

DEPARTMENT OF MECHANICAL ENGINEERING

FACULTY OF ENGINEERING & ARCHITECTURE

JNV UNIVERSITY, JODHPUR

SYLLABUS

BACHELOR OF ENGINEERING

MECHANICAL

(SEMESTER SCHEME)

FOUR YEAR INTEGRATED COURSE

B. E. Second Examination, 2015

B. E. Third Examination, 2016

B. E. Final Examination, 2017

B.E. II Year (Mechanical), 2014-15

SEMESTER III EXAMINATION SCHEME

Branch Code	Subject Code	Subject	Lectures	Tutorials	Practicals	Contact Hours	Credits	Units	Exam Hours	Marks		
										Theory	Pract & Sess	Total
A: Written Papers												
ME	201 A	Engineering Thermodynamics (M)	3	1	-	4	3½	1	3	60	-	60
ME	202 A	Materials Technology (M)	3	-	-	3	3	½	3	60	-	60
ME	203 A	Kinematics of Machine (M)	3	1	-	4	3½	1	3	60	-	60
ME	204 A	Mechanics of Solids (M)	3	1	-	4	3½	1	3	60	-	60
MA	205 A	Mathematics (M)	3	-	-	3	3	½	3	60	-	60
EE	206 A	Electrical Technology (M)	2	-	-	2	2	½	3	50	-	50
Total (A)			17	3	-	20	18½	4½	-	350	-	350
B: Practicals and Sessionals												
ME	221 B	Thermal Engineering Lab. I (M)	-	-	3	3	1	½	-	-	50	50
ME	222 B	Machine Drawing (M)	-	6	-	6	2	1½	-	-	100	100
ME	223 B	Mechanics of Solids Lab. (M)	-	-	3	3	1	½	-	-	50	50
EE	224 B	Electrical Engineering Lab. (M)	-	-	2	2	½	½	-	-	50	50
Total (B)			-	6	8	14	4½	3	-	-	250	250
Grand Total (A+B)			17	9	8	34	23	7½	-	350	250	600

B.E. II Year (Mechanical), 2014-15

SEMESTER IV EXAMINATION SCHEME

Branch Code	Subject Code	Subject	Lectures	Tutorials	Practicals	Contact Hours	Credits	Units	Exam Hours	Marks		
										Theory	Pract & Sess	Total
A: Written Papers												
ME	251 A	Refrigeration & Air Conditioning (M)	3	1	-	4	3½	1	3	60	-	60
ME	252 A	Foundry & Welding Engineering (M)	3	-	-	3	3	½	3	60	-	60
ME	253 A	Kinematics & Dynamics of Machines (M)	3	1	-	4	3½	1	3	60	-	60
ME	254 A	Machine Design I (M)	2	-	-	2	3	½	3	60	-	60
ME	255 A	Numerical Analysis & Computer Programming (M)	2	-	-	2	3	½	3	60	-	60
ME	256 A	Engineering Statistics (M)	3	-	-	3	3	½	3	60	-	60
Total (A)			16	2	-	18	19	4	-	360	-	360
B: Practicals and Sessionals												
ME	271 B	Thermal Engineering Lab. II (M)	-	-	3	3	1	½	-	-	60	60
ME	272 B	Production Engineering Lab. I (M)	-	-	3	3	1	½	-	-	60	60
ME	273 B	Machine Design I (M)	-	4	-	4	1½	½	-	-	60	60
ME	274 B	Numerical Analysis & Computer Programming Lab. (M)	-	-	3	3	1	½	-	-	60	60
Total (B)			-	4	9	13	4½	2	-	-	240	240
Grand Total (A+B)			16	6	9	31	23½	6	-	360	240	600
FE	276 B	Co-curricular Activities	-	2	-	2	1	½	-	-	-	100

B.E. III Year (Mechanical), 2015-16

SEMESTER V EXAMINATION SCHEME

Branch Code	Subject Code	Subject	Lectures	Tutorials	Practicals	Contact Hours	Credits	Units	Exam Hours	Marks		
										Theory	Pract & Sess	Total
A: Written Papers												
ME	301 A	Steam Power Engineering (M)	3	1	-	4	3½	1	3	60	-	60
ME	302 A	Production Machine Tools (M)	3	-	-	3	3	½	3	60	-	60
ME	303 A	Industrial Organization & Management (M)	3	-	-	3	3	½	3	60	-	60
ME	304 A	Dynamics of Machines (M)	3	1	-	4	3½	1	3	60	-	60
ME	305 A	Machine Design II (M)	2	-	-	2	3	½	3	60	-	60
ME	306 A	Mechanical Measurements & Instrumentation (M)	3	-	-	3	3	½	3	60	-	60
Total (A)			17	2	-	19	19	4	-	360	-	360
B: Practicals and Sessionals												
ME	321 B	Thermal Engineering Lab. III (M)	-	-	3	3	1	½	-	-	60	60
ME	322 B	Production Engineering Lab. II (M)	-	-	3	3	1	½	-	-	60	60
ME	323 B	Machine Design II (M)	-	4	-	4	1½	½	-	-	60	60
ME	324 B	Mechanical Measurements & Instrumentation Lab. (M)	-	-	3	3	1	½	-	-	60	60
Total (B)			-	4	9	13	4½	2	-	-	240	240
C: Others												
ME	325 C	Practical Training I (M)	-	-	-	-	1	½	-	-	-	25
Grand Total (A+B+C)			17	6	9	32	24½	6½	-	360	240	625

B.E. III Year (Mechanical), 2015-16

SEMESTER VI EXAMINATION SCHEME

Branch Code	Subject Code	Subject	Lectures	Tutorials	Practicals	Contact Hours	Credits	Units	Exam Hours	Marks		
										Theory	Pract & Sess	Total
A: Written Papers												
ME	351 A	Internal Combustion Engines (M)	3	1	-	4	3½	1	3	60	-	60
ME	352 A	Fluid Mechanics I (M)	3	1	-	4	3½	1	3	60	-	60
ME	353 A	Metal Cutting & Metrology (M)	3	1	-	4	3½	1	3	60	-	60
ME	354 A	Industrial Engineering (M)	3	1	-	4	3½	1	3	60	-	60
ME	355 A	Mechanical Vibrations (M)	3	1	-	4	3½	1	3	60	-	60
ME	356 A	Machine Design III (M)	2	-	-	2	3	½	3	60	-	60
Total (A)			17	5	-	22	20½	5½	-	360	-	360
B: Practicals and Sessionals												
ME	371 B	Thermal Engineering Lab. IV (M)	-	-	3	3	1	½	-	-	60	60
ME	372 B	Production Engineering Lab. III (M)	-	-	3	3	1	½	-	-	60	60
ME	373 B	Machine Design III (M)	-	4	-	4	1½	½	-	-	60	60
ME	374 B	Technical Dynamics Lab. (M)	-	-	2	2	½	½	-	-	60	60
Total (B)			-	4	8	12	4	2	-	-	240	240
Grand Total (A+B)			17	9	8	34	24½	7½	-	360	240	600
FE	376 B	Co-curricular Activities	-	2	-	2	1	½	-	-	-	100

B.E. Final Year (Mechanical), 2016-17

SEMESTER VII EXAMINATION SCHEME

Branch Code	Subject Code	Subject	Lectures	Tutorials	Practicals	Contact Hours	Credits	Units	Exam Hours	Marks		
										Theory	Pract & Sess	Total
A: Written Papers												
ME	401 A	Heat and Mass Transfer I (M)	3	1	-	4	3½	1	3	70	-	70
ME	402 A	Fluid Mechanics II (M)	3	1	-	4	3½	1	3	70	-	70
ME	403 A	Power Generation (M)	3	-	-	3	3	½	3	70	-	70
ME	404 A	Manufacturing Technology (M)	3	1	-	4	3½	1	3	70	-	70
ME	405 A	Operations Research (M)	3	1	-	4	3½	1	3	70	-	70
Total (A)			15	4	-	19	17	4½	-	350	-	350
B: Practicals and Sessionals												
ME	421 B	Thermal Engineering Lab. V (M)	-	-	3	3	1	½	-	-	50	50
ME	422 B	Fluid Mechanics & Machines Lab. (M)	-	-	2	2	½	½	-	-	50	50
ME	423 B	Production Engineering Lab. IV (M)	-	-	3	3	1	½	-	-	50	50
ME	424 B	Design Engineering (M)	-	3	-	3	1	½	-	-	50	50
ME	425 B	Project (Phase I) (M)	-	3	-	3	1	½	-	-	50	50
Total (B)			-	6	8	14	4½	2½	-	-	250	250
C: Others												
ME	426 C	Practical Training II (M)	-	-	-	-	1	½	-	-	-	50
Grand Total (A+B+C)			15	10	8	33	22½	7½	-	350	250	650

B.E. Final Year (Mechanical), 2016-17

SEMESTER VIII EXAMINATION SCHEME

Branch Code	Subject Code	Subject	Lectures	Tutorials	Practicals	Contact Hours	Credits	Units	Exam Hours	Marks		
										Theory	Pract & Sess	Total
A: Written Papers												
ME	451 A	Heat and Mass Transfer II (M)	3	1	-	4	3½	1	3	70	-	70
ME	452 A	Gas Dynamics & Gas Turbines (M)	3	1	-	4	3½	1	3	70	-	70
ME	453 A	Hydraulic Machines (M)	3	1	-	4	3½	1	3	70	-	70
ME	454 A	Production & Operations Management (M)	3	-	-	3	3	½	3	70	-	70
ME	455 A	Elective (M)	3	-	-	3	3	½	3	70	-	70
Total (A)			15	3	-	18	16½	4	-	350	-	350
B: Practicals and Sessionals												
ME	471 B	Heat & Mass Transfer Lab. (M)	-	-	3	3	1	½	-	-	50	50
ME	472 B	Production Engineering Lab. V (M)	-	-	3	3	1	½	-	-	50	50
ME	473 B	FMS & Industrial Engineering Lab. (M)	-	-	3	3	1	½	-	-	50	50
ME	474 B	Project (Phase II) (M)*	-	6	-	6	2	1½	-	-	100	100
Total (B)			-	6	9	15	5	3	-	-	250	250
C: Others												
ME	475 C	Educational Tour (M)	-	-	-	-	1	½	-	-	-	25
Grand Total (A+B+C)			15	9	9	33	22½	7½	-	350	250	625
FE	476 B	Co-curricular Activities	-	2	-	2	1	½	-	-	-	100

*Project (Phase II) is continuation of Project (Phase I).

ME 202 A: MATERIAL TECHNOLOGY (M)

3L

3 Hours, 60 Marks

Crystalline Nature of Solids: Crystal structure and space lattice, packing arrangement, coordination number, crystallographic planes and Miller indices; Imperfection in crystals, point defects – vacancies, Schottky, Frenkel – and line defects – dislocations, edge, screw; Burgers vector; Diffusion and crystallization of metals, Cooling curves, Nucleation, Grain growth.

Plastics Deformation of Metals and Alloys: Internal stresses, role of dislocation, slip, Frank-Read source, twinning; Strain hardening, Effect on mechanical properties – Stress-strain curve, Strength and Toughness, Hardness, Impact, Ductility and Brittleness, Fatigue, Creep, and Fracture. Effect of temperature – Recovery, Recrystallisation, Hot and Cold deformation.

Phase Diagrams and Structure of Alloys (Iron-Carbon system): Components and Phases, Solidification and Solubility; Equilibrium Phase Diagrams, Dendritic segregation (Coring), Diffusion, Precipitation hardening, Ageing; Eutectics and Eutectoids.

Heat Treatment of Steels: Phase transformation, TTT diagrams (S curves); Stress relief and Annealing, Quenching and Hardening, Tempering, Normalizing, Hardenability, Case hardening, Carburising, Nitriding, Cyaniding.

Engineering Materials: Effects of alloying elements in steels; Plain Carbon steels, Alloy steels –Stainless steels, Magnetic materials; Non-ferrous metals and alloys – Brass and Bronze, Aluminium alloys, Bearing materials. *Brief introduction to non-metallic materials:* Polymers, Ceramics, Composites, Nano materials, Smart materials and their applications.

Powder metallurgy: Metallic powders – Production and Characteristics; Compaction and Sintering; Materials and Products.

ME 252 A: FOUNDRY AND WELDING ENGINEERING (M)

3L

3 Hours, 60 Marks

Foundry: Mould making; Pattern – types, allowances; Moulding sand – ingredients, additives, properties, methods of testing; Core materials. *Casting Design:* Metal solidification, cooling, shrinkage, directional solidification; Chaplet and Chill, Gate, Runner and Riser; Product design considerations.

Expendable Mould Casting methods: Sand casting – Green, Dry, Loam sand moulding, Carbon dioxide moulding, Pit and Floor moulding; Shell moulding; Investment casting; Plaster and Ceramic mould casting. *Permanent Mould Casting Methods:* Die casting; Centrifugal casting; Continuous casting.

Foundry Practices: Equipment, machines and mechanization; Melting furnaces – constructional features and operation of Cupola, Electric furnace; Fettling, cleaning and inspection; Casting defects and remedies; Sand reclamation.

Welding: Metal coalescence; Types of joints, welds and welding positions; Physics and metallurgy of welding; Weldability. *Brazing and Soldering:* Methods and materials.

Fusion Welding: (i) *Arc Welding:* Principle; Electrodes, welding machines, tools and power source – current, voltage and polarity; Constant current and Constant potential machines; Shielded metal arc welding; Gas metal arc (MIG); Flux-cored arc; Electrode gas; Submerged arc. Non-consumable electrode arc welding processes – Gas tungsten arc (TIG); Plasma arc; Carbon arc and Stud welding. (ii) *Resistance Welding:* Spot, Seam, Projection, Flash butt, Upset, Percussion, High-frequency resistance welding; Thermal spraying. (iii) *Oxyacetylene Gas Welding:* Heat generation and flame; Torch and other equipment; Gas cutting; Oxyhydrogen welding. (iv) Electron beam; Laser beam; Electroslag; Thermit welding.

Introduction to Solid-State Welding: Forge; Roll; Hot pressure; Diffusion; Explosive; Friction; Ultrasonic welding. *Weld Quality:* Residual stresses and distortion; Heat affected zone; Welding defects and remedies; Inspection and Non-destructive testing – Dye penetrates; Magnetic particles; Ultrasonic; Radiographic.

ME 302 A: PRODUCTION MACHINE TOOLS (M)

3L

3 Hours, 60 Marks

Constructional Details of, Operations on and Ancillary Tools for: (i) Centre, Capstan and Turret Lathes, (ii) Shaper, Planner and Slotter – Quick return mechanism.

(iii) Drilling and Boring machines – Radial, gang, multi-spindle, deep hole drilling, jig boring, (iv) Horizontal, Vertical and Universal Milling machines; Indexing – types and heads, (v) Broaching machines.

(vi) Grinding machines – Surface, Cylindrical and Centreless; Tool and cutter grinding; Grinding wheels – dressing and truing, (vii) Lapping, Honing and Super finishing. *Special purpose tools:* Jigs and Fixtures – Principles of location and clamping; Drilling jigs and Milling fixtures.

Automats and Semi-automats – Single and multi spindle, operation planning, tool layout and cam design; Hydraulic tracer controlled machine tools. *Forging and Press tools:* Punch-Die for bulk deformation and sheet metal working – Compound, Combination and Progressive dies.

Numerically controlled machine tools (except NC programming): Automation strategies; Classification of NC machine tools – Open and Closed loop, PTP and Contouring, NC/CNC/DNC; Position and Velocity feedback devices; Adaptive control; Machine control unit; NC Tooling; Machining centers; Economics.

ME 303 A: INDUSTRIAL ORGANIZATION AND MANAGEMENT (M)

3L

3 Hours, 60 Marks

Business Organization: Objectives of business; Formation and working of Sole proprietorship, Partnership, Private and Public limited company, Public sector undertaking, Cooperative society.

Management: Principles, Functions and Elements of Management; Historical development and Theories of management – contributions of Taylor (Scientific management), Fayol, Gilbreths, Mayo, Drucker, etc. Planning – Long-term and Short-term decisions; Organization structure and chart – Line and Staff relations and conflicts, Span of control, Authority and Responsibility, Delegation and Decentralization, Organizational behavior – Formal and Informal organization; Motivation – Maslow's and Herzberg's theories; Direction; Communication; Leadership; Co-ordination; Control.

Marketing Management: Functions; Product and Pricing strategies; Advertising and Sales promotion; Distribution channels; Marketing research, e-Business – Exports and Globalization.

Financial Management: Functions; Financial Statements – Profit and Loss account, Balance Sheet, Ratio analysis; Break even analysis and profit planning; Working capital, Capital budgeting – Investment appraisal criteria – Money-time relationship and Discounting.

Personnel Management: Functions; Manpower planning; Recruitment and Selection; Job specification and Job qualification; Training and Placement.

ME 353 A: METAL CUTTING AND METROLOGY (M)

3L, 1T

3 Hours, 60 Marks

Metal Cutting: Machining operations – types, elements and cutting conditions; Theory of chip formation and chip flow – shear angle; Orthogonal and Oblique cutting; Geometry and designation of single point cutting tool, milling cutters, twist drill, broaches; Form tools.

Merchant's Force Analysis: Forces, Stresses and Power consumption in orthogonal cutting; Velocities, Strain (rate), Specific cutting energy; Measurement of cutting forces – Strain gauges and dynamometers.

Friction and Thermal Aspects: Stick and Slip phenomenon; Heat generation; Measurement of cutting temperatures. *Tool Wear:* Location – Crater, Flank; Mechanism – Abrasion, Adhesion, Diffusion, Oxidation; Tool life – Taylor's equation; Effects of cutting parameters on forces, power and surface finish; Machinability; Economics of machining. *Cutting Tools:* Requirements; Materials and characteristics. *Cutting Fluids:* Functions; Materials and applications.

Metrology: Dimensional, Geometrical and Relative Co-ordination accuracy and precision of machined surfaces – Types of errors; Interchangeability; Standardization; BIS system of Limits, Fits and Tolerances; Tolerance analysis in manufacturing and assembly; Design of Limit gauges – Taylor's principle; Slip gauges and Angle measurement; Comparators – Mechanical, Electrical, Optical and Pneumatic; Measurement of flatness, parallelism and surface finish – Autocollimators, Optical Interferometry; Measurement of screw threads – Major, Minor and Effective diameters, Best wire size, Pitch, Angle; Measurement of gears – Pitch, Chord width, Run-out checking, Composite error checking; Machine tool metrology – Alignment tests.

Statistical Quality Control: Implementation of quality at Policy, Design, Manufacturing and Installation stages; Assignable and unassignable causes of variability in quality; Control charts for Variables – \bar{X} , R , and Attributes – p , c ; Acceptance sampling – OC curve, Single and multiple sampling plans; Total quality management; ISO 9000.

ME 354 A: INDUSTRIAL ENGINEERING (M)

3L

3 Hours, 60 Marks

Demand and Supply Analysis: Theory of supply and demand – Market structure, Equilibrium, Demand elasticities; Demand forecasting techniques – Qualitative, Regression, Correlation and Least Squares, Time series, Exponential smoothing; Make-or-buy decision.

Elements of Costing: Classification of costs – direct, indirect, labor, material, overheads, prime cost, factory cost; Allocation of overhead costs; Depreciation – Methods of computing; Standard costing; Budgets and budgetary control.

Value engineering: Value analysis; Product development – Product life cycle, Standardization, Simplification, Diversification.
Reliability and Plant Maintenance: Maintenance policies – Preventive, Break-down, Corrective maintenance; Failure rate analysis – Hazard curve, System reliability; Economics of replacement – models.

Work study: Productivity; Method study; Recording techniques – various charts, diagrams, graphs; Micro and Memo motion study; Principles of motion economy; Work measurement – Time study, Work sampling, Synthetic data and Pre-determined motion time standards; Learning curve; Ergonomics.

Wages Payment: Job evaluation; Merit rating; Methods of wage payment – Time wages, Piece wages, Incentive schemes. *Industrial Relations:* Management-union relations; Trade union movement; Industrial disputes and methods of settling them – Conciliation, Arbitration, Collective bargaining, Workers' participation; Legal legislation and Acts; Labor welfare and safety; Pollution and Waste management.

ME 404 A: MANUFACTURING TECHNOLOGY (M)

3L, 1T

3 Hours, 70 Marks

Metal Working: Metal behavior in metal forming – Principal stresses and strains, Plastic deformation and Yielding criteria; Hot and Cold working; Friction and Lubrication in metal forming.

Bulk Deformation Processes: Forging – Open and Closed die, Impression, Drop, Upset and Press forging; Rolling – Flat and Shape rolling; Extrusion – Forward, Backward and Impact extrusion; Wire, Rod and Tube drawing. *Sheet Metal Working:* Cutting – Shearing, Blanking, Punching; Drawing; Bending; Spinning; High energy rate forming.

Modern Machining Methods: Classification; Abrasive and Water jet; Ultrasonic; Electrochemical; Chemical milling; Electric discharge; Plasma arc machining.

Production of Machine Components: Processes of producing Shafts; Threads – Chasing, Rolling, Dies and Taps, Milling, Grinding; Gears – Casting, Stamping, Rolling, Milling, Shaping, Hobbing, Shaving, Grinding.

Rapid Prototyping: Techniques; Applications. *Robotics and Mechatronics.* *Flexible Manufacturing Systems:* NC part programming – Manual and Computer assisted (APT); Concept of flexibility; Computer integrated manufacturing systems.

ME 405 A: OPERATIONS RESEARCH (M)

3L, 1T

3 Hours, 70 Marks

Operations Research: Characteristics; Scope; Methodologies; Modeling.

Linear Programming: Problem formulation; Graphical and Simplex methods – Restricted or unrestricted variables, Equality or inequality constraints, Degeneracy, Alternative optima, Unbounded space and solution, Infeasibility; Duality – Primal-dual relationship; Sensitivity analysis – Changes in resource and contribution coefficients.

Transportation and Assignment: LP formulation; Transportation algorithm; Hungarian algorithm. *Game Theory:* Pure and mixed strategies; Graphical solution; Dominance; LP formulation.

Inventory Control: Types of inventories; Relevant costs; Static inventory decisions under risk – Payoff, Opportunity cost, Expected value of perfect information; Uncertainty – decision criteria; Dynamic inventory models under certainty – EOQ with finite or infinite rate of replenishment, with or without shortages, price breaks; Probabilistic inventory models – safety stocks, re-order levels; Selective control of inventories.

Queuing Theory: Elements; Measures of performance; (M/M/1):(FCFS/ ∞/∞) model. *Simulation:* Monte Carlo technique; Applications to inventory and queuing situations.

ME 454 A: PRODUCTION AND OPERATIONS MANAGEMENT (M)

3L

3 Hours, 70 Marks

Production System: Inputs, Outputs, Value addition, Control feedback, External factors; Goods and Services; Decisions in POM; Types of production systems – Characteristics, Design, Operational control; Historical evolution.

Plant Engineering: Location: Major factors influencing the location of an industry and choice of site; Qualitative and Quantitative methods. *Plant Layout:* Principles; Techniques for recording Material flow pattern, Types – Product, Process, Fixed, Cellular; Computer software. *Materials Handling:* Functions; Relationship with plant layout, Types of equipment – Selection; Automated material handling – Transfer lines, Robots and AGVs.

Planning and Control of Mass Manufacturing: Industrial applications; Assembly line balancing. *Planning and Control of Batch Processing:* Optimal batch size; Aggregate production planning; Master production scheduling; Material requirement planning; Capacity requirement planning.

Planning and Control of Job-Shop System: Scheduling and Sequencing heuristics; Gantt chart. *Planning and Control of Project:* CPM and PERT.

Modern Production Concepts: Group technology – Part families, Product flow analysis; CAD-CAM integration; Computer aided process planning – Retrieval, Generative; Just-in-time manufacturing – Kanban system; Supply chain logistics and management; Agile and Lean manufacturing.

ME 455 A: ELECTIVE (M)

FACILITIES LOCATION AND LAYOUT PLANNING (M)

3L

3 Hours, 70 Marks

Site Selection: Factors affecting plant location and site selection.

Plant Layout: Types of plant layout – Process and Product Layout, Types of production activities - Job shop, Mass production, similar products and special product manufacturing and their influence on plant layout.

Layout Fundamentals: Information necessary for layout planning, Factors affecting plant layout – Materials, machinery, man movement, building, service, safety, storage and warehouses planning and layout, Process planning material of building, determination of equipment cost.

Layout Development: Collection of information, flow analysis, Process charts, multi-product charts, assembly charts, flow diagrams; Layout development aids - templates, models, etc. Computer assisted layout development: Introduction to modern layout development, Computer programs such as CRAFT, CORELAP, ALDEP, etc. *Installing and evaluating the Layout:* Procedure, plant engineering and acceptance

Materials Handling: Principles of material handling, its relationship with plant layout, safety in operation, traffic and handling of equipment. *Material Handling Equipment:* Conveyors, cranes, hoists, mobile equipment, positioning equipment, container and support equipment, problems of packing cost size consideration, Suitability and uses of material handling equipment, Replacement models with special emphasis on material handling equipment and their obsolescence.