

REFRIGERATION AND AIR-CONDITIONING

CODE ME 301

L T P
2 -- 2

RATIONALE

In modern society the use of refrigeration and air-conditioning is not limited to comfort only but it is extended to commercial and industrial applications such as storage of food products, medicines, chemicals, wines, beverages. It also requires producing suitable environment conditions for process work, CAM. Surgery superconductivity. This subject will help the students to have adequate knowledge.

CONTENTS

1. Principles of Refrigeration :

- 1.1 Meaning : heat pump, refrigeration
- 1.2 Refrigeration methods
- 1.3 Units of refrigeration machines
- 1.4 Rating of refrigeration machines

2. Refrigeration System :

- 2.1 Air Refrigeration System
 - 2.1.1 Reversed Carnot cycle, theoretical and actual. Reversed Brayton cycle-closed and open system.
 - 2.1.2 Applications and limitations
 - 2.1.3 Advantages and disadvantages of air refrigeration cycle
- 2.2 Vapour Compression System
 - 2.2.1 Theoretical vapour compression cycle
 - 2.2.2 Effect of sub-cooling, super heating on compression cycle
 - 2.2.3 Deviation of actual cycle from theoretical cycle
 - 2.2.4 Coefficient of performance
 - 2.2.5 Effect of varying condensing and suction temperatures and pressure on C.O.P.
 - 2.2.6 Use of p-h chart. Simple numerical problems
- 2.3 Methods of improving C.O.P.
 - 2.3.1 Flash chamber
 - 2.3.2 Sub cooling of liquid refrigerant by using vapour refrigerant
 - 2.3.3 Sub cooling by external cooling source
 - 2.3.4 Sub cooling with liquid refrigerant
- 2.4 Vapour Absorption System
 - 2.4.1 Simple vapour absorption systems
 - 2.4.2 Comparison with vapour compression system
 - 2.4.3 Electrolux refrigerator

3. Refrigerants:

- 3.1 Classification
- 3.2 Important properties of refrigerants
- 3.3 Nomenclature of refrigerants.
- 3.4 Refrigerants - primary refrigerants, secondary refrigerants.
- 3.5 New refrigerants viz : Tetraflouroethane, propone and isobutene

4. Refrigeration System, Components and Controls :

- 4.1 Reciprocating compressors, rotary compressors, centrifugal compressors
- 4.2 Condensers of various types

- 4.3 Cooling towers, spray ponds,
- 4.4 Evaporators of various types
- 4.5 Defrosting and throttling devices
- 4.6 Automatic expansion valve, thermostatic expansion valve and capillary tube, solenoid valve.

5. Refrigeration Applications :

- 5.1 Domestic and commercial refrigerators, their systems, specifications and types
- 5.2 Water coolers of various types
- 5.3 Effect of moisture in refrigeration system and methods of removing it.

6. Production of Low Temperature :

- 6.1 Introduction
- 6.2 Limitation of vapour compression system in creating of low temperature
- 6.3 Two stage cascade refrigeration system (no analysis)
- 6.4 Manufacturing of dry ice (no numerical problems)

7. Pshychrometry :

- 7.1 Properties of air vapour mixture
- 7.2 Saturation of air, dry and wet bulb temperatures, dew point temperature, specific humidity, degree of saturation and relative humidity.
- 7.3 Enthalpy of moist air
- 7.4 Psychrometric chart and its uses.
- 7.5 Psychrometric processes, sensible heating and cooling, cooling with dehumidification and humidification, evaporative cooling,
- 7.6 Mixing of air streams.

8. Air-conditioning :

- 8.1 Physiological basis of air conditioning
- 8.2 Human comfort, metabolism in human body, comfort chart and effective temperature.
- 8.3 Summer and winter design conditions
- 8.4 Classification of air-conditioning systems, room air conditioners, package air conditioners.
- 8.5 Air distribution system.

PRACTICALS

- 1. To acquaint with the use of refrigeration tools, charging board, special refrigeration tube fittings.
- 2. Copper tube jointing practice, flaring and brazing.
- 3. Study of domestic refrigerator & water cooler with electrical system and equipment arrangement.
- 4. Study of Window and Split Air-conditioner.
- 5. Study of following components-
 - 5.1 Compressor open and hermetic sealed type
 - 5.2 Expansion valves
 - 5.3 Starting and over load relay
 - 5.4 Thermostates
 - 5.5 Strainer and drier
- 6. Charging practice on refrigerating machine including making vacuum, pressure testing, charging and final testing for performance
- 7. Determination of psychrometric properties of air at different places with the help of sling- psychrometer and hygrometer.
- 8. Using refrigeration trainer test rig to find out its refrigerating capacity, power input and C.O.P.
- 9. Use of Air-conditioning trainer to find out C.O.P
- 10. To determine the Ice-making capacity and C.O.P. of an Ice plant.
- 11. Study of following plants by industrial visits.

- 11.1 Ice plant
- 11.2 Cold storage plant
- 11.3 Central air conditioning plant.

12. A seminar on study of various models of refrigerator and A.C. available in the market.

REFERENCE BOOKS :

- | | |
|-------------------------------------|---------------|
| 1. Refrigeration & Air Conditioning | Domkundwar |
| 2. Refrigeration & Air Conditioning | Manohar Singh |
| 3. Refrigeration & Air Conditioning | C.P.Arora |
| 4. Principles of Refrigeration | Dossatt |
| 5. Refrigeration & Air Conditioning | R.K. Rajput |
| 6. Refrigeration & Air Conditioning | R.S. Khurmi |
| 7. प्रशीतन एवं वातानुकूलन | एन. के. मंगल |

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PROCESSES IN MANUFACTURING

CODE ME 302
MA302

L T P
2 -- 2

RATIONALE

Manufacturing processes are developing very fast with rapid changes in technology. This subject will provide insight to the students regarding metal forming methods, newer machining processes, jigs and fixtures. These processes are needed for modern and mass production processes. In order to create interest in the subject theory should be supplemented by visit to industries where new manufacturing processes are being used.

CONTENTS

1. Metal Forming Process :

- 1.1 Forging
 - 1.1.1 Forging process, open die forging, closed die forging (drop forging)
 - 1.1.2 Press forging, upset forging, Swaging, up setters, roll forging
 - 1.1.3 Cold and hot forging, forging defects and their remedies
- 1.2 Rolling
 - 1.2.1 Elementary theory of rolling, types of rolling mills
 - 1.2.2 Roll passes, rolling defects and remedies
- 1.3 Press forming
 - 1.3.1 Types of presses, working, selection of press dies, die material.
 - 1.3.2 Press operations - shearing piercing, trimming, punching, Notching, shaving, guering or rubber forming, embossing, stamping
 - 1.3.3 Deep Drawing
- 1.4 Extrusion
 - 1.4.1 Types of extrusion - Hot and Cold, Direct and Indirect
- 1.5 Drawing
 - 1.5.1 Pipe drawing, Tube drawing

2. Conventional Metal Cutting Processes :

- 2.1 Metal Cutting
 - 2.1.1 Elementary theory of metal cutting, chip formation, continuous chip, continuous chips with B.U.E., discontinuous chips
 - 2.1.2 Mechanism of chips formation, geometry of chip formation, forces on chip. Merchant's diagram
 - 2.1.3 Tool life, Economics of tool life
 - 2.1.4 Machinability
 - 2.1.5 Factors affecting Machinability
- 2.2 Broaching Machine :
 - 2.2.1 Classification and description of broaching machines
 - 2.2.2 Elements of broach
 - 2.2.3 Types of boraches
- 2.3 Gear manufacturing processes :
 - 2.3.1 Gears hobbing
 - 2.3.2 Gear shaping

- 2.4 Gear Finishing methods :
 - 2.4.1 Gear shaving, gear burnishing
- 2.5 External threading processes :
 - 2.5.1 Die heads, thread milling
 - 2.5.2 Thread grinding, thread rolling
- 3. Newer Machining Processes :**
 - 3.1 Mechanical Processes
 - 3.1.1 Ultrasonic Machining (USM) : Introduction, fundamental principles, process, advantages and Limitation, application
 - 3.1.2 Abrasive jet machining (AJM) - Introduction, principles, process, advantages and Limitation, application
 - 3.2 Electro Chemical Processes
 - 3.2.1 Electro chemical machining (ECM) - Fundamental principles, process, applications
 - 3.2.2 Electro chemical grinding (ECG) - Fundamental principles, process, applications
 - 3.3 Electrical Discharge Machining (EDM) -
 - 3.3.1 Introduction, mechanism of metal removal basic EDM circuit
 - 3.3.2 Principle of operation, material removing rate, dielectric fluid and applications of EDM
 - 3.4 Laser beam machining (LBM) - Introduction, machining process and applications
 - 3.5 Electro beam machining (EBM) - Introduction, principle processes and applications
 - 3.6 Plasma arc machining (PAM) and Welding - Introduction, principle processes and applications.
- 4. Metallic Coating Processes :** Metal spraying, galvanising, Electroplating and anodising.
- 5. Plastic Process - Working principle, Advantages and limitation of following process :**
 - 5.1 Injection moulding
 - 5.2 Blow moulding
 - 5.3 Compressive moulding
- 6. Jigs and Fixtures :**
 - 6.1 Importance and use of jigs and fixtures
 - 6.2 Principle of location
 - 6.3 Locating devices
 - 6.4 Clamping devices
 - 6.5 Types of jigs-Drilling jigs, bushes (fixed, liker, slip). Types of drilling jig - Template jigs, plate jig, channel jig, leaf jig.
 - 6.6 Fixture for milling, Advantages of jigs and fixtures

PRACTICALS

- 1. Exercise on forging operation by power hammers
- 2. Study of USM.
- 3. Exercise on buffing.
- 4. Exercise on lapping.

5. Exercise on super finishing.
6. Exercises on Electro plating.
7. Demonstration of Engine cylinder honing with the help of honing machine through industrial visit.
8. Design and manufacture of one drilling jig.
9. Design and manufacture of one milling fixture.
10. Demonstration of newer machining processes / metal cutting process/ plastic process through industrial visits.

REFERENCE BOOKS :

- | | |
|---------------------------------|-------------------------------|
| 1. Production Engineering | R.K. Jain |
| 2. Manufacturing Science | Amitabha Ghosh & A.K. Mallik |
| 3. Production Technology | Pandey.Singh |
| 4. Manufacturing Technology | Gupta & Adithan |
| 5. Modern Machining Methods | M.Adithan |
| 6. Production Engineering | P.C. Sharma (S. Chand) |
| 7. Introduction to Mfg. Process | John Schely (Mc-Graw Hill) |
| 8. Metal Forming Process | G.R. Nagpal (Khanna Pub.) |
| 9. Manufacturing Process – II | Bhatnagar, Sharma (Nav Bhart) |

RATIONALE

Due to the increased use of thermal power plants in power generation the students are required to know about the steam nozzles, steam turbines, steam condensers, air pumps, cooling towers and various modes of heat transfer. This subject will impart necessary knowledge about all these.

CONTENTS

1. Steam Nozzles :

- 1.1 Flow of steam through convergent- divergent nozzle
- 1.2 Velocity of steam leaving nozzles, Mass of steam discharged through nozzles.
- 1.3 Critical pressure ratio.
- 1.4 Area of cross section of throat and exit for maximum discharge. Length of nozzle
- 1.5 Supersaturated flow
- 1.6 Numerical problems.

2. Steam Turbines :

- 2.1 Classification and industrial application of steam turbines.
- 2.2 Principle and operation of impulse and reaction turbine
- 2.3 Compounding of turbines
- 2.4 Description of simple De-Laval turbine, velocity diagram, work done and efficiency.
- 2.5 Description of Parson's reaction turbine, velocity diagram, work done and efficiency.
- 2.6 Reheating of steam, Bleeding of steam'
- 2.7 Lubrication system for steam turbines
- 2.8 Blade materials and defects in blades
- 2.9 Simple numerical problems.

3. Steam Condenser :

- 3.1 Introduction, main elements of a condensing plant
- 3.2 Types of condenser
- 3.3 Low level, high level and ejector type of jet condenser
- 3.4 Down flow, central flow, inverted flow, regenerative and evaporative type of surface condenser
- 3.5 Source of air leakage and its effect
- 3.6 Condenser efficiency and Vacuum efficiency
- 3.7 Numerical problem.

4. Air Pumps and Cooling Tower :

- 4.1 Types of air pumps
- 4.2 Description of wet and dry types air pumps
- 4.3 Types of cooling towers
- 4.4 Description of cooling towers

5. Heat Transfer :

- 5.1 Importance of Heat Transfer
- 5.2 Mode of Heat transfer
 - 5.2.1 Conduction
 - 5.2.2 Convection
 - 5.2.3 Radiation

6. Conduction :

- 6.1 Fourier's law
- 6.2 Heat transfer by conduction through a plane & composite wall
- 6.3 Radial Heat transfer by conduction through a cylinder & sphere
- 6.4 Overall Heat transfer coefficient
- 6.5 Critical insulation
- 6.6 Heat transfer through fins
- 6.7 Numerical problem

7. Convection :

- 7.1 Natural convection
- 7.2 Forced convection
- 7.3 Heat exchangers
 - 7.3.1 Direct contact type
 - 7.3.2 Regenerator & Storage type
 - 7.3.3 Recuperator & Transfer type
- 7.4 Double pipe heat exchanger- LMTD & NTU

8. Radiation :

- 8.1 Absorption, Reflection and transmission
- 8.2 Radiant energy distribution curve
- 8.3 Emissive power
- 8.4 Black body & white body
- 8.5 Grey body
- 8.6 Kirchoff's law
- 8.7 Wien's displacement law
- 8.8 Planks law & stefan boltzman's law
- 8.9 Radiosity
- 8.10 Shape factor

PRACTICALS

- 1. Study of steam turbine
- 2. Study of steam condensers, Jet condenser and surface condenser
- 3. Study of air pump
- 4. Study of cooling towers
- 5. Study of heat transfer equipments available in the laboratory.

REFERENCE BOOKS :

- 1. Thermal Engineering Vol. I & Vol. II Mathur & Mehta
- 2. Thermal Engineering R.K. Rajput
- 3. Thermal Engineering R.K. Purohit
- 4. Thermal Engineering Raynor Joel
- 5. Elements of Heat Engineering (Vol I & II) Patel & Karamchandani
- 6. Thermal Engineering Rai & Sonrao (Satya Prakashan)
- 7. Heat Transfer Arora & Domkundwar

CNC MACHINES & AUTOMATION

CODE ME 304
MA 304/ MP 304

L T P
2 -- 2

RATIONALE

Diploma holders in mechanical engineering are required to supervise and handle CNC machines. For this purpose, knowledge and skills about CNC machines and part programming for CNC machines are required for enabling them to perform this function.

CONTENTS

1. Introduction :

- 1.1 NC machines
- 1.2 CNC machines
- 1.3 DNC machines
- 1.4 Advantages of NC machines over conventional machines
- 1.5 Difference between NC machines and SPM
- 1.6 Advantage and disadvantages of CNC machines over NC machines
- 1.7 Application of CNC machines

2. Component of NC Machines :

- 2.1 Basic components of NC system
- 2.2 Input mediums- punched cards, magnetic tapes, floppy disks and papers tape
- 2.3 NC coding
- 2.4 Machine control unit (MCU)
- 2.5 Sub units of MCU
- 2.6 Machines tool
- 2.7 Numerical control procedure

3. Classification of Numerical Control Machines :

- 3.1 Classification based on feed back control system
- 3.2 Feed back devices – Velocity feed back devices and position feed back devices.
- 3.3 Classification based on motion control system
- 3.4 Interpolators
- 3.5 Classification based on circuit technology
- 3.6 NC coordinate system
- 3.7 Axis identification

4. Constructional Details of CNC Machines :

- 4.1 Introduction
- 4.2 Machine structure
- 4.3 Slide ways
- 4.4 Spindle
- 4.5 Drive System
- 4.6 Motion transmission
- 4.7 Location of transducers
- 4.8 Swarf removal
- 4.9 Safety and guarding

5. Tooling for CNC Machines :

- 5.1 Introduction
- 5.2 Cutting tools for CNC machines
 - 5.2.1 Pre set tools
 - 5.2.2 Indexable inserts

5.2.3 Qualified tools

- 5.3 Cutting tools material for CNC machines
- 5.4 Automatic tool changer (ATC)
- 5.5 Work holding devices

6. Fundamentals of Part Programming :

- 6.1 NC Words
- 6.2 Programming formats
- 6.3 Part programming for machining- point-to-point , straight line and along curved surface
- 6.4 Part programming for lathe, milling and drilling operations

7. Advanced Part Programming :

- 7.1 Standardised fixed cycles
- 7.2 Non- Standardised fixed cycles
 - 7.2.1 Do-loops
 - 7.2.2 Subroutines

8. Computer Aided Part Programming :

- 8.1 Geometry statements
- 8.2 Motion statements
- 8.3 Post processor statements
- 8.4 Auxiliary statements

9. Robotics :

- 9.1 Introduction
- 9.2 Advantages of a robot
- 9.3 Robot terminology
- 9.4 Major Features of a robot
 - 9.4.1 Manipulator
 - 9.4.2 Controller
 - 9.4.3 Sensors
 - 9.4.4 Power supply unit
- 9.5 Types of Robots
 - 9.5.1 According to the structure of Manipulator
 - 9.5.2 According to type of system
 - 9.5.3 According to type of control loops
- 9.6 Application of robots.

10 Automation in Manufacturing :

- 10.1 Introduction to machining centre
- 10.2 Introduction to computer Integrated manufacturing (CIM)
- 10.3 Introduction to flexible manufacturing system (FMS)
- 10.4 Introduction to group technology (GT)
- 10.5 Introduction to computer process planning (CAPP)

PRACTICALS

1. To prepare jobs on CNC machine by using various operations like turning, facing, taper turning, step turning, profile cutting, threading, chamfering etc on available machine.
2. To develop various types of CNC machine programmes.
3. Industrial Visit

REFERENCE BOOKS :

1. CNC Machine- Programming & Application

Adithan & Pabla New Age International

2. CNC Machine
3. CAD/CAM
4. Computer Aided Manufacturing
5. CAM
6. CAM

Dhanpat Rai & Sons
 Groover (TMH)
 Rao, Kundra, Tiari (TMH)
 Vikram Sharma (S. K. Kataria & Sons)
 S. Vishal (S. K. Kataria & Sons)

POWER GENERATION

CODE ME 305
 MA305

L T P
 2 2/2 --

RATIONALE

With the increased consumption of electrical power in industries, agriculture and human comfort, more and more thermal, hydro and nuclear power plants are being installed throughout the country. Gas turbine power plants are also being set up. This all has necessitated to train more and more people for the operation of different types of power plants, Solar energy, wind energy and renewable energy sources.

CONTENTS

1. Introduction :

- 1.1 Different types of conventional sources of energy
- 1.2 Base load and peak load plants
- 1.3 Scope of conventional energy sources in India
- 1.4 Status of conventional power plants in India

2. Thermal Power Plants :

- 2.1 General layout and working
- 2.2 Factors of site selection
- 2.3 Methods of coal handling
- 2.4 Unloading devices
- 2.5 Ash handling system
- 2.6 Concept of super thermal power plants
- 2.7 Combustion equipment
 - 2.7.1 Basic requirements
 - 2.7.2 Methods of coal burning : Hand firing, Stoker fired systems, Pulverised fuel fired system
 - 2.7.3 Coal Burners : Stream line, Turbulent types
 - 2.7.4 Combustion control, fluidised bed combustion

3. Hydro-Electric Power Plant :

- 3.1 Advantages and application of hydroelectric power plants
- 3.2 Elements of hydroelectric power plant
- 3.3 Plant layout of low head and high head intake
- 3.4 Combination of Hydel – Thermal power plants
- 3.5 Hydro electric power plants in India.

4. Nuclear Power Plant :

- 4.1 Introduction to nuclear reactions and nuclear fuels
- 4.2 Site selection of nuclear power plants
- 4.3 Nuclear reactors : various elements of nuclear reactors.
- 4.4 Comparison of nuclear power plant with thermal and hydel power plants
- 4.5 Common types of nuclear reactors
 - 4.5.1 Pressurised water reactor
 - 4.5.2 Boiling water reactor
 - 4.5.3 Gas cooled reactors
 - 4.5.4 Liquid metal cooled reactor
 - 4.6.5 Fast breeder reactor
- 4.6 Nuclear power plants in India

- 4.7 Hazards in nuclear power plants and safety measures
- 4.8 Nuclear waste disposal

5. Diesel Power Plants :

- 5.1 Elements of a diesel power plant
- 5.2 Building and general layout
- 5.3 Use of diesel engine with steam power plants
- 5.4 Applications of diesel power plants
- 5.5 Limitation of diesel power plants

6. Gas Turbine Plants :

- 6.1 Classification and application
- 6.2 Elementary description of gas turbines
- 6.3 Details of elements of a gas turbine plant and plant layout
- 6.4 Advantages over thermal and diesel power plants

7. Power Plant Economics :

- 7.1 Elements of cost of power
- 7.2 Factors affecting economics of generation and distribution of power
- 7.3 Factors affecting choice and type of power plants on economics of power generation
- 7.4 Simple numerical problems on cost of power generation.

8. Renewal Energy Sources :

- 8.1 Present position of conventional energy sources in India
- 8.2 Need for non-conventional energy sources
- 8.3 Various alternate energy sources – solar, biogas, wind, geothermal, tidal, Magneto hydro dynamic, thermo electric power etc.

9. Solar Energy :

- 9.1 Introduction to solar power
- 9.2 Solar energy collectors
- 9.3 Application of solar energy
 - 9.3.1 Solar water heating
 - 9.3.2 Solar heating of Buildings
 - 9.3.3 Solar thermal electric conversion
 - 9.3.4 Solar photo voltaic
 - 9.3.5 Solar distillation
 - 9.3.6 Solar green house
 - 9.3.7 Space cooling
- 9.4 Solar energy storage
 - 9.4.1 Thermal storage
 - 9.4.2 Chemical storage
 - 9.4.3 Mechanical energy storage
 - 9.4.4 Solar pond

10. Wind Energy :

- 10.1 Scope of wind energy
- 10.2 Merits and demerits of wind energy
- 10.3 Measurement of wind velocity by Anemometer : Indicating and recording type
- 10.4 Wind Machines

- 10.4.1 Horizontal axis wind machine
- 10.4.2 vertical axis wind machine
- 10.5 Wind power and energy pattern factor
- 10.6 Efficiency of wind machine
- 10.7 Site selection of wind machine

REFERENCE BOOKS :

- | | |
|------------------------------------------------|------------------------------|
| 1. Power Plant Engineering | Dr. Mahesh Verma |
| 2. Power Plant Engineering | Keshwani |
| 3. शक्ति सयंत्र | R.L.Agrawal |
| 4. Power Plant Engineering | Domkumdwat |
| 5. Power Plant Engineering (Hindi) | Prakash & Kumar |
| 6. Power Plants Engineering | P.K. Nag (TMH) |
| 7. Power Plants | G.R. Nagpal |
| 8. Power Plants Technology | M.M. El-Wakil (Mc-Graw Hill) |
| 9. Non Conventional Energy Sources | G.D. Rai (Khanna Pub.) |
| 10. Energy Technology – Non Conventional | S.Rao (Khanna Pub.) |
| 11. Non Conventional Sources of Energy (Hindi) | Agrawal & Gupta (Nav Bharat) |
| 12. अपारम्परिक ऊर्जा स्रोत | ए. एन. माथुर / एन.एस. राठौड़ |

ADVANCE WORKSHOP TECHNIQUES

CODE ME 306
MA306

L T P
2 -- 3

RATIONALE

This subject gives knowledge to the students with regard to many kinds of machine tools used in industry. Major thrust is to expose the students to acquire practical skill in handling milling machines, grinding machines, capstan and turret lathes and many other kinds of machines. This enables students to perform well on the shop floor in the industry.

CONTENTS

1. Metal Cutting Saws :

- 1.1 Specifications, description, working and uses of sawing machine
- 1.2 Description, specification of cutters/ blade for sawing machines, blade setting.

2. Boring :

- 2.1 Principle of boring
- 2.2 Classification of boring machines and their description
- 2.3 Specification of boring machine
- 2.4 Boring tools
- 2.5 Boring bars and boring heads
- 2.6 Description of Jig boring machine

3. Milling Machine :

- 3.1 Specifications and working principle of milling machine
- 3.2 Classification of milling machines and their brief description and their applications.
- 3.3 Details of column and knee type milling machine
- 3.4 Milling machine accessories and attachment -Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment, spiral milling attachment, slotting attachment and rack milling attachment.
- 3.5 Work holding devices.
- 3.6 Milling methods-up milling and down milling
- 3.7 Various types of milling cutters and mandrels for milling machines
- 3.8 Milling operations-face milling, angular milling, form milling, straddle milling and gang milling
- 3.9 Cutting speed and feed. Simple numerical problems
- 3.10 Indexing on dividing heads, plain and universal dividing heads
- 3.11 Indexing methods : direct, plain or simple, compound, differential and angular indexing. Numerical problems on indexing
- 3.12 Helical and spiral milling
- 3.13 Introduction to machining centre

4. Grinding and Grinding Machines :

- 4.1 Purpose of grinding
- 4.2 Various elements of grinding wheel – Abrasive, Grade, Structure, Bond
- 4.3 Common wheel shapes and types of wheels - built up wheels, mounted wheels and diamond wheels. Specifications of grinding wheels as per BIS
- 4.4 Truing and dressing, balancing and mounting of wheel
- 4.5 Grinding methods: surface grinding, cylindrical grinding and centreless grinding.
- 4.6 Grinding Machines- cylindrical grinders, surface grinders, internal grinders, centreless grinders and tools and cutter grinders.
- 4.7 Selection of grinding wheel

5. Capstan and Turret Lathes :

- 5.1 Concept of ram or capstan type and turret or saddle type machine
- 5.2 Principal parts of capstan and turret lathes

- 5.3 Capstan and Turret lathe mechanism : Turret indexing mechanism, Bar feeding mechanism
- 5.4 Work holding devices : Jaw and collet chucks
- 5.5 Tool holding devices : slide tool holder, knee tool holder, knurling tool holder, recessing tool holder, form tool holder, Tap and Die holder, V-steady box tool holder, roller steady box tool holder
- 5.6 Introduction to turret tooling layout
- 5.7 Difference among capstan, turret and conventional lathe.

6. Automatic Machines :

- 6.1 Brief description of single spindle and multi-spindle automatic machines viz. Swiss type automatic screw machine and Turret type screw machines
- 6.2 Transfer Machines- Inline , Rotary Indexing Table , Drum Machines

7. Metal Finishing Processes :

- 7.1 Purpose of finishing surfaces
- 7.2 Description of lapping, super finishing, polishing and buffing processes
- 7.3 Description of honing machine and honing tools

8. Maintenance of Machine Tools :

- 8.1 Importance of maintenance
- 8.2 Different type of maintenance
- 8.3 Sequence of maintenance operation : Disassembly, washing, fault finding, assembly

9. Installation and Testing of Machine Tools :

- 9.1 Different types of machine foundation
- 9.2 Foundation plan
- 9.3 Machine tool testing

PRACTICALS

- 1. Face milling.
- 2. Gear cutting on a milling machine. (Spur and Bevel)
- 3. Key way cutting on shaft
- 4. Exercise on gang milling
- 5. Job on Capstan lathe and Turret lathe.
- 6. Job on grinding machine.
 - 6.1 Surface grinding
 - 6.2 Cylindrical grinding (internal and external)
 - 6.3 Centre less grinding (internal and external)
- 7. Milling cutter grinding on tool and cutter grinder
- 8. Job using copying attachment on lathe
- 9. Exercises on honing and lapping machine
- 10. Super finishing practice on lathe
- 11. Maintenance of milling, Grinding and Lathe machines

REFERENCE BOOKS :

- | | |
|---------------------------------|-----------------------|
| 1. Workshop Technology II | Hazra Chaudhary |
| 2. Workshop Technology II | Raghuvanshi |
| 3. Production Technology | R.K.Jain & S.C. Gupta |
| 4. Workshop Technology (Hindi) | Tahil Maghnani |
| 5. Production Technology | H.M.T |
| 6. Workshop Technology II & III | Chapman |
| 7. Production Technology | Pandey & Singh |

INDUSTRIAL ENGINEERING

CODE ME 307
MP307

L T P
2 2/2 --

RATIONALE

To achieve the target and goals of an industry, it is essential to co-ordinate the entire manufacturing system, for efficient working of an organisation, evaluation and improvement in manufacturing of jobs and components. For this purpose topic like plant location and layout, work-study and production, planning and control are included in this subject.

By learning of above topics, capacity to work as middle level manager is developed amongst the students. It is suggested that students should be taken to nearby industries to acquaint them with various engineering aspects of an industry.

CONTENTS

1. Production, Planning and Control :

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

2. Inventory Control :

- 2.1 Definition, types of inventory - Codification and standardization
- 2.2 ABC analysis. Economic ordering quantity
- 2.3 Procurement cost, carrying charges, lead-time, re-order point, simple problems.

3. Inspection and Quality Control :

- 3.1 Definitions, types of inspection and procedure
- 3.2 Statistical quality control - Basic theory of quality control, Process capability
- 3.3 Control charts for variables – \bar{X} and R, relationship between control limits and specification limits. Control chart for fraction defective (p), control chart for number of defect (c)
- 3.4 Acceptance sampling - Selection of samples, sample size, method of taking samples. Samplings plan - single, double, sequential. Acceptance quality level (AQL), lot tolerance percentage defective (LTPD), producer's risk, consumer's risk. Operating characteristic curve, simple problems.

4. Work Study :

- 4.1 Definition, advantages and procedure of work-study. Difference between production and productivity, Factors to improve productivity
- 4.2 Method Study :- Definition, objectives and procedure of method study.
- 4.3 Symbols, flow process chart (man-machine-material), flow diagram, machine chart, two hand chart
- 4.4 Critical examination. Developing a new method
- 4.5 Principles of motion economy. Therblig symbols, SIMO chart, simple problems.
- 4.6 Work Measurement -time study, definition, principle and method of time study
- 4.7 Stop watch study - number of reading, calculation of basic time, rating techniques, normal time, allowances, standard time
- 4.8 Simple numerical problems.
- 4.9 Work Sampling - Definition, method, advantages and disadvantage of work sampling Applications.

5. Plant Location and Layout :

- 5.1 Definition, factors affecting the site selection of plant
- 5.2 Factor affecting plant layout
- 5.3 Types of layout - process, product, combination and fixed position layout
- 5.4 Techniques in making layout-Flow diagram, templates, distance volume matrix, travel chart
- 5.5 Line balancing, workstation, Numerical problem.

6. Material Handling :

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

7. Linear Programming :

- 7.1 Formulation L.P. problem
- 7.2 Graphical method for optimal solution
- 7.3 Simplex method for optimal solution

8. Depreciation :

- 8.1 Definition
- 8.2 Obsolescence and amortization
- 8.3 Different methods of calculating depreciation
- 8.4 Numerical problems.

REFERENCE BOOKS :

- | | |
|-------------------------------------|---------------|
| 1. Industrial Engineering (Hindi) | V.K.Sharma |
| 2. प्रारम्भिक उद्योग अभियांत्रिकी | सुरेश दलेला |
| 3. Industrial Engineering | S.C.Sharma |
| 4. Industrial Engg. & Management | T.R.Banga |
| 5. Elements of Work Study | Suresh Dalela |
| 6. Construction Equipment | Mahesh Verma |
| 7. Construction Equipment | S.C.Sharma |
| 8. Industrial Engg. & Management | O.P. Khanna |
| 9. Production, Operation Management | B.S. Goel |

MACHINE DESIGN

CODE ME 308

L T P
2 2/2 --

RATIONALE

Knowledge of method of finding shapes and sizes of various machine elements is very essential from their strength and stiffness/rigidity viewpoints. Also the knowledge of calculation of manufacturing cost of machine elements is essential. This subject would impart the basic knowledge about the designing of various machine elements.

CONTENTS

1. Introduction :

- 1.1 General consideration in machine design
- 1.2 General procedure in machine design
- 1.3 Selection of material
- 1.4 Working stress and factor of safety, selection of factor of safety
- 1.5 Stress concentration, stress concentration factor and methods of reducing stress concentration
- 1.6 Fatigue and endurance limit
- 1.7 Effect of load, surface finish and size on endurance limit
- 1.8 Preferred number

2. Design of Welding Joints :

- 2.1 Types of welded joint and Design of lap joint and butt joint
- 2.2 Strength of transverse and parallel fillet welded joints in axial loading
- 2.3 Basic welding symbols
- 2.4 Welded joint subjected to twisting moment and bending moment
- 2.5 Eccentrically loaded welded joints

3. Design of Screw and Bolts :

- 3.1 Initial stresses due to screwing up
- 3.2 Stress due to external forces
- 3.3 Stress due to combined forces
- 3.4 Bolt of uniform strength
- 3.5 Screw thread, designations and its dimensions.
- 3.6 Design of Power screw
- 3.7 Design of screw jack

4. Design of Joints :

- 4.1 Design of simple cotter joints
- 4.2 Design of knuckle joints
- 4.3 Design of turnbuckle

5. Design of Keys and Couplings :

- 5.1 Design of sunk key
- 5.2 Design of rigid flange coupling
- 5.3 Design of pin type flexible couplings

6. Design of Shaft :

- 6.1 Shaft subjected to twisting moment
- 6.2 Shaft subjected to bending moment
- 6.3 Shaft subjected to combined twisting and bending moment

7. Design of Components :

- 7.1 Cast Iron pulley
- 7.2 Flywheel
- 7.3 Helical spring
- 7.4 Leaf spring.

8. Bearings (no numerical problems) :

- 8.1 Introduction and Classification
- 8.2 Material used for bearings and their properties
- 8.3 Types and uses of rolling contact bearings
- 8.4 Standard dimension and designations of ball bearings
- 8.5 Selection of rolling elements bearings

9. Lever :

- 9.1 Introduction
- 9.2 Design of a hand lever
- 9.3 Design of a foot lever
- 9.4 Design of Lever for safety valve

REFERENCE BOOKS :

- | | |
|-----------------------|-------------------------------|
| 1. Machine Design | Pandya & shah |
| 2. Machine Design | R.S.Khurmi |
| 3. Machine Design | Sharma & Aggrawal |
| 4. Machine Design | V. B. Bhandari |
| 5. Engineering Design | J. E. Shieglay (McGraw-Hill) |
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MECHANICAL ESTIMATING AND COSTING

CODE ME 309

L T P
2 2/2 --

RATIONALE

The Knowledge about estimation and costing is required for engineers. This subject is designed to develop understanding of various components of costs and making cost estimation.

CONTENTS

1. Introduction :

- 1.1 Estimating
 - 1.1.1 Definition
 - 1.1.2 Importance of estimating
 - 1.1.3 Aims and functions
 - 1.1.4 Estimating procedure
- 1.2 Costing
 - 1.2.1 Definition
 - 1.2.2 Aims of costing
 - 1.2.3 Procedure of costing
- 1.3 Difference between estimating and costing

2. Elements of Costs :

- 2.1 Material cost
- 2.2 Labour cost
- 2.3 Expenses
 - 2.3.1 Direct expenses
 - 2.3.2 Indirect expenses
- 2.4 Component of cost
- 2.5 Overhead cost
- 2.6 Allocation of on cost

3. Break Even Analysis and Equipment Replacement Analysis :

- 3.1 Break even analysis (cost, volume, profit analysts), determination of Break even point, break even point theory
- 3.2 Equipment Replacement Analysts
 - 3.2.1 Regions
 - 3.2.2 Policy
 - 3.2.3 Guide line
 - 3.2.4 Various methods
- 3.3 Hire Purchasing

4. Estimation of Material Cost :

- 4.1 Estimation of volumes, weights and cost of materials for
 - 4.1.1 Pulley
 - 4.1.2 Spindle
 - 4.1.3 Lathe centre
 - 4.1.4 Fly wheel
 - 4.1.5 Crank shaft

MANAGEMENT & ENTREPRENEURSHIP

CODE ME 310

Common to all branches except CC/CE/CS/EE/ IT/MA/MR

L T P

2 1

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RATIONALE

To achieve the target and goals in an organisation it is essential to co-ordinate the entire system. For this purpose the knowledge of principles of management, human resources development, material management and financial management is required.

Entrepreneurship will introduce the students about how to set up a small-scale industry. The subject includes the procedure for how to select, proceed and start the SSI, which also involves a concrete market survey report and project formulation.

CONTENTS

1. Principles of Management :

- 1.1 Management, administration and organisation, difference between them.
- 1.2 Scientific management : Meaning, characteristics, object and advantage : Taylor's scientific management – Fayol's principles of management, functions of management
- 1.3 Types of ownership, sole trading, partnership, joint stock, co-operative and public enterprise
- 1.4 Types of organisation, different types and their charts.
- 1.5 Importance of human relation professional ethics
- 1.6 Need for leadership, leadership qualities
- 1.7 Motivation

2. Human Resources Development :

- 2.1 Introduction, object and functions of human resource development department
- 2.2 Recruitment, sources and methods of selection, need for effective training, method of training, duties of supervisor / Foremen, Role of HRD in industries.

3. Wages and Incentives :

- 3.1 Definition and requirements of a good wage system methods of wage payment
- 3.2 Wage incentives - type of incentive, difference in wage incentive and bonus. incentive to supervisor.

4. Material Management :

- 4.1 Purchasing Functions and duties of purchase department organisation of purchase department, methods of purchasing, purchase order contracts, legality of contracts types of contracts i.e. piece work contract, lumpsum contract, item rate contract, percentage contract, merits and limitation of each contract system, departmental execution of works, rate contract - D.G.S & D and C.S.P.O. tender, necessity, types of tenders, tendering procedure, earnest money and security money
- 4.2 Store and store keeping : Functions and duties of store department, location and layout of store, bin cards, store ledger, receipt and issue procedure of materials, physical verification of stores, disposal method of unserviceable articles and protection of stores.
- 4.3 Sales : function and duties of sales department sales promotion advertisement service after sales.

5. Financial Management :

- 5.1 Function and duties of finance department
- 5.2 Brief idea of journal, ledger, trial balance, trading account, profit and loss account, balance sheet.
- 5.3 Cheques (crossed and bearer), draft, promissory note, letter of credit, brief idea of cost accounting.
- 5.4 Numerical problems.

6. Marketing Management :

- 6.1 Concept of Marketing
- 6.2 Problems of Marketing

- 6.3 Pricing policy
 - 6.4 Distribution channels and methods of marketing
- 7. Entrepreneurship :**
- 7.1 Entrepreneurship and Entrepreneur
 - 7.2 Need of Employment and Opportunities.
 - 7.3 Essential Characteristics of a good Entrepreneur
 - 7.4 Industrial Policy.
 - 7.5 Classification of industries- Tiny, small scale , Medium scale, Large scale, Handicraft, Ancillary
 - 7.6 Type of industries- Production, Job based & Service
- 8. Entrepreneurial Development :**
- 8.1 Product identification/ selection
 - 8.2 Site selection
 - 8.3 Plant layout
 - 8.4 Institutional support needed
 - 8.5 Pre-market survey
- 9. Entrepreneurship Support System:**
- 9.1 Role of District Industries Centre in setting up industry
 - 9.2 Function of NSIC, SISI, NISIET, NRDC, SSIC, SIDO, NMTC, KVIC, RSMML.
 - 9.3 Role of state finance corporation, state electricity corporations, pollution control board, BIS, I.S.O. etc.
- 10. Setting up SSI :**
- 10.1 Registration of SSI
 - 10.2 Allotment of land by RIICO
 - 10.3 Preparation of project report
 - 10.4 Structure of organisation
 - 10.5 Building construction
 - 10.6 Establishment of machines
- 11. Tax System and Insurance :**
- 11.1 Idea of income tax, sales tax, excise duty and custom duty
 - 11.2 Industrial and fire insurance, procedure for industrial insurance.
- 12. Financial Sources for SSI :**
- 12.1 Various institutions providing loans for industries
 - 12.2 Various types of loans
 - 12.3 Subsidies
- 13. Labour Legislation and Pollution Control Acts :**
- 13.1 Industrial acts : factory act 1948
 - 13.2 Workmen's compensation act 1923
 - 13.3 Apprentices act 1961
 - 13.4 Water pollution contract act 1974 and 1981
 - 13.5 Air pollution contract act 1981
 - 13.6 Environmental protection act 1986
 - 13.7 Forest (animal conservation act 1972)
 - 13.8 Pollution control provisions in motor vehicle act.
- 14. Project Report :**
- 14.1 Procedure of preparing a project report
 - 14.2 Format of project report
 - 14.3 Preparation of project report for some SSI items
- 15. ISO : 9000 Series of Quality System :**

- 15.1 Definition of few important terms related to ISO quality system
- 15.2 Various models for quality assurance in ISO : 9000 series
- 15.3 Various elements of ISO : 9001 model (20 points)
- 15.4 Benefits by becoming an ISO : 9000 company
- 15.5 Introduction to total quality management (TQM)

REFERENCE BOOKS :

- | | |
|----------------------------------------------|---------------------------|
| 1. Industrial Management | V.K. Sharma & O.P. Harkut |
| 2. Industrial Engg. & Management | O.P. Khanana |
| 3. Industrial Engg. & Management | T.R. Banga |
| 4. Hand Book of Small Scale Industry | P.M. Bhandari |
| 5. Hand Book on Entrepreneurship Development | O.P. Harkut |
| 6. Entrepreneurial Development | S.S. Khanka |
| 7. Statistical Quality Control | Mahohar Mahajan |
| 8. ISO : 9000 Quality System | S. Dalela |
