

## 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
  - 4.6. Concept of Just-In-Time (JIT)
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
  - 5.3. Nature of maintenance problems
  - 5.4. Range of maintenance problems
6. Value Engineering (04 hrs)
  - 6.1. Introduction, Concept
  - 6.2. Objectives of value engineering

- 6.3. Value Analysis Procedures
- 6.4. Benefits of value analysis
- 6.5. Technique 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 INJECTION MOULD - DESIGN AND DRAWING

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4 - 2

### RATIONALE

A diploma holder should be able to conceive, design and draw assembly drawing and detailed part drawings of injection/compression/transfer moulds with proper dimensioning and calculations. Hence this subject.

### DETAILED CONTENT

#### Section – A

1. **Introduction to Moulding Process** (3 hrs)  
Injection moulding, blow/rotational moulding, compression/transfer moulding, Extrusion, thermoforming, examples for the above machines used.
2. **Moulding Machines** (3hrs)  
Injection and compression moulding machines- classification, specifications, parts and their functions. Hand machines.
3. **Injection Moulds** (12 hrs)  
Main parts and their function, feeding systems, runners, gates, parting line, ejection systems, ejector return mechanism, under cuts, sliders, split moulds, multicavity moulds, moulds for threaded components, draft angle placement of cavities, three plate moulds, mould cooling, location and guide system, shrinkage allowances, clamping force, mould ventilation, moulding defects, moulding cycle.
4. **Moulds for Extrusion and Thermoforming** (8hrs)  
Main parts and their functions, die design and its related different parts, effective process parameters.
5. **Material for Mould Parts** (4 hrs)  
Materials used for various mould parts, their treatment like hardening, tempering, electroplating.
6. **Mould Maintenance** (2 hrs)  
Maintenance, storage and safety of moulds, transportation/handling.

## Section B

Making drawings of the relevant topics learnt such as bushes, pillars, spare bush, register ring etc. design and drawing of multicavity, injection moulds for simple components.

### Note: -

The question paper on the subject will consist of two parts i.e. Section-A and Section-B. Section A will contain Theory contents to the extent of 50%. Section B will contain Design and Drawing to the extent of 50%.

At last 2 industrial visits should be arranged in the concerned industry dealing with plastic moulds and moulding machine.

## RECOMMENDED BOOKS

1. Injection Mould design fundamentals by A.B. Glanvill, E.N. Denton, Industrial Press Inc.
2. Plastic Material handbook Vol. I and II. by A.S. Athalye, Multitech Publishers Co. Mumbai.
3. Injection Moulding by A.S. Athalye, Multitech Publishers Co. Mumbai.
4. Rubber and Plastic technology by Chandra and Mishra, CBS Publishers and Distributor, New Delhi
5. Plastics Mould Engineering Handbook by J. Harry Du Bois and Waynel Pribble; Van Nostrand Rehnhold Company.
6. Injection moulds by R.G.W. Pye

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Allotted Time	Allotted Hours
1	06	09
2	06	09
3	24	40
4	16	24
5	08	12
6	04	06
<b>Total</b>	<b>64</b>	<b>100</b>

### 5.3 DIE CASTING - DESIGN AND DRAWING

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3 - 4

#### RATIONALE

A diploma holder should be able to conceive, design and draw assembly drawings and detailed part drawings of die casting dies with proper dimensioning and calculations. Hence this subject.

#### DETAILED CONTENT

##### Section – A

1. Introduction to Die Casting Process (10 hrs)  
  
Gravity die-casting, pressure die casting, examples of the component, machines used, various casting processes, i.e. investment casting, centrifugal casting, vacuum and differential casting. Furnace and its types used for melting the metal.
2. Die casting machines (10 hrs)  
  
Classification & specification, parts and their functions, locking unit, injection unit ejection unit.
3. Die casting dies (14 hrs)  
  
Gravity die casting: main parts, top gating, side gating, bottom gating, runner & risers, book type mould, rack and pinion mould, draft angle.  
  
Pressure die casting: Types, main parts- parting line, runner layout, gates, gating formula, location of gates, vents, core shrinkage, cooling methods, overflow, sprue, ejectors, ejector return mechanism, die lubricants, basic calculations, mould release agents.
4. Investment casting (08 hrs)  
  
Investment casting process, mould making  
Centrifugal casting  
Spin casting  
Vacuum casting
5. Maintenance and Storage (06 hrs)  
  
Maintenance, safety and storage of forging die tools and material, handling of dies.

## Section - B

1. Making drawing of different dies parts. Design and drawing of die casting for simple components.

Note \* Question paper will consist of section A and B.

Section A will contain theory contents up to 50%. Section B will contain design and drawing up to 50% marks.

At least, 2 Industrial visits to the concerned industry involved in die casting dies should be arranged.

## RECOMMENDED BOOKS

1. Forging handbook-forging methods by A. Thomas, Drop Forging Research Association, Sheffield Street, Sheffield.
2. Forging die design and practice by R. Sharam, S.N. Parsad, N.P. Saxena; S. Chand and Company. New Delhi.
3. Die, Mould and Jigs by V. Vladimi Rov, MIR. Publisher.
4. Forging and Forming metal by S.E. Rusinoff, S. Chand and Company, New Delhi.
5. Forging handbook by T.E. Byrer, American Society for metal.
6. Handbook of Die Design by Ivana Suchy; Mc Graw Hill.

## SUGGESTED DISTRIBUTION MARKS

Topic No.	Allotted Time	Allotted Marks
1	10	22
2	10	22
3	14	28
4	08	16
5	06	12
<b>Total</b>	<b>48</b>	<b>100</b>



## 5.4 MANUFACTURING PROCESSES – III

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### RATIONALE

Understand the facts, concepts, principles and procedures of using machine tools and related techniques efficiently effectively to plan manufacturing of tool and die parts to specification considering safety and environment. It is also useful in understanding technology and apply in areas such as workshop practice, tool design, production planning, estimation and industrial management. It also describes concept, principle and procedures to identify and report maintenance requirement for corrective action.

### DETAILED CONTENTS

1. Grinding Operation and Grinding Machine (Tool and Cutter Grinder) (08 hrs)
  - 1.1 Grinding operations and grinding machines
  - 1.2 Concept of main parts and functions of tool cutter grinder. Work holding devices: chucks and universal vice. Cutting tools: grinding wheels, dressers. Cutting parameters: Machine time calculation, Tool and cutter grinder, wheel selection and dressing
  - 1.3 Operational principles, cutting and material removal, wheel selection
  - 1.4 Various steps performed in tool and cutter grinding operations
2. Gear and Gear Cutting Techniques (12 hrs)
  - 2.1 Gear cutting techniques
  - 2.2 Concept of major gear manufacturing techniques: Spur gear, Rack and pinion, Helical, Bevel
  - 2.3 Principle of cutters and setting up machine and accessories
  - 2.4 Identification of operational sequence, cutting tools and accessories by applying standard practice and norms with respect to safety and maintenance
3. Jig Boring Operation and Jig Boring Machine (08 hrs)
  - 3.1 Jig boring operation and machine
  - 3.2 Concept of main parts and functions of machine (e.g. Hauser), work holding attachment, cutting tools, cutting tool holders, operations,
  - 3.3 Operational principles of machine and parts, setting up machine for operation
  - 3.4 Various steps performed in jig boring operations
4. Jig Grinding and Jig Grinder (08 hrs)
  - 4.1 Jig grinding and jig grinder machine

- 4.2 Concept of main parts and functions of machine (e.g. Hauser), work holding attachment, cutting tools, cutting tool holders, operations,
- 4.3 Operational principles of machine and parts, setting up machine for grinding operation
- 4.4 Various steps performed in jig grinding operations
- 5. Rapid Prototyping (08 hrs)
  - 5.1 Rapid prototyping and application
  - 5.2 Concept of main parts and functions of rapid prototyping
  - 5.3 Working principle of process
  - 5.4 Various steps performed in rapid prototyping operations
- 6. Polishing, Lapping and Honing (12 hrs)
  - 6.1 Polishing, lapping, honing methods
  - 6.2 Concept and function of polishing, lapping, honing materials and polishing, lapping, honing machines
  - 6.3 Principles of polishing, lapping, honing technique
  - 6.4 Selection of polishing, lapping, honing materials and polishing, lapping, honing, technique for various jobs
- 7. Electroplating (08 hrs)
  - 7.1 Electroplating technique
  - 7.2 Concept of main functions, features of electroplating process, material used for process
  - 7.3 Working principles of process
  - 7.4 Various steps performed in electroplating process

## **PRACTICAL EXERCISES**

### **Advance Machine Shop**

- 1. Exercise of grinding a single point cutting tool on tool and cutter grinder
- 2. Exercises on sharpening a milling cutter on tool cutter grinder
- 3. Exercise on gear cutting as a milling machine
- 4. Exercise on lapping in workshop
- 5. Exercise on honing in workshop
- 6. Industrial visits to give exposure of gear cutting, jig boring, jig grinding, rapid prototyping, polishing, lapping, honing, electroplating etc.

## **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. Workshop Technology (Vol. 1, II & III) by Chapman A.J.; Amol Publication, New Delhi.
2. Elements of Workshop Technology by Hazra S.K. & Choudhary S.K.; Metropolitan Publishers, Bombay
3. Workshop Technology by Raghuwanshi B.S. & Others; New Heights, New Delhi.
4. Workshop Technology (Vol. 1 & II) by Gupta K.N. & Kaushish J.P.; New Heights, New Delhi
5. Workshop Technology ( Vol. I to V) by Antherton W.H; New Era Publishers, London
6. All About Machine Tools by Gerling; Wiley Eastern Ltd, New Delhi
7. Tool & Die Making by V.K. Mahajan
8. Westermann Tables by Hermann & Jutz Eduard Scharkus; Wiley Eastern Ltd, New Delhi

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	12
2	12	20
3	08	12
4	08	12
5	08	12
6	12	20
7	08	12
<b>Total</b>	<b>64</b>	<b>100</b>

## 5.5 ENVIRONMENTAL SCIENCE

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### RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

### DETAILED ONTENTS

1. Basics of ecology, eco system and sustainable development (03 hrs)
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table (04 hrs)
3. Sources of pollution - natural and man made, their effects on living and non-living organisms, Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms, Pollution of air-causes and effects of man, animal, vegetation and non-living organisms, Sources of noise pollution and its effects (18 hrs)
4. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods (06 hrs)
5. Mining, blasting, deforestation and their effects (03 hrs)
6. Legislation to control environment (04 hrs)
7. Environmental Impact Assessment (EIA), Elements for preparing EIA statements (04 hrs)
8. Current issues in environmental pollution and its control, role of non-conventional sources of energy in environmental protection (06 hrs)

### RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Lqw and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Engineering and Management by Suresh K Dhamija; SK Kataria and Sons, New Delhi.
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted</b>
1	03	06
2	04	10
3	18	40
4	06	12
5	03	04
6	04	08
7	04	08
8	06	12
<b>Total</b>	<b>48</b>	<b>100</b>

## 5.6 TOOL ROOM PRACTICE

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### Rationale

The diploma holders are expected to have the competency to fabricate. The students should be provided opportunities to make machine tools, jigs & fixtures, moulds and casting dies as per market requirement. Therefore, this subject is essentially required for fabrication practice.

At least one complete project must be accomplished from the given detailed contents.

### DETAILED CONTENTS

- 1) Fabrication of Press Tool:- Washer, Rectangular Component.
- 2) Fabrication of Jigs & Fixture:- Drilling Jig and Milling Fixture.
- 3) Fabrication of Machine moulds:- Coaster Cover and Carom board Striker with hole.
- 4) Fabrication of Compression Moulds, Carom Board Striker with hole.

**Note:** Visit to industries / Tool Room Organisation should be planned to demonstrate operation of following machines:

- Wire cut EDM
- Jig Boring
- Jig Grinding
- Profile Grinding
- Injection moulding machines
- Compression moulding machines
- Blow moulding machines
- Press shop

### **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