GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Subject Code: BE04000191
Subject Name: Manufacturing Processes

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

Prerequisite:	Nil
Rationale:	Manufacturing Technology – I is related to Metal cutting Machine tools and different processes. All conventional machines are included in this course to understand the basic concepts in machining science. It also provides knowledge of safety precautions while performing operations on machine tools.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Interpret basics of cutting tools and metal cutting mechanism.	Remember
2	Make use of their skill in manufacturing of workshop job by using different machine tools.	Understanding
3	Illustrating different cutting parameters and calculation of machining time for different metal cutting operations.	Application
4	Illustrating different cutting forces acting while machining and its importance for economic manufacturing	Analyze, Evaluate
5	Evaluate Monitoring and testing of machine tools for better performance.	Analyze, Evaluate

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	Total no of hours per semester		ESE (E)	PA / CA (M)	PA/CA (I)	PBL (I)	ESE (V)	
45	0	30	45	120	4	70	30	20	30	50	200

* **Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Metal cutting Principles and Machine Tools:** Machine tools classification, working and auxiliary motions in machine tools, Primary cutting motions in machines tools, Elements of Metal cutting, Orthogonal and Oblique cutting, Classification of tools and tool Materials. Systems of Cutting- Tool Nomenclature: British Maximum Rake System, ASA system, German System. International Standards: Tool in hand and tool in Use systems, Setting system, Mathematical relationship between tool and Working systems, Calculation of Tool Angles and Working Angles. Chip formation: Types of chip and effect of cutting parameter, Chip thickness and Shear Plane angle measurement, Velocity relationship. Chip control and chip breakers, Concept of different forces in metal cutting: Merchant circle diagram, Stress and Strain in chip, Work done in Cutting, Power calculation in cutting. Concept of Tool life, Tool Wear, cutting fluid, Machinability and Economics of metal cutting. Introduction to Jig and Fixture: Basics of Jig and Fixture, Advantages, Application and differences of Jig and Fixture, 3-2-1 Principles, Principles of location- types of location Principles of clamps – types of clamps. Jig bushing and drill jigs.	10	22
2.	**Metal Cutting Lathes:** The Lathe and its working Principle, Types, Different Parts of Lathe, Lathe Accessories and Attachments, Change of speed and Speed ratios. Feed Mechanism and change gears, Apron and Apron Mechanism. Specifications of Lathe. Different Operations on Lathe, Threading, Boring, Reaming knurling, Grooving, Parting off and form turning on lathe. Chip disposal devices. Estimating machining time calculations. Turret and Capstan lathes as compared with a centre lathe. Main parts of Turret and capstan lathe and classification. Primary and secondary motions, common tools, attachments and feeding mechanisms. Safety Precautions associated in Lathe.	08	18
3.	**Shapers, Slotters and Planers:** Classification of Shapers, Slotters, and Planer Machine, Attachments extending the processing capacities of Shapers, Slotters, and Planer, Different Parts and Tooling requirements. Working Principle and Mechanism, Machining time calculations. Safety Precautions associated with Shapers, Slotters, and Planer Machine.	04	08
4.	**Drilling, Reaming and Boring Machines:** Drilling Machine: Purpose and field of application of drilling machines, Classifications of Drills, Twist drill, Twist drill parts and terminology. Types of drilling machines, Specifications of Drilling machines. Driving	04	08

	Mechanism of Drill. Drilling and allied operation, Estimating of machining time, Drill Grinding, Reaming: Reamer terminology, Types of reamer, reaming operations. Boring Machine: Purpose and filed of application, Classification Boring Machines, Operations performed on Boring machines. Safety Precautions associated with Drilling, Reaming and Boring machines.		
5.	**Milling Machines**: Working Principles, Purpose and types of Milling machines, Size and specifications of Milling machines. Types of Milling machines, Different types of milling operations, milling cutters and attachments extending the processing capabilities. Cutting Speed and Feed. Estimating machining time. Indexing or Dividing heads, Helical and spiral milling operation and its set up. Safety Precautions associated with Milling machine	06	16
6.	**Sawing and Broaching Machines:** Metal sawing classification, Blade specification, Machine Size and specification. Cutting speed, Blade failure and their preventions. Types of broaching machines, Broach constructions and elements of broach. Method of broaching. Tooth load on broach, Broaching speed and machining time calculation. Advantage and limitations of broaching. Safety Precautions associated with Sawing and Broaching machine.	04	08
7	**Abrasives and Grinding Machines:** Common form of abrasive tools, Grinding wheels and wheel material. Abrasive and bond material, symbolic representation of bonds. Grain and Grit, Grade, structure, common wheel shapes. Method of specifying grinding wheels, Loading, glazing, trueing and Dressing of grinding wheels, Classification of grinding machines, Grinding operations. Centerless grinders: Through feed, Infeed and End feed grinding. Special grinding machines, Size and specifications of grinding machines. Method of grinding, Sharpening of tools. Speed, feed and depth of cut in grinding, Machining time calculations. Safety Precautions associated with Grinding.	05	12
8	**Installation and Testing of Machine Tools:** Foundations for the machine tools, different types of machine foundations: Block, Box, Wall, Frame types. Factor affecting the type and size of foundation. Transportation and Erection: Types of Lifting and transporting equipment: pulley blocks, slinging, levelling and aligning. Machine tool testing: Alignment and practical test, Acceptance tests, site for testing, degree of accuracy, measuring equipment. Common geometrical tests, mode of tolerance and understanding of test charts.	04	08

	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**
25	**30**	**30**	**5**	**5**	**5**

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

References/Suggested Learning Resources:

(a) Books:

1. Fundamentals of Machining and Machine tools, by Geoffery Boothroyd and Winston. Taylore & Francis Publication
2. A Textbook of Production Engineering, by P C Sharma, S Chand Publication.
3. Workshop technology (Manufacturing Processes) by S K Garg, University science press.
4. Processes and Materials of Manufacture; Lindberg Roy A.; Prentice-Hall India.
5. Principles of Manufacturing Materials and Process, J S Campbell

(b) Open-source software and website:

1. NPTEL
2. Machining Process videos

List of Experiments:

Following experiments are suggested for Laboratory work

1. Demonstration of safety aspect while using Machine tools
2. Demonstration on Chip formation, Shear plane angle measurement.
3. Workshop Practices on Job making on lathe machine. (All Operations)
4. Demonstration of job making on shaper/slotter, Milling, Drilling and Grinding machine.
5. Demonstration on Force Measurement on Lathe.
6. Assignments for Machining time calculation for different machining operations.
7. Alignment test on lathe machine / any other machine

Major Equipment:

1. Lathe Machine
2. Milling Machine
3. Drilling Machine
4. Shaper/Planner/Slotter Machine
5. Grinding Machine
6. Lathe tool Dynamometer

List of Open Source Software/learning website:

1. http://nptel.ac.in/courses/

- **List of suggested activities for Problem Based Learning:**

Sr. No	Name of the Activity	No. of Hours	Evaluation Criteria
1	Manufacturing Industry (Machine tools) visit	Visit: 5h, Report preparation: 5h Total: 10h	Based on the report submitted. Report should contain observations and calculations based on Industry/ lab data.
2	Technical Video based learning related to the subject	Duration of video: 5h Report preparation: 5h Total: 10h	Report /presentation based on the video learning outcomes.
3	Assignment writing Numerical based assignment is preferable.	5 assignments of 4h each. Total:20h	Based on the assignment submitted.
4	Problem solving/Coding using c, c++, Pyhon, SCILAB, MATLAB, MS-EXCEL or any other relevant software	5 small coding based assignments of 2h each. Total: 10h	Based on the coding solution submitted.
5	Self-learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
6	Complex problem solving	Maximum 2 problems. Study of the problem and solution finding. Total: 10h/ problem	Based on the depth of the solution submitted.
7	Videos on Industrial safety/Disaster Management aspects based on subject	Duration of video: 5h Report preparation: 5h Total: 10h	Based on quiz report submitted
8	Discussion on research paper based on relevant subject	5 research paper : 20h	Summarize research paper and evaluation critical parameters
9	Poster/chart/PowerPoint preparation on technical topics	Duration:6 h	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics	Working : 12h Non-working: 8 h	Based on inter department/external evaluation
11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society /environment/health/other issue	Duration: 15 h for industrial exposure Problem identification and tentative solution: 10h Total:25 h	Based on evaluation of critical problems and solutions
12	Group Discussion on	Duration: t h each	Based on performance in group

	emerging/trending technical topics based on subject		discussion, technical depth, knowledge etc.
13	Real world case studies-based learning	Duration of data collection/study: 5h Report preparation: 5h Total: 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
14	Application Software development	Duration: 10 h	Depending on the complexity of the Application/Software
15	Depending on the complexity of the Application/Software	Duration 2 hrs. For attending the lecture/session - 2 hrs. and for report writing 2 h.	Based on the proof of attendance and report submitted
16	Blog or Technical Article Writing	10h (Research - 6h, Writing - 4h)	Based on originality, technical content, references cited, and clarity of communication.
17	Annotated Video Explanation of Concept / Problem	10h (Preparation * Recording + Submission)	Based on accuracy of explanation, clarity, and presentation style.
18	Online Technical Quizzes/Simulations	Multiple quizzes summing up to 10h	Based on quiz scores and reflection report after each quiz.
19	Tech Blog/YouTube Channel Curation	10h (Content curation * Analysis)	Summary report on curated content and learning outcomes.
20	Patent Search and Innovation Gap Identification	10h (Search + Report)	Based on number of relevant patents analyzed and identification of innovation scope.
21	Maintenance or Troubleshooting Logbook	10h (For example: lab instruments, computer hardware)	Based on documented cases, approach, and resolution.

Activity Note

- All activities should be related to the subject.
- The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, the total number of hours is fixed.
- For a course, min 3 activities must be carried out as per the availability of faculties and students. There is no limit to the maximum number of activities.
- Rubrics for the evaluation can be prepared by the respective faculty members.
- Subject teachers can add the relevant activities from the above list other than those mentioned in the syllabus, with the consent of the head of the department and DQAC.
- Subject coordinator shall identify activities from the above list as per the subject needs, they will also declare a list of activities wise hours, evaluation scheme and rubrics to students at the beginning of the semester.

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