Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2024

4th Semester, Mechanical Engineering

ME 5402 & Metal cutting and machine tools

(Regulation 2019)

Time : 3 Hours | Max. Marks 100

CO 1	Apply fundamental knowledge, principles in material removal processes and importance of metal cutting parameters.
CO 2	Apply the fundamentals of turning and automatic machine tools
CO 3	Apply the principles of reciprocating, milling and gear cutting machines.
CO 4	Apply the principles of abrasive processes and broaching processes
CO 5	Apply the CNC machine tools and programming manufacturing processes

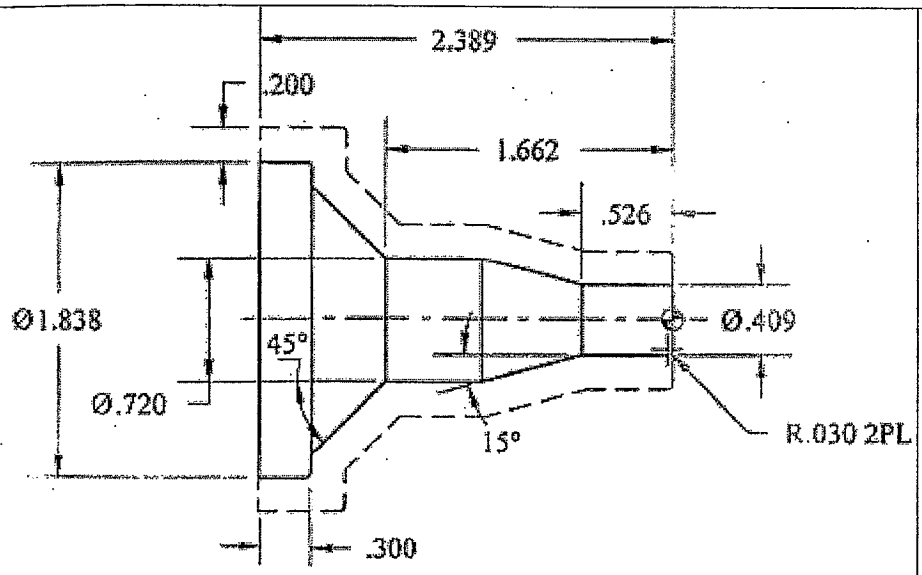
BL – Bloom's Taxonomy Levels
(L1 – Remembering; L2 – Understanding; L3- Applying; L4 – Analysing; L5 – Evaluating; L6 – Creating)

Answer ALL Questions

	PART-A (10 x 2 = 20 Marks)	Marks	CO	BL
1.	Show the primary shear zone and the secondary shear zone graphically in machining?	2	1	2
2.	Write Merchant's equation for determining the shear angle and enumerate the various terms in the equation.	2	1	2
3.	What are changewheels in a lathe?	2	2	2
4.	Find the machining time for minimum production time for a cutting tool which obeys Taylor's tool life equation $VT^{0.3} = C$ if the tool change time is 2 minutes.	2	2	3
5.	What are indexable insert drills?	2	3	2
6.	How is quick return achieved in a hydraulic shaper?	2	3	3
7.	Write any two important process capabilities of grinding.	2	4	2
8.	Name any four abrasives used in making grinding wheels?	2	4	2
9.	What is cutter radius compensation?	2	5	1
10.	What is the use of ball screws in CNC machine tools?	2	5	1

		Part – B (5 x 13 = 65 marks)	Marks	CO	BL
11.	a)	During orthogonal cutting of steel with 10° rake tool with a depth of cut of 2 mm and feed rate of 0.20 mm/rev, the cutting speed is 200 m/min. The chip thickness ratio is 0.31. The vertical cutting force is 1200 N and the horizontal cutting force is 650 N. Calculate from the merchant's theory, the forces on the rake face and shear plane, the	13	1	3

		shear work, friction work and total work done in the metal cutting operation.			
		OR			
	b)	With neat diagrams explain the three major mechanisms of tool wear in machining. How does cutting speed influence these three mechanisms?	13	1	3
12	a)	A taper pin of length 90 mm has a taper length of 50 mm. The larger diameter of taper is 95 mm and the smaller diameter is 85 mm. Determine i. Taper in mm/metre and in degrees ii. The angle to which the compound rest should be set up iii. The tailstock setting over	13	2	2
		OR			
	b)	Write a note on any three workholding devices in a lathe.	13	2	1
13.	a)	Compare the conventional and climb milling on the basis of the following parameters: (i) Use in manual / CNC machine tools (ii) Surface roughness of the machined surface (iii) Machining castings / forgings (iv) Clamping requirements during machining Use a table to report your answers in the form of a comparison.	13	3	2
		OR			
	b)	Explain any two gear generation processes? Write their advantages in comparison with gear forming processes.	13	3	2
14.	a)	Discuss the problems encountered in grinding process.	13	4	2
		OR			
	b)	Explain the principle and applications of any two micro-finishing methods.	13	4	2
15.	a)	Write a note on interpolation and Canned cycles.	13	5	1
		OR			
	b)	Write a CNC part program to machine the contour of the part shown in the figure below starting from the home position shown in figure below. Use suitable speed and feed values assuming the material is Ti alloy. State any assumptions made.	13	5	2



	Part – C (1 x 15 = 15 marks)	Marks	CO	BL
16.	Jobs of diameter D are turned on a lathe over a length L. The following observations have been made concerning tool life at a feed rate of 0.1 mm/rev.	15	1,2	4

S.No	Spindle speed rpm	Number of components turned before tool change
1	250	249
2	300	144

Determine the number of components that can be turned at 312 rpm before tool change. Use Taylor's tool life equation.