

## 5.1 PRODUCTION MANAGEMENT

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### RATIONALE

Diploma holder in this course is responsible for controlling production and quality of the product on the shop floor as well as for production planning and control. He is also required to supervise erection, installation and maintenance of equipment including material handling and undertake work-study for better utilization of resources. For this purpose, knowledge and skills about these topics need to be imparted to them. This subject aims at development of competencies to prepare material, equipment schedule and production control schedules and maintain required quality levels. In addition, it will also help in developing skills in erection, installation and testing of equipment.

### DETAILED CONTENTS.

1. Production Planning and Control (PPC) (06 hrs)
  - 1.1 Introduction.
  - 1.2. Objectives and factors affecting PPC
  - 1.3. Functions(Elements) of PPC - Planning, Routing, Loading, scheduling, dispatching, progressing and inspection
  - 1.4. Types of production system - Flow or continuous production, Intermittent Production
  - 1.5. Production Control - Objectives and fields of production control, Production control system
  - 1.6 Break even analysis and Gantt chart.
  
2. Plant Location, Layout and Material Handling (12 hrs)
  - 2.1 Definition and Factors affecting the plant location, Rural versus Urban Plant sites.
  - 2.2 Definition and importance of Plant layout, Factors affecting plant layout.
  - 2.3 Types of Plant layout- Process, product, combination and fixed position layout..
  - 2.4 Methods of plant layout - Process flow charts, layout analogues Travel chart, distance, volume matrix.,
  - 2.5. Plant layout procedure and work station design.
  - 2.6. Material Handling- Definition, Significance and objectives of material handling, Principles of economic material handling,. Types of material handling equipment - Characteristics and classification of material handling equipment, Hoisting and conveying equipment (different types), Safety requirements while using material handling equipment

3. Work Study (12 hrs)
- 3.1 Production System and Productivity(Introduction and definitions), Difference between Production and productivity, Measures to improve productivity
  - 3.2 Definition, advantages and procedure of work study
  - 3.3 Method study – Definition, Objectives and Procedures, Process chart symbols, outline process chart, Flow process charts, Two handed processes charts, Multiple activity chart(Mn-Machine charts), Flow diagram, string diagram.
  - 3.4 Principles of motion economy, Therblig symbols, SIMO chart.
  - 3.5. Work Measurement :- Definition and objective, Work measurement technique, Time Study- Definition, objectives and procedure, Calculation of basic time, performance rating and its techniques, normal time, allowance and its types, standard time (simple numerical problems)
4. Inventory Control (10 hrs)
- 4.1 Definition and objectives of inventory control.
  - 4.2 Inventory types
  - 4.3 Procurement and carrying cost, EOQ, lead time, reorder point (simple numerical problems)
  - 4.4 Inventory Classification - ABC Analysis, VED Analysis, FMS Analysis
  - 4.5 Standardization and Codification - Objective and advantages of standardization, Levels and types of standards, .Objective and advantages of codes. Coding systems-. National and International Codes, ISO-9000 Concept and Evolution
5. Repair and Maintenance (06 hrs)
- 5.1. Objectives and importance of Maintenance
  - 5.2. Different types of maintenance- Corrective or Breakdown maintenance, Scheduled Maintenance, Preventive Maintenance, Predictive Maintenance
6. Value Engineering (04 hrs)
- 6.1. Introduction, Concept
  - 6.2. Objectives of value engineering
7. Cost Estimation and Control: (14 hrs)
- 7.1 Definition and functions of cost estimation
  - 7.2 Estimation procedure

- 7.3 Elements of cost, ladder of costs (simple numericals)
- 7.4 Overhead expenses and its distribution
- 7.5 Depreciation - Concept and Definition, Methods of calculating depreciation. Straight line method, Diminishing Balance Method, Sinking fund method (Numerical problems).
- 7.6 Cost control- definition and objectives, Capital cost control (planning and scheduling), operating cost control.
- 7.7. Cost estimation for machining processes like turning, drilling, and milling. Cost estimation of forming processes like forging, pattern making, and casting .

### **INSTRUCTIONAL STRATEGY**

- 1. Teacher should put emphasis on giving practical problems related to plant location and plant layout
- 2. Students should be taken to industrial units to give an exposure of production environment, plant layout and material handling
- 3. Live problems may be given to students to carry out case studies in teams under guidance of teacher

### **RECOMMENDED BOOKS**

- 1. Industrial Engineering and Management by T.R. Banga and SC Sharma; Khanna Publishers, Delhi.
- 2. Industrial Engineering and Management by O.P. Khanna; Dhanpat Rai and Sons, New Delhi.
- 3. Production Management by C.L. Mahajan; Satya Parkashan Company Limited, New Delhi.
- 4. Mechanical Costing, Estimation and Project Planning by CK Singh; Standard Publishers, New Delhi.
- 5. A Text Book of Reliability and Maintenance Engineering by A Manna, Prentice Hall of India

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	06	08
2	12	20
3	12	20
4	10	15
5	06	10
6	04	05
7	14	22
<b>Total</b>	<b>64</b>	<b>100</b>

## 5.2 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.

### DETAILED CONTENTS THEORY

1. Simple Mechanisms (08 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. Power Transmission (16 hrs)
  - 2.1 Introduction to Belt and Rope drives
  - 2.2 Types of belt drives and types of pulleys
  - 2.3 Concept of velocity ratio, slip and creep; crowning of pulleys (simple numericals)
  - 2.4 Flat and V belt drive: Ratio of driving tensions, power transmitted, centrifugal tension, and condition for maximum horse power (simple numericals)
  - 2.5 Different types of chains and their terminology
  - 2.6 Gear terminology, types of gears and their applications; simple and compound gear trains; power transmitted by simple spur gear
  
3. Flywheel (10 hrs)
  - 3.1 Principle and applications of flywheel
  - 3.2 Turning - moment diagram of flywheel for different engines
  - 3.3 Fluctuation of speed and fluctuation of energy - Concept only
  - 3.4 Coefficient of fluctuation of speed and coefficient of fluctuation of energy
  
4. Governor (12 hrs)
  - 4.1 Principal of governor
  - 4.2 Simple description and working of Watt, Porter and Hartnel governor (simple numerical based on watt and porter governor)
  - 4.3 Hunting, isochronism, stability, sensitiveness of a governor

5. Balancing (08 hrs)

- 5.1 Concept of balancing
- 5.2 Introduction to balancing of rotating masses (simple numericals)
- 5.3 Simple problems related to several masses rotating in different planes

6. Vibrations (10 hrs)

- 6.1 Types-longitudinal, transverse and torsional vibrations (simple numericals)
- 6.2 Dampening of vibrations
- 6.3 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 Jagdish Lal; Metropolitan Publishers, New Delhi.

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	8	12
2	16	25
3	10	18
4	12	18
5	8	12
6	10	15
<b>Total</b>	<b>64</b>	<b>100</b>

## 5.3 HYDRAULICS AND HYDRAULIC MACHINES

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### RATIONALE

Diploma holders in this course are required to deal with problems of fluid and use of hydraulics and pneumatics in power generation. For this purpose, knowledge and skills about fluid mechanics and machinery, hydraulics and pneumatics systems are required to be imparted for enabling them to perform above functions.

### DETAILED CONTENTS

1. Introduction (04hrs)  
  
Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, surface tension, kinematic viscosity and dynamic viscosity and their units.
2. Pressure and its Measurement (07 hrs)
  - 2.1 Concept of pressure (Atmospheric Pressure, gauge pressure, absolute pressure), Pascal's Law, Static Pressure
  - 2.2 Pressure measuring devices: peizometer tube manometers - simple U-tube, differential single column, inverted U-tube, micromanometer including simple problems
  - 2.3 Bourdon pressure gauge, Diaphragm pressure gauge, dead weight pressure gauge
3. Flow of Fluids (08 hrs)  
  
Types of fluid flow – steady and unsteady, uniform and non-uniform, laminar and turbulent; rate of flow and their units; continuity equation of flow; potential energy of a flowing fluid; total head; Bernoulli's theorem (statement and proof) and its applications. Discharge measurement with the help of venturi-meter, orifice meter, pitot-tube, limitations of Bernoulli's theorem simple problems.
4. Flow through Pipes (11 hrs)
  - 4.1 Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Darcy's equation of head loss (without proof), Reynold's number and its effect on pipe friction; siphon, Nozzle - definition, velocity of liquid flowing through the nozzle, power developed. Water hammer, anchor block, syphon, surge tank (concept only).
  - 4.2 Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings (without proof)

5. Hydraulic Machines (06 hrs)
- Description, operation and application of hydraulic systems – hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press, selection of specification of above systems for different applications
6. Water Turbines and Pumps (15 hrs)
- 6.1 Concept of a turbine, types of turbines –impulse and reaction type (concept only), difference between them. Construction and working of pelton wheel, Francis turbine, Propeller and Kaplan turbines. Unit speed, unit power, unit discharge, specific speed of turbines, selection of turbines based on specific speed.
- 6.2 Concept of hydraulic pump, single acting reciprocating pump (construction and operation only), vane, screw and gear pumps.
- 6.3 Construction, working and operation of centrifugal pump. Performance, efficiencies and specifications of a centrifugal pump. Trouble shooting and problems in centrifugal pumps and remedial measures, pitting, cavitation, priming.
7. Introduction to Oil Power Hydraulics and Pneumatics (04 hrs)
- 7.1 Introduction to oil power hydraulics and pneumatic system
- 7.2 Industrial applications of oil power hydraulics and pneumatic system
8. Components of Hydraulic Systems (09 hrs)
- 8.1 Basic components of hydraulic system, function of each component in a hydraulic circuit.
- 8.2 Oil reservoirs, couplings, motors and pumps – definition and functions of the parts,
- 8.3 Filters- definition and purpose, classification
- 8.4 Seals and packing- classification of seals, sealing materials.

### **LIST OF PRACTICALS**

1. Measurement of pressure head by employing.
  - i) Piezometer tube
  - ii) Single and double column manometer
2. To find out the value of coefficient of discharge for a venturimeter.
3. Measurement of flow by using venturimeter.



4. Verification of Bernoulli's theorem.
5. To find coefficient of friction for a pipe (Darcy's friction).
6. To study hydraulic circuit of an automobile brake and hydraulic ram.
7. Study the working of a Pelton wheel and Francis turbine.
8. To study a single stage centrifugal pump for constructional details and its operation to find out its normal head and discharge.

### **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. Fluid Mechanics by KL Kumar; S Chand and Co Ltd., Ram Nagar, New Delhi.
2. Hydraulics and Fluid Mechanics Machine by RS Khurmi ; S.Chand & Co. Ltd., New Delhi.
3. Fluid Mechanics through Problems by RJ Garde; Wiley Eastern Ltd., New Delhi.
4. Fluid Mechanics by Dr AK Jain, Khanna Publishers, New Delhi.
5. Hydraulic and Pneumatic Control by K Shammuga Sundaram, S. Chand & Co. Ltd., New Delhi
6. Hydraulics and Hydraulic Machinery by Dr. Jagadish Lal; Metropolitan Book Company Ltd., Delhi.
7. Hydraulic and Pneumatic Power and Control Design, Performance and Application by Yeaple, McGraw Hill, New York..
8. Pneumatic Controls by Festo Didactic; Bangalore.
9. Pneumatics Control: An Introduction to the Principles by Werner Deppert and Kurt Stoll; Vogel – Verlag.

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	4	8
2	7	12
3	8	12
4	11	18
5	6	10
6	15	22
7	4	8
8	9	10
<b>Total</b>	<b>64</b>	<b>100</b>

## 5.4 MANUFACTURING TECHNOLOGY

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### 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.

### 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
  - 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 Indexing on dividing heads, plain and universal dividing heads.
  - 1.11 Indexing methods: direct, Plain or simple, compound, differential and angular indexing, numerical problems on indexing.
  - 1.12 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, Electro chemical Grinding (ECG) – Fundamental principle, process, application
  - 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 Electro beam machining (EBM)- 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 Super finishing process, its applications.
  - 6.10 Polishing
  - 6.11 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.

## **RECOMMENDED BOOKS**

1. Manufacturing Technology by Rao; Tata McGraw Hill Publishers, New Delhi.
2. Manufacturing Technology by M. Adithan and A.B. Gupta; New Age International (P) Ltd., New Delhi.
3. Workshop Technology Vol. I, II, III by Chapman; Standard Publishers Distributors, New Delhi.
4. Practical Handbook for Mechanical Engineers by Dr. AB Gupta; Galgotia Publications, New Delhi.
5. Production Technology by HMT; Tata McGraw Publishers, New Delhi.
6. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
7. Modern Machining Processes by Pandey; Tata McGraw Publishers, New Delhi.
8. A Text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.
9. Workshop Technology Vol-III, by R.P. Dhiman, Ishan Publications Jalandhar

### 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>

## 5.5 COMPUTER AIDED DRAFTING

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1. Detail and assembly drawing of the following using AUTOCAD (2D) (4 sheets)
  - 1.1. Plummer Block
  - 1.2. Wall Bracket
  - 1.3. Stepped pulley, V-belt pulley
  - 1.4. Flanged coupling
  - 1.5. Machine tool Holder (Three views)
  - 1.6. Screw jack or knuckle joint
2. Isometric Drawing by CAD using Auto CAD (one sheet)

Drawings of following on computer:

  - Cone
  - Cylinder
  - Isometric view of objects
3. Modelling (02 sheets)

3D modelling, Transformations, scaling, rotation, translation
4. Introduction to other CAD softwares;

(Pro Engineer/CATIA / Inventor/Unigraphics/Solid Work: Salient features, simple drawing of components (2 D and 3D)(At least one software)

### 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. Nageswara Rao; Tata McGraw Hill, New Delhi.

3. AutoCAD 2000 for you by Umesh Shettigar 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 MINOR PROJECT WORK

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The object of this training is to:

- i) Expose the students to industrial/field procedures and practices so as to have an appreciation of the size and scale of operations.
- ii) Develop comprehension regarding concepts, principles and practices taught in the classroom in their application in solving field/industrial tasks/problems.

For effective planning and implementation of this practical training, it is proposed to:

- i) Identify adequate number of industrial/field organizations where students will be sent for practical training.
- ii) Prepare a workbook, which can be used by students for guiding students to perform definite task during the practical training.
- iii) Identification of teachers who would supervise the students and provide guidance during practical training.

The components of evaluation will include the following:

- Punctuality and regularity
- Initiative in learning
- Relationship at works
- Industrial training report

## **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 Interview' 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