5.1 CAD

L	T	P
-	-	6

RATIONALE

Engineering systems have been undergoing rapid transformation due to advances in Information Technology. The quality, speed and flexibility are the key factors in modern design and drafting system. Auto CAD is a general-purpose computer aided design programme to prepare wide variety of two-dimensional drawing and three-dimensional models. After studying this subject, students will be acquainted with Auto CAD.

DETAILED CONTENT

1. **Fundamental Concepts** (6 hrs)

- Introduction to Auto CAD
- Starting & finishing Auto CAD
- Screen layout
- Different menus, icons, toolbars, cursor
- Command prompt area
- Concept of units and scales
- Drawing units
- Create new drawing
- Open an existing drawing
- Saving a drawing
- Exercise on viewing pull down menus and tool bars in new drawing

2. **Basic Drawings** (9 hrs)

- Setting drawing limits
- Using zoom all option
- Using grid and snap
- Drawing a line using absolute, relative and polar co-ordinates, using ortho command
- Drawing a circle
- Exercise on drawing a triangle
- Using various co-ordinate systems
- Exercise on drawing a ball bearing

3. **Advance drawing commands** (15 hrs)

Drawing ray, double line, polyline, construction line, rectangles, polygons, arcs, point, do nut, splines, ellipse, sketch. Use of object snap in drawing.

- Exercise on a drawing a hexagonal bolt head.
- Exercise on drawing front view of a plummer block.

4. **Modify Commands** (15 hrs)

Erase, move, copy, rotate, array, offset, mirror, zoom, pan, break, trim, scale, lengthen, stretch extend, fillet, chamfer, divide, measure, undo, redo, oops.

- Practice of these commands on an existing drawing

5. **Text and Dimensioning** (12 hrs)

- Text creation – single line and multiline
- Modifying text
- Types of dimensions - linear, aligned, ordinate, radius, diameter, angular, leader, base line, continue, oblique, align text
- Formatting dimension style, modifying line and arrows, extension line, arrowheads, center mark, text, and units
- Inserting tolerances
- Exercise on dimensioning an existing drawing

6. **Advance drawing techniques** (12 hrs)

- Creating a new layer, on/off, freeze/thaw, lock/unlock a layer
- Loading line type and line weight
- Changing color of layer and line
- Match properties
- Hatching – pick points, select objects; using various patterns
- Drawing various views of sectional flange coupling using layers.

7. **Blocks and External References** (12 hrs)

- Making a block, inserting a block, writing a block
- Exploding blocks, polyline & hatch objects
- Using external references, inserting one file into another file
- Exercise on making a block and using it in same file and another file

8. **Introduction to 3 – Dimensional Drawing** (12 hrs)

- UCS Icon – world, face, view, named. creating 3D objects by giving thickness
- Hiding and shading
- 3D solids and surfaces
- Union, substract, extrude
- Converting a 2D object into 3D object and vice versa, view ports
- Exercise on converting 2D plummer block drawing into 3D.

9. **Plotting** (3 hrs)

- Plotting a drawing, plot preview, page set up
- Exercise on plotting various existing drawings.

RECOMMENDED BOOKS

1. Engineering Graphics with Auto CAD 2000 by S.C. Sharma; Galgotia Publications Pvt. Ltd., New Delhi.
2. Illustrated Auto CAD 2002 for you – by Umesh Shettigar, Abdul Khader A.A.; Janata Publishers, Udupi.

5.2 MATERIAL MANAGEMENT

L	T	P
3	-	2

RATIONALE

A diploma holder in production engineering is a link between shop floor and material/purchase section. This subject imparts knowledge and skills of complete procurement procedure, shop floor inventories, material handling and optimal utilization of materials as well as resources provided with in the shop floor. The subject also imparts skill in analyzing the material requirement well before, and buffer (re-order) stock quantity.

DETAILED CONTENT

1. **Introduction** (4 hrs)

Basics of materials management, scope and importance of materials management, objectives of materials management, organization of material management.

2. **Material Procurement** (10 hrs)

Meaning and objectives of purchasing, steps involved in material procurement, purchase requisition, selection of suppliers, vendor development & rating, make or buy decision, floating of enquiry, preparation of tender notices, comparative statement, placing of purchase order, follow up, inspection of incoming material, verification of bills. Statistical quality control, value analysis, pricing theory.

3. **Inventory Control** (12 hrs)

Function and necessity of inventory control, classification of inventories, determination of safety and re –order quantity, economic order quantity, fixed order quantity, ABC analysis, receiving and storing of materials, work in process inventories, finished goods inventories, management of surplus and scrap, spares in inventory, codification and standardization of items.

4. **Storing of Materials** (6 hrs)

Material planning and factors affecting the planning, store location and layout, storing methods and equipments, procedure for issue of material and receipt of materials, store record keeping, bin card system, protection and physical verification of stores.

5. **Forecasting for Materials Management** (4 hrs)

Concept, advantages and objectives of forecasting for materials management. Types of forecasting, methods of forecasting, statistical approach in forecasting, least square method of forecasting.

6. **Material Handling** (12 hrs)

Concept, objectives & advantages of material handling in industries. Classification of material handling equipment, working and uses of conveyors such as belt conveyor, roller conveyor, screw conveyor with relative example. Working & uses of fork trucks, pallets, cranes such as overhead type, piller type and mounted mobile type of cranes. Advance material handling systems.

LIST OF PRACTICALS

1. List sources of information for locating sources of supply for a particular product.
2. Floating enquiry for tenders for a given items and prepare comparative statement for the same. Select the most appealing source and comment on the factors governed your selection.
3. To find out lead time and minimum order quantity for a given item of store.

RECOMMENDED BOOKS

1. Material Management by M.M.Verma; Sultan Chand & Sons, Delhi.
2. Production Planning and Control by Samuel Elion.
3. Production Management by Jain and Aggarwal.
4. Production Management Systems by S.C. Sharma.
5. Industrial Engineering and Management by O.P. Khanna.

5.3 INDUSTRIAL ENGINEERING

L	T	P
4	-	-

RATIONALE

A diploma holder will have to conduct time and motion study to improve the methods/system. This subject impart valuable skills to plan and understand plant layout, and production planning and control.

DETAILED CONTENT

1. **Production and Productivity** (6 hrs)

   Production, production functions, productivity, factors affecting productivity, measurement of productivity, causes of decrease in productivity, difference between production and productivity.

2. **Plant Location, Layout and Material Handling** (8 hrs)

   Plant location, factors affecting plant location, concept of plant layout, types of layout, their characteristics, factors affecting plant layout, work station design, factors considered while designing a work station, introduction, need and objective of material handling, factors considered while selecting a material handling device, safety concept of material handling equipment.

3. **Work Study** (12 hrs)

   Definition and scope of work study; areas of application of work study in industry, Role of work study in improving productivity, Objectives, needs and methods of method study, information collection, recording techniques, process symbols, charts and diagrams, critical examination, development, installation and maintenance of improved methods, work measurement objectives, needs and methods of work measurement, time study, various allowances, calculation of time, work sampling, standard data and its use. Application of engineered time standards and work sampling Ergonomics, concept and advantages.

4. **Job Evaluation and Incentives** (12 hrs)

   Introduction, objectives, needs of job evaluation, job definition, job analysis, data source, job evaluation methods such as ranking method, grade description method, point system and factor comparison method,

hybrid system.
Incentive-definition and concept, incentive and productivity relation, types of incentives such as financial, non financial. Individual and group incentives, pre requisites for incentives, characteristics of a good incentives plan

5. **Production Planning and Control** (14 hrs)

Introduction, objectives and components (functions) of P.P.C, Advantages of production planning and Production Control, stages of P.P.C, process planning, routing, scheduling, dispatching and follow up, routing purpose, route sheets, scheduling – purpose, machine loading chart, Gantt chart, dispatching – purpose, and procedure, follow up – purpose and procedure. CPM/PERT technique, drawing of simple networks and critical time calculation. Production Control in job order, batch type and continuous type of productions. Difference between these controls.

6. **Estimation and Costing** (12 hrs)

Introduction, purpose/functions of estimating, costing concept, ladder and elements of cost, difference between estimation and costing. Overheads and their types, estimation of material cost, estimation of cost for machining processes, numerical problems.

RECOMMENDED BOOKS

1. Industrial Engineering by O.P. Khanna; Dhanpat Rai and Sons, New Delhi.
2. Industrial Engineering by S.C. Sharma; Khanna Publisher.
3. Industrial Engineering and Management by T.R. Banga.
4. Elements of work study by Suresh Dalela.
5. Production Management by Jain and Aggarwal.

5.4 WORKSHOP TECHNOLOGY - III

L T P
3 - -

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, modern machining methods, processing of plastic, CNC machining, tool, jigs and fixtures is required to be imparted. Hence the subject of workshop technology.

DETAILED CONTENTS

1. Modern Machining Processes (20 hrs)

   - Mechanical Process: Ultrasonic machining (USM): Introduction, principle, process, advantages and limitations, applications.

   - Electro Chemical Processes: Electro chemical machining (ECM) – Fundamental principle, process, applications.

   - Electrical Discharge Machining (EDM): Introduction, principle parts of EDM machine, EDM terminology. Principal, metal removing rate, dielectric fluid and properties of electric fluid, applications. Wire cut EDM.

2. Plastic Moulding Techniques (8 hrs)

   - Injection moulding – working principle, advantages and limitations
   - Blow moulding – working principle, advantages and limitations
   - Compression moulding – Working principle, advantages and limitations

3. Metallic Coating Process (4 hrs)

   - Metal spraying – Wire process, powder process, applications
   - Electro plating, anodizing and galvanizing
   - Organic Coatings- oil base paint, rubber base coating

4. Gear Manufacturing and Finishing Processes (4hrs)

   - Gear hobbing
   - Gear shaping
   - Gear shaving
   - Gear burnishing

5. Finishing Processes (5hrs)

- Purpose of finishing surfaces
- Surface roughness – definition & units.
- Honing process and its applications.
- Description of hones.
- Brief idea of honing machines.
- Lapping process, its applications.
- Description of lapping compounds & tools.
- Brief idea of lapping machines.
- Super finishing process and its applications.
- Use of super finishing attachment on center lathe.
- Polishing.
- Buffing.

6. Jigs & Fixtures (7hrs)

- Importance and use of jigs & fixtures.
- Principle of location.
- Locating devices.
- Clamping devices.
- Types of jigs – Drilling jigs, bushes, template jigs, plate jigs, channel jig, leaf jig.
- Fixture for milling.
- Advantages of jigs & fixtures.

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. Manufacturing Technology by M. Adithan and A.B. Gupta; New Age International (P) Ltd., New Delhi.

4. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi

5. Modern Machining Process by Pandey; Tata McGraw Publishers, New Delhi

6. A text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi

5.5 CNC MACHINES AND AUTOMATION

L	T	P
3	-	-

RATIONALE

Diploma holders are required to supervise and handle specialized machines and equipment like CNC machines. For this purpose, knowledge and skills about NC machines, part programming in NC machines and tooling for CNC machines are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills about CNC machines, tools, equipment and use of high tech machines for increased productivity and quality.

DETAILED CONTENTS

1. **Introduction** (6 hrs)

- Basic concepts of NC, CNC & DNC, adoption controls.
- Advantages & Disadvantage of CNC Machines.
- Application of CNC Machines.
- Difference between conventional & CNC Machines.
- Profitable applications of CNC Machines.

2. **Construction of CNC Machines** (12 hrs)

- Machine control unit.
- NC control.
- PLC control, its advantages & disadvantages.
- Application aid limitations of PLC machines.
- Axis designate of CNC machines.
- Special constructional requirement of CNC machines.
- Slide ways, bolt screw & nut assembly.
- Lubrication & cooling of CNC machines.
- Spindle & spindle motors, axis drives motor.
- Swarf removal & safety provision of CNC machines.
- Feedback mechanism in CNC machines.

3. **Tooling of CNC Machines** (6 hrs)

- Introduction.
- Various cutting tools for CNC machines.
- Work holding devices.
- Automatic tool changer.

4. **Control System** (8 hrs)

- Open & close loop control system

- Fundamental problem in control: Accuracy, resolution, repeatability, instability, response & damping,
- Type of position control:
    i) Point to point
    ii) Straight line
    iii) Continuous

5. **Part Programming** (8 hrs)

Part programming and basic concepts of part programming, NC words, part programming formats, simple programming for rational components, part programming using conned cycles, subroutines and do loops, tool off sets, cutter radius compensation and wear compensation

6. **Common Problems in CNC Machines** (4 hrs)

Common problems in mechanical, electrical, pneumatic, electronic and PC components of NC machines, diagnostic study of common problems and remedies, use of on-time fault finding diagnosis tools in CNC machines

7. **Industrial Automation** (4 hrs)

- What is automation?
- Need of automation.
- Different types of automation.
- Advantages/disadvantages of automation.

RECOMMENDED BOOKS

1. CNC Machines – Programming and Applications by M Adithan and BS Pabla; New Age International (P) Ltd., Delhi.
2. Computer Aided Manufacturing by Rao, Kundra and Tiwari; Tata Mc Graw Hill, New Delhi.
3. Numerical Control of Machines Tools by Yorem Korem and IB Uri; Khanna Publishers, New Delhi.
4. CNC Machine by Bharaj; Satya Publication, New Delhi.
5. Mechatronics by HM, Banglore.

5.6 WORKSHOP PRACTICE – III

L	T	P
-	-	9

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, skills in various machining processes, modern machining methods, processing of plastic, CNC machining, tool, jigs and fixtures is required to be imparted. Hence the subject of workshop practice.

LIST OF PRACTICALS

CNC Machine

1. Plain turning, facing, step turning, taper turning.
2. Taper turning.
3. Concave and convex curves.
4. Threading.
5. Two surface at 90* on a square block.
6. Machine students' first name on an acrylic sheet on a CNC milling machine.
7. Demonstration of FMS & Wire cut EDM machine
8. Exercise for preparation of one female & one male electrode on EDM machine.
9. Exercise on profile cutting on EDM wire cut.
10. Various types of programming like polar programming, blue print programming and profile programming.

Milling & Shaper

11. Machine of a square block of 100mm*100mm. *100mm on a shaper.
12. Cutting of a slot & V-groove on opposite faces of the block on the shaper.
13. Cutting of a slot and V-groove by a milling machine on a suitable block.
14. Cutting of a T slot by milling.
15. Milling of a spur gear.
16. Flute cutting of a tap or reamer.

Surface Finishing

17. Exercise on hand lapping.
18. Honing of a hole.
19. Buffing practice
20. Electroplating of copper and nickel.
21. Barrel polishing and barrel plating for small pieces.

Grinding

22. Grinding of surface at 45°, 60°, 75° on tool and cutter grinder.
23. Grinding and sharpening of lathe tool, drills.
24. Grinding of job on cylindrical grinder.
25. Grinding of job on centreless grinder.
26. Grinding of die plate on a surface grinder.
27. Grinding of a wedge shape job on a surface grinder.

Project Work

The students will make preparations for the project to be undertaken by them in the final semester like detailed drawing, materials, cost analysis and all other prerequisites. (A Foreman Instructor in consultation with HOD/Workshop Superintendent will handle this group.

Note: The Workshop Superintendent. will finalize the specific drawings of all the jobs in the beginning of semester in consultation with the staff.

5.7 TOOL ENGINEERING -I

L	T	P
3	-	3

RATIONALE

A diploma holder in production engineering should have complete knowledge of basic tools, their materials and their optimal utilization. This subject imparts skill and awareness of quality production in minimum time by using jigs and fixtures.

DETAILED CONTENT

1. **Cutting Tools** (18 hrs)

Mechanical property and uses of high-speed steel, stellite, cemented carbide, ceramics diamond, study of commercially available cutting tools. Tool geometry of single point cutting tools, multipoint cutting tools, reamer, drill, milling cutter, throw away inserts, chip breaker, tool and cutter maintenance, regrinding and lapping of tools.

2. **Location & Clamping** (10 hrs)

Principles of location, 3-2-1 principle, and location with previous machined hole, different locating devices, V-location, comical locations. Purpose of elamping elements, types of clamps.

3. **Jigs & Fixtures** (20 hrs)

Need for jigs and fixtures, fundamental principles of jigs and fixtures design.
Types of bushes, advantages of bushings.
Types of drilling jigs-template jigs, channel jigs, latch jigs, quick acting jigs, indexing jigs, box jig. Types of fixtures-simple fixture, milling fixture, welding fixture, turning fixture, assembly fixture & inspection fixture.

LIST OF PRACTICALS

1. Drawing of tool geometry of:
   a) Single point cutting tool
   b) Drill bit
   c) Milling cutter
   d) Throw away inserts

2. Drawing of:
   a) Latch jig
   b) Box jig

3. Drawing of:
   a) Milling fixture
   b) Welding fixture

RECOMMENDED BOOKS

1. Production Engineering by P.C. Sharma; S. Chand & Company Ltd., Delhi.
2. Tool Design by Donaldson and Lecain; Tata McGraw Hill Company, New Delhi
3. Production Engineering & Design by Dr. Surender Kumar and Umesh Chandra; Satya Prakashan, New Delhi.