

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 701 M Machine Design II

	Lectures	Tutorial	Practical
Teaching Hours	3	1	4
Examination scheme	100	25	Continuous Evaluation 40
Marks			Examination 60

1. Design of power transmission elements: Design of belt drives, selection of flat and V-belts, design of pulleys and flywheels. Design of gear drives-spur, helical, bevel and worm gear drives. Design of single and multistage speed reducers. Rating of gears as per I.S. and AGMA standards.
2. Design of gear boxes. Types of gear boxes, design of machine tool gear boxes using preferred numbers.
3. Design of clutches and brakes, types of clutches, design of single & multiple clutches, cone clutch and centrifugal clutch. Design of block brake, pivoted shoe brake, long shoe brake, internal shoe brake. Simple and differential band brake.
4. Design of bearings: Design of hydrodynamic journal bearings – Classification, material selection, Sommerfeld number and use of charts for the estimation of minimum film thickness, temperature rise, flow quantity etc. design of pressure fed and self contained bearings. Rolling contact bearings – classification and selection, factors affecting bearing life, bearing assembly and lubrication.
5. Load Lifting Devices: Selection of steel wire rope for hoists and cranes, crane hooks, design of hook block, sheaves and rope winding drums.
6. Introduction to pressure vessels: Thin and thick cylinder, classification of pressure vessels, loads, stresses and types of failures.
7. Statistical Consideration in machine Design: - Statistical analysis of tolerances, reliability, statistical factor of safety, MTBF, reliability of systems in series and parallel.

Practical: Based on the above syllabus each student has to submit at least two Major designs along with assembly and detail drawings for each and design report along with at least ten small design problems as tutorials.

References:

1. V.B. Bhandari, Design of Machine Elements, Tata McGraw-Hill Publishing Co., (1994).
2. Joseph Shigley, Mechanical Engineering Design, McGraw Hill Book Co., (1989).
3. R.C. Patel et. Al, Machine Design, Vol. & II, C. Jamnadas & Co., (1992).
4. Various Indian Standards and Design Data Books.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 702 M Energy Systems

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Introduction: Sources of energy, conventional and non conventional energy systems. Types of power plants. Like combined cycle and cogeneration plants, Thermal power stations.
2. Steam Generation: Types & steam generators, Natural circulation and its limitations. Critical pressure and forced circulation. High pressure boilers such as La Mont, Benson, Schmidt, Velox. Boiler accessories, Furnaces, performance of boilers. Fuel handling systems.
3. Steam Turbines: Classification and general constructional features, compounding of turbines. Basic thermodynamics cycles. Rankine cycle regenerative, reheat and combined regenerative and reheat and cycles. Steam nozzles, flow through nozzles, nozzle efficiency. Super saturated flow in nozzles.
4. Impulse steam turbine: Velocity diagrams, forces on blades, blade efficiency. Gross stage efficiency of multistage turbines. Blade height calculations, carry over factor, blade velocity coefficient, reheat factor.
5. Impulse reaction turbines: Degree of reaction, Parson's reaction turbine, height of blade, stage efficiency, carries over factor.
Internal losses in steam turbines, governing.
6. Introduction to non-conventional energy systems such as solar, wind, tidal, wave, OTEC Bio-mass etc.

References:

1. M, M + WA-KIL, Power plant technology Mc. Graw-Hill.
2. Stridls boiler, F. ro, Dodge corporation, newgozle
3. Chrocch, Turbines, McGaw-Hill.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 703 M Production Technologies I

	Lectures	Tutorial	Practical
Teaching Hours	3	1	2
Examination scheme	100	25	Continuous Evaluation 20
Marks			Examination 30

Mechanics of metal cutting, tool materials, tool angles, chip formation, Merchant's theory, shear plane angle, shear stress and shear strain, tool forces, tool wear, tool life, temperature in machining, surface roughness, economics of machining, cost estimation, E.L.S and B.E.P. Introduction to thread and gear manufacturing process like hobbing, shaping rolling etc. Introduction to unconventional machining process like EDM, ECM, AJM, USM, etc. Introduction to kinematics of machine tools like lathe, milling machine, hobbing machine, shaping machine etc. Machine tool control and hydraulic circuits. Introduction to automates, tool layout for automates.

Tutorials and at least eight experiments based on above syllabus are to be performed by each student.

References:

1. A. Ghosh, A.K. Mallik, "Manufacturing science", East – West Press, 1988.
2. HMT, "Production Technology", Tata MC Graw Hill, 1980.
3. P.C. Pandey, H.S. Shah, "Modern Manufacturing Process", Tata MC Graw Hill, 1995.
4. B.P. Sinha, "Mechanical Estimating & Costing", Tata Mc Graw Hill, 1995.
5. N.K. Mehta, "Machine Tool Design", Tata MC Graw Hill, 1992.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 704 M CAD-CAM

	Lectures	Tutorial	Practical
Teaching Hours	3	1	2
Examination scheme	100	25	Continuous Evaluation 30
Marks			Examination 45

A: COMPUTER AIDED DESIGN (CAD)

1. Principles of computer aided design: Computer configuration for CAD applications. Computer peripherals for CAD.
2. Fundamentals of computer graphics: Two dimensional transformation, three dimensional transformation and projections.
3. Plane curves and space curves: Surfaces description and generation. Hidden line algorithms for wire frame modeling, surface modeling, and solid modeling.
4. Introduction to computer aided drafting and analysis software such auto CAD, PRO-ENGINEER, ANSYS, etc. CAD system utilization application.

B: COMPUTER AIDED MANUFACTURING (CAM)

5. Introduction, Numerical control of m/c tools nomenclature, types features, MCU, actuations systems.
6. Transducers, tooling for N.C. Machines ISO G & M codes N.C. part programming, tool setting, cutter compensation, parametric programming, APT language structure APT Geometry, motion commands, post processor commands, respective programming, compilation and control commands.
7. Introduction & Group Technology, coding methods, CAPP, FMS scheduling and sequencing.

At least eight experiments are to be performed based on the above syllabus.

References:

1. David F. Rogers & J. Alan Adams Mathematical Elements for Computer Graphics Mc Graw Hill International Edition, 1990.
2. T.K. Kundra, P.N. Rao, M.K. Tewari Numerical control and Computer Aided Manufactures pub Tata Mc Graw Hill International Edition, 1990.
3. M.P. Groover, Automation, Production Systems & Computer Integrated Manf., Prentice Hall, 1989.
4. C.S. Krishnamoorthy and S. Rajeev, Computer Aided Design, Narosa Publishing House, 1991.
5. M.P. Goover and E.W. Zimmers, Computer Aided Design and Manufacturing, Prentice Hall of India Pvt., New Delhi, 1997.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 705 M Project Preliminaries

	Lectures	Tutorial	Practical
Teaching Hours	0	0	3
Examination scheme	0	0	Continuous Evaluation 20
Marks			Examination 30

This shall consist of preliminary work pertaining to project, such as study of literature, design calculations, sketches & drawings, material procurement, preparations for fabrication planning and preparation of experiments, additions and alternations of existing test rigs, industrial visits etc.

The work done shall be compiled in form of a brief report and shall be submitted to the head of the department at end of the semester VII for purpose of evaluation.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 710 M (Elective I) Microprocessor Application Mechanical Engineering

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Introduction to microprocessors and microcomputers review of digital logic, Boolean algebra and numbering systems.
2. Combinational and sequential logic, Boolean functions of two, three and four variables, karnaugh maps, Elementary ideas about logic circuits of interest such as half and full adder, magnitude comparator, decoders, encoders, multiplexers, demultiplexers, flip-flops counters, and timers.
3. 8085 microprocessors architecture and its operations, instruction set, memory, input-output, interfacing devices, instruction timing and operation status.
4. Assembly language programming, elementary ideas of other microprocessors and micro controllers, programmable logic controllers.
5. Application of microprocessors to mechanical and production engineering such as Data acquisition systems, process control etc.

Reference:

1. R.S. Gaonkar, "Microprocessor Architecture, Programming and Applications" Wiley Estern Ltd., 1995.
2. A.P. Malvino and D.P. Leach, "Digital Principles and Applications", Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 1991.
3. C.M. Gilmore, "Microprocessors Principles and Applications", Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 1997.
4. T. Hanley, "Microprocessors and Microcomputer Technology", BPB Publications, New Delhi, 1994.
5. V.K. Bansal, "Design of Microprocessors Based Systems", New Age International (P) Ltd., New Delhi, 1992.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 711 M (Elective I) Mechanical Vibrations

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Review of Fundamental: Undamped & damped free vibration of single degree of freedom systems. Equations of motions, energy method, free vibration with viscous damping.
2. Forced vibration of single degree of freedom system: Forced vibration with constant harmonic excitation, steadily state vibrations, forced vibration with reciprocating & rotary unbalance, vibration isolation & transmissibility frequency response curves.
3. Two degrees of freedom system: Normal modes & natural frequencies, Torsional system. Generalized co-ordinates and co-ordinates couplings, vibration absorbers, lagrange's equation.
4. Multi degree of freedom system: Equations of motion in terms of influence coefficients flexibility coefficients, Maxwell's reciprocal theorem, mass & stiffness matrix, matrix methods, torsional vibrations of multi rotor systems. Stodola method, holzer's method, forced vibration of multi rotor system, dynamics of rotor.
5. Vibration of continuous systems: Longitudinal vibration of bar, torsional vibration of shaft.
6. Industrial applications: Vibration isolation, shock isolation, practical aspects of vibration isolation. Uses of vibration in cleaning, conveying, machining, conditioning machining, conditioning monitoring. Vibration measuring instruments etc.

Reference:

1. G.K. Grover, Mechanical Vibrations, Nem chand & Bros, Roorkee-1996.
2. S. Graham Kelley, Fundamental of Mechanical Vibrations, McGraw Hill international, 1993.
3. W.I. Thomson, theory of vibration with application prentice hall, 1975.
4. R.A. Anderson, fundamentals of vibration, Amerind Pub Co., 1972.
5. S.S. Rao, Mechanical Vibrations, Addison – Wesley Pub Co., 1995.
6. G.W. Van santen, introduction to a study of mechanical vibration, cleaver-hume press ltd., 1961.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 713 M (Elective) Analysis and Synthesis of Mechanics

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Introduction to mechanics: Geometry of motion, plane and space mechanisms, terminology, definitions and assumptions. Relative motion, degree of freedom, kinematics inversions, mechanical advantage.
2. Kinematic analysis of plane mechanics: Position and displacement analysis-position of a point, graphical and complex-algebra method for displacement. Rotational and translational displacement. Velocity analysis-relative motion, linear and angular velocity, relative, velocity, instant centers, Aronhold Kennedy theorem of three centers, angular velocity ratio Freudenstein's theorem. Velocity analysis by analytical method, graphical method. Acceleration analysis-linear and angular acceleration, acceleration difference, relative acceleration and Coriolis acceleration. Acceleration analysis by analytical graphical methods. Computer-aided kinematic analysis.
3. Curvature theory. Fixed and moving centroids, velocity and acceleration, inflection circle. Euler Savary equation. Boiler's theorem, cubic of stationary curvature.
4. Kinematic synthesis of plane mechanism: Type, number and dimensional synthesis, function generation and path generation Chebyshev spacing three, four, five point synthesis. Burmester point theory, synthesis by analytical and graphical methods. Computer aided kinematic synthesis.

Reference:

1. J.E. Shigley and J.J. Vicker, theory of machines and mechanics: International student edition McGraw Hill.
2. G.N. Sandor and A.G. Erdman Mechanism Design – Analysis and synthesis Vol. I & II. Prentice Hall of India Pvt. Ltd. (Eastern Economic Edition).
3. A.Ghosh and A.K. Mallik, theory of mechanisms and machines (East West Press Pvt. Ltd.)
4. A.S. Hall, Kinematic and Linkage Design (Prentice Hall of India Pvt. Ltd.)
5. R.S. Hartenberg and J. Dovanit, Kinematic synthesis of Linkages (McGraw Hill Book Co.).
6. J. Duffy analysis of mechanisms and robot manipulators. (Edward Arnold Publishers Ltd.), 1980.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 713 M (Elective) Mechanical Design Analysis

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Introduction: Review of Force, Moment and stress, force-moment equivalents, static equilibrium-general three dimensional cases. Dynamic force equilibrium stress strain relation, principle stresses, theories of failure.
2. Elements of theory of elasticity: stress tensor, plane stress problems, and equilibrium and compatibility equations in Cartesian co-ordinates. Airy's stress function.
3. Stress analysis of rotating discs and flat plates special cases of circulars and rectangular plates.
4. Fatigue failure: Soderberg and goudman's equations, designing for finite life, cumulative fatigue damage.
5. Elementary analysis of creep and thermal stresses.
6. Experimental techniques: Strain gauges, Rosettes.

References:

1. Arthun H. Burr, "Mechanical Analysis and Design, Preantice-Hall of India"
2. Kenneth S. Edwards, Jr and Robert B. McKee, "Fundamentals of Mechanical Component Design" Mc Graw Hill (1991)
3. R.C. Patel, et. al "Advanced Strength of Materials", C. Jamanadas & Co. (1987).
4. Joseph E. Shigley, "Mechanical Engg. Design", Mc Graw Hill (1989)
5. Vera B. Anand, "Computer graphics and geometric modeling for Engineers", John Wiley & Sons Inc. (1993).

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 714 M (Elective I) Advance Refrigeration & Air Conditioning

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Compound Vapor Compression Refrigeration System: Two stage compression with water intercooler, liquid sub cooler and flash chamber. Three stage compression with multiple expansion valves and flash intercoolers. Recent developments in refrigerants. Methods of defrosting, expansion devices.
2. Analytical Of Vapor Absorption Systems: Temperature concentration and enthalpy concentration diagrams. Enthalpy balance for various components of aqua ammonia systems.
3. Steam Jet Refrigeration Systems: Introduction analysis of steam jet refrigeration system, performance of the system.
4. Non Conventional Refrigeration Systems: Thermo electric refrigeration system, vortex tube, pulse tube refrigeration, adiabatic demagnetization.
5. Comfort Air-conditioning: Requirements of comfort air conditioning, thermodynamics of human body, comfort charts, effective temperature, ventilation standards.
Design of air conditioning systems: Review of cooling load calculations by pass factor, effective sensible heat factor, design consideration for cooling coils, de-humifiers and air washers, central air conditioning and unitary air conditioning systems, factory air conditioning.
6. Duct Design: Fluid flow and pressure losses duct design, duct arrangement system, noise and noise control.

Reference:

1. Thrakeld J.L.: Thermal environmental engineering, prentice hall, 1982.
2. Khurmi R.S. and Gupta J.K.: A text book of air conditioning and refrigeration, Eurasia publishing house (P) Ltd., New Delhi, 1994.
3. Arora S.C. and Domkundwar S., A. course in refrigeration and air conditioning, Dhanpat rai and sons, Delhi, 1997.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 715 M (Elective I) Safety Engineering

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Safety and Safety Psychology: Concept-Needed-Altitude-Conflict-Morule-Different etc.
2. Statistics Of Safety: Nature-source-need of static in safety-accident cost-management policy-Direct (Indirect loss/cost-cost to society tubler)
3. Appraisal Analysis Inspection Investigation Control: Technique-investigation approach-check list-house keeping.
4. Light Color Ventilation And Temperature: Purpose-principles-types-regulaion-control-of heat.
5. Safety in Engineering Ind. Other Industries: Need-type of ind.-statutory provision-health hazurel-control on site-of site energy-etc.
6. Safety in Mat. Handling And At Work Station: Lifting equipments-lifts-hoist-safety as peet-design consideration statutory need-testing-insp-responsibilities etc.
7. Noise Vibration Pollution: Concept-need-effect-on work force-statutory recommendation, remedy, compilation-control.
8. Safety Laws: Factory act 1948-ILO corenkan-social security legislation-boiler act-environment rules-public liabilities, insurance-child act etc.

Reference:

1. B.K. U Mistry, "A course in industrial safety".

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 716 M (Elective) Automobile Engineering

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Power Plant: Constructional features of different types of engines used in automobiles.
2. Vehicle Performance: Resistance to motion of vehicle, air, rolling and gradient resistance. Power requirement for acceleration and grad ability, selection of suitable rear axle and gear ratios, carburetion.
3. Drive Mechanisms: Torque, thrust, propeller shaft, joints (universal). Differential axles, materials, bearing loads, rear wheel drive, front wheel drive, all wheel drive.
4. Suspension: Types, springs, materials, shackles and mounting, independent suspension system, torsion bar, shock absorber – types, construction and working, vibration and riding comforts.
5. Brakes: Types, stopping time and distances, braking efficiency, weight transfer during braking, shoe and disc brakes, Brakes power ratio, hydraulic and power brakes. Layout and details of components.
6. Front Axle and Steering Systems: Axle parts and material, Load and Stress, steering heads, axle bearing wheel alignment, steering geometry layout of system. Steering system for independent suspension and front wheel drive, wheel wobble etc.
7. Clutch: Types and necessity, description and working, torque damper, pedal pressure, centrifugal automatic, vacuum hydraulic operated clutch, Fluid transmission-advantages and disadvantages.
8. Gear Box: Necessity, Sliding mesh, constant mesh, synchromesh, epicycle, Overdrives. Electric transmission-advantages and disadvantages.
9. Electrical Equipment: Circuits, wiring system, ignition coil, magneto and electronics, charging system, battery and auxiliary circuits.

Reference:

1. G.B.S. Narang: Automobile Engineering 1979, khanna publishers, Delhi.
2. R.P. Sharma: A course in Automobile Engineering, 1977 Dhanpat Rai & Sons, Delhi
3. Automobile Engineers Reference Book Editor E. Molloy, London, George Newves Limited.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 717 M (Elective I) Analysis of Solar Thermal Systems

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Thermal of flat plate collectors: Radiation transmission through covers, absorption, transmittance absorption product, basic energy equation of collector, temperature distribution, collector efficiency factors, collector heat removal factor, collector overall efficiency, collector performance.
2. Theory of Solar Air Heater, Basic Energy equation, collector efficiency factors, collector heat removal factors, air heater efficiency, performance of air heaters.
3. Analysis of cabinet drier & cooker: Basic energy balance, performance analysis of cooker, cooking period, various types of driers & cookers.
4. Theory of concentrating collectors: Concentration principles, thermodynamic limit of concentration, theory of cylindrical parabolic collectors, collector heat removal factor, and collector heat removal factors, collector efficiency, collector performance, introduction to CPC.

Reference:

1. Sukhtme S.P., "Solar Energy Principles of Thermal Collection and Storage", 2nd Edi. Tata McGraw Hill, New Delhi, 1996.
2. Daffie, J.A. and Beckman, W.A. "Solar Engineering of Thermal Processes", 2nd Edi. John Wiley & Sons, N.Y., 1991.
3. Tiwari G.N., suneja sangeeta. "Solar Thermal Engineering Systems", Narosa Publishing House, New Delhi, 1997.
4. Saigh A.A.M. "Solar Energy Engineering" Academic press, N.Y. 1977.
5. Kreith F. and Kreider J.F. "Handbook of Solar Energy" McGraw Hill, N.Y., 1980.
6. Channiwala S.A. "Soalr Energy Data Book".
7. A. Mani "Solar Radiation Data for India".

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 718 M (Elective I) Corrosion Engineering

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Concept of electrometallurgy, electrochemistry electrode kinetics, polarization, exchange current density, mixed electrodes, mixed potential theory passivity, behavior of active, passive metals.
2. Principles of corrosion and oxidation, principles of corrosion in aqueous solutions. Electrochemical aspects. Metallurgical & other aspects.
3. Eight forms of corrosions, galvanic, crevice, pitting, intergranular, selective leaching, erosion corrosion, stress corrosion & hydrogen damage.
4. High temperature corrosion, corrosion environments corrosion of cast-irons, high alloy steels, nickel alloys, thermodynamics of gas metal systems.
5. Effects of mechanical factors on corrosion, stress corrosion cracking of stainless steels, high tensile stresses, aluminium & magnesium alloys corrosion fatigue, fretting corrosion & cavitation damage.
6. Corrosion control: Design & corrosion, cathodic protection, pretreatment and design of metal finishing methods of applying coatings. Some specific case studies related to engineering industries.

Reference:

1. A.S. Khanna, S.N. Malhotra, K.V.S. Santaram, M.K. Totalani, Metallic Corrosion Principles & Control, Wiley Estern Ltd., 1994.
2. Mrs. G. Fontana, corrosion Engineering, McGraw Hill Edition, 1987.
3. L.L. Sheir, Corrosion of Metals and Alloys, George Newnes Ltd., London, W.C.Z., 1965.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E- IV

Mechanical

Semester -VII

MED 719 M (Elective I) Production Management

	Lectures	Tutorial	Practical
Teaching Hours	3	1	0
Examination scheme	100	25	Continuous Evaluation 00
Marks			Examination 00

1. Production & Operations management: history, introduction, production system, functions of production planning & control, production & process planning.
2. Rotating sequencing-line balancing, loading, scheduling-short term scheduling Johnson method, dispatching, expending.
3. Material requirement planning (MRP)-MRP processing logic, MRP system components, lot sizing.
4. Capacity requirement planning (CRP) Capacity management capacity time horizons, CRP processing logic, CRP system components.
5. Replacement models-group replacement-selection of equipment.
6. Japanese management Techniques- total quality emphasis, KANBAN, repetitive manufacturing: push v/s pull systems, flexible manufacturing.
7. Just-In-Time manufacturing (JIT) JITB production system, elements of JIT.
8. Total quality management (TQM)-principle, TQM system, techniques of TQM. ISO 9000-elements, applications & benefits, zero defect. Implementation, registration & certification of ISO 9000.
9. Plant layout & plant location-location factors & models types of layouts, plants layout tools & techniques, evaluation of layout.
10. Material handling-principles of material handling, factors in material handling problems, cost aspects, introduction to material handling equipments.

Reference:

1. E.E. Adam & R.J. Elbert "Production & Operation Management" Prentice Hall of India Pvt. Ltd. New Delhi, 1993.
2. J.B.Dilworth, "Operation Management", McGraw-Hill Inc. Co., 1992.
3. J.G. Monks, operations Management, McGraw-Hill Book Co., 1987.
4. Dr. K.C. Jain & Dr. L.N. Agarwal, "Production Management", Khanna Publishers, Delhi, 1995.
5. M.G. Korgaonker, Just in time Manufacturing, "McMillan India Ltd. Mumbai, 1992".
6. J.M. Apple, "Plant layout & Material Handling", John Wiley & sons, 1997.