Mandsaur University, Mandsaur
MhowNeemuch By-Pass Road, Sh. 31, Mandsaur 458001 (M.P.)
Syllabus of Examination w.e.f. (Session 2018-19)
Mechanical Engineering Diploma(03YDC)
Heat Transfer MEC ()

SEMESTER: V

Course Objectives:

The course is designed to explore the concepts of mechanisms of heat transfer under steady and transient condition .to understand the concepts of heat transfer through extended surfaces and its practical applications, to learn the thermal analysis and sizing of heat exchangers from industrial applications point of view .

Unit : 1 . Basic Concepts of Heat Transfer:

Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer; combined heat transfer mechanism. **Conduction:** General Heat Conduction equation – Cartesian and Polar Coordinates, conduction through a slab, tubes and composite structures, electrical analogies, critical-insulation-thickness for pipes,

Unit: 2: Unsteady heat conduction: Transient conduction, Newtonian cooling . Extended surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross section; fin efficiency, fin effectiveness, applications of fins.

Unit: 3: Convection:

Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes . Buckingham 'pie' theorem, correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient.

Unit: 4: Heat Exchangers:

Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method - NTU method, effectiveness of heat exchanger, industrial applications of heat exchangers.

Unit 5: Heat transfer through Thermal radiation:

Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from real surfaces; Black Body Radiation ,grey body radiation - Shape Factor , Electrical Analogy, radiation shields, radiation through gases.

Course Outcome:

Upon completion of this course, the students will be able to understand and apply different heat transfer principles in practical field for different applications.

List of Experiments (expandable):

(1) Conduction through a rod to determine thermal conductivity of material
(2) Forced and free convection over circular cylinder
(3) Free convection from extended surfaces
(4) Parallel flow and counter flow heat exchanger effectiveness and heat transfer rate
(5) Calibration of thermocouple
(6) Experimental determination of Stefen-Boltzman constant

References:

(1) Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley& Sons, 1998.
(2) Venkateshan. S.P., "Heat Transfer", Ane Books, New Delhi, 2004.
(3) Ghoshdastidar, P.S, "Heat Transfer", Oxford, 2004,
(4) Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
(5) Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000
(6) Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
(7)Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
(8) Yadav, R., "Heat and Mass Transfer", Central Publishing House, 1995.
(9) Fundamentals of Heat and Mass Transfer, Dr. D.S.Kumar

Mandsaur University, Mandsaur
MhowNeemuch By-Pass Road, Sh. 31, Mandsaur 458001 (M.P.)
Syllabus of Examination w.e.f. (Session 2018-19)
Mechanical Engineering Diploma(03YDC)
Industrial Training (MEC)

SEMESTER: V

Objective of Industrial Training

The objective of undertaking industrial training is to provide work experience in an industry so that student's engineering knowledge is enhanced. The student should take this course as a window to the real World and should try to learn as much as possible from real life experiences by involving and interacting with industry staff.

Scheme of Studies:

Duration: Minimum 2 weeks in summer break after IV semester, assessment to be done in V Semester

Scheme of Examination:

For the assessment of industrial training undertaken by the students, following components are considered with their weightage.

(a) Term Work in Industry	**Marks Allotted**
Attendance and General Discipline	5
Daily diary Maintenance	5
Initiative and participative attitude during training	5
Assessment of training by Industrial Supervisor	5
Total	20*

(b) Practical/Oral Examination (Viva-Voce) in Institution	**Marks Allotted**
1. Training Report	15
2. Seminar and cross questioning (defense)	15
Total	30

* - Marks of various components in industry should be awarded by the I/c of training in Industry but in special circumstances if not awarded by the industry then faculty in charge /T.P.O. will give the marks.

During training students will prepare a first draft of training report in consultation with section in charge. After training they will prepare final draft with the help of T.P.O. /Faculty of the Institute. Then they will present a seminar on their training and they will face viva-voce on training in the Institute.

Daily Diary- Industrial Training

Name of the Trainee---------- College ----------
Industry / work place ---------- Week No----------
Department /Section ---------- Date ----------

Dates	Brief of observations made, work done, problem/project undertaken, discussion held, literature consulted etc.

Signature of Supervisor (TPO/Faculty)	Signature of Trainee	Signature of Official in charge for Trg. In Indutry.

Supervision of Industrial Training

Faculty and TPO are supposed to plan industrial training in such a manner that students get exposure on most of the above area in the field.

One faculty member or TPO will plan industrial training of students in consultation with training manager of the industry (work place) as per the predefined objectives of training.

Monitoring visits will be made by training and placement officer/faculty in-charge for the group of students, of the college during training.

Guidance to the faculty / TPO for Planning and implementing the Industrial Training

Keeping in view the need of the contents, the industrial training program, which is spread to minimum 2 weeks duration, has to be designed in consultation with the authorities of the work place; Following are some of the salient points:

- Spelling out the objectives of the industrial training in behavioral terms and same is informed in advance to the 1) students, 2) authorities of the work place and 3) supervising faculty members.
- Discussing and preparing students for the training for which meetings with the students has to be planned.
- Meeting with industrial personnel and orienting them regarding the objective of the training and the expectations of the program.
- Correspondence with the authorities of the work place.
- Orientation classes for students on how to make the training most beneficial- monitoring daily diary, writing weekly reports, how to interact with various categories of industrial personnel, how to behave and undertake responsibilities, how to gather information form the workplace, ethics etc.
- Guiding students to make individual plans (week wise/ day wise) to undertake industrial training.,
- Developing a system of maintaining training records, by teachers for every batch of students for convenient retrieval.
- Inviting industrial personnel to deliver lectures on some aspects of training.

Action plan for planning stages at the Institutional Level

S.No.	Activity	Commencing Week	Finishing week	Remark
1.	Meeting with Principal			
2.	Meeting with colleagues			
3.	Correspondence with work place(Industry concerned)			
4.	Meeting with authorities of work place			
5.	Orientation of students for industry training			
6.	Scrutinizing individual training plan of students.			
7.	Commencement of individual training			
8.	First monitoring of industrial training			
9.	Second monitoring of industrial training			
10.	Finalization of Training report			
11.	Evaluation of performance at industry level			
12.	Evaluation of Industry Program in the Institutions.			

Course Outcome

Through industrial training students will learn about:

- Industrial environment and work culture.
- Prevention measures taken in industry against accident.
- Safety measures taken in industry during accident.
- Organizational structure and inter personal communication.
- Machines/equipment/instrument-their working and specifications.
- Project Planning, monitoring and control.
- Quality control and assurance.
- Maintenance system

- Costing system
- Stores and purchase systems.
- Roles and responsibilities of different categories of personnel.
- Customer services.

Mandsaur University, Mandsaur
MhowNeemuch By-Pass Road, Sh. 31, Mandsaur 458001 (M.P.)
Syllabus of Examination w.e.f. (Session 2018-19)
Mechanical Engineering Diploma(03YDC)
Mechatronics (MEC)

SEMESTER: V

Course Objective: To impart knowledge about the elements and techniques involved in Mechatronics systems• which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION: Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics.

UNIT II Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN Types- of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process.

Course Outcome:

Upon completion of this course, the students can able to design Mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International edition, 2007.

2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.

3. Smaili.A and Mrad.F , “Mechatronics Integrated Technologies for Intelligent Machines”, Oxford University Press, 2007.

4. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company, 2007.

5. Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007. 6. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

Mandsaur University, Mandsaur
MhowNeemuch By-Pass Road, Sh. 31, Mandsaur 458001 (M.P.)
Syllabus of Examination w.e.f. (Session 2018-19)
Mechanical Engineering Diploma(03YDC)
Metal Cutting & Machine Tool (MEC)

SEMESTER: V

Course Objective:

The course provides students with fundamental knowledge and principles in material removal processes.In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, Computer Numerical Control etc. To demonstrate the fundamentals of machining processes and machine tools. To develop knowledge and importance of metal cutting parameters. To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

UNIT – I : FUNDAMENTALS OF MACHINING: Elementary treatment of metal cutting theory – element of cutting process – geometry of single point tool angles, chip formation and types of chips – built up edge and its effects chip breakers, mechanics of orthogonal cutting – Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, coolants, tool materials.

UNIT – II : LATHE MACHINES: Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – box tools taper turning, thread turning – for lathes and attachments,. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes – tool layout and cam design for automats.

UNIT – III : SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working – principal parts – specifications, operations performed, machining time calculations.

DRILLING & BORING MACHINES: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – fine Boring Machines – jig boring machine, deep hole Drilling Machine.

UNIT – IV : MILLING MACHINES: Principles of working – specifications – classification of Milling Machines – Principle features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories to milling machines.

UNIT –V : FINISHING PROCESSES: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

1. To study of Tool geometry nomenclature.
2. To study of lathe machine
3. To make a job on lathe machine with operations like turning, step turning, drilling, thread cutting, knurling.
4. To study of drilling machine.
5. To prepare a job on drill machine.
6. To study of indexing on milling machine.
7. To prepare a spur gear on milling machine through indexing method.
8. Study of centre less grinding machine
9. To prepare a keyway on shaper machine.

Course Outcomes

Upon successful completion of this course, the students will be able to:
Apply cutting mechanics to metal machining based on cutting force and power consumption.
Operate lathe, milling machines, drill press, grinding machines, etc.
Select cutting tool materials and tool geometries for different metals.
Select appropriate machining processes and conditions for different metals.
Learn machine tool structures and machining economics.
Write simple CNC programs and conduct CNC machining.

TEXT BOOKS

1. Production Technology by R.K. Jain and S.C. Gupta.
2. Workshop Technology – B.S.Raghu Vamshi – Vol II
3. Metal cutting Principles by M.C. Shaw
4. Metal cutting and machine tools by Boothroyd
5. Production Technology by H.M.T. (Hindustan Machine Tools).
6. Production Engineering, K.C Jain & A.K Chitaley, PHI Publishers
7. Manufacturing technology II, P.N Rao
8. Technology of machine tools, S.F.Krar, A.R. Gill, Peter SMID, TMH (I)
9. Machine Tool & Shilp Vigyaan, P.N.Vijayvargiya, Deepak Prakashan

Mandsaur University, Mandsaur
MhowNeemuch By-Pass Road, Sh. 31, Mandsaur 458001 (M.P.)
Syllabus of Examination w.e.f. (Session 2018-19)
Mechanical Engineering Diploma(03YDC)
Plant Maintenance and Safety Engineering(MEC)

SEMESTER: V

Course Objective: The course imparts the exposure of various methods of plant maintenance and safety engineering which is an important aspect of manufacturing and processing industries The subject focuses on knowledge and understanding of various techniques of plant maintenance and industrial safety.

Unit : 1 . Basic concepts of Maintenance Engineering

Introduction of maintenance engineering : its definition, scope and aim, responsibility of maintenance department, Primary and secondary functions, .Types of maintenance, Types and applications of tools used for maintenance, cost of Maintenance & its relation with replacement economy,Service life of equipment.

Unit : 2 : Corrosion & Wear : Cause and prevention

Wear : definition and significance , types of wear , causes and effects , methods of wear reduction. Lubricants-types and applications. Lubrication methods –General sketch, Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wet and dry sump lubrication, Wick feed lubrication , Side feed lubrication, Ring lubrication .Definition, principle and factors affecting the corrosion, Types of corrosion, methods of corrosion prevention.

Unit : 3 : Fault finding, Periodic and preventive Maintenance :

Fault tracing-concept its importance, types of faults in general purpose machines, Decision tree analysis, need and applications ,Sequence of fault finding activities, problems in machine tools, hydraulic, pneumatic, automotive, Pump, Air compressor ,Internal Combustion engine. Periodic inspection-concept, .Degreasing, cleaning and repairing schemes , Overhauling of mechanical equipments, Common troubles and remedies. Concept of preventive maintenance, .procedure for periodic and preventive maintenance of Machine tools .

Unit :4: Industrial Safety

Industrial hazards and safety, Safety equipments, Accident – causes and effect, prevention measures, safety planning and plant maintenance, Factories act 1948 (for health and safety) wash rooms, drinking water, plant layouts, light, cleanliness, fire, guarding, pressure vessels, etc. Safety color codes .Fire prevention and fire fighting, equipment and method, CompensationAct-1923.

Unit : 5: Recovery, reconditioning and retrofitting:

Definition of recovery, reconditioning and retrofitting. Methods of recovery and their applications. Selection criteria of recovery methods .Reconditioning - process, features and advantages .Retrofitting - concept, need and applications.

List of Experiments (expandable) :

(1) To study about various types of plant layout and material flow patterns.
(2) To Identify and determine plant facility location
(3) To Study about material handling equipments.
(4) To study about Flexible Manufacturing System.
(5) To study about preventive and predictive maintenance techniques.
(6) To study about industrial acts and safety measures.

Course Outcome: After learning the course the students will be able to:

(a)learn various plant engineering and safety aspects
(b) Analyze and determine plant facility location their applications .
(c) understand various types of plant layout and flow patterns and material handling equipments.
(d) learn about industrial acts and safety aspects .

References:

(i) Maintenance Engineering by H.P. Garg (S. Chand and Company)
(ii) Maintenance Engineering Handbook by Higgins & Morrow(DA Information Services).
(iii) Maintenance and Safety Engineering" by A K Gupta
(iii) "Reliability and Maintenance Engineering" by R C Mishra

---

Mandsaur University, Mandsaur
MhowNeemuch By-Pass Road, Sh. 31, Mandsaur 458001 (M.P.)
Syllabus of Examination w.e.f. (Session 2018-19)
Mechanical Engineering Diploma(03YDC)
Process Planning, Estimating & Costing (MEC)

SEMESTER: V

Course Objective:

An engineer is supposed not only to design and produce a product in any industry, but also to give weight age for the economic factors. Knowledge of different manufacturing process only may not fulfils the need in field, but also to select the best process suiting to the technical and economic requirement of situation along with the right type of process selection

Unit I : Introduction to Planning: Process engineering, its scope and relation with product engineering and manufacturing, production system, types and characteristics.
Selecting and Planning the Process of Manufacture: Function, fundamental rules for the manufacturing process, basic design of product, influence of process engineering on product design, rechecking specifications, how materials selected affect process cost, using materials more economically, material cost balance sheet, eliminating operations, combined operations, selecting the process tooling, availability of equipment, make or buy decisions.

Unit II : Determining the Manufacturing Sequence: Operation, classifications and the manufacturing sequence, purpose of major process sequence Operation Routing - Routing uses, routing descriptions. Elements of Costs and their Allocation : Definition and objective of Estimating & costing, desirable conditions for a costing system, advantages of costing, elements of cost, , direct material cost, direct labour cost, direct expenses, prime cost overheads, indirect materials, indirect labour, indirect expenses administrative and selling expenses, analysis of total cost fixed cost and variable cost. Break even analysis.

Unit III: Depreciation: Definition & Concept, causes of depreciation methods of depreciation calculation. Profit: Profit methods of increasing profit, effects of the methods on production, market and sales. Budget : Definition, departmental budget and purpose of budgetary control. Overhead Allocation: Definition and classification of overheads, methods of overheads allocation viz-direct material cost, direct labour cost, man hour rate and machine hour rate, selection of appropriate method limitation of various methods.

Unit IV: Actual Cost Estimation: Process Materials and Manpower - Terminology associated with estimation, Calculation of volume, weight and cost of materials.
Machine Shop: Process, Materials and Man power - Terminology used in machine shop estimation, use of standard table to determine time elements for various machining processes, use of formulas to calculate actual machining time for different operations of machine tools, Calculation of production operation time per product per cycle, batch production time,

Welding shop- process, materials and Man-power Gas and Arc. Welding terminology, production operation time, labour cost, materials cost, cost elements, batch production cost.

Forging Shop: Process, Materials and Man power - Forging gross and net weight of forging, forging losses, materials cost, labour cost and batch production cost.

Course Outcome: . Estimation of material and manpower requirement and factors affecting the cost of production are other areas which are quite important from the production point of view. The curriculum of this course of process planning, estimating and costing has been outcome to for these requirements.

REFERENCES

1.Cost Control by G. R. Sharma. (National Productivity Council)
2 Engineer' s Glude to Costing (Institute of cost works Accounts)
3 Mechanical Estimating And Costing by T.R. Banga and & S. C. Sharma
(Khanna Pub.)
4 Mechanical Estimation and Costing by R.L. Shrimali & P.C. Jain (Jain Pub. House)
5 Mechanical Estimation And Costing (Resource Persons of Hill Publishing Co. T.T.T.L, Madars Tata McGraw Hill)
6 Machine Shop Estimation by Nordoff .
7 Learing Packing In Costing And Estimating (T.T.T.I. Bhopal Publication)
8 Process Engineering For Manufacturing By Eary and Johnson (Prentice Hall)
9 Fundamentals of Process Engineering by Benjaman W. Nicbel, Alon & Ropy
10 Produce Design And Process Engineering (McGraw Hill)
11 Yantriki Abhiyantriki Abhikalpan (Hindi) by K. D. Saxena. (Deepak Prakashan, Morar, Gwalior) .

Mandsaur University, Mandsaur
MhowNeemuch By-Pass Road, Sh. 31, Mandsaur 458001 (M.P.)
Syllabus of Examination w.e.f. (Session 2018-19)
Mechanical Engineering Diploma(03YDC)
Finite Element Analysis (Elective-I) (MEC)

SEMESTER: V

Course Objective: Finite Element Method is a key method to analyse engineering problem. To understand the concepts of FEM this course is designed.

Unit-I

Introduction

Structural analysis, objectives, static, Dynamic and kinematics analyses, Skeletal and continuum structures, Modeling of infinite d.o.f. system into finite d.o.f. system, Basic steps in finite element problem formulation, General applicability of the method.

Unit-II

Element Types and Characteristics

Discretization of the domain, Basic element shapes, Aspect ratio, Shape functions, Generalized co-ordinates and nodal shape functions. ID spar and beam elements, 2D rectangular and triangular elements, Axisymmetirc elements.

Unit-III

Assembly of Elements and Matrices

Concept of element assembly, Global and local co-ordinate systems, Band width and its effects, Banded and skyline assembly, Boundary conditions, Solution of simultaneous equations, Gaussian elimination and Choleksy decomposition methods, Numerical integration, One and 2D applications.

Unit-IV

Higher Order and Isoparametric Elements

One dimensional quadratic and cubic elements, Use of natural co-ordinate system, Area co-ordinate system continuity and convergence requirements, 2D rectangular and triangular requirement.

Course Outcome: The various methods of FEM have been learnt. Element type, assembly of elements, higher order and isoperimetric conceps has been learned.

REFERENCES

1. Rao, S.S., The Finite Element Method in Engineering, 2nd ed.., Peragamon Press,Oxford.
2. Robert, D. Cook., David, S. Malkins, and Michael E. Plesha, Concepts and
3. Application of Finite Element Analysis 3rd ed., John Wiley.
4. Chandrupatla, T.R. an Belegundu, A.D., Introduction to Finite Elements in
5. Engineering, Prentice Hall of India Pvt. Ltd.
6. Zienkiewicz O C, The Finite Element Method, 3rd ed, Tata McGraw Hill.

Mandsaur University, Mandsaur
MhowNeemuch By-Pass Road, Sh. 31, Mandsaur 458001 (M.P.)
Syllabus of Examination w.e.f. (Session 2018-19)
Mechanical Engineering Diploma(03YDC)
Industrial Engineering & Concepts (Elective-I) (MEC)

SEMESTER: V

Course Objective:

To enable the students understand the demand forecasting techniques and costing. To provide students an insight into the concepts of industrial engineering and organization. To familiarize the students with principles of work-study and Ergonomics. To introduce students to various aspects of plant design and materials planning.

Unit 1

Industrial Organization: Introduction to Industrial Engineering – Concepts - History and Development of Industrial engineering – Roles of Industrial Engineer – Applications – Productivity – Factors affecting productivity – Increasing productivity of resources – Kinds of productivity measures.

Unit 2

Production, Planning and Control: Definition and importance, types of production -job, batch and mass forecasting, routing, scheduling, dispatching and follow up. Break even analysis and Gantt chart Project scheduling, application of CPM and PERT techniques Analysis and control of project cost in CPM and PERT, simple numerical problems.

Unit 3

Plant Layout and Group Technology Plant location - Factors - Plant layout - Types - Layout design process – Computerized Layout Planning – Construction and Improvement algorithms - ALDEP - CORELAP and CRAFT.

Group technology-Problem definition - Production flow analysis - Heuristic methods of grouping by machine matrices – Flexible Manufacturing System - FMS work stations Material handling and Storage system-Cellular Manufacturing System.

Unit 4

Inventory Control : Definition, types of inventory - Codification and standardization ABC analysis. Economic ordering quantity Procurement cost, carrying charges, lead-time, re-order point, simple problems. Definitions, types of inspection and procedure Statistical quality control - Basic theory of quality control, Process capability Control charts for variables - and R, relationship between control limits and specification limits. Control chart for fraction defective (p), control chart for number of defect

Unit 5

Material Handling: Principles of economic material handling Hoisting equipment - forklift truck, Cranes- mobile motor cranes, overhead cranes, travelling bridges crane. Derrick crane. Whiler crane Conveying equipment - Package conveyors, gravity roller conveyors, screw conveyors, flight or scraper conveyors, bucket conveyors, bucket elevators, belt conveyors, and pneumatic conveyors.

Course Outcome:

Student will be able to conduct market research, demand forecasting and costing .Demonstrate the knowledge of designing plants and controlling production. Optimize the resources of an organization and improve productivity.

References:

1. Barnes Ralph M., "Motion & Time study: Design and Measurement of Work", Wiley Text Books, 2001.
2. Marvin E, Mundel & David L, "Motion & Time Study: Improving Productivity", Pearson Education,2000.
3. Benjamin E Niebel and Freivalds Andris, "Methods Standards & Work Design", Mc Graw Hill, 1997.
4. International Labour organization, "Work-study", Oxford and IBH publishing company Pvt. Ltd., N.Delhi, 2001.
5. Sanders Mark S and McCormick Ernert J, "Human Factors in Engineering and Design", McGraw-Hill Inc., 1993.
6. Khanna RB; Production and Operations Management; PHI
7. K.D.Saxena; Audhyogik Abhiyantriki; Deepak Prakashan
8. J.K.Kale; Audhyogik Prabandh; Deepak Prakashan