risk analysis **(HIRA)**, Fault tree analysis **(FTA)**, Hazards & operability Study **(HAZOP)**, Failure mode & Effect analysis**(FMEA)**, Failure mode, criticality & effect analysis **( FMCEA)**, Safety audits, Safety Integrity Level **(SIL)**, Level of Protection Analysis **(LOPA)**.[a,b,d,g,h,l,j,k ]

**Unit 4**                                                                                    **[7Hrs]**
**Safety & The Law**
Introduction to various Laws & Rules pertaining to Safety, Health & Welfare of Indian work-force. Provisions of Factories Acts' 1948 pertaining to Safety only, **[b, c, d, e, g, h]**
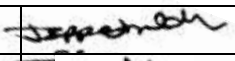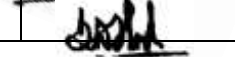
**Unit 5**                                                                                    **[8Hrs]**
**Safety with Machines**
Safety in design, Plant layout & housekeeping, Machine maintenance, Machine guarding, types of machine guards, special tools for enhancing safety, safety in use of compressed gas cylinder, safety around grinding wheel, safety in drill machines, safety in use of hand tools, safety in press machines, handling and disposal of hazardous chemicals, electrical safety, fire safety.**[ a, b, c, d, i, j, k, ]**

**Unit 6**                                                                                    **[7Hrs]**
**Safety Training & Awareness**
Safety training and safety education, safety awareness methods viz safety competitions, safety posters and hording, safety magazine, safety pamphlets, safety campaign, Tool-Box talk, Employees participation in promoting safety.**[a, b, c, d, i, j, k ]**

| Text books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Industrial Safety | 3<sup>rd</sup> editiion | Roland Patton Blake | Prentice-Hall, 1963 |
| 2 | Industrial Safety | 1977 | Jack W. Boley | Gulf Publishing Company, Book Division, |

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME460/ME855 | Advance Welding Techniques | L=4 | T=0 | P=0 | Credits=4 |
|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 15 | 15 | 10 | 60 | 100 | 3 Hrs |

## OBJECTIVES

To study and analyze various welding methods with advanced techniques to pin engineering materials.

**Unit 1**                                                                                                         **[8 hrs]**

Resistance Welding Methods, Variations in the process, Effect of current, Pressure and resistance on nugget quality, Expulsion of metal, Mushrooming of electrodes, Temperature variations in set up. Weld cycle, metal contact during cycle, Materials, Direct spot welding, two sides spot welding, multiple spot welding, Shunt current, Electrode material, Approximate values for steel, seam welding, Projection welding, Butt welding Flash butt welding, applications.**[ a, b, c,  e, g, h, l, k,  m]**

**Unit 2**                                                                                                         **[7 hrs]**

High energy Density Welding processes, Electron Beam Welding, Principle Bead geometry, Mediums of beam, Vacuum range, Laser Beam welding, Principle, Keyhole technique, applications, Laser materials, Gaseous Lasers. **[ a, b, d, f, g, h,  k, l, m]**

**Unit 3**                                                                                                         **[8 hrs]**

Solid state welding Processes, Friction, Welding, Principle, Variables affecting weld quality, Heat generated, Machines used, Ultrasonic welding, Principle, Comparison with Resistance Spot Welding, Diffusion Bonding, Principles of inter atomic diffusion, equation, diffusion length, Rate of inter atomic Diffusion, Use of Inert Gas, Application, Explosive Welding. **[ a, b,  h,  k, l, m]**

**Unit 4**                                                                                                         **[7 hrs]**

Brazing, Soldering, ,Capillary action, wetting action, joint designs for sheet metal brazements, methods of prep.lacing brazing filler wire, Butt Joint design for sheet metal brazements, brazing methods, filler materials in brazing, Soldering, materials solder combinations, soldering fluxes,
Hardfacing, cladding metal sprying , hard facing materials, selection of thermal spray coatings.
**[ a, b, e, f, h, j, k, l, m]**

**Unit 5**                                                                                                         **[8 hrs]**
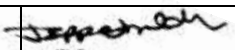
Cutting, Arc cutting, Flame cutting, Plasma cutting, Gouging, Plasma cutting with different gases, Comparision with Oxyacetylene cutting, Oxyacetylene cutting, colour codes for cylinder. Welding of ceramics, plastic and composite**[ a, b, e,  h, l, k, l, m]**

**Unit 6**                                                                                                         **[7 hrs]**

Welding defects, Weldment testing, Destructive and non destructive testing, Coupon, Determination of yield strengths, ultimate strength, visual Inspection, Dye Penetrant test, penetrants and developers, Eddy current testing, Ultrasonic testing, Magnetic particle Inspection , advantages and application of each method.
Welding Procedure specifications,  Weldor qualification. **[ a, b,  f, h,  k, l, m]**

| Text books: | | | | |
|---|---|---|---|---|
| S.N. | Title of the book | Edition (Year of publication) | Author(s) | Publisher |
| 1 | Welding and Welding Technology | 2008 | Richard Little | McGraw-Hill, 1973 |
| 2 | Welding | 10<sup>th</sup> edition | A. C. Davies, Davies | Cambridge University Press, 2002 |
| 3 | Laser Machining and Welding | 2007 | Rykalin, Uglov, kokora | Pergamon Press, 1978 |
| 4 | Welding Engineering and Technology | 1997 | R. S. Parmar | Khanna, 1997 |
| 5 | Welding Metallurgy | 2<sup>nd</sup> edition 2003 | Sindo Kau | John Wiley & Sons, 2003 |
| 6 | Manufacturing Science | | Ghosh and Mallik | Ellis Horwood |
| 7 | Manufacturing Technology Vol-I 3E | 3<sup>rd</sup> edition 2009 | P.N.Rao | Tata McGraw-Hill Education, |
| 8 | Welding of ceramics, plastic and composite | | David A.Grewelland Avrahm Benatar | Hanser |

| Chairperson | | Date of Release | May 2013 | Applicable for AY 2013-14 Onwards |
|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |

| ME472/ME867 | Comprehension Viva Voce | L=0 | T=0 | P=0 | Credits=3 |
|---|---|---|---|---|---|

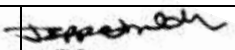| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | 50 | 50 | External Evaluation |

**OBJECTIVES**

To equip the students with the thorough knowledge of the Mechanical Engineering branch. Through knowledge of each and every subject learnt till date. This will be helpful for preparations of competitive examinations and campus interviews.

**COMP. VIVA VOCE**

The viva voce will be on complete syllabus learnt during the period of 4 years for completion of studies to obtain the degree of Mechanical Engineering.

**[ a, b, c, d, e, f, g, h, I, j, k, l, m ]**

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| ME473/ME868 | PROJECT – Phase-II | | L=0 | T=0 | P=6 | Credits=6 |
|---|---|---|---|---|---|---|

| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 40 | 60 | 100 | External Evaluation |

**OBJECTIVES**

The project topic for the batch is decided in the 1<sup>st</sup> semester of final year, the student shall carry out the project work further 2<sup>nd</sup> semester of final year.
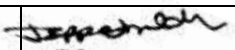The project work consists of :
1. A comprehend since and update survey of literature.
2. Demonstration on processes /phenomenon related to project.
3. Design of any equipment its fabrication and testing.
4. Critical analysis of design or process for optimization
5. Verification by experimentation.
6. In case of industrial project the necessary modifications with the proper drawing / design suggested to the industry should be explained. The letter from the industry should be attached in the report related to the performance of the batch.

**Evaluation**

The term work will be assessed by the project guide. The students will be examined by the external examiner and the project guide. Marks will be allotted on the basis of work done and performance in the examination.

**[ a, b, c, d, e, f, g, h, I, j, k, l, m ]**

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| ME474/ME869 | EXTRA CURRICULUR ACTIVITIES | L=0 | T=0 | P=0 | Credits=2 |
|---|---|---|---|---|---|

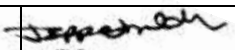| Evaluation Scheme | MSE-I | MSE-II | TA | ESE | Total | ESE Duration |
|---|---|---|---|---|---|---|
| | 0 | 0 | 50 | 0 | 50 | Internal Evaluation |

**OBJECTIVES**

**EXTRA CURRICULUR ACTIVITIES**

Every student has to participate in at least two extra-curricular activities from Second year. The certificate of these activities to be submitted to the related Coordinator/head of the department.
The credit for these activities shall be given in 8<sup>th</sup> semester.
**[ a, b, c, d, e, f, g, h, I, j, k, l, m ]**

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|---|---|---|---|---|
| Dean (Acad. Matters) | | Version | 1.00 | |