SEMESTER - VII						
S. NO.	**CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDITS**
1	MED-411	REFRIGERATION & AIR CONDITIONING	3	1	0	3
2	MED-412	TURBO MACHINES	3	1	0	3
3	MED-413	OPERATIONS RESEARCH	3	1	0	3
4	MEE-414	ELECTIVE - 1 (DESIGN)	3	1	0	3
5	MEE-415	ELECTIVE - 2 (PRODUCTION)	3	1	0	3
6	MED-416	PROJECT – I	0	3	6	4
7	MED-417	REFRIGERATION & AIR CONDITIONING	0	0	3	2
8	MED-418	TURBO MACHINES	0	0	3	1
9	MED-419	INDUSTRIAL TRAINING VIVA	0	0	0	2
10	MED-410	TERM PAPER	0	0	0	1
	TOTAL		**H = 35**			**25**

SEMESTER - VIII						
S. NO.	**CODE**	**SUBJECT**	**L**	**T**	**P**	**CREDITS**
1	MED-421	AUTOMOBILE ENGINEERING	3	1	0	3
2	MED-422	COMPUTER AIDED DESIGN	3	1	0	3
3	MED-423	CONDITION MONITORING	3	1	0	3
4	MEE-424	ELECTIVE – 3 (THERMAL)	3	1	0	3
5	MEE-425	ELECTIVE – 4 (INDUSTRIAL)	3	1	0	3
6	MED-426	CAD LAB	0	0	0	3
7	MED-427	PROJECT – 2	0	3	9	6
8	MED-428	GENERAL PROFICIENCY	0	0	0	3
	TOTAL		**H = 35**			**25**

ELECTIVE - 1: Rapid Prototyping & Manufacturing, Finite Element Methods, Bearings & Lubrication, Industrial Tribology, Mechanical Vibration

ELECTIVE - 2: Composite Materials, Engineering Materials, Non-Conventional Machining, Industrial Robotics, Computer Integrated Manufacturing

ELECTIVE - 3: Adv. Fluid Mechanics, Power Plant Engg., Alternate Sources of Energy, Solar Energy Engg., Adv. Thermodynamics, gas Turbines & Jet Propulsion, CFD & Heat Transfer, Cryogenics

ELECTIVE - 4: Production & Op. Management, Management Info. System, Facility Layout Planning, Total Quality Management, Optimization, Productivity Management, Maintenance Engg. & Management, Inspection Quality Control & Reliability, Production Planning & Control

MED– 411 REFRIGERATION AND AIR CONDITIONING

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Refrigeration system and its types, refrigeration methods, unit of refrigeration capacity, coefficient of performance.

2. AIR REFRIGERATION

Carnot cycle, Bell Coleman air refrigeration cycle, air craft refrigeration systems, dry air rated temperature.

3. VAPOUR COMPRESSION

Theoretical and actual vapor compression cycle, factors affecting the performance of a vapor compression cycle, methods of improving vapor compression cycle, pressure-enthalpy and temperature- entropy charts, multi stage compression, cascade refrigeration.

4. VAPOUR ABSORPTION REFRIGERATION SYSTEM

Comparison between absorption and compression system, adiabatic mixing of two systems, lithium bromide – Water absorption system, aqua ammonia absorption system, properties of aqua ammonia solution, PT-X chart, heat of solution, enthalpy concentration diagram.

5. REFRIGERANTS

Classification of refrigerants, nomenclature, desirable properties of refrigerant, secondary refrigerants, leak detection, charging of refrigerants.

6. LIQUEFACTION OF GASES

Joule Thompson Coefficient, thermodynamically ideal liquefaction system, Liquefaction systems – simple Linde Hampson cycle, Precooled Liquid Hampson cycle, dual pressure Linde Hampson cycle, Claude cycle, engineering application of cryogenics.

7. AIR CONDITIONING

Properties of moist air, Gibbs Dalton law, specific humidity, dew point temperature, degree of saturation, relative humidity, enthalpy, humid specific heat, wet bulb temp., thermodynamics wet bulb temp., psychrometric chart; psychrometry of air-conditioning processes, mixing process, basic processes in conditioning of air, Industrial and comfort air conditioning, physiological principle, comfort indices, comfort chart, ventilation requirements, evaporative cooling, humidifier efficiency, cooling tower and their performance cooling and dehumidification by chilled water spray and cooling coils equivalent by pass factor chemical dehumidification, sensible heat factor and apparatus dew points, load calculations, design considerations, central air conditioning plants.

8. EQUIPMENTS

Description of refrigeration and air conditioning equipment, compressors, condensers, evaporators, air washer and expansion devices.

TEXT BOOKS:

1. Refrigeration and Air Conditioning : Jordan Priester
2. Elementary Refrigeration and Air Conditioning : Stoecker
3. Refrigeration and Air Conditioning : C.P. Arora
4. Refrigeration and Air Conditioning : M. Prasad
5. Refrigeration and Air Conditioning : S. N. Sapali

MED- 412 **TURBO MACHINES**

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Definitions of turbo machineries, Euler's turbine equation, classifications, turbines (reversed turbines), axial, radial and mixed flow turbomachines, and method of energy transfer in axial, radial and mixed flow machines.

2. CASCADE THOERY

Blade terminology, Cascade of blades, Flow angles, Flow deviation, Lift and drag, Losses in cascades, Velocity diagrams, Degree of reaction.

3. THREE DIMENSIONAL FLOW IN TURBO MACHINES

Effect of radial pressure gradient, free vortex flow, Forced vortex flow, Effect of vortex flow on design, Secondary flow, Losses due to secondary flow, Theoretical head capacity relations ill various types of turbo machines, Performance characteristics of different types of turbomachines: head capacity, Efficiency- Capacity, Power- Capacity, Stall, and Surge.

4. CENTRIFUGAL PUMPS, FANS AND BLOWERS

Inlet section, Pre-rotation, Including section, Prewhirl, Limiting inlet velocity, Flow in impeller channel modification of Euler's theory, Vane and channel shape, Flow in the discharge casing, Volute casing, diffuser performance characteristics, Losses, Regulating blowers, General principles, Adjustable inlet guide vane, Adjustable blade tip, Adjustable disc, Adjustable guide devices, Control of rotation, Self-adjustment by characteristics, Mechanical and Hydraulic speed adjustment, Gears etc.

5. AXIAL FLOW COMPRESSORS

Construction and working, Velocity diagrams and work done of a stage of axial flow compressors, Degree of reaction, Losses in axial flow compressor stage, Performance of axial flow compressor.

6. HYDRAULIC TURBINES

Classification, Euler's equation for turbines, Velocity triangle for single stage axial and radial machines, Impulse and reaction turbines, Pelton, Francis & Kaplan turbine, Power and efficiency calculations, Draft tube, Cavitation, Water turbine governing.

TEXT BOOKS:

1. Turbo Machine : S L Dixon
2. Turbines, Compressors & Fans : Yahya
3. Hydraulic Machines : J.Lal.

MED – 413 OPERATIONS RESEARCH

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Nature and development of operation research, some mathematical preliminaries, general methodology of operation research, and application of operation research to industrial problems, a survey.

2. LINEAR OPTIMIZATION MODELS

Formulation of linear programming deterministic models; graphical solution; simplex algorithm, computational procedure in simplex, duality and its concept, dual linear programming, appl1cation of simplex technique to industrial problem. Assignment Models; formulation of assignment problems, methods for solutions; transportation problems; methods for obtaining optimal solution; degeneracy in transportation problems; transshipment problems.

3. GAME PROBLEMS

Introduction and scope of game problems in business and Industry; Mini-max criterion and optimal strategy, solution of two person zero sum game; game problem as a special case of simplex.

4. NET WORK TECHNIQUES

Basic principles of network construction, CPM/PERT and solution of simple problems.

5. QUEING PROBLEMS

Queuing systems and concepts; classification of queuing situations; solution of queuing problems, single channel, single stage, finite and infinite queues with Poisson arrival and exponential service time; applications to industrial problems, simulation techniques.

6. SEQUENCING MODELS

Processing of 'n' jobs through two machines, processing of 'n' jobs through three machines, processing of 'n' jobs through ‘m’ machines.

TEXT BOOKS:

1. Operation Research : Hira Gupta.
2. Operation Research : Loomba
3. Operation Research : H.A.Taha.
4. Fundamentals of Operation & Research : AC Koff & Sasiene
5. Linear Programming : L.S.Srinath.

MEE – 414 **FINITE ELEMENT METHODS**

L	T	P	Cr
3	1	0	3

1. FUNDAMENTAL CONCEPTS

Introduction, Historical background, stresses and equilibrium, boundary conditions, strain-displacement relations, stress-strain relations, temperature effects, Rayleigh-Ritz Method, Galerkin's Method, Saint Venant's Principle, Matrix algebra, Gaussian Elimination.

2. FINITE ELEMENT MESHES

Choice of mesh, mesh data in numerical form, generation of mesh data, mesh modification.

3. ONE -DIMENSIONAL PROBLEMS

Introduction, Finite element Modeling, Coordinates and Shape Functions, Potential energy approach, The Galerkin Approach, Assembly of Global stiffness matrix and load vector, Finite element equations; Treatment of boundary conditions, quadratic shape functions, Temperature effects.

4. TRUSSES

Introduction, plane trusses, three dimensional trusses, assembly of global stiffness matrix for the banded and skyline solution.

5. TWO- DIMENSIONAL PROBLEMS

Introduction, finite element modeling, constant strain triangle (CST), Problem modeling and boundary conditions.

6. AXISYMMETRIC SOLIDS SUBJECTED TO AXISYMMETRIC LOADING

Introduction, Axisymmetric formulation, finite element modeling: Triangular elements, Problem modeling and boundary conditions.

7. TWO - DIMENSIONAL ISOPARAMETRIC ELEMENTS AND NUMERICAL INTEGRATION

Introduction, The four node quadrilateral, Numerical Integration, Higher order element, Problem related to beams.

8. BEAMS AND FRAMES

Introduction, finite element formulation, load vector, boundary considerations, shear force and bending moment beams on elastic supports, plane frames, three dimensional frames.

9. FINITE ELEMENT METHODS IN FLUID FLOW &. HEAT TRANSFER

1-D Steady heat conduction, 1-D heat conduction in thin fins, 2-D Steady heat conduction, 2-D Fins. 1-D & 2-D heat diffusion, incompressible inviscid flow (potential flow), acoustic flow, and viscous incompressible fluid flow.

RECOMMENDED BOOKS

1. Introduction to Finite Elements in Engineering : Tirupathi, R. ,Chandrupatle Ashoka D. Belegundu
2. An Introduction to Finite Element Method : J.N. Reddy
3. Finite Element Analysis-Theory & Programming : C.S. Krishnamurthy
4. The Finite Element Method in Engineering : S.S. Rao
5. Finite Element Methods for Engineers : Roger T.Fennee
6. Finite Element Analysis in Engg. Design : Rajoebaron

MEE – 414 BEARINGS AND LUBRICATION

L	T	P	Cr
3	1	0	3

1. INTRODUCTION

Types of bearings, Bearing concepts and applications, Lubrication types, lubrication regimes, Lubrication Fundamentals.

2. FUNDAMENTAL EQUATIONS

Continuity momentum (N-S) equations/ Reynolds equation, Energy equation, Solution of N-S/Reynolds equations, Mechanisms of pressure development in fluid film bearings.

3. HYDRODYNAMIC SLIDER BEARINGS

Infinite width slider bearings, Rayleigh Step Bearing, Finite slider bearings, analysis of slider bearings, Application of slider bearings in Machine tools.

4. HYDRODYNAMIC JOURNAL BEARINGS

Infinitely long journal bearing, Finite journal bearing, Boundary conditions, analysis of journal bearings, phenomenon of cavitation.

5. HYDROSTATIC AEROSTATIC BEARINGS

Linear slider bearing, variation of friction with supply pressure, hybrid conical supports, Static and Dynamic response of Oil Bearing, Air film lubrication.

6. ELASTOHYDRODYNAMIC LUBRICATION

Basic concepts, lubrication between two contacting bodies, Hertzian and non-hertzian contact, phenomenon of starvation, applications of elasto-hydrodynamic lubrication.

7. LUBRICANTS

Types of lubricants, Selection of lubricants, Properties and tests on lubricants, Analysis of used oils/lubricants, Particle counter, Spectroscopic Oil Analysis, Ferrography.

TEXT BOOKS:

1. Fundamentals of Tribology : Basu, Sengupta, & Ahuja
2. Fundamentals of Tribology : Bharat Bhushan
3. Fundamentals of Fluid Film Lubrication : Hamrock, Schmid & Jacobson
4. Fundamentals of Machine Elements : Hamrock, Schmid & Jacobson
5. Basic Lubrication Theory : Comeron
6. Applied Tribology : Khonsari

MEE – 414 INDUSTRIAL TRIBOLOGY

L	T	P	Cr
3	1	0	3

1. INTRODUCTION

Tribology, Contact of solids, nature of surfaces, surface topography, surface interactions and characterization, micro and nano tribology, surface roughness measurement techniques.

2. FRICTION

Types, laws, modern theories, dry sliding friction, temperature of sliding surface, Mechanism of rolling friction, friction instabilities.

3. WEAR

Classification, theories of adhesive, abrasive, surface fatigue and corrosives wear, erosive, cavitation and fretting wear, wear models, wear of miscellaneous machine components such as gears, plain bearings and rolling element bearings, ASTM standards for wear measurement, wear resistant materials, wear resistant components.

4. VISCOSITY

Basic definition, conversions, dynamic viscosity, Measurement, variation with temperature, ASTM Charts, Viscosity index, Grade of oil.

5. LUBRICATION THEORIES

Lubrication regimes, viscous flow and viscometry, Reynold's equation, hydrodynamic lubrication, hydrostatic lubrication, elasto - hydrodynamic lubrication, boundary lubrication, squeeze films, turbulent lubrication.

TEXT BOOKS:

1. Basic Lubrication Theory : A Comeron
2. Friction Wear & Lubrication : Kenneth C.Ludema
3. Engineering Tribology : J.A.Williams
4. Fundamentals of Tribology : Basu, Sengupta & Ahuja
5. Engineering Tribology : Stachowiak & Bachelor
6. Fundamentals of Tribology : Bharat Bhushan
7. Applied Tribology : Khonsari

MEE – 414 MECHANICAL VIBRATIONS

L	T	P/D	Cr
3	1	0	3

1. SINGLE DEGREE FREEDOM SYSTEMS

Free and forced vibration with non-harmonic and transient excitation, Fourier analysis, response to arbitrary loading (Duhamel's Integral), Impulse response, Mechanical shock, Parametric Excitation.

2. TWO DEGREE FREEDOM SYSTEM

Free Vibration – General solution and method of influence coefficient, Damped–free vibration, undamped forced vibrations with application to dynamic vibration Absorber, and Technical applications.

3. MULTI-DEGREE FREEDOM SYSTEMS

Generalized coordinates, Derivation of Lagrange's equations, and Lagrange's equation for non-conservative systems.

4. COMPUTING TECHNIQUES FOR FREQUENCY AND MODE SHAPE CALCULATION

Matrix iteration Method, Transfer matrix Method, Rayleigh's minimum principle, Stodola's Method, Holzer's Method.

5. VIBRATIONS OF CONTINUOUS SYSTEMS

Transverse vibration of strings, Vibration of membranes, longitudinal vibration of rods, Flexural vibration of beams.

6. MEASUREMENTS TECHNIQUES

Vibration Monitoring, Vibration parameters, Vibration Instrumentation for its Measurement.

TEXT BOOKS:

1. Mechanical Vibration Analysis : P. Srinivasan – 2nd Ed.,
2. Vibration & Noise for Engineers : K. Pujara and R.S. Pujara,
3. Introduction Course on Theory and Practice of Mechanical : J.G. Rao & Gupta,
4. Machinery Noise & Diagnostics : R.H. Lyon
5. Mechanical Vibrations : S.S.Rao

MEE – 415 INDUSTRIAL ROBOTICS

L	T	P/D	Cr
3	1	0	3

1. FUNDAMENTAL OF ROBOTICS

Introduction, automation and robotics, history of robotics, Anatomy of robot, classification of robot, robot configurations, robotic systems, robot specifications, performance parameters, robot drive systems, wrist and motions, Robot end effectors, Investment on robot, Economic analysis of robot, characteristics and application of the present robot, The characteristics and applications of robot of future industrial robot.

2. ACTUATORS AND END EFFECTORS

Electric actuators, Hydraulic actuators, Pneumatic actuators, Selection of Motors, End effectors, Grippers, Force analysis of gripper mechanisms, Gripper design considerations, selection consideration of grippers.

3. MANIPULATOR SENSORS AND CONTROL SYSTEM

Introduction, classification of sensors and their functions, Position, velocity, acceleration sensors, proximity and range sensors, Touch and slip sensors, force and Torque sensors, Vision: Introduction to machine vision, Image processing and analysis, Robotic applications. Robot control system, components and analysis.

4. TRANSFORMATIONS

Introduction, Co-ordinate frames, Representation of rigid Body in Space, Homogenous transformation, Types of Transformation, Composite Transformation Matrices, Basic Transformation Matrices, Inverse Homogenous Transformation Matrix.

5. MANIPULATOR KINEMATICS

Introduction to manipulator kinematics, Manipulator parameters, Forward Kinematics arm equations, Denavit and Hartenberg (D-H) representation, Forward Kinematic Solutions, Inverse Kinematic Equation, inverse kinematics problems.

6. MANIPULATOR DYNAMIC ANALYSIS

Introduction, Lagrangian formulation of manipulator dynamics, Dynamic equations for multi-degree of freedom manipulators, Forward and inverse Dynamics, Manipulator dynamics in Cartesian Space, Differential motions of manipulators, Trajectory planning.

7. ROBOT PROGRAMMING

Introduction, methods of programming, Motion interpolations, Robot programming languages, Language structure, Programming languages-features and applications, Introduction to artificial Intelligence and robotics.

8. APPLICATIONS, IMPLEMENTATION PRINCIPLES, SOCIAL ISSUES AND FUTURE OF ROBOTICS

Engineering applications for manufacturing: Robot cell design and control, Robot as peripheral device, Material transfer, machine loading and unloading, processing operations applications, Assembly and applications. Plant survey to identify potential applications, planning and engineering. The installation, safety, training and maintenance issues, social and labor issues, robotic technology of the future and future applications.

TEXT BOOKS:

1. Robotic Engineering - An Integrated Approach : Richard D. Klafter Thomas A.
2. Industrial Robotics : Gordon M. Mair
3. Introduction to Robotics : S.K. Saha
4. Robotics &Control and Programming : J.Srinivas
5. Industrial Robotics : Mikell P. Groover, Nicholas
6. Fundamentals of Robotics : Robert J. Schilling

MEE-415 NON-CONVENTIONAL MACHINING

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Types of advanced manufacturing processes; Evolution, need, and classification of advanced machining processes (AMPs).

2. MECANICAL TYPE AMPs

USM, AJM, WJM, AWJM processes: Process principle and elements; Tool design; Mechanism of material removal, parametric analysis; Shape and material applications; Operational characteristics; Limitations.

3. ADVANCED FINE FINISHING PROCESS

Abrasive Flow Machining; Magnetic Abrasive Finishing; Magneto Rheological Abrasive Finishing: Process principle, process equipment Analysis and modeling of finishing mechanism; parametric analysis; Applications.

4. CHEMICAL TYPE AMPs

Process principle and details of Chemical Machining; Photochemical Machining, and Bio-Chemical Machining processes.

5. ELECTRO CHEMICAL TYPE AMPs

ECM-Process principle, mechanism of material removal; Kinematics and dynamics of ECM; Tooling design; Choice and analysis of process pariJ'11eters; Surface finish and accuracy.

6. THERMAL TYPE AMPs

EDM, LBM and EBM processes: Working principle; Power circuits; Mechanism of material removal; Process parameters and characteristics; Surface finish and accuracy: Shape and materials applications, limitations.

7. DERIVED and HYBRID AMPs

Introduction of processes like rotary ultrasonic machining, electro stream drilling, shaped tube electro machining, wire electro discharge machining, electro chemical grinding, electro chemical honing, electro chemical deburring and electro-chemical spark machining.

TEXT BOOKS:

1. Modern Machining Processes : Pandey,P.C Shan,H.S,Tata Mcgrahill
2. Manufacturing Science : Ghosh, A. Malik,A.K Affiliated East-West Press 1985
3. Nontraditional Manufacturing Processes : Benedict, G.F., , Marcel Dekker 1987
4. Advance Method of Machining : McGeough, J.A, Ch'apman and Hall 1988
5. Nonconventional Machining : Mishra, P.K., Narosa Publishing House 1997
6. Advanced Machining Processes : Jain, V.K., Allied Publishers 2002

MEE-415 COMPOSITE MATERIALS

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION TO COMPOSITES

Fundamentals of composites need for composites; Enhancement of properties, classification of composites, Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fiber reinforced composites, Nano composites. Applications of various types of composites.

2. POLYMER MATRIX COMPOSITES

Polymer matrix resins, thermosetting resins, thermoplastic resins, Reinforcement fibers, Rovings, Woven fabrics, Non-woven random mats, various types of fibers. PMC processes, Hand layup processes, Spray up processes, Compression molding – Reinforced reaction injection molding - Resin transfer molding – Pultrusion – Filament winding – Injection molding. Fiber reinforced plastics (FRP), Glass fiber reinforced plastics (GRP).

3. METAL MATRIX COMPOSITES

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibers. Effect of reinforcement – Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

4. CERAMIC MATRIX COMPOSITES

Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminum oxide – silicon nitride – reinforcements – particles- fibers- whiskers. Sintering – Hot pressing – Cold isostatic pressing– Hot isostatic pressing.

5. COMPOSITE MECHANICS

Special cases of Laminate stiffness, lay-of-out laminates and their types, strength of Laminates, Laminate Strength Analysis Procedure, Thermal and Mechanical stress Analysis, Concept of inter-laminar stresses and Delamination. Engineering constants for orthotropic materials, Restriction on elastic constant, Stress-strain relations for plane stress in an orthotropic materials, Stress-strain relations for a lamina of arbitrary orientation, Invariant properties of an orthotropic lamina, Strength of an orthotropic lamina, Experimental Determination of strength and stiffness, Failure theories for lamina.

6. ADVANCES IN COMPOSITES

Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fiber – chemical vapor deposition of carbon on carbon fiber perform. Sol gel technique. Composites for aerospace applications.

7. INDUSTRIAL APPLICATION OF COMPOSITES

Civil constructions of structures, aerospace industries, automobile and surface transfer industries, Packaging industry, Household and sports component.

TEXT BOOKS

1. Mathews F.L. and Rawlings R.D., Composite materials: Engineering and Science, Chapman and Hall, London, England, 1st edition, 1994.
2. Chawla K.K., Composite materials, Springer – Verlag, 1987

REFERENCES

1. Clyne T.W. and Withers P.J., Introduction to Metal Matrix Composites, Cambridge University Press, 1993.
2. Strong A.B., Fundamentals of Composite Manufacturing, SME, 1989.
3. Sharma S.C., Composite materials, Narosa Publications, 2000.

MED –361 AUTOMOBILE ENGINEERING

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Classification of automobiles, components of an automobile, the basic structure, transmission system, auxiliaries, controls, superstructure, car body styles, Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles.

2. CHASSIS CONSTRUCTION

Conventional construction, underbody, sub frames, defects in frames, frameless construction, Industrial vehicle frames, structural tasks, design & structural testing.

3. TRANSMISSION

Necessity & functions of transmission, types of transmission, sliding mesh gear box, constant mesh gear box, synchromesh gear box, selector mechanism, transfer box, automatic transmission, epicyclic gear box, principle of automatic transmission, Driveline dynamics: Engine Dynamics, Driveline & Efficiency, Gearbox dynamics.

4. CLUTCHES

Requirements and principle of clutches, dry friction clutches, clutch components, types of clutches-single plate, multi plate, semi centrifugal and centrifugal, clutch operation, wet clutch, clutch dynamics, Clutch trouble shooting.

5. PROPELLER SHAFT AND REAR BOX

Propeller shaft, universal joints, final drive, differential, rear axle, rear axle drives, rear axle casing, improvements in four wheel drive.

6. SUSPENSION SYSTEM

Basic requirements & Coordinate frames, function of suspension springs, types of suspensions, shock absorbers, stabilizer or anti-roll device, suspension mechanics: solid axle suspension, Independent suspension, roll center and roll axis**,** trouble shooting.

7. FRONT AXLE AND STEERING

Front axle, wheel geometry, factors of wheel alignment, steering geometry, angle, mechanisms, cornering force, self- righting torque, understeer and oversteer, steering gears & ratio, reversibility, power steering, steering dynamics: kinematic steering, vehicle with more than two axles, steering trouble shooting.

8. WHEELS AND TYRES

Types of wheels, wheel & rim, tyre and sidewall information, tyre components & material, tyre properties, types of tyres, comparison of radial and non-radial tyres, tread & tread design, tyre selection, designations, factors affecting tyre life, Tyre dynamics: tyre coordinate frame and tyre force system, tyre stiffness, tyre print force, effective radius, rolling resistance, longitudinal, lateral force, camber force, tyre force, precautions regarding the tyres.

9. BRAKES

Principle, braking requirements, brake efficiency and stopping distances, fading of brakes, weight transfer, wheel skidding, types of brakes, drum brakes-brake shoes, brake linings, disc brakes, mechanical brakes, hydraulic brakes, brake fluid, electric brakes, engine exhaust brakes, air brakes, hand brake, hill holding device, bleeding of brakes.

10. BODY AND SAFETY CONSIDERATIONS AND MODERN DEVELOPMENTS IN AUTOMOBILES

Requirements of automobile body, materials for body work, rust protection, safety considerations & norms, crash worthiness, ABS Systems.

RECOMMENDED BOOKS

1. Automobile Engineering Vol. I & II : Kirpal Singh, Standard Publishers, Delhi
2. Automotive Mechanics : Joseph Heitner, East West Press, Delhi
3. Automotive Mechanics : Crouse, TMH, Delhi
4. Vehicle Dynamics : Reza N. Jazar, Springer, New York
5. The Automotive Chassis Vol. I & II : G. Gewa, L. Morello, Springer
6. Automobile Engineering : R.B. Gupta, Satya Prashan, New Delhi

MED-422 **COMPUTER AIDED DESIGN**

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Design steps, role of computers in design and drafting, computer hardware, types of display - raster display, vector display, color display, input devices, output devices.

2. TRANSFORMATIONS

World to device coordinate transformation, world coordinates, window and view port, and window to view port transformation, Normalized coordinates, zooming and panning.

3. TWO DIMENSIONAL TRANSFORMATION

Mathematical aspects of translation, scaling, shearing, rotation, Reflection, Composite (concatenation) transformation, concatenation properties of matrices, practical example - rotation about a pivot point, scaling relative to fixed point, scaling relative to arbitrary directions, shearing relative to a fixed point. Inverse Transformation: Inverse translation, scaling, rotation shearing matrix.

4. THREE-DIMENSIONAL TRANSFORMATIONS

Scaling, translation, rotation.

5. THREE-DIMENSIONAL VIEWING OPERATIONS

Projections- Multiview orthographic projections, axonometric projections, Oblique projections, Perspective projections, Vanishing points, Special techniques for producing perspective views.

6. CURVES

Geometric curve description, Parametric and implicit formulations, Conics- Circles, Ellipses; Interpolation techniques for curve definition- Lagrange polynomial, Parametric cubic, Matrix approach, Cubic spline; Bezier curves.

7. SOLID MODELLING SYSTEM

Octree or Quadtree representations, boundary or perimeter modelling, primitive or constructive solid geometry or building block method.

TEXT BOOKS:

1. Mathematical Elements for Computer Graphics : D.F. Rogers & J. Alan Adam.
2. Microcomputer Graphics using Pascal : Richard Halpern
3. Computer Graphics : Hern & Baker
4. Introduction to CAD/CAM : Oniver & Zimer
5. Computer graphics and Geometrical Modeling for Engineers : Vera B.Anand

MED – 423 **CONDITION MONITORING**

L	T	P/D	Cr
3	1	0	3

1. Importance of machine health monitoring and fault diagnosis of plant, Classification of Maintenance Activities: Breakdown, Preventive and Predictive Maintenance, Condition Monitoring maintenance strategies.

2. Fault identification/detection; visual inspection; crack detection techniques like magnetic crack detection, dye penetrant, radiography; oil analysis; wear particle analysis; Ferrography; strain gauge technology, ultrasonic crack detection, thermography.

3. Condition monitoring methods; sensors required for various applications viz. electrical fluid, mechanical; wear debris analysis; vibration of mechanical components; on line and off line techniques.

4. Noise analysis; fluid borne, structural borne, air borne noise measurement and its analysis.

5. Signal processing; signature analysis and their significance; machine signatures; spectrum analysis; time series analysis.

6. Expert systems and real time process analysis; microcomputer interfacing; data acquisition, expert system skills, Classification of Maintenance Activities: Breakdown, Preventive and Predicitive Maintenance, Condition Monitoring.

TEXT BOOKS:

1. Mechanical Faults Diagnostics and Condition Monitoring : R. A. Colacott
2. Handbook of Condition Monitoring : B.K.N. Rao
3. Engineering Condition Monitoring Practice, Methods and Applications : Barron, R., Addison
4. Condition Monitoring for Engineering Services : Armstrong, J.H. & & Taylor P.
5. Maintenance Engineering and Management : Mishra R.C. & Pathak K.

MEE -424 **SOLAR ENERGY ENGINEERING**

L	T	P/D	Cr
3	0	0	3

1. **SOLAR RADIATION**
   Introduction, solar system-sun, earth and earth-sun angles, time, derived solar angles, estimation of solar radiation (direct and diffuse), measurement systems-Pyrheliometer and other devices.

2. **EFFECT OF SOLAR RADIATION**
   Steady state heat transmission, solar radiation properties of surfaces, shading of surfaces, periodic heat transfer through walls and roofs.

3. **SOLAR COLLECTORS**
   Flat plate and concentrating-comparative study, design and materials, efficiency, selective coatings, heliostats.

4. **HEATING APPLICATIONS OF SOLAR ENERGY**:
   Air and Water heating systems, thermal storages, solar bonds, solar pumps, solar lighting systems, solar cookers, solar drying of grains.

5. **COOLING APPLICATIONS OF SOLAR SYSTEMS**
   Continuous and intermittent vapor absorption systems for cooling applications, absorbent refrigerant combination, and passive cooling systems.

6. **SOLAR ELECTRIC CONVERSION SYSTEMS**
   Photovoltaic, solar cells, satellite solar power systems.

7. **EFFECTS ON ENVIRONMENT**:
   Economic scenario, ozone layer depletion, greenhouse effect, global warming, Remedial measures by international bodies.

TEXT BOOKS

1. Solar Energy : S. P. Sukhatme
2. Solar Energy and Thermal Process : Duffie & Beckman

REFERENCE BOOKS

1. Applied Solar Energy : Maniel & Maniel
2. Solar Energy: Fundamentals and Applications : R. P. Garg &Jai Prakash
3. Principles of Solar Engineering : F. Kreith & J. F. Kreider

MEE -424 COMPUTATIONAL FLUID DYNAMICS AND HEAT TRANSFER

L	T	P	Cr
3	1	0	3

1. INTRODUCTION

Review of Governing equations, continuity, momentum and energy, classification of quasi-linear partial differential equations, general behavior of different classes of PDE, parabolic, hyperbolic and elliptic, review of solutions of simultaneous algebraic equations. Solution of initial value problem.

2. BASIC OF FINITE DIFFERENCE METHODS

Introduction to finite differences, discrimination, difference representation of partial differential equations, explicit and implicit methods, errors and analysis of stability.

3. APPLICATION TO SELECTED MODEL EQUATIONS

Numerical methods for solution of wave equation, heat equation, Lap lace equation; Burger equation.

4. FINITE VOLUME METHOD

Discretization, control volume formulation, steady 1-D conduction, interface conductivity, nonlinearity, unsteady one-dimensional conduction, zero, Two and Three-dimensional conduction, over and under relaxation. Steady one-dimensional convection and diffusion.

5. SOME CFD TECHNIQUES

Lax-Wendorff technique, Maccormack Technique, relaxation technique, aspects of numerical dissipation and dispersion, alternating-direction implicit technique, pressure correction technique, subsonic-supersonic isentropic nozzle flow, steady and unsteady state conduction in two-dimensional bodies, laminar boundary layer flows.

TEXT BOOKS

1. Computational Fluid Dynamics : A.D.Anderson Jr.
2. Computational Fluid Flow and Heat Transfer : D.A.Anderson Tannehil
3. Computational Fluid Flow and Heat Transfer : K.Muralidhar

MEE -424 **POWER PLANT ENGINEERING**

L	T	P	Cr
3	1	0	3

1. INTRODUCTION

Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

2. HYDRO ELECTRIC POWER PLANTS

Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

3. STEAM POWER PLANTS

Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection mechanical dust collector and electrostatic precipitator.

4. COMBINED CYCLES

Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal, using PFBC systems with organic fluids, parameters affecting thermodynamic efficiency of combined cycles, Problems.

5. NUCLEAR POWER PLANTS

Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled, Advantages and limitations, nuclear power station, waste disposal.

6. POWER PLANT ECONOMICS

Load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, input-output curves, efficiency, heat rate, economic load sharing, Problems.

7. NON-CONVENTIONAL POWER GENERATION

Solar radiation estimation, solar energy collectors, low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

8. DIRECT ENERGY CONVERSION SYSTEMS

Fuel cell, MHD power generation principle, open & closed cycle systems, thermoelectric power generation, and thermionic power generation.

TEXT BOOKS:

1. Power Plant Engineering : P.K. Nag
2. Power Plant Engineering : P.C. Sharma
3. Power Plant Engineering : M. Wakil
4. Modern Power Plant Engineering : Weisman & Eckart

MEE -424 ADVANCE THERMODYNAMICS

L	T	P/D	Cr
3	1	0	3

1. **REVIEW OF LAWS**
   Thermodynamics laws, Steady flow energy equation, Transient flow analysis, entropy, entropy generation, real gases and mixtures, equation of state.

2. **THERMODYNAMIC PROPERTY RELATION**
   Residual property function, property of saturation state, Thermodynamic properties of homogeneous mixture, Chemical potential fugacity and fugacity coefficient.

3. **EXERGY ANALYSIS**
   Concepts, exergy balance, exergy transfer, exergetic efficiency, exergy analysis of power and refrigeration cycles.

4. **RECATING SYSTEMS**: Laws of reacting systems, absolute entropy, fuel cells, exergetic efficiency of reacting systems, chemical equilibrium.

TEXT BOOKS

1. Thermodynamics : Cengel
2. Thermodynamics : Moran & Shapiro
3. Thermodynamics : Van Wylen

MEE-424 GAS TURBINES AND JET PROPULSION

L	T	P	Cr
3	1	0	3

1. COMPRESSIBLE FLOW

Wave propagation and sound velocity; Mach number and compressible flow regimes; basic equations for one-dimensional compressible flow, isentropic flow relations; area-velocity relation; normal shock waves, relation between upstream and downstream flow parameters.

2. GAS TURBINE SYSTEMS AND CYCLES

System of operation of gas turbines, constant volume and constant pressure gas turbines; thermodynamics of Brayton cycle; regeneration-intercooling, reheating and their combinations; closed cycle and semi-closed cycle gas turbines; gas v/s I.C engines and steam turbines.

3. COMPRESSORS

Classification-positive displacement and dynamic compressors, Operation of single stage reciprocating compressors; best value of index of compression; isothermal efficiency; effect of clearance and volumetric efficiency; multi-stage compression; air motors. Centrifugal compressors; static and total head values; velocity vector diagrams; slip factor; pressure coefficient and pre-whirl, Axial flow compressors; degree reaction and polytrophic efficiency Performance characteristics; surging, choking and stalling.

4. COMBUSTION SYSTEMS

Types, combustion process, combustion intensity efficiency and pressure loss.

5. AIR-BREATHING PROPULSION SYSTEMS

Principle of jet propulsion; analysis and performance characteristics of turbojet, turboprop, ramjet and pulsejet; thrust power and propulsion efficiency.

6. ROCKET PROPULSION

Operating principle; solid and liquid propellants, performance analysis-calculations for specific impulse and propulsive efficiency.

TEXT BOOKS:

1. Gas Turbine Theory : Cohen & Rogers
2. Principle of Jet Propulsion and Gas Turbine : Zucrow M J
3. Heat Engineering : Vasandani V P & Kumar D S

MEE -425 PRODUCTION PLANNING AND CONTROL

L	T	P	Cr
3	1	0	3

1. INTRODUCTION

Definition of PPC, Concept of production planning and production control, objectives and functions of PPC, Comparison among production planning and production control, Information requirement for PPC, Production Procedure, Organization for PPC, Manufacturing methods and PPC, Problems of PPC.

2. FUNCTION OF PPC

Routing: concept, procedure, route sheet, routing in job order, Scheduling: objectives, factors affecting scheduling, Priority Sequencing, master scheduling, production, Machine loading: objectives, adjustments, Dispatching: centralized and decentralized dispatching, Production Control: concept, objectives, progress reporting, correction actions, Principles of sound Production Control Systems, Types of Production Systems.

3. FORECASTING TECHNIQUES

Concept and purpose of sales forecasting and production volume forecasting, Market Potential, Basic elements, Delphi methods, Moving average technique, Correlation analysis, Linear regression analysis, Forecast error, Costs and accuracy of Forecasts.

4. MATERIALS MANAGEMENT

Objectives, functions and types of materials management, organization and economic aspects of materials management, Buying Techniques, Purchasing Procedures and methods, inventory control, Economic Order Quantity, Inventory models, MRP: terminology, system, output, and logic, Break even analysis, Vendor rating, Outsourcing.

5. PROCESS PLANNING

Framework for Process Engineering, Process and equipment selection, Application of Bea in the Choice of machines and processes, machine requirements, Machine outputs, Manpower planning, Combined Operations, Computer Aided Process Planning, Heuristics in Line balancing, Problems.

6. SUPPORTING PPC ACTIVITIES

Group Technology: group layout, stages, benefits and problems, Lean Manufacturing, Agile manufacturing, JIT, Supply Chain Management, Role of Database Management System in PPC, Lean Manufacturing, Enterprise Resource Planning.

RECOMMENDED BOOKS

1. Production Planning and Control : Samuel Eilon
2. Production and Operations Management : Adam Ebert
3. Production Planning & Inventory Control : Narsimhan

MEE – 425 TOTAL QUALITY MANAGEMENT

L	T	P	Cr
3	1	0	3

1. QUALITY MANAGEMENT

Evolution of Philosophy of Quality, Quality Gurus- Crosby, Deming and Juran, Attributes of Quality, Quality Characteristics-Quality of Design, Quality of Performance and Quality of Conformance, Organization For Quality, Total Quality Management (TQM), TQM Models, 4 – C'S of TQM; Barriers to Implement TQM.

2. ORGANISING FOR QUALITY

Developing an Organization Al Structure for Quality. Quality Management System. Role of top Management ,Quality Council, Quality Policies ,Quality Improvement Teams, Role of Middle and Lower Management ,Quality Circles, Organization Structure for Quality Circles. Problem Solving Techniques, Zero Defects.

3. QUALITY MEASUREMENT; TOOL AND TECHNIQUES

Seven Basic (B7)Tools – Cause & Effect Diagram, Flow Diagrams, Trend Charts, Histogram, scatter Diagram, Control Chart, New Seven (S7)Tools – Affinity Diagram, Inter relationship Diagram, Tree Diagram, Matrix Diagram, Process decision Program chart (PDPC) and Matrix Data Analysis.

4. QUALITY ASSURANCE & CONTROL

Causes of Quality Failure, Quality Assurance-Need and Various Elements in Quality Assurance Programme. Quality Control on Line and Off Line, Statistical Concepts in Quality, Chance and Assignable causes. Types of control charts. Control chart for variables (X and R charts).Interpreting patterns of variations on X and R charts. Control chart for attributes: Attribute chart for defectives, P- chart, and NP-chart. Attribute chart for number of defects per unit, C-Chart and U-Chart.

5. INNOVATIVE TECHNIQUES IN QM

Quality Function Deployment (QFD)- Definition and Phases in QFD , Taguchi Approach to quality-system design, parameter design and Tolerance design, Six- Sigma -Definition & Implementation Steps, ISO-9000 and 14000, Role of Total Productive Management (TPM), Bench Making in quality management.

6. QUALITY SYSTEMS

Seven QC tools of quality control, Histogram, Scatter diagram, Standardization.

RECOMMENDED BOOKS

1. TQM Text with Cases : Amrik Sohal
2. Managing Quality : B. G. Pale
3. TQM Text with Cases : John S. Oaklend
4. TQM and ISO –14000 : Arora
5. TQM : Besterfield

MEE-425 PRODUCTION AND OPERATION MANAGEMENT

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Functional subsystems of Organizations; definition, Systems of Production System; Flow Shop; Job Shop; Batch Manufacturing; The Project, Productivity, Strategic Management; Corporate Strategies; Generic Competitive & Functional Strategies, GDP and its Impact, World class Manufacturing.

2. CAPACITY PLANNING AND INVESTMENT DECISIONS

Capacity Planning; determination of Plant Capacity; Capacity Planning Strategies; Equipment Selection, Investment Decisions; Interest Formulas; Base for Comparison Alternatives.

3. FACILITY LOCATION DESIGN

Introduction; Factors influencing plant location, Single Facility Location Problems; Model of Multi - facility Location Problem; method of Transformation; Model of Determine X-Coordinates & Y coordinates of New Facilities, , Model of Warehouse Location Problem; Descriptive Model; Working Mathematical Model, Advantages and Limitations of Process and Product Layout, Layout Design Procedure; Computerized Relative Allocation of Facilities Technique (CRAFT); CRAFT Procedure and Application; Automated Layout Design Program (ALDEP); Computerized Relationship Layout Planning (CORELAP);Monte Carlo simulation with case studies, Mathematical Model for Machine-Component Cell Formation, Materials Handling Systems; Unit Load Concept; Material Handling Principles; Classification of Material Handling Equipment.

4. LINE BALANCING

Concept of Mass Production System; Objective of Assembly Line Balancing; Generalized Algorithm; Rank Positional Weight Method; The COMSOAL Algorithm; Model for Assembly Line Balancing; Integer Programming Model for Minimize Number of Work Station; Model to Minimize Balancing Delay, Stochastic Assembly Line Balancing.

5. AGGREGATE PLANNING AND MASTER PRODUCTION SCHEDULING

Concept of Aggregate Planning; Nature and Strategies of Aggregate Planning; Aggregate Planning Methods, Master Production Plan/Schedule; Cut-and-Fit Methods, Concept of Machine Scheduling and Single Machine Scheduling; Measure of Performance; Shortest Processing Time (SPT) Rule to Minimize Mean Flow Time of single dual and N machines.

6. PROJECT MANAGEMENT

Introduction and Phases of Project Management; Guidelines and Rules for Network Construction; Critical Path Method (CPM); Gantt Chart/Time Chart; Project Evaluation and Review Technique (PERT), General Guidelines for Crashing Network; Crashing of project Network with Costs Trade-Off, Project Scheduling with Constrained Resources; Resources Levelling Techniques; Resources Allocation Technique, Graphical Evaluation and Review Technique (GERT), Project Management Softwares; InstaPlan III; Yojana.

TEXT BOOKS:-

1. Operations Management : Mc Gregor D
2. Operations Management : Russell & Taylor
3. Operations Management : Jaseph G. Monk
4. Introduction to Work Study : I.L.O.
5. Production and Operations Management : Adam Ebert
6. Production Management : Buffa
7. Industrial and Systems Engineering : Turner, Prentice Hall Pub.

MEE-425 INSPECTION, QUALITY CONTROL AND RELIABILITY

L	T	P	Cr
3	1	0	3

1. INTRODUCTION

Inspection, Definition, Objectives, Kinds of Inspection, Centralized Inspection, Decentralized Inspection, Functions of Inspection, Quality Control- Need and Functions, Difference between Inspection and Quality Control.

2. ACCEPTANCE SAMPLING, AND O.C. CURVES

Sampling Inspection –Need and Types, Inspection by attributes and variables, Various Sampling Plans- Single sampling Plan, Double Sampling Plan, Sequential Sampling Plan, Operating Characteristics Curve (O.C), Consumer Risk, Producer Risk and Average Outgoing Quality Level (AOQL).

3. MEASUREMENT AND TESING

Classification of Measuring Instruments, Measurement Terminology – Accuracy, Interchangeability, Tolerance, Fits, Allowances, Clearance and Interference. Errors – Sources & Safeguards, Methods of Destructive and Non – Destructive Testing (NDT).

4. QUALITY PLANNING, IMPROVEMENT AND ASSURANCE

Concept of Quality Planning, Quality Loop, Quality Gurus on Quality Improvement, Quality assurance, Responsibilities of Quality Assurance Department, Quality Assurance Activities, and Quality Audit.

5. RELIABILITY

Failure Characteristics, Failure Data Analysis – Mean time Between Failures- MTBF, Mean Time To Repair- MTTR, Reliability, Difference between Reliability and Quality, Systems Reliability – Parallel and Series System, Means for Improving Systems Reliability – redundancy – Derating – Operating and environmental Conditions.

TEXT BOOKS:

1. Inspection quality Control and Reliability : S. C. Sharma
2. Industrial Engineering : O.P.Khanna
3. Quality Management : Howard Gitlow
4. Quality Planning & Analysis : Gryana M. Jr
5. Creating Quality Concepts, Systems & Tools : W.J. Kolarik
6. Quality Control Handbook : Juran
7. Reliability : Srinath

MEE-425 **PRODUCTIVITY MANAGEMENT**

L	T	P	Cr
3	1	0	3

1. INTRODUCTION

Concern and Significance of Productivity, Management; Rationale of Productivity Measurement; Productivity's Perspectives, Relation of Productivity with Production, Productivity and Profitability, Productivity and Quality.

2. PRODUCTIVITY MEASUREMENT MODELS

Some Recent Attempts to Define Productivity; Review of Productivity Measurement Models, Production Function Models, Financial Ratios as Measures of Productivity, Production Based Models, Product Oriented Models, Surrogate Models, Economic Utility Models, Models Based on System Approach.

3. PRODUCTIVITY MEASUREMENT; A CONCEPTUAL FRAME WORK:

Objectives of Productivity Measurement; Management by Objectives (MBO) and Productivity Measurement, System Approach to Productivity Measurement; "Performance Objectives-Productivity" (PO-P), Concept Model, Methodology and Applications.

4. PRODUCTIVITY MEASUREMENT IN MANUFACTURING

Productivity Measurement in a Small, Medium and Large Sized Organizations; Objectives, Weightages, Productivity Indices of KPA's, Sub System and the System; Productivity Measurement in a Medium Sized Organization, Its Strength and Weaknesses, Marketing Characteristics, Production Characteristics, Productivity Indices- Calculations, Identification KPA's for Improvement.

5. POP APPLICATION

Need for Measuring Productivity in Service Sector; Difficulties in Measuring; Productivity of an R&D System, Ranking and Weightages of Sub Systems, KPA's and PO's; Methodology of Productivity Measurement of a Service Sector.

6. IMPLEMENTATION STRATEGIES

Productivity Management System; Productivity Policy; Productivity Organization and Planning; Productivity Measurement and its Evaluation; Productivity Improvement Strategies; The Organization Factor, Human Factor, Technology Factor, Productivity Improvement Programmes and Action Plans; Productivity Audit and Control.

TEXT BOOKS:

1. Productivity Management -A System Approach : Prem Vrat, Sardalia & Sahay
2. Introduction to Work Study : ILO
3. Industrial Engineering and Production Management: : M. Mahajan

MEE-425 **FACILITY LAYOUT PLANNING**

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Growth of Formal Planning, Functional Subsystems of Organizations, Facility Layout and Planning; Strategic Management, Corporate Strategies & Functional Strategies; Industrial Plant Design Considerations; Factors Influencing Site Selections; Rural & Urban Location of Sites.

2. FACILITY LOCATION

Break Even Analysis; Single Facility Location Problem; Multi Facility Location Problems; Model for Ware House Location Problems.

3. PLANT LAYOUT

Classifications, Advantages, Disadvantages of Plant Layouts; Effects of Plant Layout on Industrial Production Management; Flow Systems, Effect of Automation on Layout; Symptoms of a Bad Layout; Evaluation of Layout and Criteria for Evaluating Alternative Layouts; Graphic & Schematic Analysis.

4. COMMON PROBLEMS IN PLANT LAYOUT

Material Handling Problem; Balancing of Line; Group Technology; Storage; Flexibility in Buildings, Service & equipment.

5. MATERIAL HANDLING

Importance, Principles & Organization of Material Handling Analysis of Material Handling Problems; Classification of Material Handling equipment According to Their Construction & Nature of service; Space Planning & Area Allocation, Application of Robotics.

6. EQUIPMENT MAINTENANCE & MANAGEMENT

Importance; Types of Maintenance; Preventive Maintenance; Breakdown Maintenance; Corrective Maintenance; Condition Based Maintenance; Developments in Maintenance Engineering; Maintenance Planning; Evaluation of Maintenance Performance.

1. **TEXT BOOKS:**
2. Plant Layout and Design : Moore
3. Production and Operations Management : R. Panneerselvan
4. Materials Management & Material Handling : S.C. Sharma
5. Production Planning & Control : Samuel Eilon
6. Practice Plant Layout : Mulher
7. Plant Layout and Material Handling : Apple

MEE-425 MAINTENANCE ENGINEERING & MANAGEMENT

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Introduction to maintenance concepts: Corrective maintenance, Preventive maintenance, predictive maintenance, Total Productive maintenance, Maintenance economy & operation research (OR) techniques, Maintenance organization.

2. CONDITION MONITORING & MAINTENANCE MANAGEMENT

Introduction, Machine condition diagnosis Techniques, The economics of condition based maintenance, Formalized assessment of monitoring techniques, Condition based maintenance Policy, development in practice of Maintenance Management.

3. RELIBILITY CENTRED MAINTENANCE

Changing world of maintenance, maintenance and Reliability Centered Maintenance (RCM), Reliability Centered Maintenance (RCM), seven Basic questions, applying the Reliability Centered Maintenance process, Reliability Centered Maintenance (RCM) achieves.

4. TOTAL PRODUCTIVE MAINTENANCE

Basic concept of Total productive maintenance (TPM), Maximizing Equipment effectiveness, twelve steps of TPM development, Preparation for introducing TPM Development Activities, Master plan for TPM Promotion, Basic policies and objectives of TPM.

5. SPARE PART MANAGEMTNT

Strategies for spare parts management, ABC and XYZ analysis, just in time (JIT) lean manufacturing, Introduction to new approaches.

6. ROLE OF COMPUTERS IN MAINTENANCE

Role of computer in Preventive maintenance program, computerized trouble shooting, computerized maintenance management system, Functions of CMMS, Implementation of computerized maintenance management systems.

7. EQUIPMENT MANAGEMENT AND EVALUATION SYSTEM

Approaches to equipment management, integrated approach of TPM, Participative approach of TPM, 5-Ps approach to equipment management.

8. FAILURE STASTISTICS/ANALYSIS

Failure Analysis of Mechanical Components and Troubleshooting, Failure Mode Effects and Critical Analysis, Weibull Analysis, Fault Tree Analysis, FRACAS.

TEXT BOOKS

1. Introduction to TPM : Nakajima
2. Maintenance Engineering Handbook : Higgins
3. Maintenance Planning and Control : Kelly
4. Industrial Engineering and Management : O. P. Khanna

MEE-425 MANAGEMENT INFORMATION SYSTEM

L	T	P/D	Cr
3	1	0	3

1. INTRODUCTION

Organization and management, Management classification and Functions, Organizational structure, scalar point, span of control, Unity of command. Organizational systems, Open and Closed system, Application of systems concept to an organization, Information system, characteristics of MIS.

2. INFORMATION SYSTEM AND CONTNROL

Definition of information, Components of Information system, Evolution of Information systems Technology – The First generation, The Second generation, The Third generation, The fourth generation and Information systems today, Computer Hardware, A sample program, Data Representation, File processing and database processing. Case studies. Enterprise Information systems – Applications and goals. Information system control.

3. DECISION MAKING

Phases in Decision making process, Behavioral models of decision maker- classical Economic model, Administrative Model. Methods for decisions among alternatives, optimization techniques, pay off matrices, decision trees, Utility and Inference curves, statistical Technologies, Mini case studies.

4. DECISION SUPPORT SYSTEMS

Characteristic of DSS, classes of DSS, Expert system, cases, computer based decision support system, developing and implementing application system – life cycle approach, [prototyping approach, Quality assurance and evaluation of Information systems. Future development and Impact of Information Technology on organization and Society.

TEXT BOOKS:

1. Management Information System : Jerome Kanter
2. Information Management for Decision Making : Nambudiri
3. Management Information System : Davis Olson
4. Management Information System : Kroenke & Hatch
5. Information System : Steven Alter