

# Management [MAN]

T.Y. Diploma : Sem VI

[EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/EE/EP/CH/CT/PS/TX/TC]

## EVALUATION SYSTEM

	Time	Marks
<b>Theory Exam</b>	3 Hrs.	100
<b>Practical Exam</b>	–	–
<b>Oral Exam</b>	–	–
<b>Term Work</b>	–	–
<b>Class Test (Two Test)</b>	–	25 (each)

# External Assessment, @ Internal Assessment

## SYLLABUS

### 1. Overview of Business

- Types of Business
  - Service
  - Manufacturing
  - Trade
- Industrial sectors
  - Introduction to
  - Engineering Industry
  - Process Industry
  - Textile Industry
  - Chemical Industry
  - Agro Industry
- Globalization
  - Introduction
  - Advantages & disadvantages w.r.t India
- Intellectual Property Rights I( I P R )
  - Concept
  - Types of IPR

### 2. Management Process

- What is Management?
  - Evolution
  - Various Definitions
  - concept of Management
  - Levels of Management
  - Administration and Management
  - Scientific Management by F W Taylor
- Principles of Management (14 principles of Henry Fayol)
- Functions of Management:
  - Planning
  - Organizing
  - Coordinating
  - Directing
  - Controlling
  - Decision Making

### **3. Organizational Management**

- Organization
  - Definition
  - Steps in forming organization
- Types of Organization
  - Line
  - Line & Staff
  - Functional
  - Project type
- Departmentation
  - Centralized & Decentralized
  - Authority & Responsibility
  - Span of Control (Management)
- Forms of ownerships
  - Proprietorship
  - Partnership
  - Joint stock company
  - Co-operative society
  - Govt. Sector

### **4. Human Resource Management**

- Personnel Management
  - Introduction
  - Definition
  - Function
- Staffing
  - Introduction to HR
  - Introduction to HR Planning
  - Recruitment procedure
- Personnel - Training & Development
  - Types of training
  - Induction
  - Skill enhancement
- Leadership & Motivation
  - Leadership- Styles & types
  - Motivation -Definition , Intrinsic & Extrinsic
  - Maslow's theory of Motivation and its significance
- Safety Management
  - Causes of Accidents
  - Safety Procedures
- Introduction, Objectives & feature of Industrial Legislation such as
  - Factory Act
  - ESI Act,
  - Workman Compensation Act,
  - Industrial Dispute Act

### **5. Financial Management (No Numericals)**

- Financial Management- Objectives & Functions
- Capital Generation & Management
  - Types of capitals
  - Sources of finance
- Budgets and Accounts

- Types of Budgets
- Production Budget ( including Variance Report)
- Labour Budget
- Introduction to Profit & Loss Account ( Only concept)
- Balance sheet etc.
- Introduction to Various Taxes
  - Excise Service Tax,
  - Income Tax
  - VAT
  - Custom Duty

#### **6. Materials Management**

- Inventory Management ( No Numericals)
  - Meaning & Objectives
- ABC Analysis
- Economic Order Quantity:
  - Introduction & Graphical Representation
- Purchase Procedure
  - Objectives of Purchasing
  - Functions of Purchasing Department
  - Steps in Purchasing
- Modern Techniques of Material Management
  - Introductory treatment to Just inTime( JIT)/ System Applications & Products (SAP) /Enterprise Resource Planning (ERP)

#### **7. Project Management (Simple /Elementary Numericals)**

- Project Management
  - Introduction & Meaning
  - Introduction to CPM/PERT Techniques ( simple network problems )
  - Concept of Break Even Analysis and its significance
- Quality Management
  - Definition of Quality, Concept of Quality, Quality Circle, Quality Assurance
  - Introduction to TQM, Kaizen, 5 'S' & Six Sigma

#### **Reference :**

1. Industrial Engg & Management (Dr. O.P. Khanna) Dhanpal Rai & sons New Delhi
2. Business Administration & Management (Dr. S.C. Saksena) Sahitya Bhavan Agra
3. The process of Management (W.H. Newman E.Kirby Warren Andrew R. McGill) Prentice- Hall of India Pvt. Ltd. New Delhi - 110001

# Design of Machine Elements [DME]

T.Y. Diploma : Sem VI  
[ME]

## EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	25#
Term Work	–	25@
Class Test (Two Test)	–	25 (each)

## SYLLABUS

### 1. Introduction to Design

- a) Machine Design philosophy and Procedures
- b) General Considerations in Machine Design
- a) Fundamentals:- Types of loads, concepts of stress, Strain, Stress - Strain Diagram for Ductile and Brittle Materials, Types of Stresses such as Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion, Principle Stresses (Simple Numerical)
- b) Creep strain and Creep Curve
- a) Fatigue, S-N curve, Endurance Limit.
- b) Factor of Safety and Factors governing selection of factor of Safety.
- Stress Concentration - Causes & Remedies
- a) Converting actual load or torque into design load or torque using design factors like velocity factor, factor of safety & service factor.
- b) Properties of Engineering materials, Designation of materials as per IS and introduction to International standards & advantages of standardization, use of design data book, use of standards in design and preferred numbers series.
- Theories of Elastic Failures - Principal normal stress theory, Maximum shear stress theory & maximum distortion energy theory.

### 2. Design of simple machine parts

- Cotter Joint, Knuckle Joint, Turnbuckle
- Design of Levers:- Hand/Foot Lever & Bell Crank Lever
- Design of C - Clamp, Off-set links, Overhang Crank, Arm of Pulley

### 3. Design of Shafts, Keys and Couplings and Spur Gears

- Types of Shafts, Shaft materials, Standard Sizes, Design of Shafts (Hollow and Solid) using strength and rigidity criteria, ASME code of design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley
- Design of Sunk Keys, Effect of Keyways on strength of shaft.
- Design of Couplings - Muff Coupling, Protected type Flange Coupling, Bush-pin type flexible coupling.
- Spur gear design considerations. Lewis equation for static beam strength of spur gear teeth. Power transmission capacity of spur gears in bending.

### 4. Design of Power Screws

- Thread Profiles used for power Screws, relative merits and demerits of each, self locking and overhauling property

- Torque required to overcome thread friction, efficiency of power screws, types of stresses induced.
  - Design of Screw Jack, Toggle Jack.
- 5. Design of springs**
- a) Classification and Applications of Springs, Spring-terminology, materials and specifications.
  - b) Stresses in springs, Wahl's correction factor, Deflection of springs, Energy stored in springs.
  - Design of Helical tension and compression springs subjected to uniform applied loads like I.C. engine valves, weighing balance, railway buffers and governor springs.
  - Leaf springs - construction and application
- 6. Design of Fasteners**
- Stresses in Screwed fasteners, bolts of Uniform Strength
  - Design of Bolted Joints subjected to eccentric loading.
  - Design of parallel and transverse fillet welds, axially loaded symmetrical section, Merits and demerits of screwed and welded joints
- 7. Antifriction Bearings**
- a) Classification of Bearings - Sliding contact & rolling contact.
  - b) Terminology of Ball bearings - life load relationship, basic static load rating and basic dynamic load rating, limiting speed. Selection of ball bearings using manufacturer's catalogue.
- 8. Ergonomics & Aesthetic consideration in design**
- a) Ergonomics of Design - Man -Machine relationship. Design of Equipment for control, environment & safety.
  - b) Aesthetic considerations regarding shape, size, color & surface finish.

**Reference :**

1. Introduction to Machine Design (V.B.Bhandari) Tata Mc- Graw Hill
2. Machine Design (R.KJain) Khanna Publication
3. Machine design (Pandya & Shah) Dhanpat Rai & Son
4. Mechanical Engg. Design (Joseph Edward Shigley) Mc- Graw Hill
5. Design Data Book (PSG Coimbtore) PSG Coimbtore
6. Hand Book of Properties of Engineering Materials & Design Data for Machine Elements (Abdulla Shariff) Dhanpat Rai & Sons
7. Theory and Problems of Machine Design (Hall, Holowenko, Laughlin) Mc- Graw Hill

# Industrial Fluid Power [IFP]

T.Y. Diploma : Sem VI  
[ME/PG/PT]

## EVALUATION SYSTEM

	Time	Marks
<b>Theory Exam</b>	3 Hrs.	100
<b>Practical Exam</b>	–	–
<b>Oral Exam</b>	–	25#
<b>Term Work</b>	–	25@
<b>Class Test (Two Test)</b>	–	25 (each)

# External Assessment, @ Internal Assessment

## SYLLABUS

### 1. Introduction to oil hydraulic systems

- Practical applications of hydraulic systems.
- General layout of oil hydraulic systems.
- Merits and limitations of oil hydraulic systems.
- Properties of hydraulic fluid -viscosity, demulsibility, lubricity etc.

### 2. Components of Hydraulic systems

- Pumps - Vane pump, gear pump, Gerotor pump, screw pump, piston pump
- Valves - Construction, working and symbols of  
Pressure control valves - pressure relief valve, pressure reducing, pressure unloading  
Direction control valves - Poppet valve, spool valve, 3/2, 4/2  
D.C. valves, Sequence valves.  
Flow control valves - pressure compensated, non pressure compensated flow control valve.
- Actuators- Construction, working and symbols of Rotary  
Actuators - Hydraulic motors  
Linear Actuators - Cylinders - single acting, double acting.
- Accessories - Pipes, Hoses, fittings, Oil filters, Seals and gaskets, Accumulators. (Types, construction, working principle and symbols of all components)

### 3. Hydraulic Circuits

- Meter in, Meter out circuits
- Bleed off circuit
- Sequencing circuit - travel dependant, pressure dependant
- Hydraulic circuits for Milling machine, Shaper machine, Motion synchronization circuit.

### 4. Introduction to pneumatic Systems

- Applications of pneumatic system
- General layout of pneumatic system
- Merits and limitations of pneumatic systems

### 5. Components of pneumatic system

- Compressor - Reciprocating & Rotary compressors.
- Control Valves - Pressure regulating valves, Flow Control valves, Direction Control Valves.
- Actuators - Rotary - Air motors, Types, construction, working principle Linear- Cylinders- Types, construction & working principle

- Accessories - Pipes, Hoses, Fittings, FRL unit (Types, construction, working principle and symbols of all components)

#### **6. Pneumatic Circuits**

- Speed control circuits – for double acting cylinder
  - for bidirectional air motor
- Sequencing circuits – Position based sequencing circuit
  - Time delay circuit

#### **References :**

1. Industrial Hydraulics (Pippenger Hicks) McGraw Hill International
2. Oil Hydraulic system- Principle and maintenance (Majumdar S.R) Tata McGraw Hill
3. Pneumatics Systems Principles and Maintenance (Majumdar S.R) Tata McGraw Hill
4. Hydraulics and Pneumatics (Stewart) Taraporewala Publication

# Production Technology [PTE]

T.Y. Diploma : Sem VI  
[ME/PG/PT]

## EVALUATION SYSTEM

	Time	Marks
<b>Theory Exam</b>	3 Hrs.	100
<b>Practical Exam</b>	–	–
<b>Oral Exam</b>	–	–
<b>Term Work</b>	–	–
<b>Class Test (Two Test)</b>	–	25 (each)

## SYLLABUS

### 1. Production System

- Production - Definition , Types of production systems
- Productivity - Importance , Measurement of Productivity, Techniques of improving productivity.
- Elements of cost- Fixed cost, Variable Cost. Break even analysis, Calculation of Break even point.

### 2. Plant location, plant layout and material handling

- Plant Location - Importance of Site Selection, Factors affecting Site Selection, Government Policies, relaxation for Backward Areas.
- Plant Layout - Objectives, types, design principles, characteristics of Plant Layout, Symptoms of Bad Plant Layout.
- Group Technology, Cellular layout.
- Material handling - Need, Principles and Types of material handling devices - conveyors , Hoist & cranes , forklift truck, trolleys, Pipes, Automated Guided Vehicles (AGV's) Selection of Material Handling systems and Devices.

### 3. Process planning

- Planning of Processes from raw material to finished product, Factors affecting Process Planning.
- Deciding sequence of operations, Operation Sheet, Combined operations, Determination of Inspection Stages. Selection of Machine
- Techniques of assembly planning, Types of assembly.
- Plant Capacity, Machine Capacity, Plant Efficiency. Numerical not to be asked

### 4. Production planning and control

- Definition & concept of Routing, Sequencing [n job 2 machines] Scheduling, Dispatching.
- Meaning of Control, Progressive Control.
- Gantt chart.
- Concept of Line balancing

### 5. Work Study

- Method Study- Definition, Objectives, Procedure, Selection of work.
- Recording Techniques: - Process Charts - Outline process chart, Flow process chart, Two Hand process chart, Multiple activity chart, Flow diagram, String diagram, Travel chart.
- Micro motion study-Critical Examination, Principles of Motion Economy, Concept of ergonomics and workplace layout.



### **Work Measurement**

- Objectives, procedure, Time Study, Time Study Equipments. Stop Watch Time Study, Standard Time, Work Sampling
- Analytical Estimating, Predetermined Motion Time Study, Allowances, Calculation of Standard Time
- Concept of Merit Rating

### **6. Inventory Control**

- Methods of Inventory Management
- Inventory Cost relationship, Deciding Economic Batch Quantity, EOQ Model, Calculation of EOQ, Concepts of discounts.
- Introduction of Material Requirement Planning.
- Stores Function - Storage systems - One bin , Two bin system, Material Issue Request (MIR), Bin card.

### **7. JIGS AND FIXTURES**

- Introduction. Difference between jig and fixture, Different components of Jig/ fixture, Types of jigs and fixtures.
- Types of locators and clamping devices, 3-2-1 principle of location.
- General principles of jig/fixture, design

### **8. MODERN TRENDS**

- Just In Time manufacturing - Pull and push types of manufacturing systems.
- 5 'S'- concepts, meaning of each term, 5 'S' as Waste management technique, inventory reduction by 5 'S'.
- Single Piece Production Systems.
- Basic concepts of
  - Kaizen, Brain storming.
  - Poka Yoke.
  - Lean manufacturing
  - Business Process Re-engineering
  - DMAIC cycle
  - Flexible Manufacturing System.
  - Rapid Prototyping - concept, need, method, advantages, limitations

### **References :**

1. Industrial Management (L.C. Jhamb) Everest
2. Production System, Planning, Analysis & Control (James C. Rigs) N.Y. Wiley & Sons
3. Industrial Engineering and Management (O.P. Khanna) Dhanpat Rai & Sons
4. Work Study (ILO) ILO Geneva
5. Jigs & Fixtures (P. H. Joshi)
6. Production Engineering (P.C. Sharma)
7. Introduction to Jigs and Fixtures Design (Kempster)
8. Modern Production and Operations Management (Baffna , Sarin)
9. Total Productive Maintenance (Terry Wireman) Industrial press inc.
10. Toyota Production system (Taiichi ohno) Productivity Press

# Alternate Energy Sources and Management [AES]

T.Y. Diploma : Sem VI  
[ME/AE/PG/PT]

(Elective - II)

## EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	25@
Class Test (Two Test)	–	25 (each)

@ Internal Assessment

## SYLLABUS

### 1. Introduction to Energy Sources

- Introduction.
- Major sources of energy: Renewable and Non-renewable.
- Primary and secondary energy sources.
- Energy Scenario:
  - Prospects of alternate energy sources
  - Need of Alternate energy sources

### 2. Solar Energy

- Principle of conversion of solar energy into heat and electricity
- Solar Radiation: Solar Radiations at earth's surface
  - Solar Radiation Geometry: Declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle
- Applications of Solar energy
  - Construction and working of typical flat plate collector and solar concentrating collectors and their applications
  - Advantages and limitations
  - Space heating and cooling.
  - Photovoltaic electric conversion.
  - Solar distillation, Solar cooking and furnace
  - Solar pumping and Green House.
  - Agriculture-Solar drying for foods
  - (no derivations and numerical)

### 3. Wind Energy

- Basic Principle of wind energy conversion
- Power in wind, Available wind power formulation, Power coefficient, Maximum power
- Main considerations in selecting a site for wind mills.
  - Advantages and limitations of wind energy conversion.
- Classification of wind mills
  - Construction and working of horizontal and vertical axis wind mills, their comparison
  - Main applications of wind energy for power generation and pumping

### 4. Energy from Biomass

- Common species recommended for biomass.
  - Methods for obtaining energy from biomass

- Thermal classification of biomass
  - Gasifier
  - Fixed bed and fluidized
  - Application of gasifier
- Biodiesel properties, production and application
- Agriculture waste as a biomass
  - Biomass digester
- Comparison of Biomass with conventional fuels

#### **5. Energy Conservation & Management**

- Energy scenario in various sectors and Indian economy
- Need and importance of energy conservation and management
- Concept of Payback period, Return on investment (ROI), Life cycle cost, Sankey diagrams, specific energy consumption.

#### **6. Energy Conservation Techniques**

- Distribution of energy consumption
  - Principles of energy conservation.
  - Energy audit
  - Types of audit
- Methods of energy conservation
  - Cogeneration and its application
  - Combined cycle system
- Concept of energy management
- Study of different energy management techniques like
  - Analysis of input
  - Reuse and recycling of waste
  - Energy education
  - Conservative technique and energy audit

#### **7. Economic approach of Energy Conservation**

- Costing of utilities like steam, compressed air, electricity and water.
  - Ways of improving boiler efficiency
- Thermal insulation, Critical thickness of insulation
- Waste heat recovery systems, their applications, criteria for Installing unit.
- An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.

#### **References :**

1. Non conventional energy Resources (Dr. B.H.Khan) Tata McGraw Hill
2. Non conventional energy sources (G. D. Rai) Khanna publication
3. Solar energy (S. P. Sukhatme) Tata McGraw Hill
4. Solar energy (H. P. Garg) Tata McGraw Hill
5. Power plant engineering (Arrora Domkundwar) Dhanpat Rai & co.
6. India- The energy sector (P.H. Henderson) University Press
7. Industrial energy conservation (D. A. Ray) Pergaman Press
8. Energy management handbook (W. C. Turner) Wiley Press
9. Non-conventional energy source (K. M. Mittal)
10. Energy resource management (Krupal Singh Jogi) Sarup and sons

# Material Handling Systems [MHS]

T.Y. Diploma : Sem VI

[ME]

(Elective-II)

## EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	25@
Class Test (Two Test)	–	25 (each)

@ Internal Assessment

## SYLLABUS

### 1. Introduction to Material Handling System

Main types of material handling equipments & their applications, types of load to be handled, types of movements, methods of stacking, loading & unloading systems, principles of material handling systems.

### 2. Hoisting Machinery & Equipments

- Construction, working & maintenance of different types of hoists such as lever operated hoist, portable hand chain hoist, differential hoists, worm geared and spur geared hoists, electric & pneumatic hoists, jumbo.
- Construction, working & maintenance of different types of cranes such as rotary cranes, trackless cranes, mobile cranes, bridge cranes, cable cranes, floating cranes & cranes traveling on guide rails.
- Construction, working & maintenance of elevating equipments such as stackers, industrial lifts, freight elevators, passenger lifts, mast types elevators, vertical skip hoist elevators.

### 3. Conveying Machinery

- Construction, working & maintenance of traction type conveyors such as belt conveyors, chain conveyors, bucket elevators, escalators.
- Construction, working & maintenance of traction less type conveyors such as gravity type conveyors, vibrating & oscillating conveyors, screw conveyors, pneumatic & hydraulic conveyors, hoppers gates & feeders.

### 4. Surface Transportation Equipment

- Construction, function, working of trackless equipment such as hand operated trucks, powered trucks, tractors, AGV- Automatic Guided vehicle, industrial Trailers.
- Construction, function, working of cross handling equipment such as winches, capstans, Turntables, Transfer tables, monorail conveyors

### 5. Components of material handling systems

- Flexible hoisting appliances such as welded load chains, roller chains, hemp ropes, steel wire ropes, fastening methods of wire & chains, eye bolts, lifting tackles lifting & rigging practices.
- Load handling attachments.
  - a) Various types of hooks-forged, triangular eye hooks, appliances for suspending hooks,
  - b) Crane grab for unit & piece loads
  - c) Electric lifting magnet, vacuum lifter.
  - d) Grabbing attachment for loose materials

- e) Crane attachment for handling liquids / molten metals
- Arresting gear & Brakes.
  - a) Arresting gear - construction & working
  - b) Construction & use of electromagnetic shoe brakes Thruster operated shoe brakes, control brakes.

#### **6. Mechanism used in material handling equipment**

- Steady state motion, starting & stopping of motion in following mechanisms.
  - Hoisting mechanism
  - Lifting Mechanism
  - Traveling Mechanism
  - Slewing Mechanism
  - Rope & chain operated Cross- Traverse Mechanism

#### **7. Selection of material handling equipment**

Factors affecting choice of material handling equipment such as type of loads, hourly capacity of the unit, direction & length of travel, methods of stocking at initial, final & intermediate points, nature of production process involved, specific load conditions & economics of material handling system.

#### **Reference :**

1. Material handling equipment (N. Rundenko) Peace Publisher, Moscow
2. Material handling equipment (M. P. Alexandrov) MIR Publisher, Moscow
3. Material handling (Y. I. Oberman) MIR Publisher, Moscow
4. Material handling equipment (R. B. Chowdary & G. R. N. Tagore) Khanna Publisher, Delhi
5. Material handling (Principles & Practice) (Allegri T. H.) CBS Publisher, Delhi
6. Plant layout & materials handling (Apple j. M) JohnWiley Publishers.
7. Material handling Hand book (Bolz and others)
8. Encyclopedia of materials handling (Daylas R. W. Pergaman, Berlin)
9. Material handling (Immer J. R.) Mc Graw Hill, New York
10. Material handling equipment (Parameswaran M. A.) C.D.C. in Mechanical Engg., I.I.T., Chennai

# Refrigeration and Air-Conditioning [RAC]

T.Y. Diploma : Sem VI  
[ME]

(Elective-II)

## EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	25@
Class Test (Two Test)	–	25 (each)

@ Internal Assessment

## SYLLABUS

### 1. Basics of Refrigeration

- a) Definition of refrigeration.
- b) Necessity of refrigeration
- c) Unit of refrigeration, C.O.P. and refrigerating effect.
- d) Concept of heat engine, heat pump and refrigerator.
- Methods of refrigeration
  - Ice refrigeration
  - Refrigeration by expansion of air
  - Refrigeration by throttling of gas
  - Vapour refrigeration system
  - Steam jet refrigeration system
  - Non conventional methods of refrigeration like Vortex tube, Pulse tube refrigeration, solar refrigeration
- Major application areas of R.A.C. like domestic, commercial and industrial.

### 2. Refrigeration Cycles

- a) Reversed Carnot Cycle and its representation on PV and TS diagram.
- b) Air Refrigeration Cycles
  - Bell Coleman air refrigerator, its representation on PV and TS diagram, types and applications like air craft refrigeration using simple air cooling system..
  - (Simple numerical on Reversed Carnot cycle.)
- Vapour Compression Cycle (V.C.C)
  - principle, components, Representation on P-H and T-S diagram, effects of wet compression, dry compression, calculation of COP, Effect of superheating, under cooling, suction pressure and discharge pressure, Actual V.C.C., (simple numerical), Methods of improving COP (no description).
  - Introduction to multistage V.C.C., its necessity, advantages.
- Vapour Absorption system
  - Principle, components and working of aqua-ammonia system (simple & practical) Li-Br Absorption System Electroflux Refrigeration System, Desirable properties of Refrigerant and absorbent used in Vapour Absorption System. Comparison of vapour compression refrigeration system and vapour absorption refrigeration system

### 3. Refrigerants

- a) Classification of refrigerants.

- b) Desirable properties of refrigerants.
- a) Nomenclature of refrigerants.
- b) Selection of refrigerant for specific applications.
- a) Concept of Green House Effect, Ozone depletion, Global warming.
- b) Eco-friendly refrigerants like R-134a, hydrocarbon refrigerants etc.

#### 4. Equipment selection

- Components of Vapour Compression Refrigeration System
  - a) Compressors
    - Classification, Construction and working of open type, hermetic, centrifugal, rotary, screw and scroll compressor and their applications.
  - b) Condensers
    - Classification, description of air cooled and water cooled condensers, comparison and applications
    - Evaporative condensers.
  - c) Expansion devices
    - Types: - Capillary tube, automatic thermostatic expansion valve and their working principle & applications
  - d) Evaporators and chillers
    - Classification of evaporators Construction and working of Bare tube, Plate surface, finned, shell and tube, flooded and dry expansion evaporator
    - Capacity of evaporator and their applications
    - Classification of chillers
    - Construction and working of dry expansion Chillers and flooded chillers and their applications.
- Selection criteria for Vapour compression refrigeration system components for the following applications: Water coolers, ice plants, cold storage, domestic refrigerator.

#### 5. Psychrometry

- a) Definition and necessity of air conditioning.
- b) Properties of Air, Dalton's law of partial pressure
- a) Psychrometric chart
- b) Psychrometric processes, Bypass Factor, ADP, concept of SHF, RSHF, ERSHF, GSHP
- c) Simple numerical using Psychrometric chart
- d) Adiabatic mixing of Air streams
- Equipments used for Air- conditioning like humidifier, dehumidifier, filter, heating and cooling coils.

#### 6. Comfort conditions and cooling load calculations

- a) Thermal exchange of body with environment
- b) Factors affecting human comfort
- c) Effective temp. and comfort chart
- Components of cooling load- sensible heat gain and latent heat gain sources, calculation of cooling load (No numericals)

#### 7. • Air- conditioning systems

- a) Classification of A.C. systems
- b) Industrial and commercial A.C. systems
- c) Summer, winter and year round A.C. systems
- d) Central and unitary A.C. systems

- Application areas of A.C. systems

## **8. Air distribution systems**

- Duct systems
  - a) Closed perimeter system, extended plenum system, radial duct system, duct materials, requirement of duct materials, losses in ducts
  - b) Air distribution outlets
    - Supply outlets, return outlets, grills, diffusers
  - c) Fans and Blowers
    - Types, working of fans and blowers
- Insulation
  - Purpose, properties of insulating material, types of insulating materials, methods of applying insulation.

### **Reference :**

1. Refrigeration and Air Conditioning (R.S.Khurmi) S.Chand and Co
2. Refrigeration and Air Conditioning (Arrora and Domkundwar) Dhanpat Rai and Sons
3. Refrigeration and Air Conditioning (Manohar Prasad) New Age Publications
4. Refrigeration and Air Conditioning (P.N.Ananthanarayanan) Tata McGraw Hill
5. Principles of Refrigeration (Roy Dossat) Pearson Education
6. Commercial Refrigeration (Edwin P. Anderson) Taraporevala Sons & Co
7. IS/International Codes/Publications:
  - a) ISHRAE handbooks
  - b) Manohar Prasad: Refrigeration and Air Conditioning hand book, New Age Publications.



# CAD-CAM and Automation[CCA]

T.Y. Diploma : Sem VI  
[ME/AE/PG/PT/PS]

(Elective-II)

## EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	25@
Class Test (Two Test)	–	25 (each)

@ Internal Assessment

## SYLLABUS

### 1. Introduction to CAD/CAM

Role and Need of Computers in industrial manufacturing. Product Cycle, CAD/CAM.  
CAD/CAM hardware: - Basic structure, CPU, Memory, I/O devices, Storage devices and system configuration.

### 2. Geometric Modeling

Requirement of geometric modeling, Types of geometric models.  
Geometric construction methods:-sweep, solid modeling-Primitives & Boolean operations, free formed surfaces (Classification of surface only), Rapid Prototyping (No numerical treatment)  
Introduction to computer numerical Control  
Introduction - NC, CNC, DNC, Advantages of CNC, The coordinate system in CNC  
Motion control system - point to point, straight line, Continuous path (Contouring). Absolute system and Incremental system, Feedback control system, Application of CNC

### 4. Part programming

Fundamentals, manual part programming, NC -Words, Programming format, part programming, use of subroutines and do loops, computer aided part programming (APT).

### 5. Industrial Robotics

Introduction, Types of Robots and their working principle, physical configuration, basic robot motions, technical features such as - work volume, precision and speed of movement, weight carrying capacity, drive system, End effectors, robot sensors.  
Applications - Material transfer, machine loading, welding, spray coating, processing operation, assembly, inspection.

### 6. Automation

Basic elements of automated system, advanced automation functions, levels of automation.  
Flexible manufacturing system – Introduction, Scope and benefits, Types, Major elements of FMS, FMS equipment, FMS application, Introduction to CIM  
Lean Manufacturing – Introduction

### Reference :

1. CAD/CAM Principles and Applications (P.N.Rao) Tata McGraw-Hill
2. CAD/CAM/CIM (RadhaKrishna P. & Subramanyam) Wiley EasternLtd
3. CNC Machine (B.S.Pabla and M.Adithan) New age International(P)Ltd
4. Computer Aided design and manufacturing (Groover M.P. & Zimmers Jr) Prentice hall of India