B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
FLUID MACHINES
ME-351

L	T	P	Cr		
3	1	-	4	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT I

Impact of Jets: Impact of jet on stationary and moving, flat and curved plates, Force on series of vanes, Radial vanes, Vortex motion, Free and forced vortex jet propulsion of ships

Units and dimensions: Dimensional homogeneity, Dimensional analysis methods, Rayleigh and Buckingham methods, Applications and limitations of dimensional analysis, Dimensionless numbers.

UNIT II

Turbines: Introduction, Development of hydraulic turbines, Components of hydropower plant, Classification of turbines, Surge tank and its type.

Pelton Turbine: Components, Number and dimension of buckets, Speed ratio, Jet ratio, Energy conversion, Condition for maximum efficiency, Design considerations, Governing etc.

Francis turbine: Components, working principles. Draft tube, Types of draft tube, Design considerations, Outward vs. Inward flow reaction turbines, Introduction to Deriaz turbine, Evolution of axial flow turbines, Kaplan turbine, Operation at off-design loads, Governing etc.

Unit quantities, Specific speed, Runway speed, Characteristics of turbines,

UNIT III

Centrifugal Pumps: Introduction, Classification, Components, Principle of working of centrifugal pumps. Various heads, Energy conversion, Euler's head and its variation with vane shapes. Effect of finite number of vanes, Losses and efficiencies, Minimum starting speed of centrifugal pump, Limitation of suction lift, Net Positive Suction Head (NPSH), Multistage pumps, Specific speed and performance.

Reciprocating Pumps: Working principles, Classification, Components of reciprocating pumps, Discharge, Discharge slip, Power input, Indicator diagram, Effect of friction, Acceleration and pipe friction, Maximum speed, Air vessels, Comparison with centrifugal pumps. Model testing of pumps.

UNIT IV

Cavitation: Cavitations and their effects, Cavitation parameters, Detection and Prevention of cavitations. Model-testing of turbine.

Hydraulic devices: Jet pump, Airlift pump, Gear pump, Submersible pump, Pump problems Hydraulic accumulators, Hydraulic intensifier, Hydraulic lift, Hydraulic crane, Hydraulic coupling, Torque converter, Hydraulic ram.

Text Books:

1. Fluid mechanics and machines- R. K. Bansal
2. Fluid machines and machinery – S. K. Aggarwal, TMG.

Reference Books:

1. Fluid mechanics and Fliud power engineering – D. S. Kumar, Katson Publisher
2. Fluid Mechanics and Hudraullic machines – S. S. Rattan, Khanna publisher
3. Introduction to fluid mechanics and machinery – Som and Bishwas, TMH

B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
INTERNAL COMBUSTION ENGINES AND GAS TURBINES
ME-352

L	T	P	Cr		
3	1	0	4	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT -I

Heat engines: Heat engines, Internal and external combustion engines, Classification of I.C. Engines, Cycle of operations in four strokes and two-stroke IC engines, Wankle Engine.

Air standard cycles: Assumptions made in air standard cycles, Otto cycle, Diesel cycle, Dual combustion cycle, Comparison of Otto, diesel and dual combustion cycles, Sterling and Ericsson cycles, Air standard efficiency, Specific work output. Specific weight, Work ratio, Mean effective pressure, Deviation of actual engine cycle from ideal cycle.

UNIT-II

Carburetion: Mixture requirements for various operating conditions in S.I. Engines, Elementary carburetor, Calculation of fuel air ratio, Carburetors.

Injection Systems: Requirements of a diesel injection system, Type of injection system, Petrol injection, Requirements of ignition system, Types of ignition timing, Spark plugs.

Combustion in IC engines: S.I. engines, Igniting limits, Stages of combustion in S. I. Engines, Ignition lag, Velocity of flame propagation, Detonation, Effects of engine variables on detonation, Theories of detonation, Octane ratio of fuels, Pre-ignition, S.I. engine combustion chambers. Stages of combustion in C.I. Engines, Delay period, Variables affecting delay period, Knock in C.I. Engines, Cetane rating C.I. Engine combustion chambers.

UNIT-III

Lubrication and Cooling: Functions of a lubricating system, Types of lubrication system, Mist, Well sump and dry sump systems, Properties of lubricating oil, SAE rating of lubricants, Engine performance and lubrication, Necessity of engine cooling, Disadvantages of overcooling, Cooling systems, Air-cooling, Water-cooling, Radiators.

IC Engine Performance: Performance parameters, BHP, IHP, Mechanical efficiency, Brake mean effective pressure and indicative mean effective pressure, Torque, Volumetric efficiency, Specific fuel consumption (BSFC, ISFC), Thermal efficiency, Heat balance, Basic engine measurements, Fuel and oil consumption, Brake power, Indicated power and friction power, Heat lost to coolant and exhaust gases, Performance curves.

UNIT-IV

Pollution from IC Engines: Pollutants from S.I. and C.I. Engines, Methods of emission control, Alternative fuels for I.C. Engines, Alternatives to Hydrocarbon fuel engines (Fuel Cell), The Recent scenario on the pollution front.

Air Compression: Working of a single stage reciprocating air compressor, Calculation of work input, Volumetric efficiency, Isothermal efficiency, Advantages of multi stage compression, Two stage compressor with inter-cooling, Perfect inter cooling, Optimum intercooler pressure, Rotary air compressors and their applications, Isentropic efficiency.

Gas Turbines: Brayton cycle, Components of a gas turbine plant, Open and closed types of gas turbine plants, Optimum pressure ratio, Improvements of the basic gas turbine cycle, Multi stage compression with inter-cooling, Multi stage expansion with reheating between stages, Exhaust gas heat exchanger, Application of gas turbines.

Text Books:

1. Internal combustion engine: Mathur & Sharma.
2. Heat power engineering - vasandhani & kumar.

Reference Books:

1. Internal combustion engine – Ramalingam
2. Internal combustion engine – Ganeshan

B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
HEAT AND MASS TRANSFER
ME– 353

L	T	P	Cr		
3	1	-	4	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT -I

Introduction: Definition of heat, Modes of Heat Transfer, Basic Laws of heat transfer, Electrical Analogy of heat conduction, Conduction through composite Walls, Overall heat transfer coefficient.

Steady State Conduction: The general conduction equation in Cartesian, cylindrical and spherical coordinates, Steady state one dimensional heat conduction without internal heat generation, The plane slab, Cylindrical and spherical Shell, Critical thickness of insulation, Variable thermal conductivity, Steady state one dimensional heat conduction with uniform internal heat generation, Cylindrical and spherical systems, Fins of uniform cross section, Governing equation, Temperature distribution and heat dissipation rate, Efficiency and effectiveness of fins.

Unsteady State Conduction: Introduction to Transient (Unsteady State) Heat Conduction, Lumped Parameter Analysis, Biot Number, Time Constant

UNIT– II

Convection: Free and forced convection, Newton's law of cooling, Convective heat transfer Coefficient, Nusselt number, Dimensional analysis of free and forced convection, Analytical solution to forced convection problems, The concept of boundary layer, Hydrodynamic and thermal boundary layer, Momentum and Energy equations for boundary layer, Exact solution for laminar flow over an isothermal plate using similarity transformation, The integral approach, Integral momentum and energy equations, Solution of forced convection over a flat plate using the integral method. Analysis of free convection, governing equations for velocity and temperature fields. Relation between fluid friction and heat transfer, Reynolds analogy. **Dimensionless numbers:** Dimensionless numbers, Reynolds number, Prandtl number, Nusselt number, Grashoff number and Stanton Number and their significance, Heat transfer with change of phase, Nusselt theory of laminar film Condensation.

UNIT – III

Radiation: Theories of thermal radiation, Radiation Properties of Surfaces, Absorption, Reflection and transmission, Monochromatic and total emissive power, Black body concept, Planck's distribution law, Stefan Boltzmann law, Wein's displacement law, Lambert's cosine law, Kirchoff's law, Radiation Heat Exchange between black surfaces , Shape factor Algebra , Radiation Heat Exchange between Non - black surfaces , Network Analysis , Radiation Shields , Solar Radiation, Numericals

UNIT – IV

Heat Exchanger: Introduction, Classification of heat exchangers, Logarithmic mean temperature Difference, Area calculation for parallel and counter flow heat exchangers, Effectiveness of heat exchangers, N T U method of heat exchanger design, Applications of heat exchangers, Numericals. .

Reference and Text books:

1. A Text book of Heat Transfer by S.P Sukhatme, university press
2. Heat transfer by J.P. Holman, TMG
3. Heat and Mass transfer by D.S Kumar
4. Heat and Mass Transfer by R.K. Rajput

B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
STEAM GENERATION AND POWER
ME-354

L	T	P	Cr		
3	1	-	4	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Boilers: Introduction and classification, Comparison of fire tube and water tube boiler, Advantages of boilers, Lancashire, locomotive, Babcock, Wilcox boilers etc. Boiler mountings: stop valve, safety valve, blow off cock, feed check valve, water level indicator, fusible plug, pressure gauge. Boiler accessories: feed pump, feed water heater, preheater, super heater, economizer

Boiler Exhaust: Natural draught chimney design, artificial draught, stream jet draught, mechanical draught, calculation of boiler efficiency and equivalent evaporation

UNIT-II

Vapour and Combined Power Cycles: Carnot cycle, simple and modified Rankine cycle, Effects of operating parameters on Rankine cycle performance: effect of superheating, effect of maximum pressure, effect of exhaust pressure. Reheating and regenerative Rankine cycle. Types of feed water heater, reheat factor, binary vapour cycle.

Steam Engine: Simple steam engine, compound engine, function of various components.

UNIT-III

Steam nozzle: Function of steam nozzle, shape of nozzle for subsonic and supersonics flow of stream, variation of velocity, area of specific volume, steady state energy equation, continuity equation, nozzle efficiency, critical pressure ratio for maximum discharge, physical explanation of critical pressure, super saturated flow of steam, design of steam nozzle.

Condensers: Advantage of steam condensation, component of steam condensing plant, types of condensers, air leakage in condensers, Dalton's law of partial pressure, vacuum efficiency, calculation of cooling water requirement, air expansion pump.

UNIT-IV

Steam turbines: Introduction, classification of steam turbine, impulse turbine, working principal, compounding of impulse turbine, velocity diagram, calculation of power output and efficiency, maximum efficiency of a single stage impulse turbine, design of impulse turbine blade section, impulse reaction turbine, working principle, degree of reaction. Parsons turbine, velocity diagram, calculation of power output, efficiency of blade height, condition of maximum efficiency, internal losses in steam turbine, governing of steam turbine.

Text Books:

1. Thermal Engineering – P L Ballaney, Khanna Publishers
2. Thermodynamics and Heat Engines vol II – R Yadav, Central Publishing House

Reference Books:

1. Applied Thermodynamics for Engineering Technologists – T D Eastop and A McConkey, Pearson Education
2. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt Ltd

B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
MACHINE DESIGN - I
ME-355

L	T	P	Cr		
4	2	-	6	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note:-

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Fundamentals of Design:
Mechanical, Physical & Dimensional Properties of Materials, Plastic, Ceramic & Composite Material, Selection of Engineering Materials. Type of Loads, Stresses; Static stress, Varying stress, Thermal stress, Impact stress. Factor of Safety, theory of failures, Stress concentration & its Effect, Creep, Fatigue & Endurance limit & its Consideration in design. Goodman, Soderberg Criterion of design, Design for Limits, Fits & surface Finish, Principles of Mechanical Design.

UNIT-II

Considerations required for Design of Components:
Preferred Number, Concept of Tearing, Bearing, Shearing, Crushing & Bending etc.
Design of Fasteners & joints:
Riveted joints: Design of Riveted joints with/without Eccentric Loading.
Welded joints: Design of Welded joints with/without Eccentric Loading.
Bolted joints: Design of Bolted joints with/without Eccentric Loading.
Design of Pin joints & Cotter joints.

UNIT-III

Transmission Shafts: Design of Shafts Subjected to Pure Torsion; Simple Bending; Combined Bending & Torsion; combined bending& torsion as well as axial Loading.
Keys: Design of keys,
Shaft couplings: Design of Sleeve & Muff Coupling; Flange Coupling; Universal Coupling & Flexible Coupling.

UNIT-IV

Levers: Design of levers; Hand & foot lever; Crank lever; Lever for safety valve; Bell crank lever.
Pressure Vessels: Design of pressure vessels.
Pipe Joints: Design of Pipe joints; Oval, Circular & Square Flange pipe joint.
Power Screw: Function & type of Power Screw; Stresses & Design calculations.

Text Book:

1. Design of Machine Elements by Bhandari
2. A Text Book of Machine design by R.S Khurmi & J.K Gupta

Reference Book:

1. Machine Design by Sharma & Aggarwal
2. PSG Design Data Book.
3. Machine Design an integrated Approach by Robert Norton, Prentice Hall
4. Fundamental of Machine Component Design by R.C juvinnal,Johan Wiley& Sons

B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
FLUID MACHINES LAB
ME-35P1

L	T	P	Cr		
-	-	2	1	**On Semester Evaluation**	120
				End Semester Evaluation	80
				Maximum Time	2 hrs

List of Experiments

1. To study and perform lest on the Pelton wheel and to plot curves Q. P. V/S N at full, three fourth & half gate opening.
2. To study and perform test in the Francis Turbine and to plot curves Q, P V/S N at full, three- fourth & half gate opening.
3. To study and perform test on the Kaplan Turbine and to plot curves Q, P V/S N at full, three- fourth & half opening.
4. To study and perform test on Centrifugal Pump and to plot curves η, P V/S Q
5. To study and perform test on a Hydraulic ram and to find its Rankine, Abussion efficiencies.
6. To study and perform test on a Reciprocating pump and to plot the P and ηV/s H.
7. To study and perform test on a Gear Pump and to plot the curves Q, P V/s Pressure rise.
8. To study the working principle of Hydraulic press.

B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
I. C. ENGINE LAB
ME-35P2

L	T	P	Cr		
-	-	2	1	**On Semester Evaluation**	120
				End Semester Evaluation	80
				Maximum Time	2 hrs

List of Experiments

1. To make a trial on single cylinder 4-stroke Diesel Engine to calculate B. H. P., S.F.C. and to draw its characteristics curves.
2. To make a trial on 4-stroke high-speed diesel engine and to draw its Heat Balance Sheet.
3. To make a trial on Wiley's jeep Engine at constant speed to calculate B. H. P., S. F. C. Thermal efficiency and to draw its characteristic Curves.
4. To make Morse Test to calculate IHP of the multi cylinder petrol engine and to determine its mechanical efficiency.
5. To calculate the isothermal efficiency and volumetric efficiency of a two stage reciprocating air compressor.
6. To find out the efficiency of an air Blower.
7. To study the following models
   (a) Gas Turbine (b) Wankle Engine.
8. To study (a.) Lubrication and cooling systems employed in various I. C. Engines in the Lab (b.) Braking system of automobile in the lab
9. To study a Carburetor.
10. To study (i) the Fuel Injection System of a C. I. Engine.
    (ii) Battery Ignition system of a S. I. Engine
11. To study multi Cylinder four strokes vertical Diesel Engine test rig with Hydraulic Dynamometer.

Note: At least eight experiments should be performed from the above list.

B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
HEAT TRANSFER LAB
ME-35P3

L	T	P	Cr		
-	-	2	1	**On Semester Evaluation**	120
				End Semester Evaluation	80
				Maximum Time	2 hrs

List of Experiments

1. Determination of thermal resistance of a composite wall.
2. Determination of thermal conductivity of a slab using Guard plate method.
3. Forced convection heat transfer from a cylindrical surface.
4. Determination of critical heat flux.
5. Temperature distribution of a pin fin in free-convection.
6. Temperature distribution of a pin fin in forced-convection.
7. To determine the emissivity of a copper plate at different temperatures.
8. Determination of Stefan-Boltztman constant.
9. Determination of Effectiveness of a Heat exchanger.
10. To determine the overall heat transfer coefficient of finned tube heat tube exchanger.

Note: Out of above list, eight experiments must be performed.

ELECTIVES

B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
PRINCIPLES OF INDUSTRIAL ENGINEERING
ME– 35E1

L	T	P	Cr		
3	0	-	3	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT I

Introduction: Introduction to work study, Method study, Basic procedure, Recording techniques (charts and diagrams), Micro-motion studies, Therbligs, SIMO-chart, and Principles of motion –economy.
Introduction, Objectives, technique, (time) information recording, methods of timings, Time study allowances, Work sampling technique, Performance rating and its determination PMTS, M.T.M., Work factor.

UNIT II

Study of Organization: Principles of organization, Importance and characteristics of organization, Organization theories, Classical Organization theory, Neo-Classical organization theory, Modern organization theory, Types of organization, Military or line organization, Functional organization, Line and staff organization, Committees.
Production Planning and Control: Objectives of PPC, Functions of PPC, Routing, Estimating, scheduling-master schedule, and Daily schedule, Gantt chart, Dispatching –centralized vs. decentralized.
Introduction, Product development, Product characteristics, Role of product development, 3Ss – Standardization, Simplification and Specialization.

UNIT III

Forecasting: Introduction, Objectives of sales forecasting, Types of forecasting, Methods of sales forecasting-Collective opinion method, Delphi technique, economic indicator method, Regression analysis, Moving average method, Time series analysis.
Inventory: Introduction, Functions of inventory, Types of inventory, Control importance and functions, Inventory costs, Factors affecting inventory control. Various inventory control models. A B C analysis, Lead-time calculations.

UNIT IV

Value engineering: Introduction, Objectives, Concept and life cycle of a product and VE, Steps in VE. Methodology and techniques.

Various concepts in industrial engineering

a) WAGES AND INCENTIVES: Concept, Types, Plans, Desirable characteristics.
b) ERGONOMICS: Importance, Man-machine work place system.
c) SUPPLY CHAIN MANAGEMENT: Definition, Concept, Objectives, Applications, benefits, some successful cases in Indian Industries.
d) JIT: Definition, Concept, Importance, Misconception, Relevance, Applications, Elements of JIT (brief description).
e) MRP: Introduction, Objectives, factors, Guide lines, Techniques Elements of MRP system, Mechanics of MRP, MRP-II
f) TIME MANAGEMENT: Introduction, Steps of time management, Ways for saving time.

Reference and Textbooks:

1. Production planning and control by S.Elion
2. Modren production Management by S.S Buffa
3. Industrial engg. and management manufacturing system by Surender kumar, Satya prakashan
4. Essence of Supply Chain Management by R.P mohanty and S.G Deshmukh
5. Industrial engg. and management by S Sharma and Savita sharama

B. TECH. 5TH SEMESTER (MECHANICAL ENGINEERING)
WORK STUDY & ERGONOMICS
ME– 35E2

L	T	P	Cr		
3	0	-	3	**On Semester Evaluation**	100
				End Semester Evaluation	100
				Maximum Time	3 hrs

Note: -

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Introduction: Introduction to industrial engineering and productivity, measurement of productivity, Introduction to work study, methods study principles and motion economy, Filming techniques and micro-motion analysis, Introduction to work measurement. Time study, performance allowances, work sampling,

UNIT-II

Introduction of Ergonomics: System approach to ergonomic model, Area of study covered under ergonomics. Man/machine systems, characteristics of man machine system, limitation of man & machine with respect to each other. Design approach: Work design consideration, General principles for carrying out the physical activities, Design of work place, machine at work place, seat for workplace.

UNIT-III

Controls: Criteria for control design, Hand controls and foot controls, Relationship between controls and display instruments, Controls for high precision work (Push buttons, Toggle switches, knobs etc.), Layout of panels and machine

Displays: Types of displays, Design recommendation for quantitative displays.

UNIT-IV

Climates:- Heat Humidity- Fundamentals of human thermal regulation, measuring the thermal environment, work in hot climate, work in cold climate protection against climatic extremes, effect of climate on performance.

Noise:- Terminology, physiological effects of noise, annoyance of noise, speed interference, hearing loss, temporary and permanent threshold shift, effect of noise on performance reduction of noise, personal noise protection.

Text Books:

1. Method Engineering study – Krick, S.V.
2. Work study and Ergonics – Suresh Dalela, Saurabh.

Reference Books:

1. Introduction of Ergonomics-Bridger-Tata McGraw Hill 1995
2. Work Study - Khanna– Dhanpat Rai & Sons-1995

PLANT LAYOUT AND MATERIAL HANDLING
ME-35E3

L	T	P	Cr		
3	0	0	3	**On Semester Evaluation**	**100**
				End Semester Evaluation	**100**
				Maximum Time	**3 hrs**

1. **There will be NINE questions in the question-paper. All questions carry equal marks.**
2. **First question covers the whole syllabus. It is objective/ short answer type (at least ten questions). Two questions will be taken from each of the four units.**
3. **Attempt five questions in all. FIRST question is compulsory. Attempt ONE question from each of the other four Units**

UNIT-I

Introduction

Importance of plant layout in plant design; essential features of good layout; Types of layout-product, process, combination types; characteristics features of plant layout in job shop, batch and continuous production system.

Factors in Plant Layout

Factors affecting design, design of plant layout viz. processes and operations, machinery and equipment; materials- their nature, volume, flow and storage, building and services, safety and man power.

UNIT-II

Planning, Design and Presentation

Process planning; principles of layout design, getting the facts, determination of flows, diagramming of flow, measurement of time involved, layout aids viz drawing, tapes, templates and three dimensional scaled model

Evaluation and Installation

Alternative layouts and their evaluation by travel chart and line balancing techniques; layout installation; role of flexibility in plant.

UNIT-III

Material Handling

Introduction; Definition and scope of Material Handling, Symptoms of inefficient Material handling, Benefits of properly planned material handling systems, Limitation and negative aspects of material handling systems, Objectives and Principles of material handling, analysis of material handling systems, unit load concept, Material in movement; factors affecting material handling; organization of material handling; relationship to plant layout.

UNIT-IV

Material Handling Systems and Equipment

Introduction, Classification of Material handling equipment, Material handling systems and selection of equipment; Different types of Conveyors, Hoists, cranes and Monorails, Mobile material handling equipments, container a support equipment, problems of packing, cost and size of organization

Text and Reference Books:

1. Material Handling — Immer
2. Production Operations Management — B.S.Goel
3. Plant and Design — F.Moor
4. Plant Layout and Material Handling — G.K.Aggarwal