**Gondwana University, Gadchiroli**

**Faculty of Engineering and Technology**

# B.E. (MECHANICAL ENGINEERING): EIGHTH SEMESTER

## ME801: INDUSTRIAL MANAGEMENT (Theory)

## CREDITS: 04

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT – I** **[ 9 Hrs. ]**

**Principles of Management:**
Concepts of management, development of scientific management, Principles of Management.

**UNIT – II** **[ 9 Hrs. ]**

**Functions of Management:**
Functions such as planning, organizing, leading, motivating, communicating, controlling, decision making,

**UNIT – III** **[ 9 Hrs. ]**

**Personnel Management:**
Meaning, functions of personnel management, manpower planning, collective bargaining, wages & salary administration, labor welfare, training, trade unions, Introduction to Industrial Factories Act, Industrial Boils Act, Trade Union Act.

**UNIT – IV** **[ 9 Hrs. ]**

**Marketing Management:**
Definition, Importance & scope, selling & modern concepts of marketing, market research, product launching, sales promotion, pricing, channels of distribution, advertising, market segmentation, marketing mix.

**UNIT – V** **[ 9 Hrs. ]**

**Financial Management:**
Sources of finance, financing organizations, types of capital, elements of costs & allocation of indirect expenses, cost control, budgets & budgetary control, balance sheet, ratio analysis, profit & loss statement.

**BOOKS RECOMMENDED:**

1. Principles of Management - Koontz & O. Denial
2. Industrial Organization & - T. R. Banga & S. C. Sharma.
3. Elementary Economic Theory – Dewett K.K., Varma J.D.
4. Financial Management - Kuchal
5. Principles of Marketing Management - Philip Kotler & William Stau

## ME802: REFRIGERATION & AIR CONDITIONING (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT - I Vapour Compression Refrigeration Systems : [ 9 Hrs. ]**

Refrigeration Principles, Methods, Applications, Reverse Carnot Refrigeration Cycle, Analysis of Single Vapour Compression Refrigeration Cycle, Effect of Sub cooling Superheating, Pressure Drops, Non-isentropic Compression on the Performance of cycle. Actual Cycle.

Multiple Compressor and Multi Evaporator Systems, Cascade Refrigeration Systems (Elementary)

**UNIIT - II Refrigerants and System Components : [ 9 Hrs. ]**

Nomenclature of refrigerants, refrigerant properties, mixture refrigerants, global warming potential & Ozone depletion potential, Montreal & Kyoto protocol, alternate refrigerants. Compressors –reciprocating and rotary (Introduction), Types of Condensers, Evaporators, Expansion Devices, Refrigeration Controls.

**UNIT – III Vapour Absorption, Air Cycle Refrigeration & Cryogenics : [ 9 Hrs. ]**

Vapour Absorption Refrigeration Principles, Aqua - Ammonia, Li-$Br_2$ System and Three Fluid Refrigerator, Air Cycle Refrigeration, Air Craft Refrigeration Systems (Elementary treatment)

Joule – Thomson Coefficient, Inversion Curve, Methods of Liquification, Application of Cryogenics, Thermoelectric Refrigeration, Vortex Tube.

**UNIT – IV Psychrometry and Air conditioning Systems : [ 9 Hrs. ]**

Airconditioning Principles and application
Psychrometric properties of moist Air , Psychometric Chart, Psychometric processes, Concept of ADP, Bypass Factor, Air Conditioning System, RSHF, GSHF, ESHF.

**UNIT – V Heat Load Calculation & Air Distribution Principles : [ 9 Hrs. ]**

Human Comfort, Mechanisms of Body Heat Losses, Factors Affecting Human comfort, Effective Temperature, Comfort Chart, Inside and Outdoor Design Conditions. Data Collection for Heat Load Calculations, Various Components of Heat Load Estimation, Cooling Load and Heating Load Calculations.

Methods of Duct Design, Air Outlets Types & Selection, Air Conditioning Controls.

**TEXT BOOKS :**


1. A text book of Refrigeration & Air-conditioning - R. S. Khurmi & J. K. Gupta ( S. Chand Publication )
2. Refrigeration & Air-conditioning - Dr. P. L. Ballany ( Khanna Publication )
3. Refrigeration & Air-conditioning - C. P. Arora ( TMH Publication )
4. Refrigeration & Air-conditioning - Manohar Prasad (New Age Int. Pub. )
5. Refrigeration & Air-conditioning - S.V. Domkundwar ( Dhanpat Rai & Sons )
6. Refrigeration & Air-conditioning - Dr. R.C.Arora (PHI)


**REFERENCE BOOKS :**


1. Refrigeration & Air-conditioning - Stocker & Jones( McGraw Hill Pub. )
2. Principles of Refrigeration - Roy J. Dossat ( Pearson Edu.)
3. Refrigeration & Air-conditioning - Jordon & Priester ( PHT Publication )
4. Thermal Environmental Engineering - James Threlkeld
5. Modern Refrigeration Practice - Guy R. King.
6. Modern Air-conditioning Practice - Norman Harris (McGraw Hill Publications )
7. ASHRAE hand books - McGrawHill Publication
8. Carriers Air-conditioning Design data book - McGraw Hill Publication
9. Air-conditioning Principles & System An Energy Approach - E.G. Pita - Pearson
10. Refrigeration Principles & Systems, An Energy Approach – E.G. Pita
12. Audels Series on Air-conditioning, Home Refrigeration & Air-conditioning & Commercial Refrigeration - D. B. Taraporewala & Sons.
13. Principles of Refrigeration - By Marsh Olivo (CBS Publications)
14. Principles of Air-conditioning - By Paul Lang CBS Publications)
15. Basic Refrigeration & Air-conditioning - By P.N. Ananthnarayanan - TMH Pub.

## ME803: ELECTIVE – II

## ME8031: AUTOMOBILE ENGINEERING (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT – I** **[ 9 Hrs. ]**

**Chassis**, articulated and rigid vehicles and vehicles layout. Engine Construction - Structural components and materials. Fuel supply system, cooling and lubrication systems, Filters, water pumps, radiators, Thermostats, antifreezing compounds, recent development in Automobiles.

**UNIT – II** **[ 9 Hrs. ]**

**Clutch –** Necessity , requirements of clutch systems, Types of clutches , centrifugal clutch, single & multi-plate clutch, fluid clutch. Gear Box - Necessity of transmission, principle, types of transmission, Sliding mesh, constant mesh, synchromesh, Transfer gear box, Gear selector mechanism, lubrication & control. Torque Converter, Automatic Transmission.

**UNIT – III** **[ 9 Hrs. ]**

**Transmission System :-** Propeller shaft, Universal joint, Constant velocity joint, Hotchkiss drive, Torque tube drive. Differential - Need & Types. Rear axles & Front axles. Brakes - Need, Types - Mechanical, Hydraulic, Pneumatic brakes. Electrical brakes, Engine Exhaust brakes, Drum & Disc brakes. Comparison. Details of components, Brake adjustment.

**UNIT – IV** **[ 9 Hrs. ]**

**Steering systems,** principle of steering, center point steering, steering linkages, steering geometry and wheel alignment, power steering, special steering systems. Tyres, tyres specification, factors affecting tyres performance, special tyres, wheel balancing. Suspension systems - Function of spring and shock absorber, conventional and independent suspension system, Telescopic shock absorber, linked suspension systems.

**UNIT – V** **[ 9 Hrs. ]**

**Electrical Systems -** Construction, Operation & maintenance of batteries, Alternator. Working principles and operation of regulators, starter motor, battery. Ignition and magneto ignition systems, ignition timing. Electronics ignition, Lighting, Horn, Side indicator wiper. Automobile air-conditioning. Panel board instruments. Maintenance,

Trouble shooting and service, procedures. Overhauling, Engine tune up, Tools and equipment for repair and Overhaul. Testing equipments.

**BOOKS RECOMMENDED:**


1. Automobile Mechanics - Joseph Heitner
2. Motor Vehicle Technology - J. A. Dolan
3. Automotive Mechanics - W. H. Crouse
4. Motor Vehicle : K. Newton and W. Seeds, T. K. Gawet.
5. Automotive Mechanics - Ganeshan

## ME803: ELECTIVE – II

## ME8032: MACHINE TOOL DESIGN (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT I** **[ 9 Hrs. ]**

**DESIGN OF MACHINE TOOL DRIVES**

1) **Selection of Electric Motor**
2) **Stepped Regulation of Speed**, Laws of Stepped Regulation, Why Geometric Progression is used against Arithmetic, Harmonic & Logarithmic despite shortcomings, Relation between Range ratio, Geometric Progression Ratio and No. of Speed Steps
3) **Design of Stepped Drives:**
   Break up of Speed Steps, Structural Formulae, Structural Diagram, Selection of Best Structural Diagram, Ray Diagram, Speed Chart, General recommendations for Developing the Gearing Diagram, Determining the number of teeth of Gears
   a) **Speed Gear box:** Limiting Transmission Ratio of Speed Gear Box, Design Case Study of Speed Gear Box for Lathe, Classification of Speed Gear Boxes
   b) **Feed Gear box:** Limiting Transmission Ratio of Feed Gear Box, Design Case Study of Feed Gear Box (with Gear Cone & Sliding Key) for Drilling Machine, Classification of Feed Gear Boxes, Study of Application of Norton's & Meander's Mechanism for Thread Cutting

**4) Step less Drives :** Step less Regulation of Speed & Feed Rates through Hydraulic, Electric & Mechanical means, Positively Infinitely Variable Drive, Case Study of CNC Lathe with Electronic Controller for Speed & Feed Step less Regulation

**UNIT II** **[ 9 Hrs. ]**

**DESIGN OF MACHINE TOOL STRUCTURE**

Function & Requirement of Machine Tool Structure, Design Criteria from Strength & Stiffness considerations, Concept of Unit Rigidity, Unit Strength under Tension, Unit Strength under Torsion & Unit Strength under Bending for Material of Machine Tool Structures, Compare Steel & Cast Iron on the basis of Material Properties, Manufacturing Problems and Economy, Role of Static & Dynamic Stiffness in the design of elements of machine tools, Profiles of Machine Tool Structures, Factors affecting stiffness of machine tool structures & methods of improving it, Basic Design procedure of machine tool structures. Design Case Studies of a) Bed of Lathe, b) Column & Base of Milling Machine, c) Housing of Speed Gear box.

**UNIT III** **[ 9 Hrs. ]**

**DESIGN OF GUIDEWAYS**

Function & Types of Guideways, Types of Slideways & Antifriction Ways,

Functional features of Slideways, its Shapes & Materials, Methods of adjusting Clearance, Design Criteria (Wear Resistance & Stiffness) and Calculations for Slideways operating under semi liquid friction condition, 'Stick Slip' phenomena affects accuracy of setting & working motions.
Comparison of Design & stiffness of Hydrodynamic, Hydrostatic & Aerostatic Slideways,

Design of Antifriction Guideway, Concept of Combination Guideways

**UNIT IV** **[ 9 Hrs. ]**

**DESIGN OF POWER SCREWS**

Design of Sliding friction Power Screw for Wear Resistance, Strength, Stiffness, & Buckling Stability.

Design of Rolling friction Power Screw for Strength under static loading, Strength under cyclic loading, & Stiffness

**UNIT V** **[ 9 Hrs. ]**

**DESIGN OF SPINDLE AND SPINDLE SUPPORTS**

Function & Requirements of Spindle Units, their Materials,
Effect of Machine Tool Compliance on Machining accuracy
Design of Spindle for Bending Stiffness : Deflection of Spindle Axis due to a)Bending, b) - due to Compliance of Spindle Supports, c) - due to Compliance of the Tapered Joint

Optimum Spacing between Spindle Supports

Permissible Deflection & Design for stiffness: Additional Check for Strength like Additional Supports, Location of Bearings and Drive elements, Balancing

Requirements of Spindle Supports
Features of Anti-friction Bearings,Load bearing abilities of Ball & Roller Bearings. Parameters which asses the viability of combination of roller & Ball & Roller Bearings in Spindle Units. Preloading of Anti Friction Bearing & its method

Design of Sliding Bearings: Sleeve, Hydrodynamic Journal, Hydrostatic Journal, Air-Lubricated (Aerodynamic, Aerostatic)

**TEXT BOOKS:**


1. N. K. Mehta, “Machine Tool Design”, Tata McGraw Hill, ISBN 0-07-451775-9.
2. D. K Pal, S. K. Basu, “Design of Machine Tool”, 4th Edition. Oxford IBH 2005, ISBN 81-204-0968


**REFERENCE BOOKS**


1. Bhattacharya and S. G. Sen., “Principles of Machine Tool”, New central book agency Calcutta, ISBN 81-7381-1555.
2. N. S. Acherkan, “Machine Tool”, Vol. I, II, III and IV, MIR publications.
3. F. Koenigsberger, “Design Principles of Metal Cutting Machine Tools”, The Macmillan Company New York 1964.
4. H.C.Town,’The Design and Construction of Machine Tools’.

## ME803: ELECTIVE – II

## ME8033: OIL HYDRAULICS AND PNEUMATICS (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT I** **[ 9 Hrs. ]**

**FLUID POWER SYSTEMS AND FUNDAMENTALS :**
Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids - General types of fluids -Fluid power symbols. Basics of Hydraulics-Applications of Pascals Law- Laminar and Turbulent flow - Reynold's number - Darcy's equation - Losses in pipe, valves and fittings.

**UNIT II** **[ 9 Hrs. ]**

**HYDRAULIC SYSTEM & COMPONENTS:**
Sources of Hydraulic Power: Pumping theory - Pump classification - Gear pump, Vane Pump, piston pump, construction and working of pumps - pump performance - Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators - Types of hydraulic cylinders - Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators - Fluid motors, Gear, Vane and Piston motors.

**UNIT III** **[ 9 Hrs. ]**

**DESIGN OF HYDRAULIC CIRCUITS:**
Construction of Control Components : Directional control valve - 3/2 way valve - 4/2 way valve - Shuttle valve - check valve - pressure control valve - pressure reducing valve, sequence valve, Flow control valve - Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifies: Types of accumulators - Accumulators circuits, sizing of accumulators, intensifier - Applications of Intensifier - Intensifier circuit.

**UNIT IV** **[ 9 Hrs. ]**

**PNEUMATIC SYSTEMS AND COMPONENTS:**
Pneumatic Components: Properties of air - Compressors - Filter, Regulator, Lubricator Unit - Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

**UNIT V** **[ 9 Hrs. ]**

**DESIGN OF. PNEUMATIC CIRCUITS:**

Servo systems - Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics - Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

**TEXT BOOKS:**


1. Hydrantion and Pnumation by Dr. H.D.Ranchandra, Sudha Publication, Bangalore
2. Anthony Esposito, "Fluid Power with Applications", Pearson Education, 2005.
3. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2001.
4. Hydraulics & Pneumatics by Andrew Parr, Jaico Publishing House
5. Pneumatic Systems by S.R. Mujumdar, TMH
6. Srinivasan.R, "Hydraulic and Pneumatic controls", Vijay Nicole, 2006.


**REFERENCE BOOKS:**


1. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
2. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
3. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

## ME803: ELECTIVE – II

## ME8034: SYNTHESIS OF MECHANISMS (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT – I** **[ 12 Hrs.]**

Introduction to kinematics, Types of Mechanism, Kinematics synthesis, Science of relative motion, Tasks of kinematics synthesis with practical applications, Degree of freedom, Class-I, Class-II chain, Harding`s notation, Grashof criterion, Grubler`s criterion.

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.

**UNIT – II** **[ 12 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.

**UNIT – III** **[ 12 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.

**UNIT – IV** **[ 12 Hrs.]**

Synthesis for infinitesimally separate position, concept of polode and centrod, Euler`s savery equation, inflection circle, Bobbilier and Hartman`s construction.
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.

**BOOKS RECOMMENDED:**

1. Synthesis of Mechanism - D. C.Tao
2. Synthesis of Mechanism - Hall

## ME804: ELECTIVE – III

## ME8041: UNCONVENTIONAL ENERGY SYSTEMS (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT – I** **[ 9 Hrs. ]**

Solar Energy - Introduction, solar constant, beam & diffuse radiation, measurement of solar radiation and measuring instruments. Solar radiation geometry, solar angles, estimation of average solar radiation, radiation on tilted surface, tilt factor.

Solar flat plate collectors. Types of collectors, liquid flat plate collectors, solar air heaters, selective surfaces, evacuated collectors, novel designs of collector.

**UNIT – II** **[ 9 Hrs. ]**

Concentrating collectors - Line focusing, point focusing & 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 voltaic. Solar energy storage, sensible, latent & thermo chemical storage, solar pond.

**UNIT – III** **[ 9 Hrs. ]**

Bio gas - Introduction, bio gas generation, fixed dome & floating drum, bio gas plants, their constructional details, raw material for bio gas production, factors affecting generation of bio gas and method of maintaining bio gas, production, digester design considerations, fuel properties of bio gas & utilization of bio gas. Bio Mass: - Introduction, methods of obtaining energy from bio mass, Incineration, thermal gasification, classification of gasifiers & constructional details. Chemistry of gasification fuel properties, application of gasifiers.

**UNIT – IV** **[ 9 Hrs. ]**

Wind & ocean Energy - Power in wind, forces on blades, wind energy, basic principle of wind energy, conversion site, selection consideration, wind data & energy Estimation, basic components of WECS. Classification of WEC systems, savonius and darrieus rotors, applications wind energy.
Ocean Energy Introduction :- Ocean thermal electric conversion, open & closed cycle of OTEC, hybrid cycle, energy from tides, basic principle 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.

**UNIT – V** **[ 9 Hrs. ]**

Geothermal & MHD power Generation :- Geothermal Energy :- Introduction, classification of geothermal systems, vapour dominated, liquid dominated system, total flow concept, petro thermal systems, magma resources, applications of geothermal operational & environmental problems. Magneto Hydro Dynamic Power Generation :- Introduction, principles of MHD power generation, MHD open & closed systems, power output from MHD generators, design problems of MHD generation, gas conductivity, seeding.

**BOOKS RECOMMENDED:**


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|---|---|---|
| 1. Non Conventional Energy Sources | - | G.D.Rai, Khanna Publication. |
| 2. Non Conventional Energy Sources | - | Rao & Parulekar |
| 3. Solar Energy | - | Garg & Prakash, Tata McGraw Hill |
| 4. Solar Energy | - | S.P. Sukhatme |

## ME804: ELECTIVE – III

## ME8042: STRESS ANALYSIS (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT – I** **[ 12 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, Airy's stress function, Stress analysis of cantilever subjected to concentrated load, Stress Analysis of simply supported beam subjected to Uniformly Distributed Load..

**UNIT – II** **[ 12 Hrs. ]**

Two dimensional problems in polar coordinate systems – General equations of equilibrium in polar coordinate, compatibility equation, 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.

**UNIT – III** **[ 12 Hrs. ]**

Two Dimensional Photo elasticity – Introduction to basic optics related to photo elasticity, stress optic law, plane & circular polariscope arrangements, effect of stressed model in plane & circular polariscope, Isoclinic & Isochromatics, stress trajectories, calibration of photo elastic material (determination of fringe constant), various photo elastic materials & their properties. Casting of photo elastic models, Tardy`s compensation technique, Separation techniques like shear difference, oblique incidence & electrical analogy.

**UNIT – IV** **[ 12 Hrs. ]**

Introduction to 3D photo elasticity – Phenomenon of Stress freezing, Method of stress freezing, slicing techniques, determination of material fringe constant at critical temperature. Scaling Model – Prototype relations.

Introduction to Reflection polariscope, fringe sharpening & fringe multiplication.

Strain gage technique for stress & strain analysis – Introduction to electrical resistant strain gage, gage factor, bridge circuit, bridge balance, output voltage of Wheatstone bridge, temperature compensation, various bridge configurations.

Determination of principle strains & stresses using strain rosettes.

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.

Brittle coating method for stress & strain analysis.

**BOOKS RECOMMENDED:**


1. Theory of Elasticity - S.P. Timoshenko

2. Experimental Stress Analysis - Dalley S.W., Riley W.F.

3. Experimental Stress Analysis - T.K.Ray

4. Experimental Stress Analysis - L.S. Srinath

## ME8043: PROJECT EVALUATION AND MANAGEMENT (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT – I** **[ 9 Hrs. ]**

Need analysis, market survey, characteristics of market, sample survey, demand forecasting, secondary data, accuracy, confidence level, uncertainty.

**UNIT – II** **[ 9 Hrs. ]**

Technical feasibility: Process selection, Level of automation, Plant capacity, Acquiring technology, appropriate technology plant location, Equipment selection and procurement, Govt. policies.

**UNIT – III** **[ 9 Hrs. ]**

Economic Feasibility**:** Cost of project, working capital analysis, fixed cost, means of finance, estimation of sales and production price analysis, Break even point, projected cash flow statements, projected balance sheet, profit and loss statement, projected cash flow, rate of return, discounted payback period, cost benefit analysis, return after taxes,.

**UNIT – IV** **[ 9 Hrs. ]**

Project Report: Preparation of Project Report, risk analysis, sensitivity analysis, methods of raising capital.

**UNIT – V** **[ 9 Hrs. ]**

Project Review: Initial review, performance analysis, ratio analysis, sickness, project revival, environmental and social aspects.

**BOOKS RECOMMENDED:**


1. Projects, Prasanna Chandra, Tata McGraw Hill Publishing Company Ltd.
2. Projects, P.K.Joy, Macmillon
3. Engineering Economy, H.G. Thuesen, W.J.Fabricky, G.J.Thuersen, Printee Hall of India Pvt. Ltd.

## ME804: ELECTIVE – III

## ME8044: MATERIAL HANDLING SYSTEM (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT – I** **[ 9 Hrs. ]**

Types of interplant transporting facility, principal groups of material handling equipments, choice 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.

Flexible hoisting appliances like ropes and chains, welded load chains, roller chains, selection of chains, hemp rope and steel wire rope, selection of ropes, 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 rope sheaves and sprockets.

**UNIT – II** **[ 9 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, electric lifting magnets, grabbing attachments for loose materials, crane attachments for handling liquid materials.

**UNIT – III** **[ 9 Hrs. ]**

Arresting gear, ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thruster operated, controller brakes, shoe brakes, thermal calculations of shoe brakes and life of linings, safety handles, load operated constant force and variable force brakes general theory of band brakes, its types and construction.

**UNIT – IV** **[ 9 Hrs. ]**

Different drives of hosting gears like individual and common motor drive for several mechanisms, traveling gear, traveling mechanisms for moving trolleys and cranes on runway rails, mechanisms for trackless, rubber-tyred and crawler cranes motor propelled trolley hoists and trolleys, rails and traveling wheels, slewing, jib and luffing gears. Operation of hoisting gear during transient motion, selecting the motor rating and determining braking torque for hoisting mechanisms, drive efficiency calculations,

selecting the motor rating and determining braking torque for traveling mechanisms, slewing mechanisms, jib and luffing mechanisms. (Elementary treatment is expected)

**UNIT – V** **[ 9 Hrs. ]**

Cranes with rotary pillar, cranes with a fixed post, jib cranes with trolley, cranes with luffing 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.

**BOOKS RECOMMENDED:**


1. Materials Handling Equipment – N. Rudenko , Envee Publishers, New Delhi
2. Materials Handling Equipment – M.P. Alexandrov. Mir publications, Moscow
3. Introduction to Material Handling – Siddharth Ray, New Age International

## ME805: COMPUTER AIDED DESIGN (Theory)

## CREDITS: 03

**Teaching Scheme**
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

**Examination Scheme**
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

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**UNIT – I** **[ 9 Hrs. ]**

Definition of CAD, CAD software modules ( Operating system, Graphics, Applications, Programming, Communication ). Rasterization principle, Rasterization of line, frame buffer, N-bit plane buffers, Simple color frame buffer.

Line generation using Bresenham`s & DDA algorithms for line, circle, ellipse.

Two dimensional geometric and co-ordinate transformations like scaling, translation, rotation, reflection, shear. Concepts of homogeneous representation and concatenated transformations. Inverse transformations. ( Enumeration of entity on graph paper )

**UNIT- II** **[ 9 Hrs. ]**

Three dimensional geometric and co-ordinate transformation like scaling, translation, rotation & reflection. Reflection about on arbitrary line, Bezier Curve (for Control points).
Algorithms for windowing and clipping.

**UNIT– III** **[ 9 Hrs. ]**

Fundamental concept of finite element method: Plane stress and strain, Compatibility condition, Minimum potential energy principle, Displacement function, shape function for linear & quadratic bar element, Stiffness matrix, Force Matrix.

**UNIT-IV** **[ 9 Hrs. ]**

Truss problems (Linear shape functions only), Shape functions for CST, Two dimensional problems using constant strain triangle.

**UNIT-V** **[ 9 Hrs. ]**

Objectives of optimum design, adequate and optimum design, Johnson's Method of optimum design, primary design equation, subsidiary design equations and limit equations, optimum design with normal specifications of simple machine elements like: tension bar, transmission shaft, pressure vessel, helical spring etc. Introduction to redundant specifications with suitable examples.

**BOOKS RECOMMENDED:**


1. CAD / CAM , Theory & Practice - Ibrahim Zeid
2. Procedural Elements for Computer Graphics - D. Rogers
3. Introduction to Finite Elements in Engineering - Chandrupatla & A. D. Belegudu
4. Optimization for Engineering Design - Kalyanmoy Deb
5. Johnson R.C., "Mechanical Design Synthesis with Optimisation Applications". Von Nostrand – Reynold Pub.

## ME806: REFRIGERATION & AIR CONDITIONING (Laboratory)

## CREDITS: 02

**Teaching Scheme**
Practical: 3 Hours/Week

**Examination Scheme**
University Assessment: 25 Marks
College Assessment: 25 Marks

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## LIST OF PRACTICALS:

**Minimum Eight experiments out of following should be performed.**

1. To study / demonstration of tools and equipments used by a Refrigeration / A/C mechanic.
2. To study / demonstration of a Window Air-conditioner / Split A/C
3. To study the evacuation, dehydration and charging of a refrigeration system.
4. To study the Refrigeration and Air-conditioning controls.
5. To determine COP of a Vapour Compression Refrigeration System.
6. To determine EER of a Air-conditioning system and to determine capacity and bypass -factor of the coil.
7. To study the COP of a Vapour Absorption Refrigerator.
8. To determine the cooling efficiency of a Desert Cooler
9. To determine the COP of a Thermoelectric Cooler / Vertex tube etc.
10. Technical report on Industrial visit to Refrigeration and Air-conditioning application.

A Journal/Report on practicals conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

## ME807: COMPUTER AIDED DESIGN (Laboratory)

## CREDITS: 02

**Teaching Scheme**
Practical: 3 Hours/Week

**Examination Scheme**
University Assessment: 25 Marks
College Assessment: 25 Marks

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## LIST OF PRACTICALS:

**Minimum Eight out of following shall be performed**

1. Development of application program for DDA.
2. Development of application program for Bresenham's Line Generation Algorithm.
3. Development of application program for Bresenham's Circle Generation Algorithm
4. Development of application program for Bresenham's Ellips Generation Algorithm
5. Development of application program for Scaling, Translation and Rotation
6. Development of application program for standard reflection
7. Development of application program for clipping
8. Solution of 1D FE problems (Linear Bar) using commercial / freeware / self developed application programs.
9. Solution of 1D FE problems (Quadratic Bar) using commercial / freeware / self developed application programs
10. Solution of Truss problems using commercial / freeware / self developed application programs
11. Solution of 2D FE problems based on CST using commercial / freeware / self developed application programs

A Journal/Report on practicals conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

## ME808: PROJECT

## CREDITS: 06

**Teaching Scheme**
Practical: 6 Hours/Week

**Examination Scheme**
University Assessment: 75 Marks
College Assessment: 75 Marks

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The project work may conform to anyone of the below stated types of broad based work.

1. Detailed design of some mechanical system. This may comprise of machines, Thermal / Hydraulic / Pneumatic system etc.
2. Detailed experimental / Practical verification of some mechanical engineering systems.
3. Detailed study of some industry/s manufacturing some product/s. This study may comprise of various aspects such as plant layout, mechanical handling systems, assembly shop, quality control system, maintenance system, various service systems, design, development and planning functions, techno-economic studies etc.

Group of students shall be considered for the project work and shall submit the report and give the presentation.