GOVT. POLYTECHNIC BALANGIR

Department of Mechanical Engineering

LESSON PLAN: 2025-26
Name of the Faculty: Paresh Kumar Mishra (Lecture Stage-I)
Subject: ADVANCE MANUFACTURING PROCESSES (Th. 4) Program: Diploma in Mechanical Engineering Semester: 6th Total Contact Hours: 60 Total Marks: 100 Assessment: Progressive –20, End Term – 80 Credits: 4

COURSE OBJECTIVES:

At the end of the course the students will be able to:

1. Understand the working principle of modern machining processes.
2. Understand the Plastic Processing
3. Understand the additive manufacturing process
4. Understand the Special Purpose Machines
5. Understand the Maintenance of Machine Tools

Unit 1 – Modern Machining Processes (Total Classes: 20)				
Class No.	**Topic**	**Subtopics**	**Teaching Aids / Activities**	**Course Objective**
1	Introduction to Modern Machining	• Need of modern machining processes • Comparison with traditional machining	• Chalk & board explanation • Comparison table	CO1
2	Overview of Non-Traditional Processes	• Classification of modern machining processes • Energy-based material removal	• Process classification chart • Discussion	CO1
3	Ultrasonic Machining (USM) – Principle	• Principle of USM • Material removal mechanism	• Diagram explanation • Working animation (if available)	CO1
4	Ultrasonic Machining – Equipment & Applications	• Description of equipment • Applications of USM	• Neat sketches • Industrial examples	CO1
5	Electric Discharge Machining (EDM) – Principle	• Principle of EDM • Spark erosion concept	• Working diagram • Classroom interaction	CO1
6	EDM – Equipment & Dielectric	• Description of EDM equipment • Role of dielectric fluid	• Component sketch • Discussion	CO1
7	EDM – Tools & Parameters	• Tool (electrode) materials • Process parameters	• Parameter table • Cause–effect explanation	CO1
8	EDM – Output & Applications	• Output characteristics • Applications of EDM	• Application examples • Short recap quiz	CO1

9	Wire Cut EDM – Principle	• Principle of Wire EDM • Difference between EDM & WEDM	• Comparative diagrams	CO1
10	Wire Cut EDM – Equipment & Applications	• Description of equipment • Controlling parameters • Applications	• Machine layout sketch • Case discussion	CO1
11	Abrasive Jet Machining (AJM) – Principle	• Principle of AJM • Material removal mechanism	• Diagram explanation	CO1
12	AJM – Equipment, MRR & Applications	• Description of equipment • Material Removal Rate • Applications	• Parameter discussion • Examples	CO1
13	Laser Beam Machining (LBM) – Principle	• Principle of LBM • Laser–material interaction	• Process diagram • Video/animation	CO1, CO4
14	LBM – Equipment, MRR & Applications	• Equipment description • MRR • Applications	• Industry case examples	CO1, CO4
15	Electro Chemical Machining (ECM) – Principle	• Principle of ECM • Electrochemical reactions	• Schematic diagram • Explanation	CO1
16	ECM – Equipment, MRR & Applications	• Description of equipment • MRR • Applications	• Parameter table • Discussion	CO1
17	Plasma Arc Machining (PAM) – Principle	• Principle of PAM • Plasma generation	• Process sketch • Explanation	CO1
18	PAM – Parameters & Performance	• Process parameters • Performance characteristics • Applications	• Cause–effect chart • Industrial examples	CO1
19	Electron Beam Machining (EBM) – Principle	• Principle of EBM • Equipment description	• Vacuum system sketch • Explanation	CO1
20	EBM – Performance & Unit Revision	• MRR • Process parameters • Performance & applications • Unit recap	• Summary table • Oral quiz	CO1, CO4

Unit 2 – Plastic Processing (Total Classes: 10)

Class No.	Topic	Subtopics	Teaching Aids / Activities	Course Objective
21	Introduction to Plastics Processing	• Definition of plastics • Classification of plastics (Thermoplastics & Thermosets) • Need for processing	• Chalk & board explanation • Material samples (if available)	CO2
22	Moulding Processes – Overview	• Classification of moulding processes • Comparison of different moulding methods	• Comparison table • Classroom discussion	CO2
23	Injection Moulding	• Principle of injection moulding • Description of equipment • Applications	• Machine layout diagram • Industrial examples	CO2
24	Compression Moulding	• Principle of compression moulding • Equipment description • Applications	• Process diagram • Comparison with injection moulding	CO2

25	Transfer Moulding	• Principle of transfer moulding • Equipment description • Applications	• Schematic sketch • Discussion	CO2
26	Extrusion Process	• Principle of extrusion • Extrusion equipment • Applications	• Extruder diagram • Product samples	CO2
27	Casting & Calendering	• Plastic casting process • Calendering process • Applications	• Process flow diagrams • Case examples	CO2
28	Fabrication Methods – I	• Sheet forming • Blow moulding	• Diagram explanation • Industrial applications	CO2
29	Fabrication Methods – II	• Laminating plastics (sheets, rods & tubes) • Reinforcing of plastics	• Product samples / images • Discussion	CO2
30	Applications of Plastics & Revision	• Applications of plastics in engineering • Advantages and limitations • Unit revision & recap	• Summary table • Oral quiz	CO2

Unit 3 – Additive Manufacturing Process (Total Classes: 15)

Class No.	Topic	Subtopics	Teaching Aids / Activities	Course Objective
31	Introduction to Additive Manufacturing	• Definition of Additive Manufacturing • Need for AM • Evolution of AM	• Chalk & board explanation • Comparison with conventional manufacturing	CO3
32	Fundamentals of AM	• Basic principle of layer-by-layer manufacturing • Digital workflow in AM	• Block diagram explanation • Classroom discussion	CO3
33	AM Process Chain	• CAD model • STL file generation • Slicing and tool path generation	• Process flow diagram • Software screenshots	CO3
34	AM Terminology	• Commonly used terms in AM • Build orientation, support structures	• Terminology chart • Oral questioning	CO3
35	Advantages & Limitations of AM	• Advantages of AM • Limitations of AM	• Comparison table (AM vs Conventional)	CO3
36	Classification of AM Processes	• ASTM classification of AM processes • Material-based classification	• Classification chart • Examples	CO3
37	Fundamental Automated Processes	• Concept of automation in AM • Role of computers and controllers	• System block diagram	CO3
38	AM vs CNC Machining	• Distinction between AM and CNC • Hybrid manufacturing concept	• Comparison table • Discussion	CO3
39	Related Manufacturing Technologies	• CNC machining • Laser-based processes • Rapid tooling	• Technology comparison chart	CO3
40	AM Applications – Design & Aerospace	• Design applications • Aerospace industry applications	• Case studies • Industry examples	CO3
41	AM Applications – Automotive & Jewelry	• Automotive industry applications • Jewelry industry applications	• Product images • Discussion	CO3
42	AM in Arts & Architecture	• Architectural models • Artistic applications	• Visual examples • Student interaction	CO3

43	Medical & Bioengineering Applications	• RP in medical field • Implants and prosthetics	• Case examples • Video (if available)	CO3
44	Web-Based Rapid Prototyping Systems	• Concept of web-based RP • Cloud manufacturing	• Process flow explanation	CO3
45	Flexible Manufacturing & Concurrent Engineering	• Concept of flexible manufacturing process • Concurrent engineering • Production tools – capstan & turret lathes • Overview of rapid prototyping processes • Unit revision	• Summary table • Oral quiz / recap	CO3, CO4

Unit 4 – Special Purpose Machines (Total Classes: 7)

Class No.	Topic	Subtopics	Teaching Aids / Activities	Course Objective
46	Introduction to SPM	• Definition of Special Purpose Machine • Need for SPM in manufacturing	• Chalk & board explanation • Industrial examples	CO4
47	Concept of SPM	• Concept and objectives of SPM • Comparison with conventional machines	• Comparison table • Discussion	CO4
48	General Elements of SPM	• Structural elements • Control elements • Tooling and work holding	• Block diagram explanation • Component identification	CO4
49	Productivity Improvement by SPM	• Cycle time reduction • Automation and accuracy improvement	• Case study discussion • Productivity chart	CO4
50	Principles of SPM Design – I	• Design objectives • Functional requirements	• Design flow diagram • Classroom interaction	CO4
51	Principles of SPM Design – II	• Selection of drives, controls and tooling • Safety and maintenance aspects	• Design checklist • Practical examples	CO4, CO5
52	SPM Applications & Revision	• Applications of SPM in industry • Advantages and limitations • Unit revision & recap	• Summary table • Oral quiz	CO4

Unit 5 – Maintenance of Machine Tools (Total Classes: 8)

Class No.	Topic	Subtopics	Teaching Aids / Activities	Course Objective
53	Introduction to Maintenance	• Definition of maintenance • Importance of maintenance in manufacturing systems	• Chalk & board explanation • Industrial examples	CO5
54	Types of Maintenance	• Breakdown maintenance • Preventive maintenance • Predictive maintenance	• Comparison table • Discussion with examples	CO5
55	Repair Cycle Analysis	• Concept of repair cycle • Downtime and turnaround time	• Flow diagram explanation • Case-based discussion	CO5

56	Repair Complexity	• Factors affecting repair complexity • Skill, tools, and time considerations	• Cause–effect chart • Classroom interaction	CO5
57	Maintenance Manual	• Purpose of maintenance manual • Contents of maintenance manual	• Sample manual discussion • Checklist preparation	CO5
58	Maintenance Records & Housekeeping	• Maintenance records • Importance of documentation • Housekeeping practices (5S concept – basic)	• Record format examples • Workplace layout discussion	CO5
59	Introduction to TPM	• Concept of Total Productive Maintenance • Objectives of TPM	• TPM pillar overview • Industrial case example	CO5
60	TPM Benefits & Unit Revision	• Benefits of TPM • Role of operators in TPM • Unit revision & recap	• Summary table • Oral quiz / doubt clearing	CO5

20/12/25

22.12.25

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