Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Mechanical Engineering	**Semester**	III
Course Code	20ME32P	**Type of Course**	Programme Core
Course Name	**Machine Tool Technology**	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1. Rationale: Diploma Engineers are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes is required to be imparted. The students are to be trained and equipped with adequate theoretical and practical knowledge about Metal Cutting Phenomenon and various processes like turning, drilling, milling, grinding etc. Hence, this course is introduced to provide hands on experience on various machine tools used in the manufacturing stream and to provide foundation for diploma engineers who want to further specialise in the field of precision manufacturing

2. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	List relevant work place Occupational health and safety standards and explain the importance of the need to comply with them.
CO-02	Explain the importance of Cutting tool Geometry, list various Cutting Parameters, the role and use of the right Coolants and Lubricants for the given machining processes.
CO-03	Demonstrate turning operation for a given component drawing and object, prepare a process chart and estimate the cost of its production as per drawing.
CO-04	Demonstrate milling and drilling operation needed as per a given component drawing, list all the machine tools needed for the operation, prepare a process chart and estimate the cost of its production as per the drawing.

3. Course Content

Week	**CO**	**PO***	**Lecture (Knowledge)**	**Tutorial (Activity)**	**Practice (Skill)**
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	01	05	1. Educate about Safety standards Practiced in the machine Shop - Importance of housekeeping and good Shop floor Practices(5S) 2. Understand the Principles of First Aid. Preventive measures to be taken during Fire and Electrical emergency	Refer Table 1	1.Read and interpret the safety signs displayed in the Machine shop Instructor has to show various Safety sign charts and Personnel Protective Equipment (PPE) and ask the trainees to identify and record in the dairy 2.Read and interpret the PPE

			Types of Fire extinguisher (Class A,B,C,D) 3. Knowledge about Safety and Environment Regulations		First aid and basic training Identify and Segregate waste material (cotton waste, metal chips, burrs etc.) Arrangement of waste in bins 3. Hazards identification and avoidance Preventive measure for electrica accidents Select the fire extinguisher according to type of fire 4. Operate the Fire extinguisher and extinguish the fire Preventive measure for Oil leakages and related Hazards Practice the safety norms while working on Deferent Machine Tool
2	02	01,04	1 Lubrication- Need of Lubrication- Selection of Lubricant as per ISO standard. 2.Theory of metal Removal- Traditional & Non Traditional material removal process- Chip forming & Non chip forming 3. Types of cutting tools- Single point tools-Multi point tools – Specification of Single Point Cutting Tool, Parting , Knurling Tool, V- tool	Refer Table 1	1. Instructor has to display all the Lubricants used in the section and brief about its uses 2. Select a Proper lubricant and demonstrate the lubrication of various m Ask the students to record in the Dairy 3. Instructor has to show all the tools, machineries and measuring instruments used in the machine shop and brief about its uses. Ask the students to record in the Dairy. 4. Identify the type of Chips formed and record in the dairy
3	02	01	1. Grinding- Abrasives- Applications of Natural abrasives- stand stone (Quartz), Corundum and Emery Diamond and Garnets- Application of Manufactured Abrasives- Silicon Carbide, Aluminum Oxide Cubic boron Nitride 2. Explain – Grit, Grade, Structure, Bond, Type ISO Designation of Grinding Wheels 3. Tool Geometry-Tool materials and Designation-Tool life & Wear	Refer Table 1	1. Practice on Grinding machine 2 Grinding Practice of Single point tool as per tool Geometry

			Concept of Cutting speed-Depth of cut-Feed		
4	03	01	1.Introduction to Surface Texture-Indication of Roughness Symbols-Complete surface symbol chart, Grade and Numbers,- Tolerances- Unilateral and Bilateral 2.Introduction to Lathe-Types of lathe- Capstone and Turret Lathe, Automatic Lathe and others - Specification of a Center Lathe -. Cutting Fluids- Selection of cutting fluids- 3.Explain Work holding Devices-Tool Holding Devices	Refer Table 1	1. Read and interpret the Surface finish and Tolerances in the given Production drawing. 2. Identify the main Parts of Lathe and its functions Identify the movements in Lathe Parts • Carriage • Cross Slide • Tail Stock 3. Remove the Chuck from Spindle Nose and again mount on it 4. Demonstration of holding Work piece in 3-Jaw and 4-Jaw chuck 5. Idle operation of Lathe. Rotation of spindle in Clockwise and Counter clockwise direction 6 .Identify the Lubrication Parts in Lathe 7. Set the Spindle speed - Feed -Lever Position.
5	03	01,02, 04	1.Explain Plain turning, Step turning, Knurling and Chamfering Operations 2. Prepare the Process plan as per the given drawing for Plain Turning, Step Turning, Knurling and Chamfering 2.Estimate the Production cost per Piece as per the given drawing for Plain Turning, Step Turning, Knurling and Chamfering (Consider all Direct and Indirect costs)	Refer Table 1	1. Read and Understand the given Drawing 2. Select the suitable Raw material 3. Fix the given material between headstock and Tail Stock after performing Facing and Countersinking. 4. Select the Speed and Feed 5. Select and set the appropriate cutting tools as per the sequence of operations 5 Perform all operations as per the process plan 6. Check the dimensions using measuring instruments 7. Observe and Identify the Chip Formation
6	03	01,02, 04	1.Explain Taper turning operations by different methods-Calculate Taper angles for	Refer Table 1	1. Read and Understand the given Drawing

			different Taper turning component Drawings 2. Prepare the Process plan as per the given drawing for Taper Turning 3. Estimate the Production cost per Piece as per the given drawing for Taper Turning(Consider all Direct and Indirect costs)		2. Mark the required dimensions as per the given drawing for Taper turning 3. Fix the given material between headstock and Tail Stock 4. Select and Set the tools to perform Taper turning 5. Select the Speed and Feed 6. Perform the Taper Turning operations and record the machining time. 7. Measure the Taper angle in the given specimen using Bevel Protractor
7	03	01,04	1.Explain Thread cutting Mechanism a) Half Nut Mechanism b) Tumbler Gear Mechanism 2. Prepare the Process plan as per the given drawing for Thread cutting 3. Estimate the Production cost per Piece as per the given drawing for Thread cutting (Consider all Direct and Indirect costs)	Refer Table 1	1. Read and Understand the given Drawing 2.Fix the given material between headstock and Tail Stock 3.Select and Set the tools to perform Thread cutting operations 4.Select the Speed ,Feed and lubricant 5.Perform the thread cutting operations Measure the Pitch of the thread for the given specimen by using Pitch Gauge
8	04	01,04	1. Introduction to Milling – Types of milling machine – Specification of a Milling machine 2. Types of Milling cutters and their uses- Milling Cutter Nomenclature- Specification of Milling Cutter 3. Methods of Milling-Up Milling and Down Milling- Work holding devices	Refer Table 1	1. Identification of Milling machine Parts and its Usage 2. Demonstrate the working Principle of Milling machine and movements of Table and Arbor 3. Setting of Vice and Job on the Table of Milling Machine 4. Set the Cutter on the Arbor 5. Illustrate the safety points to be observed while working on the Milling machine 6. Identify and Select the different Milling Cutters 7. Demonstrate the Up-milling and Down – Milling Process
9	04	01,02, 04	1.Explain Plain Milling Operation 2.. Prepare the Process plan as per the given drawing(Solid Block) for Plain Milling 3. Estimate the Production cost per Piece as per the given drawing for Plain Milling	Refer Table 1	1. Perform Plain Milling of Six faces of a Solid Block 2. Check the accuracy of the Job with suitable Measuring Instruments

			Operation (Consider all Direct and Indirect costs)		
10	04	01,02, 04,07	1.Explain Key way and V- slot Operation 2. Prepare the Process plan as per the given drawing for Key way and V- slot 3. Estimate the Production cost per Piece as per the given drawing for Key way and V-slot	Study the latest technological changes in this course and present the impact of these changes on industry	1. Perform Milling of Keyway and V Slot 2. Check the dimensional accuracy with suitable Measuring Instrument
11	04	01,02, 04,07	1. Explain Gear cutting by Indexing Methods 2. Prepare the Process plan as per the given drawing for Gear cutting 3. Estimate the Production cost per Piece as per the given drawing for Gear cutting		1. Demonstrate Indexing Head 2. Set and Align Indexing Head with reference to the Job on Milling machine Table 3. Perform Gear Teeth on a Blank by Simple Indexing Method

12	04	01,02, 04,07	1. Introduction to Drilling – Types of Drilling Machines- Specification of Drilling Machines-Specification of Drill Bit, Reamer , Die and Taps 2. Nomenclature of Drill Bit, Reamer, Die and Taps- Standard sizes of Drill Bits Explain Operations performed in Drilling Machines- Drilling, Counter sinking, Reaming, Boring, Tapping 3. Prepare the Process plan as per the given drawing and Estimate the Production cost per Piece as per the given drawing		1. Identification of Drilling machine Parts 2. Demonstrate the working Principle of Drilling machine 3. Set the Vice and Job on the Table of Drilling machine 4. Illustrate the safety points to be observed while working on the Drilling machine 5. Identify and Select the different Drill Bits 6. Set the Drill bits on the spindle. 7. Drill Equally spaced holes (Circular/Square/Rectangular plate) 8. Finish the pre-drilled hole with a Reamer
13	01, 02, 03, 04		Demonstrate the manufacturing of following components using YouTube Videos 1. Fasteners 2. Propeller Shaft 3. Gears 4. Piston manufacturing Discuss and Prepare a Report on the videos Presented for each manufactured component.		Demonstrate the manufacturing of following components using YouTube Videos 1. Tube and Piston Rod Manufacturing. 2. Cylinder manufacturing etc., 3. Single point tool 4. Drill bits Etc. Discuss and Prepare a Report on the videos Presented for each manufactured component
Total in hours			**39**	**13**	**52**

- ***PO= Program Outcome as listed and defined in year 1 curriculum**
- **Course Coordinator must prepare PO – CO mapping with strength (Low/Medium/High) before course planning**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

Sl.No.	Suggestive Activities for Tutorials
01	Present a report on Machine safety Guidelines as per the Applicable standard Guide lines (CSA Standard Z 432-04 (R 2009)) including hazards associated with machines , Power tools, Machine Shop. Also Discuss general controls for reducing machine Hazards. https://ehs.utoronto.ca

02	Discuss Common grinding Problems And their Remedies. Also discuss the need for Balancing the Grinding Wheels.. https://www.Euromarcconz
03	Whether it's granite for your countertops, backsplash, or floor tiles, making pristine cuts can be achieved with proper precautions, techniques, and specialized granite cutting tools for making tiles and slabs of this hard rock. Discuss and present a report on those tools.
04	Present a Report on Applications of Inversions of Kinematic Mechanisms: With-worth quick return motion mechanism in Shaper Double-slider crank mechanism
05	Present a Case Study on Machine tool chatter arising in an interrupted turning process https://core.ac.uk/download/pdf/33663698.pdf
06	Present a Report on Influence of Cutting Parameters on cutting force and Surface finish in Turning operation https://www.sciencedirect.com
07	Analyse tolerances in a Production Drawing
08	Analyse Surface finish symbols in a Production Drawing
09	Demonstrate the various measuring instruments used in Machine Shop
10	Collect the sample piece of various raw materials used in machine shop and Discuss their mechanical, chemical and Physical properties

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill test reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Tutorial sessions through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	**Machine Tool Technology**	Test	I/II/III	Sem	III
Course Code	20ME32P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					

Section	Assessment Questions	Cognitive Levels(R/U/A)	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			

	6			
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.				

5 . (a) For CIE Skill Test -4 **Duration: 240Min**

SL. No.	CO	Particulars/Dimension	Marks
1	03	**Question on Turning operations with Process plan, Production Cost of the product for a Given parameters** • Process plan includes Component Drawing ,process list and Tool selection=25marks • Costing includes Raw material ,process and finding Total cost , selling Price and cost of scrap =25marks • Performance of Turning and Taper turning operations(20+15)=35 marks • Dimensional accuracy=05 Marks	90
2	01,02,03	**Portfolio evaluation based on the average of all Practice Sessions (1-6 weeks)**	10
Total Marks			100

5. (b) For CIE Skill Test -5 **Duration: 240 Min**

SL. No.	CO	Particulars/Dimension	Marks
1	04	**Question on Milling operations with Process plan and Production Cost of the product for a Given parameters** • Process plan includes Component Drawing , process list and Tool selection= 20marks • Costing includes Raw material ,process and finding Total cost , selling Price and cost of scrap = 30marks • Performance of Milling operations including Key/Slot/Gear teeth cutting operations (20+15)= 35 marks • Dimensional accuracy=05 Marks	90
2	03,04	**Portfolio evaluation based on the average of all Practice Sessions (7-12 Weeks)**	10
Total Marks			100

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
						Average Marks= (8+6+2+2)/4=4.5	**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Mechanical estimation and costing T.R.Banga and S.C.Sharma Khanna publishers
2	Mechanical Estimation Malhothra
3	Industrial Organization and Engineering Economics T.R. Banga and S.C.Sharma Khanna publishers
4	Mechanical Estimation NITTTR Chennai NITTTR Chennai
5	Mechanical costing and Estimation. Singh and Khan Khanna Publishers
6	Process Planning & Cost Estimation M.Adithan New age International
7	Rao, P.N., Manufacturing Technology, Vol I & II, Tata Mcgraw Hill Publishing Co., New Delhi, 1998
8	Seropekalpakjian, Steven R Schmid Manufacturing Engineering and Technology- Pearson Education-Delhi
9	Sharma, P.C., A Textbook Of Production Technology – Vol I And II, S. Chand & Company Ltd., New Delhi, 1996
10	HMT – "Production Technology", Tata Mcgraw-Hill, 1998

8. LIST OF SOFTWARES/ LEARNING WEBSITES:

1.http://calculatoredge.com/index.htm#mechanical

2.www.nptel.ac.in/courses/112105126/36

3.www.youtube.com/watch?v=T5gjkYvMg8A

4.www.youtube.com/watch?v=ESKoaZtoB1E

5.www.freevideolectures.com

9. SEE Scheme of Evaluation **Duration: 180min**

SL. No.	CO	Particulars/Dimension	Marks
1	03,04	**Question on Turning operations with Process plan and Production Cost of the product for a Given parameters** • Process plan includes Component Drawing, process list and Tool selection= 20marks • Costing includes Raw material ,process and finding Total cost , selling Price and cost of scrap =25 marks • Performance of Operations =30marks • Dimensional accuracy=05 Marks **OR** **Question on Milling operations with Process plan and Production Cost of the product for a Given parameters** • Process plan includes Component Drawing, process list and Tool selection= 20marks • Costing includes Raw material, process and finding Total cost , selling Price and cost of scrap = 25marks • Performance of Milling operations including Key/Slot/Gear teeth cutting operations (20+10)= 30 marks • Dimensional accuracy=05 Marks	**80**
2	01,02, 03,04	Viva voce	**20**
	Total Marks		**100**

10. Equipment list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
01	Center lathe With all accessories and attachments(Gear driven)	Max 50mm Dia Holding capacity 500mm Center distance .Swing over dia 200mm	20
02	HSS cutting tool	20*20*150MM	40
03	HSS cutting tool	10*10*150MM	20
04	Cemented carbide tipped tools with holder brazed	For turning	20
05	Knurling tool Rough	Standard	10
06	Knurling tool Smooth	Standard	10
07	Vernier calipers	300mm	20
08	Outer caliper	5omm OD	20
09	Steel scale	300mm	20
10	Dial gauge for setting of work	Standard	10
11	Counter sunk Drill Bit	6mm Taper shank	20
12	Upright Drilling Machine	Upto 24mm drill With all attachment	01
13	Sensitive Drilling Machine	Upto 18mm drill	01
14	Machine Vice (To hold Job)	120mm Jaw Gap	05
15	Drill Bit set	6mm to 24mm	10 set
16	Marking Divider	200mm dia	
17	Marking punch	Standard	20nos
18	Combination Set Square	Standard	10 nos
19	Surface plate	300*300mm	01 no
20	Column and Knee type Vertical MILLING machine With all attachments	.Table Travel of 800mm .24mm cutters Bore dia (ID)	01no
21	Plain milling Cutter 24mm ID/Slab milling	Standard Size for Practice	05
22	Key way cutter	6mm	10
23	Key way cutter/Slot cutter	12	10
24	Gear cutter (Spur teeth)	Standard Size for Practice	10
25	Concave Milling cutter	Standard for Size Practice	10
26	Convex Milling cutter	Standard Size for Practice	10
27	Key way Milling cutter	40mm dia	10
28	End Milling Cutter	24mm dia	10
29	Bench Grinder	300mm wheel dia Rough and Smooth	02