

## 5.1 BASICS OF MANAGEMENT

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### RATIONALE

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Topics like Structure of Organization, Leadership, Motivation, Ethics and Values, Marketing management, Financial management, Customer Relationship Management (CRM) & Total Quality Management (TQM), etc. have been included in the subject to provide elementary knowledge about these management areas.. This course explores cyber-security measures and the different forms of cybercrime and emergent forms of cyber-warfare.

### LEARNING OUTCOME

After undergoing the subject, the student will be able to:

- Explain the principles of management including its functions in an organisation.
- Have insight into different types of organizations and their structures.
- Inculcate leadership qualities to motivate self and others.
- Manage human resources at the shop-floor
- Maintain and be a part of healthy work culture in an organisation.
- Use marketing skills for the benefit of organization .
- Maintain books of accounts and take financial decisions.
- Undertake store management.
- Use modern concepts like TQM, TPM and CRM.
- Distinguish and classify the forms of cybercriminal activity and the technological and 'social engineering' methods used to undertake such crimes.
- Analyse and assess the impact of cybercrime on government, businesses, individuals and society.

### DETAILED CONTENTS

1. **Principles of Management** (06 hrs)
  - 1.1. Introduction, importance and general functions of management.
  - 1.2. Concept and Types of an organization - Sole trading ,partnership, companies, corporation, PSU's and cooperative societies.
  - 1.3. Structure of an organisation -
    - a) Line organization
    - b) Staff organisation
    - c) Functional organization
    - d) Line and staff organization
  - 1.4. Hierarchical Management Structure
    - Top, middle and lower level management

- 1.5. Departmentalization
  - Introduction and its advantages.
  
2. **Leadership and Motivation** (06 hrs)
  - 2.1 Leadership
    - 3.1.1. Definition and Need of Leadership
    - 3.1.2. Qualities of a good leader
    - 3.1.3. Manager vs. leader
    - 3.1.4. Theories of leadership –trait theory and Behaviour theory.
  - 2.2 Motivation
    - 3.1.5. Definition and characteristics of motivation
    - 3.1.6. Factors affecting motivation
    - 3.1.7. Maslow’s Need Hierarchy Theory of Motivation and X&Y need Hierarchy theory of motivation.
  
3. **Work Culture** (06 hrs)
  - 3.1. Introduction and importance of Healthy Work Culture in organization
  - 3.2. Components of Culture
  - 3.3. Importance of attitude, values and behaviour  
Behavioural Science – Individual and group behavior.
  - 3.4. Professional ethics – Concept and need of Professional Ethics and human values.
  
4. **HRM and its functions** (04 hrs)
  - 4.1 Human Resource Management
    - Manpower Planning, recruitment and selection
    - Training and development of work force at the shop-floor.
    - Performance appraisal
    - Wages, salary and incentive schemes
  
5. **Marketing and sales** (06 hrs)
  - 5.1 Marketing
    - Introduction, importance and its functions
    - Marketing mix for industries and service sector
    - Basic Marketing strategies
  - 5.2 Sales
    - Difference between marketing and selling
    - Advertisement- print media and electronic media
    - Market-Survey and Sales promotion.
  
6. **Basic of Accounting and Finance** (06 hrs)
  - 6.1 Basic of Accounting:
    - Meaning and definition of accounting
    - Double entry system of book keeping
    - Trading account, PLA account and balance sheet of a company

- 6.2 Objectives of Financial Management  
 - Profit Maximization v/s Wealth Maximization
7. **Material and Stores Management** (04hrs)  
 - Introduction, functions and objectives of material management  
 - Purchasing: definition and procedure  
 - Just in time (JIT)
8. **TQM , TPM** (02 hrs)  
 Total Quality Management (TQM) and Total Preventive Maintenance (TPM) -  
 Concepts and importance
9. **Customer Relationship management (CRM)** (02 hrs)  
 Customer Relationship management - Concepts and importance
10. **Cyber Security** (06 hrs)  
 -Introduction to Cyberspace and Cyber Law, Pros and Cons of social media.  
 -Different Components of cyber Laws; Cyber Law and Netizens  
 - Categories of Cyber Crime: Personal, Business, Financial, Office Security  
 -Cyber Crime – Complete transparency, hacking/cracking, denial of service, IP piracy,  
 phrasing, hetaerism etc. Cyber Attack – cyber attackers.  
 -Introduction to IPR, copyright & patent

### **INSTRUCTIONAL STRATEGY**

It is observed that the diploma holders generally take up middle level managerial positions, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different functions related to management. Some of the topics may be taught using question answer, assignment or seminar method. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organizations. Appropriate extracted reading material and handouts may be provided.

### **RECOMMENDED BOOKS**

1. Principles of Management by Philip Kotler TEE Publication
2. Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi.

3. Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.
4. Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.
5. Essentials of Management by H Koontz, C O' Daniel , McGraw Hill Book Company, New Delhi.
6. Intellectual Property Rights and the Law by Dr. GB Reddy.
7. Service Quality Standards, Sales & Marketing Department, Maruti Udyog Ltd.
8. Nandan Kamath, A Guide to Cyber Laws & IT Act 2000 with Rules & Notification
9. Keith Merill & Deepti Chopra (IK Inter.), Cyber Cops, Cyber Criminals & Internet

#### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	06	12
2.	06	12
3.	06	12
4.	04	9
5.	06	12
6.	06	12
7.	04	9
8.	02	05
9.	02	05
10.	06	12
<b>Total</b>	<b>48</b>	<b>100</b>

## 5.2. REFRIGERATION AND AIR CONDITIONING

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### RATIONALE

The diploma holders in Mechanical Engineering are responsible for supervising and maintenance of RAC system. For this purpose, the knowledge and skill covering basic principles of refrigeration and air conditioning is required to be imparted to the students. Moreover, RAC industry is expanding and employment opportunities in this field are good.

### Learning Outcomes

After undergoing this course, the students will be able to:

- Explain the working and construction features of refrigeration and air conditioning systems
- Draw and interpret various refrigeration cycles.
- Make basic calculation of psychometric properties and processes.
- Calculate heating and cooling load requirements of a room.
- Explain latest developments in the field of refrigeration and air conditioning.
- Calculate the properties of air by using psychometric chart.
- Detect faults in an air-conditioner/refrigerator.
- Carry out charging of air conditioner.

### DETAILED CONTENTS

#### REFRIGERATION

1. Fundamentals of Refrigeration (02 hrs)  
Introduction to refrigeration, and air conditioning, meaning of refrigerating effect, units of refrigeration, COP, difference between COP and efficiency, methods of refrigeration, Natural system and artificial system.
2. Vapour Compression System (12 hrs)  
Introduction, principle, function, parts and necessity of vapour compression system, T-  $\phi$  and p- H charts, dry, wet and superheated compression. Effect of sub cooling, super heating, mass flow rate, entropy, enthalpy, work done, Refrigerating effect and COP. actual vapour compression system
3. Refrigerants (04 hrs)  
Functions, classification of refrigerants, properties of R - 717, R – 22, R–134 (a), CO<sub>2</sub>, R – 11, R – 12, R – 502, Properties of ideal refrigerant, selection of refrigerant

4. Air Refrigeration System (08 hrs)

Introduction, advantages and disadvantages of air-refrigeration system over vapour compression system, bell – Collemann cycle, calculation of mass flow rate, work done and COP

5. Vapour Absorption System (06 hrs)

Introduction, principle and working of simple absorption system and domestic electrolux refrigeration systems. Solar power refrigeration system, advantages and disadvantages of solar power refrigeration system over vapour compression system.,

6. Refrigeration Equipment (12 hrs)

6.1 Compressors- Function, various types of compressors

6.2 Condensers - Function, various types of condensers

6.3 Evaporators- Function, types of evaporators

6.4 Expansion Valves - Function, various types such as capillary tube, thermostatic expansion valve, low side and high side float valves, application of various expansion valves

6.5. Safety Devices-Thermostat, overload protector LP, HP cut out switch.

## **AIR CONDITIONING**

7. Psychrometry (08 hrs)

Definition, importance, specific humidity, relative humidity, degree of saturation, DBT, WBT, DPT, sensible heat, latent heat, Total enthalpy of air.

8. Applied Psychrometry and Heat Load Estimation. (09 hrs)

Psychrometric chart, various lines, psychrometric process, by pass factor, room sensible heat factor, effective room sensible heat factor, grand sensible heat factor, ADP, room DPT.

Heating and humidification, cooling and dehumidification, window air-conditioning, split type air-conditioning, car air-conditioning, central air-conditioning.

9. Latest development in refrigeration and air conditioning:- (03 hrs)  
Inverter technology, auto-defrosting, blast cooling, star rating.

### **LIST OF PRACTICALS**

1. Identify various tools of refrigeration kit.
2. Practice in cutting, bending, flaring, swaging and brazing of tubes.
3. Study of thermostatic switch, LP/HP cut out overload protector filters, strainers and filter driers.
4. Identify various parts of a refrigerator and window air conditioner.
5. To find COP of Refrigeration system
6. To measure air flow using anemometer.
7. Charging of a refrigerator/ air conditioner.
8. To detect faults in a refrigerator/ air conditioner
9. Visit to an ice plant or cold storage plant. or central air conditioning plant

### **INSTRUCTIONAL STRATEGY**

1. Teaches should take the students to industry and explain the details of refrigeration and air-conditioning systems and their components.
2. While imparting instructions, focus should be on conceptual understanding.
3. Training slides of “Carrier Fundamentals of Refrigeration Air Conditioning” to be shown to students.

### **RECOMMENDED BOOKS**

1. Refrigeration and Air Conditioning by Domkundwar; Dhanpat Rai and Sons, Delhi.
2. Refrigeration and Air Conditioning by CP Arora; Tata McGraw Hill, New Delhi.
3. Refrigeration and Air Conditioning by R.S Khurmi and J.K. Gupta; S Chand and Company Limited, New Delhi.
4. Refrigeration and Air Conditioning by Dr. Harjeev Khanna; Dhanpat Rai and Sons, Delhi.
5. Refrigeration and Air Conditioning by Dr. R.K Rajput; S.K. Kataria and Sons, Ludhiana.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	02	04
2	12	20
3	04	06
4	08	12
5	06	10
6	12	18
7	08	12
8	9	14
9	3	4
<b>Total</b>	<b>64</b>	<b>100</b>



### 5.3 THERMODYNAMICS-II

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4 - 2

#### RATIOANLE

A diploma holder in this course is supposed to know about testing of IC Engines, fuel supply, ignition system, cooling and lubrication of engines and gas turbines. Hence this subject

#### Learning Outcomes

After undergoing this course, the students will be able to:

- Explain the working of IC engine.
- Diagnose and rectify simple problems in fuel supply and ignition system.
- Explain the functioning of different components of fuel supply of diesel engine.
- Explain the working of lubrication and cooling system in IC engine.
- Assist in testing an IC engine.
- Explain the functioning of steam turbine, gas turbine and jet propulsion.

#### DETAILED CONTENTS

1. IC Engines (09 hrs)
  - 1.1 Introduction
  - 1.2 Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, diesel cycle and dual cycle
  - 1.3 Location and functions of various parts of IC engines and materials used for them
  
2. Fuel Supply and Ignition System in Petrol Engine (08 hrs)
  - 2.1 Concept of carburetion
  - 2.2 Air fuel ratio
  - 2.3 Simple carburetor and its application, carburetor of two wheeler.
  - 2.4 Description of battery coil and electro ignition system, fault finding/ and remedial action in ignition system
  - 2.5 Description of petrol injection system
  
3. Fuel System of Diesel Engine (06 hrs)
  - 3.1 Components of fuel system
  - 3.2 Description and working of fuel feed pump
  - 3.3 Fuel injection pump, Common rail direct injection (CRDI)
  - 3.4 Injectors

4. Cooling and Lubrication (10 hrs)
  - 4.1 Function of cooling system in IC engine
  - 4.2 Air cooling and water cooling system, use of thermostat, radiator and forced circulation in water cooling (description with line diagram)
  - 4.3 Function of lubrication
  - 4.4 Types and properties of lubricant
  - 4.5 Lubrication system of engine
  - 4.6 Fault finding in cooling and lubrication and remedial action
  
5. Testing of IC Engines (09 hrs)
  - 5.1 Engine power - indicated and brake power
  - 5.2 Efficiency - mechanical, thermal, relative and volumetric
  - 5.3 Methods of finding indicated and brake power
  - 5.4 Morse test for petrol engine
  - 5.5 Heat balance sheet, simple numerical problems
  - 5.6 Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO - 1, EURO - 2, Bharat methods of reducing pollution in IC engines, alternative fuels like CNG, LPG, Hydrogen
  
6. Steam Turbines and Steam Condensers (10 hrs)
  - 6.1 Function and use of steam turbine
  - 6.2 Steam nozzles - types and applications
  - 6.3 Steam turbines - impulse, reaction, simple and compound, construction and working principle
  - 6.4 Governing of steam turbines
  - 6.5 Function of a steam condenser, elements of condensing plant
  - 6.6 Classification - jet condenser, surface condenser
  - 6.7 Cooling pond and cooling towers
  
7. Gas Turbines and Jet Propulsion (12 hrs)
  - 7.1 Classification, open cycle gas turbine and closed cycle gas turbine, comparison of gas turbines with reciprocating IC engines, applications and limitations of gas turbine
  - 7.2 Open cycle constant pressure gas turbines - general layout, PV and TS diagram and working of gas turbine
  - 7.3 Closed cycle gas turbines, PV and TS diagram and working
  - 7.4 Principle of operation of ram-jet engine and turbo jet engine - application of jet engines
  - 7.5 Rocket engine - its principle of working and applications
  - 7.6 Fuels used in jet propulsion

## **LIST OF PRACTICALS**

1. Dismantle an IC engine and note down the condition of various parts, removal and fitting of piston, rings, measuring of bore size, crank shaft ovality and assemble it.
2. Dismantle a carburetor
3. Servicing of petrol injection system
4. Valve servicing, grinding, lapping and fitting mechanism and tappet adjustment.
5. Inspection of ignition system of a multi-cylinder engine stressing ignition timings, setting, fixing order and contact breaker; gap adjustment, spark plug cleaning.
6. Service of cooling & lubrication system of IC engine and note down the functioning/testing of various components.
7. Determination of BHP by dynamometer.
8. Morse test on multi-cylinder petrol engine.
9. Draw layout of modern automobile workshop and note down the special tools and equipments in each shop.
10. Local visit to roadways or private automobile workshop.

## **INSTRUCTIONAL STRATEGY**

1. Use computer based learning aids for effective teaching-learning
2. Expose students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

## **RECOMMENDED BOOKS**

1. Elements of Heat Engines by Pandey and Shah; Charotar Publishing House, Anand.
2. Thermal Engineering by PL. Ballaney; Khanna Publishers, New Delhi.
3. Engineering Thermodynamics by Francis F Huang; McMillan Publishing Company, Delhi.
4. Engineering Thermodynamics by CP. Arora; Tata McGraw Hill Publishers, New Delhi.
5. Thermal Engineering by RK Purohit; Standard Publishers Distributors, New Delhi.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	09	15
2	08	12
3	06	10
4	10	15
5	09	15
6	10	15
7	12	18
<b>Total</b>	<b>64</b>	<b>100</b>

## 5.4 THEORY OF MACHINES

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### RATIONALE

A diploma holder in this course is required to assist in the design and development of prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components and machine and application of these principles for designing. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

### Learning Outcomes

After undergoing this course, the students will be able to:

- Explain working of different types of mechanisms and draw their inversion.
- Determine the horizontal force required to move a body on an inclined plane and calculate the efficiency of screw jack.
- Solve problems on power transmission.
- Determine ratio of driving tension for flat and V-belt drive.
- Identify various types of gears and their applications.
- Construct turning moment diagram of flywheel for different types of engine.
- Explain working of different types of governors.
- Calculate balancing of rotating mass and its position.
- Identify different type of vibrations, their causes, harmful effect and remedies.

### DETAILED CONTENTS THEORY

- |    |  |          |
|----|--|----------|
| 1. | Simple Mechanisms  | (06 hrs) |
|    | 1.1 Introduction to link, kinematic pair, lower and higher pair, Kinematic chain, mechanism, Inversions. |          |
|    | 1.2 Different types of mechanisms ( with examples )  |          |
| 2. | Friction   | (10 hrs) |
|    | 2.1 Definition and its necessity   |          |
|    | 2.2 Horizontal force required to move a body on an inclined plane both upward and downward               |          |
|    | 2.3 Frictional torque in screws , both for square and V threads  |          |
|    | 2.4 Screw jack ( Derivation and Numericals)  |          |
|    | 2.5 Different types of bearings and their application  |          |

3. Power Transmission (14 hrs)
  - 3.1 Introduction to Belt and Rope drives
  - 3.2 Types of belt drives and types of pulleys
  - 3.3 Concept of velocity ratio, slip and creep; crowning of pulleys (simple numericals)
  - 3.4 Flat and V belt drive: Ratio of driving tensions, power transmitted, centrifugal tension, and condition for maximum horse power (simple numericals)
  - 3.5 Different types of chains and their terminology
  - 3.6 Gear terminology, types of gears and their applications; simple and compound gear trains; power transmitted by simple spur gear
  
4. Flywheel (08 hrs)
  - 4.1 Principle and applications of flywheel
  - 4.2 Turning - moment diagram of flywheel for different engines
  
  - 4.3 Fluctuation of speed and fluctuation of energy - Concept only
  - 4.4 Coefficient of fluctuation of speed and coefficient of fluctuation of energy
  
5. Governor (10 hrs)
  - 5.1 Principle of governor
  - 5.2 Simple description and working of Watt, Porter and Hartnel governor (simple numerical based on watt and porter governor)
  - 5.3 Hunting, isochronisms, stability, sensitiveness of a governor
  
6. Balancing (06 hrs)
  - 6.1 Concept of balancing
  - 6.2 Introduction to balancing of rotating masses (simple numericals)
  
7. Vibrations (10 hrs)
  - 7.1 Types-longitudinal, transverse and torsional vibrations (simple numericals)
  - 7.2 Dampening of vibrations
  - 7.3 Causes of vibrations in machines, their harmful effects and remedies

### **INSTRUCTIONAL STRATEGY**

1. Use teaching aids for classroom teaching
2. Give assignments for solving numerical problems
3. Arrange industry visits to augment explaining use of various machine components like belt, rope, chain, gear drives, action due to unbalanced masses, brake clutch, governors, fly wheels, cams and gear drives
4. Video films may be used to explain the working of mechanisms and machine components like clutch, governors, brake etc.

**RECOMMENDED BOOKS**

1. Theory of Machines by D.R. Malhotra; Satya Prakashan, New Delhi.
2. Theory of Machines by V.P Singh; Dhanpat Rai and sons, New Delhi.
3. Theory of Machines by Jagdish Lal; Metropolitan Publishers, New Delhi.
4. Theory of Machine by B.S Ubhi; S.K. Kataria and Sons, New Delhi.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	06	10
2	10	15
3	14	22
4	08	12
5	10	16
6	06	10
7	10	15
<b>Total</b>	<b>64</b>	<b>100</b>

## 5.5 COMPUTER AIDED DRAFTING AND MODELING

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### LEARNING OUTCOMES

- On completion of this course, students will be able to :
- know the advantages of using CAD in comparison with conventional method.
- draw and interpret CAD drawings using drawing, editing and viewing in CAD software.
- create easy and complex solids and assemblies using various tools in Solidworks software.

### DETAILED CONTENTS

1. Introduction to AutoCAD commands (6 drawing sheets)
  - 1.1 Concept of AutoCAD, Tool bars in Auto CAD, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar)
  - 1.2 Drawing commands – point, line, arc, circle, ellipse,
  - 1.3 Editing commands – scale, erase, copy, stretch, lengthen and explode.
  - 1.4 Dimensioning and placing text in drawing area
  - 1.5 Sectioning and hatching
  - 1.6 Inquiry for different parameters of drawing entity
  - 1.7 Create layers within a drawing
  - 1.8 Specifying Geometrical Dimensioning & tolerancing (GD&T) parameters in drawing
  
2. Detail and assembly drawing of the following using AUTOCAD (4 sheets)
  - 2.1 Plummer Block
  - 2.2 Wall Bracket
  - 2.3 Stepped pulley, V-belt pulley
  - 2.4 Flanged coupling
  - 2.5 Machine tool Holder (Three views)
  - 2.6 Screw jack or knuckle joint
  
3. Isometric Drawing by CAD using Auto CAD (one sheet)
 

Drawings of following on computer:

  - Cone
  - Cylinder
  - Isometric view of objects



#### 4. Introduction to Solidworks

Introduction to Sketcher: Sketch Entities, Sketch Tools, Blocks, Dimensioning

##### 4.1 Part modeling (4 models)

Part Modeling Tools:-

- 4.1.1 Creating reference planes
- 4.1.2 Creating Extrude features Creating Revolve Creating Swept features-
- 4.1.3 Creating Loft features
- 4.1.4 Creating Reference - points, axis, coordinates
- 4.1.5 Creating curves
- 4.1.6 Creating Fillet features
- 4.1.7 Inserting Hole types
- 4.1.8 Creating Chamfer
- 4.1.9 Creating Shell
- 4.1.10 Creating Rib
- 4.1.11 Creating Pattern Advanced Modeling Tools
- 4.1.12 Inserting Fastening features,
- 4.1.13 Environment& Utilities - Working with views and manipulating views,

##### 4.2 Assembly (2 models)

Assembly Modeling Tools:-

Introduction to Assembly Modeling & Approaches – Top down and Bottom up approach, Applying Standard Mates- Coincident, Parallel, Perpendicular, Tangent, Concentric, Lock, Distance, Angle. Applying Advanced Mates – Symmetric, Width, Path Mate, Linear/Linear Coupler, Limit Mate. Applying Mechanical Mates – Cam, Hinge, Gear, Rack Pinion, Screw, and Universal Joint. Manipulating Components - Replacing Components, Rotating Components, Move Components, Collision Detection, Physical Dynamics, Dynamic Clearance, Detecting Interference Creating Pattern - Assembly Pattern, Mirror, Creating Explode Views

### **INSTRUCTIONAL STRATEGY**

1. Teachers should show model or realia of the component/part whose drawing is to be made.
2. Emphasis should be given on cleanliness, dimensioning, & layout of sheet.
3. Teachers should ensure use of IS codes related to drawing.

**RECOMMENDED BOOKS**

1. Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.
2. AutoCAD for Engineering Drawing Made Easy by P. NageswaraRao; Tata McGraw Hill, New Delhi.
3. AutoCAD 2000 for you by UmeshShettigar and Abdul Khader; Janatha Publishers, Udupi.
4. Auto CAD 2000 by Ajit Singh, TMH, New Delhi.
5. Designing with Pro Engineer, Sham Tickoo by Dream Tech Publications, New Delhi.
6. Designing with CATIA, by Sham Tickoo, Dream Tech. Publications, New Delhi

## 5.6 WORKSHOP TECHNOLOGY - III

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4 - 7

### RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes and modern machining methods is required to be imparted. Hence the subject of workshop technology.

### LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Perform boring, internal threading on lathe machine.
- Perform milling machine operations on vertical and horizontal milling machine.
- Operate tool and cutter grinder
- Operate cylindrical grinder, surface grinder, internal grinder.
- Use Milling machine accessories and attachments.
- Explain gear hobbing, gear shaping, gear shaving and gear finishing processes.
- Explain the working and use of modern machining practices.
- Explain the working principle of metallic coating processes.
- Explain the working principle of metal finishing processes.

### DETAILED CONTENTS

- |    |   |          |
|----|---|----------|
| 1. | Milling   | (18 hrs) |
|    | 1.1 Specification and working principle of milling machine  |          |
|    | 1.2 Classification, brief description and applications of milling machines  |          |
|    | 1.3 Details of column and knee type milling machine   |          |
|    | 1.4 Milling machine accessories and attachment – Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment shover chuck and rotary table. |          |
|    | 1.5 Milling methods - up milling and down milling   |          |
|    | 1.6 Identification of different milling cutters and work mandrels   |          |
|    | 1.7 Work holding devices  |          |
|    | 1.8 Milling operations – face milling, angular milling, form milling, straddle milling and gang milling.  |          |
|    | 1.9 Cutting speed and feed, simple numerical problems.  |          |
|    | 1.10 Thread milling   |          |
| 2  | Grinding  | (14 hrs) |
|    | 2.1 Purpose of grinding   |          |
|    | 2.2 Various elements of grinding wheel – Abrasive, Grade, structure, Bond   |          |

- 2.3 Common wheel shapes and types of wheel – built up wheels, mounted wheels and diamond wheels. Specification of grinding wheels as per BIS.
  - 2.4 Truing, dressing, balancing and mounting of wheel.
  - 2.5 Grinding methods – Surface grinding, cylindrical grinding and centreless grinding.
  - 2.6 Grinding machine – Cylindrical grinder, surface grinder, internal grinder, centreless grinder, tool and cutter grinder.
  - 2.7 Selection of grinding wheel
  - 2.8 Thread grinding.
3. Gear Manufacturing and Finishing Processes (08 hrs)
- 3.1 Gear hobbing
  - 3.2 Gear shaping
  - 3.3 Gear finishing processes
4. Modern Machining Processes (08 hrs)
- 4.1 Mechanical Process - Ultrasonic machining (USM): Introduction, principle, process, advantages and limitations, applications
  - 4.2 Electro Chemical Processes - Electro chemical machining (ECM) – Fundamental principle, process, applications
  - 4.3 Electrical Discharge Machining (EDM) - Introduction, basic EDM circuit, Principle, metal removing rate, dielectric fluid, applications
  - 4.4 Laser beam machining (LBM) – Introduction, machining process and applications
  - 4.5 Plasma arc machining (PAM) and welding – Introduction, principle process and applications
5. Metallic Coating Processes (08 hrs)
- 5.1 Metal spraying – Wire process, powder process, applications
  - 5.2 Electro plating, anodizing and galvanizing
  - 5.3 Organic Coatings- oil base paint, rubber base coating
6. Metal Finishing Processes (08 hrs)
- 6.1 Purpose of finishing surfaces.
  - 6.2 Surface roughness-Definition and units
  - 6.3 Honing Process, its applications
  - 6.4 Description of hones.
  - 6.5 Brief idea of honing machines.
  - 6.6 Lapping process, its applications.
  - 6.7 Description of lapping compounds and tools.
  - 6.8 Brief idea of lapping machines.
  - 6.9 Polishing
  - 6.10 Buffing.

## **PRACTICAL EXERCISES**

### **Advance Turning Shop**

1. Exercise of boring with the help of boring bar
2. Exercises on internal turning on lathe machine
3. Exercises on internal threading on lathe machine
4. Exercises on external turning on lathe machine
5. Resharpener of single point cutting tool with given geometry

### **Machine Shop**

1. Produce a rectangular block by facing on a slotting machine
2. Produce a rectangular slot on one face with a slotting cutter
3. Produce a rectangular block using a milling machine with a side and face cutter
4. Prepare a slot on one face using milling machine
5. Job on grinding machine using a surface grinder
6. Prepare a job on cylindrical grinding machine.
7. Exercise on milling machine with the help of a form cutter
8. Exercise on milling machine to produce a spur gear
9. Grinding a drill-bit on tool and cutter grinder
10. Exercise on dressing a grinding wheel

## **INSTRUCTIONAL STRATEGY**

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.
4. Foreman Instructor should conduct classes of each Workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practical's.

## **RECOMMENDED BOOKS**

1. Manufacturing Technology by Rao; Tata McGraw Hill Publishers, New Delhi.
2. Workshop Technology Vol. I, II, III by Chapman; Standard Publishers Distributors, New Delhi.
3. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
4. A Text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.
5. Workshop Technology Vol-III, by R.P. Dhiman, Ishan Publications Jalandhar
6. Production Technology by HMT; Tata McGraw Publishers, New Delhi.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	18	32
2	14	20
3	08	12
4	08	12
5	08	12
6	08	12
<b>Total</b>	<b>64</b>	<b>100</b>

## **PERSONALITY DEVELOPMENT CAMP**

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person interviews; telephonic interviews, panel interviews; group interviews and video conferencing etc.
5. Presentation Techniques
6. Group Discussions Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene