GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering
Level: Diploma
Branch: Mechanical Engineering (CAD/CAM)
Subject Code : DI04065021
Subject Name : Manufacturing Engineering Processes - II

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	PCC

Prerequisite:	Students should have a fundamental understanding of basic engineering materials, including the properties and applications of ferrous and non-ferrous metals. Knowledge of primary manufacturing processes such as casting, welding and metal forming (forging, rolling, extrusion and drawing) is essential. Prior workshop experience with machining tools, equipment and safety practices will help in effectively learning a manufacturing operation.
Rationale:	This subject introduces students of the CAD–CAM branch to the essential machining processes used in modern manufacturing. It covers the working principles, construction and operational features of conventional machine tools such as lathe, milling, drilling, shaping, planing and grinding machines. The course also extends to non-conventional machining processes including EDM, ECM, LBM, USM, AJM, WJM and PAM, enabling students to understand advanced methods used for machining complex geometries and difficult-to-cut materials. By learning to select appropriate tools, work-holding devices, machining parameters and suitable processes, students develop the competence required for precision part production. The knowledge gained in this course forms a practical foundation for later subjects such as CNC machining, CAD–CAM integration and advanced manufacturing technologies. This subject strengthens the technical readiness of learners for industry practices aligned with modern machining systems and digital manufacturing environments.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Recognize machining principles, tool technologies, cutting mechanics, cutting parameters, and safety practices required for machining operations.
02	Perform basic turning operations by selecting suitable work-holding devices, tools and machining parameters on a centre lathe.
03	Perform basic milling operations by choosing appropriate cutters, holding devices, and machining parameters.
04	Perform basic drilling, boring, shaping and planing operations by selecting appropriate machines, tools, work-holding devices.

05	Perform surface and cylindrical grinding operations by selecting suitable grinding machines, wheels and associated practices.
06	Identify suitable non-conventional machining processes for machining complex shapes and advanced materials.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE(E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
	Part A : Conventional Machining Processes		
1.	**Fundamentals of Material Removal & Tool Technology** 1. **Overview of Machining** • Broad classification of machining and machine tools 2. **Cutting Tool Technology** • Tool materials and their properties. • Cutting tool nomenclature and geometry for single-point tools 3. **Mechanics of Cutting** • Orthogonal vs. oblique cutting • Chip formation, chip types 4. **Cutting Fluids** • Types, applications and Desirable properties 5. **Machining Parameters & Calculations** • Cutting speed, feed, depth of cut, MRR • Influence on tool life and surface finish 6. **Carbide Insert Systems** • ISO insert designation and tool holder coding 7. **Shop-floor Safety** • Safety practices for machining operations	**06**	**13**

2.	**Lathe Operations & Process Planning** 1. **Centre Lathe Fundamentals** • Working concept with functional block diagram • Typical specifications of training lathes 2. **All-Geared Lathes** • Constructional layout and drive kinematics • Operations: turning, facing, tapering, threading, grooving 3. **Work-Holding & Tool-Holding** • Chucks (3-jaw, 4-jaw), collets, centers, mandrels, rests, faceplate,. 4. **Thread cutting on Lathe** • Mechanism and Gear setting for thread cutting 5. **Taper turning on Lathe** • Swiveling compound rest 6. **Machining Parameter Selection** • Selection of cutting parameters for given tool–work combinations • Estimating machining time and cost — numerical examples for producing a simple lathe part. • Process Planning of simple workpiece.	**08**	**17**
3.	**Milling Machines** 1. **Introduction to Milling** • Working concept using block diagram • Horizontal vs. vertical milling machines 2. **Vertical Universal Milling Machine** • Construction and key features • Typical specifications for workshop practice • Operations performed • Up milling and down milling 3. **Tools & Tooling** • Milling cutter types and applications • Geometry of milling cutters • Cutter holding devices • Work holding devices 4. **Indexing**	**08**	**17**

	• Simple indexing: principle and simple numerical 5. **Machining Parameter Selection** • Selection of parameters calculations • Estimating machining time and cost — numerical examples for producing a simple part on milling.		
4.	**Drilling & Boring Processes, Shaping & Planing machines** **Drilling Machines** • Working principle and construction • Standard types and their applications • Sample specifications of pillar type drilling machine • Operations performed • Work holding devices • Tool holding devices **Radial Drilling** • Construction, working, Applications • Typical specifications **Twist drill Geometry** **Cutting Parameters Selection** • Selection of cutting parameters • Estimating machining time and cost — numerical examples for producing a simple drilling part. **Boring Machine** • Working principle and industrial uses, operations **Shaping machine** • Working principle and construction • Operations performed • Typical specification of standard shaper • Crank and Slotted Link Mechanism **Planing** • Working principle and construction of standard planer • Comparison with shaping	**06**	**13**
5	**Grinding machines** 1. **Grinding machines** • Construction and working of Surface Grinding, Cylindrical Grinding, Centreless Grinding, Tool& cutter	**10**	**22**

	grinding machines 2. **Grinding Wheels** • Wheel specification coding & selection 3. **Terms associated with Grinding Practices** • Dressing, truing, balancing and mounting 4. **Honning Lapping & Super finishing** • Working & applications		
Part B : Non-Conventional Machining Processes			
6	**Non-Conventional methods of Machining** 1. **Electric Discharge Machining (EDM)** • Principle, equipment, electrode materials, applications 2. **Electric Chemical Machining (ECM)** • Principle, equipment, applications 3. **Laser Beam Machining (LBM)** • Working concept, advantages, industrial applications 4. **Ultrasonic Machining (USM)** • Working concept, Tooling system, applications 5. **Abrasive Jet Machining (AJM)** • Working and applications 6. **Water Jet Machining (WJM)** • Working and applications 7. **Plasma Arc Machining (PAM)** • Working and industrial relevance 8. **Introduction and applications of MEMS**	**06**	**15**
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	25	25	00	00	00

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

Sr. No	Title of Book	Author	Publication with place, year and ISBN
1	Machining and Machine Tools	A.B. Chattopadhyay	Wiley
2	Fundamentals of Machining Processes	Hassan Abdel-Gawad El-Hofy	CRC Press ISBN-13978-0849372889
3	Workshop Technology I & II	Raghuwanshi	Dhanpat Rai and Company(P) Limited
4	Production Technology (Manufacturing Process)	Dr. P C Sharma	S Chand
5	All about Machine Tools	HEINRICH GERLING	New Age International Private Limited
6	Production Technology	R. K. Jain and S. C. Gupta	Khanna Publishers
7	Elements of Workshop Technology Volume No. II Machine Tools	Hajra Choudhary, Bose S. K., Roy Nirjhar	Media promotors and publishers pvt. Limited
8	Production Technology	HMT	Tata Mcgraw-Hill Publishing Co.
9	Workshop technology Part I	Dr. W. A. J. CHAPMAN	2011 by Routledge

Open source software and website:

i. http://nptel.iitm.ac.in/video.php?subjectId=112105126
ii. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Manuf%20Proc%20II/pdf/LM-01.pdf
iii. http://www.youtube.com/watch?v=H0AyVUfl8-k&list=PLEFE7D1579523C45D
iv. http://www.youtube.com/watch?v=FFzRIop5bpg&list=PL843C2A830C65E2EE
v. http://www.youtube.com/watch?v=81Fdif5e85c
vi. http://www.youtube.com/watch?v=A0dTvf_Q8BA&list=PL2C105C94D2955C8B
vii. http://www.youtube.com/watch?v=tDc0l9Gm8D4&list=PL3AFB507B668AF162
viii. http://www.youtube.com/watch?v=THVgkBnjLq0
ix. http://www.youtube.com/watch?v=6VpCBk7FahI
x. http://www.youtube.com/watch?v=7wC1u4WOV1o
xi. http://www.youtube.com/watch?v=VDIoUZuTunI
xii. http://www.youtube.com/watch?v=Mn9jpqI8rao
xiii. http://www.youtube.com/watch?v=8SuoH5aL1SY
xiv. http://www.youtube.com/watch?v=xxNZSQML_ZA

xv. http://www.youtube.com/watch?v=XXUHZxweBcw&list=PLD07DE61CB871A0CB
xvi. https://nptel.ac.in/courses/110106146
xvii. https://www.youtube.com/watch?v=gcWj4OcteTk
xviii. https://nptel.ac.in/courses/112103250
xix. https://www.youtube.com/watch?v=IXYZLxNd-a8
xx. https://www.youtube.com/watch?v=GNLQ81WOytU

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	**Machining Process Parameters Evaluation:** Determine cutting parameters for machining, calculate MRR for given conditions, and observe the effect of cutting parameters on chip formation and surface finish.	1	04
2	**Turning Job:** Prepare a simple turning job on a center lathe with standard turning operations. **Prepare a report including:** a. Job drawing b. Operation sequence c. Selection and calculation of cutting parameters & cutting time. d. List of cutting tools required e. Specifications of the machine used.	2	08
3	**Milling Job.** **A.** Produce a simple rectangular/prismatic component using milling operations (face, slot, side milling, end milling, etc.) on a milling machine. **Prepare a report including:** a. Job drawing, b. Operation sequence, c. Selection and calculation of cutting parameters, d. List of cutters and tools required, e. Machine specifications. **B**. Demonstrate simple indexing using an indexing head on milling machine.	3	06
4	**Shaping machine job** Prepare a flat surface on a shaping machine using proper work-	4	06

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	holding and tool selection. **Drilling job** Perform drilling and reaming operations on a given workpiece using a pillar drilling machine.		
5	**Grinding job** Perform surface and/or cylindrical grinding on a workpiece to obtain the required surface finish.	5	04
6	Demonstration and Study of Non-Conventional Machining Processes Note: Virtual demonstrations, simulations, or industrial visit–based observations may be used if equipment is not available at the institute.	6	02
		Total	**30**

List of Laboratory/Learning Resources Required:
These major equipments with broad specifications for the PrOs is a guide to procure them by the administrators to user in uniformity of practical in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Hacksaw machine.	1 to 5
2.	Lathe with standard and special accessories.	1&2
3.	Milling machines-Vertical /horizontal with standard accessories and indexing/dividing head.	3
4.	Column drilling or Radial Drilling machine	4
5.	Shaper machine.	4
6.	Tool and cutter grinder	1 to 5
7.	HSS cutting tools and their tool holders	1 to 4
8.	Carbide inserts and their tool holders	1
9.	Drill bit and their tool holder	4
10.	Surface grinding machine	5
11.	Cylindrical grinding machine	5

Suggested Activities for Students:

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

- Select two industrial components (approved by teacher) and list various machine tools and operations used to produce these components.
- Prepare a list of surrounded items which are prepared by machining processes.
- Collect/download at least four different machine tool catalogues and make report of that with price.
- List various machine tools (min. 5 machine) currently using in market for different operation to perform.
- Identify the process used for re-sharpening different types of tools and prepare report for minimum 3 tools

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