

STUDY & EVALUATION SCHEME
THREE YEAR DIPLOMA COURSE IN PRODUCTION ENGINEERING
(2014 Scheme)

FIFTH SEMESTER

Code No.	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
		L	T	P	Internal Assessment		External Assessment Exam				
					Theory	Practical	Written Paper		Practical		
					Max Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
PE-5.1	Work Holding Devices & Cutting Tools	4	-	2	50	50	100	3	100	3	300
PE-5.2	Product Design & Costing	5	-	-	50	-	100	3	-	-	150
ME-5.3	Inspection & Quality Control	2	-	2	50	50	100	3	100	3	300
ME-5.4	Industrial Engg. & Management Science	4	-	-	50	-	100	3	-	-	150
ME-5.5	CNC Machines & Automation	3	-	4	50	50	100	3	100	3	300
ME-5.6	Manufacturing Technology – III	4	-	-	50	-	100	3	-	-	150
ME-5.7	Workshop Practice – V	-	-	8	-	50	-	-	100	3	150
ME-5.8	Industrial Training	-	-	-	-	50	-	-	100	3	150
**	Student Centred activities	-	-	2	-	-	-	-	-	-	-
	TOTAL	22	-	18							1650

** Student centered activities will include: extension lectures, field visits, preparation of Major Project, Soft Skills, seminars, debates, hobby clubs, library studies, awareness regarding ecology and environment, conservation of energy (Petroleum products, electricity etc), social service camps and other co-curricular activities including games. Advanced planning for each semester has got to be made.

PE-5.1 WORK HOLDING DEVICES AND DIES

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RATIONAL

Diploma holder in production engineering are required to work in tool room, tool design section .They are suppose to have knowledge of various work holding devices and dies. This subject aims to impart skills of designing and drawing various work holding devices.

Detailed contents

- 1. Work Holding Devices (10%)**
 - 1.1 Basic requirements of work holding devices
 - 1.2 Location: Principles, methods and devices
 - 1.3 Clamping: Principles, methods and devices

- 2. Drill Jigs (15%)**
 - 2.1 Definition and types of Drilling Jigs
 - 2.2 Chip Formation in Drilling operation
 - 2.3 General Considerations in the Design of Drill Jigs
 - 2.4 Jig Bush, Slip Bush etc.
 - 2.5 Drill Jigs, and Modern Manufacturing Methods

- 3. Design of Fixtures (15%)**
 - 3.1 Fixtures and Economics
 - 3.2 Types of Fixtures
 - 3.3 Milling Fixtures
 - 3.4 Boring Fixtures
 - 3.5 Broaching Fixtures
 - 3.6 Turning Fixtures
 - 3.7 Grinding Fixture

- 4. Types of dies (15%)**
 - 4.1 Die operation , fundamentals of die design
 - 4.2 Die set
 - 4.3 Die shoe
 - 4.4 Die Clearances
 - 4.5 Blanking and Piercing dies
 - 4.6 Compound die
 - 4.7 Progressive die
 - 4.8 Combination die

- 5. Design of Die and punches (15%)**
 - 5.1 Punch and die mounting
 - 5.2 Stripper

- 5.3 Pilots
- 5.4 Feeder detectors
- 5.5 Pressure pads
- 5.6 Knock –out system
- 5.7 Strip layout
- 6. Design of forming dies (10%)**
 - 6.1 Types of forming dies
 - 6.2 Forming dies Details
 - 6.3 operation sequence of forming dies
- 7. Design of forging die (10%)**
 - 7.1 Types of forging dies
 - 7.2 Forging dies Details
 - 7.3 Operation sequence of forging dies
- 8. Injection Moulding dies (10%)**
 - 8.1 Types of moulds
 - 8.2 Details of injection moulding die
 - 8.3 Two plate & three plate mould

LIST OF PRACTICALS

1. Manufacturing of drilling jig
2. Manufacturing of milling fixture
3. Manufacturing of welding jig
4. Manufacturing of blanking Die
5. Manufacturing of compound die
6. Design & drawing of Progressive Die
7. Design & drawing of cup drawing Die

PE-5.2 PRODUCT DESIGN AND COSTING

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RATIONALE:

For manufacturing any component a production engineer needs the various skills to be will be able to design any component very efficiently and economically design, By going through this subject he will be able to design any component The course aims to introduce and explain the design concepts, methods, tools operations and costing

DETAILED CONTENTS

- 1. Product Development (20%)**
 - 1.1 Stages of Product Development
 - 1.21 Factors Influencing Design
 - 1.3 Major Phases of Design
 - 1.4 Factor of Safety
 - 1.5 Concept of virtual manufacturing & PTM
- 2. Cost Estimation (15%)**
 - 2.1 introduction
 - 2.2 Elements of cost
 - 2.3 overheads
 - 2.4 Estimates of Material cost
- 3. Cost Estimation of various of Manufacturing Processes (35 %)**
 - 3.1 Machine Shop
 - 3.2 Forging
 - 3.3 Welding
 - 3.4 Sheet Metal Parts
 - 3.5 Foundry
- 4. Value Analysis & Value Engineering (VAVE) (10%)**
 - 4.1 Value analysis
 - 4.2 Application of value analysis in cost reduction
 - 4.3 Importance of ergonomics in product design
- 5. Sustainable engineering (20%)**
 - 5.1 Sustainable engineering concepts
 - 5.2 Design for environment and for sustainability
 - 5.3 An introduction to life-cycle assessment (LCA)
 - 5.4 Sustainable manufacturing resources management

5.3 INSPECTION AND QUALITY CONTROL

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2	-	2

RATIONALE

Diploma holders in this course are required to measure and inspect for ensuring quality of product. For this purpose, knowledge and skills about standards of measurement, limits, fits and tolerances, types of inspection and various measuring instruments, SQC & quality standards are necessary.

Note: Weightage of each topic for external examination is given in the brackets.

- 1. Introduction to Quality (15%)**
Meaning of Quality. Quality Characteristics. Dimensions of Quality – Quality of Design, Quality of Conformance and Quality of Performance. Concept of Variables and Attributes. Quality Assurance. Quality related costs – Prevention Cost, Appraisal Cost, Internal and External Failure Costs. Tools for Quality Improvement – Flow Charts, Cause and Effect Diagram, Check Sheet, Histograms, Scatter Diagrams, Pareto Analysis and Control Chart
- 2. Some Philosophies and their Impact on Quality (5 %)**
Deming's Wheel. Juran's Quality Trilogy, Crossby's Absolutes of Quality Management. Taguchi's Quality Loss Function
- 3. Statistical Foundation (10%)**
Concept of Random Variable. Measures of Central Tendency and Dispersion. Sampling Process.- Advantages and Disadvantages. Basics of Probability Theory. Probability Distributions – Normal Distribution, Binomial Distribution and Poisson Distribution along with their respective tables.
- 4. Statistical Quality Control (25%)**
Meaning and importance of SQC. Inherent and Assignable sources of Quality Variations. Control Charts for Variables - \bar{X} and R charts. Control Charts for Attributes – p, np and c charts. Process Capability Analysis – Determination of Statistical Tolerance Limits. Different possibilities of statistically capable and incapable process. Process Capability Indices – C_p and C_{pk}
- 5 Acceptance Sampling (20%)**
Concept of Acceptance Sampling and comparison with 100% inspection. Different types of Sampling Plans. Operating Characteristic (OC) Curve – Importance and Significance. Concept of Producer's Risk and Consumer's Risk. Concepts of AQL, AOQL, IQL and LTPD.
- 6. Total Quality Management (20%)**

- 6.1 Principles of TQM: Customer Focus, Commitment by Top Management, Continuous Improvement, Quality Circles, Employee Empowerment, Principle of JIDOKA.
- 6.2 Quality Audit: Quality Audit Practices. Lead Assessor and Certification
- 6.3 Six Sigma: Statistical meaning of six sigma. System Improvement Methodology. DMAIC Cycle. Yellow Belt, Green Belt and Black Belt Certification.

7. ISO 9000 and other Quality Standards (5%)

Concept of Quality Standards. ISO 9000 and 14000 standards. Necessity of ISO Certification. Other Quality Standards.

List of Practical:

- 1. Calculation of mean and standard deviation of the quality characteristic for a given set of components.
- 2. Construction of \bar{X} and R chart of the quality characteristic of a given set of components
- 3. Construction of p chart of the quality characteristic of a given set of components
- 4. Construction of np chart of the quality characteristic of a given set of components
- 5. Construction of c chart of the quality characteristic of a given set of components
- 6. Construction of OC curve for a given single sampling plan.

5.4 INDUSTRIAL ENGINEERING AND MANAGEMENT SCIENCE

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RATIONALE

Diploma holders in mechanical engineering are responsible for controlling production and quality of the product on the shop floor as well as be responsible 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. He is also required to lead a team of workers and motivate them towards realization of organizational objectives. 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 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.

Note: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

- 1. Management Science** **10 %**
Introduction to Management – Definitions and Characteristics of Management. Leadership - Styles,, Functions and Qualities of a Leader, Manager as a Team Leader. Levels of Management. Managerial Skills – Technical, Conceptual and Human Relation skills. Scientific Management Theory (as given by F. W. Taylor). Principles of Management (as given by Henry Fayol). Functions of Management – Planning, Organizing, Directing, Controlling and Staffing. Systems Approach to Management
- 2. Organization** **10 %**
Introduction to Organization. The Process of Organizing. Principles of Organization. Organization Structures – Line, Functional, Line and Staff and Project Organization. Methods of Departmentalization - By Function, Process, Product and Geography. Forms of Business Ownership – Proprietorship, Partnership, Private and Public Enterprises, Cooperative Societies
- 3. Productivity** **10 %**
Introduction to Productivity. Types of Productivity Measurement – Concept of Aggregate Productivity. Factors affecting Productivity. Methods of Improving Productivity. Job Evaluation – different methods of Job Evaluation. Wages – Types of Wage Plans. Incentive Schemes. Merit Rating
- 4. Work Study** **25 %**
Introduction to Work Study. Method Study – Basic Procedure and Steps involved. Information Collection and recording Techniques in Method Study- Process Chart

Symbols, Operation process Chart, Flow Process Chart, Two Handed Process Chart, Multiple Activity Chart, Flow Process Chart, String Diagram and Travel Chart. Critical Examination. Micromotion Study – use of THERBLIGS. SIMO (Simultaneous Motion) Chart – Cyclograph and Chrono Cyclo Graph. Principles of Motion Economy. Work Measurement – Basic Procedure. Techniques in Work Measurement - Time Study, calculation of Standard Time and different Allowances given. Work Sampling (basic calculation) Predetermined Motion Time System (PMTS) Standard Data and its usage. Performance Rating. Concept of Ergonomics

5. **Managerial Economics** **10 %**
 Law of Demand and Supply. Types of Industrial Assets – Current, Fixed and Intangible Assets and Investments. Liabilities of an industrial organization. Concept of Balance Sheet. Components of Costing. Concept of Depreciation .Concept of Break Even Point
6. **Industrial Psychology** **10 %**
 Introduction to Psychology. Scope of Industrial Psychology. Motivation - Maslow's Hierarchy of Needs. Human Relations and its importance in Industry. Industrial Relations – Causes of Industrial Disputes. Process of Collective bargaining – Trade Unionism. Workers Participation in Management. Salient features of Industrial Legislations like Factories Act, ESI Act, Boilers Act, Payment of Wages Act, Minimum Wages Act, Workmen Compensation Act and Apprenticeship Act
7. **Human Resource Management** **5 %**
 Importance of Human Resources in an Industry. Aims and objectives of Human Resource Management. Staff Development - Development of Human Resource Policy in an organization. Manpower Planning – Steps involved. Training – Identification of Training Need, Training Strategies and Methods
8. **Industrial Safety** **5 %**
 Importance of Industrial safety. Causes of Accidents. Safety Awareness and Safety Drills. Safety Devices. Safety Councils and their roles
9. **Entrepreneurship Development** **10 %**
 Concept of Entrepreneurship. Need for Entrepreneurship Development. Introduction to Micro, Small and Medium Enterprises (MSME). Entrepreneurial Characteristics – Risk Taking ability. Assessment of Feasibility of the business. – Technical, Economical, Financial, Managerial and Social Feasibilities. Direct and Indirect Taxes. Concept of Cash Flows – NPV and IRR methods. Project Report
10. **Professional and Business Ethics** **5 %**
 Professional Ethics. Business Ethics. Human Values for Indian Managers. Role of Professional Bodies. Corporate Social Responsibility

5.5 CNC MACHINES AND AUTOMATION

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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.

Note: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

- 1. Introduction (12%)**
Introduction to NC, CNC & DNC, their advantages, disadvantages and applications. Basic components of CNC machines, Machine Control Unit, input devices, selection of components to be machined on CNC machines, Axis identification
- 2. Construction and Tooling (12%)**
Design features, specification of CNC machines, use of slideways, balls, rollers and coatings, motor and leadscrew, swarf removal, safety and guarding devices, various cutting tools for CNC machines, Concept of CNC tool holder, different pallet systems and automatic tool changer system.
- 3. System Devices (26%)**
Control System; Open Loop and Closed Loop System, Concept of Actuators, Transducers and Sensors, Tachometer, LVDT, opto-interrupters, potentiometers for linear and angular position, encoder and decoder and axis drives
- 4. Part Programming (18%)**
Introduction to Part programming, Basic concepts of part programming, NC words, part programming formats, simple programming for rational components, part programming using canned cycles, subroutines and do loops, tool off sets, cutter radius compensation and tool wear compensation.
- 5. Problems in CNC Machines (8%)**
Common problems in CNC machines related to mechanical, electrical and pneumatic, electronic components. Study of common problems and remedies, use of on-time fault finding diagnosis tools in CNC machines.
- 6. Automation and NC system (12%)**
Concept of automation, emerging trends in automation, automatic assembly.

Overview of FMS, Group technology, CAD/CAM and CIM.

- 7. Robot Technology** (12%)
Introduction to robotics, basic robot motion and its applications

LIST OF PRACTICALS (CNC MACHINES AND AUTOMATION)

1. Study of constructional detail of CNC lathe.
2. Study of constructional detail of CNC milling machine.
3. Develop a part programme for following lathe operations and make the job on CNC lathe.
 - Plain turning and facing operation
 - Taper turning operation
 - Circular interpolation.
4. Develop a part programme for the following milling operation and make the job on CNC milling
 - Plain milling
 - Slot milling
 - Contouring
 - Pocket milling
5. Preparation of work instructions for machine operator
6. Preparation of preventive maintenance schedule for CNC machine.
7. Demonstration through industrial visit for awareness of actual working of FMS in production.

5.6 MANUFACTURING TECHNOLOGY - III

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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.

Note: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

- 1. Milling (25%)**
 - 1.1 Specification and working principle of milling machine
 - 1.2 Classification, brief description and applications of milling machine
 - 1.3 Main parts 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 parameters
 - 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.
- 2. Grinding (20%)**
 - 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
- 3. Gear Manufacturing and Finishing Processes (5%)**
 - 3.1 Gear hobbing

- 3.2 Gear shaping
- 4. Modern Machining Processes (20%)**
- 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. Presses and press tools (10%)**
- 5.1 Types of presses, their applications, types of press operations.
- 5.2 Types of dies
- 5.3 Types of die sets
- 5.4 Punches
- 5.5 Pads
- 5.6 Die clearance
- 5.7 Stripper plates
- 5.8 Stops
- 5.9 Pilots
- 6. Metal Finishing Processes (20%)**
- 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
- 6.12 Concept of electroplating, galvanizing, powder coating

5.7 WORKSHOP PRACTICE – V

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RATIONALE:

Workshop Practice is included in the curriculum to provide practice on use of different tools and various manufacturing practices. The other objectives of this subject are to develop awareness about safety at work place and ability to work in a team.

DETAILED CONTENTS

General introduction to tools, equipments & machinery used in advance turning shop, machine shop, grinding shop, press & sheet metal shop along with safety precautions.

ADVANCE TURNING SHOP

1. Exercises on external turning of various types on lathe.
2. Exercise of boring with the help of boring bar on lathe.
3. Exercises on internal threading on lathe.

MACHINE SHOP

1. Produce a rectangular block using a Milling Machine with a side and face cutter
2. Prepare a 'V'- slot on a face using Milling Machine
3. Exercise on Milling Machine with the help of a form cutter

GRINDING SHOP

1. Prepare a Job on surface grinding machine
2. Prepare a job on cylindrical grinding machine.
3. Exercise on dressing a grinding wheel.

PRESS & SHEET METAL SHOP

1. Exercise in presswork on sheet metal components using a fly press.
2. Exercises in cold working operations on sheet metal cutting, punching, bending, embossing, coining and blanking by using Power Press.
3. Exercises involving use of dies in fabrication of sheet metal parts by power press

ADVANCE FITTING SHOP

1. Radius fitting in mild steel
2. Pipe threading with die

Note:

- * An experts may be invited from an industry to deliver expert lecturer.
- ** Relevant industrial visit may be planned.
- *** Making a record of exercises/ job completed by the students is a part of the Work for internal evaluation.