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

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)
END SEMESTER EXAMINATIONS – NOV / DEC 2024

DEGREE	B.E / B. Tech/B.Arch. (Full Time)	
Duration: 3Hrs.	**Max.Marks:**100	**Regulation** – 2019
Branch	Materials Science and Engineering	

Semester 5

ML 5501 Theory and Applications of Metal Forming

COURSE OUTCOMES:

CO 1. Ability to learn stress-strain concepts of materials during plastic deformation.
CO 2. Apply the theory of plasticity and its application for analysing various metal forming Processes.
CO 3. Understand the principle of metal working, load calculation and the applications of metal working.
CO 4. Ability to calculate the forming loads for extrusion and drawing processes.
CO 5. Understand the various sheet metal forming methods.

BL – Bloom's Taxonomy Levels

L1 – Remembering, **L2** – Understanding, **L3** – Applying, **L4** – Analyzing, **L5** – Evaluating, **L6** – Creating **CO** – Course Outcomes

Answer ALL Questions

PART- A (10 x 2 = 20 marks)

Q. No.	QUESTIONS	Marks	CO	BL
1.	What is state of stress at a point?	2	CO1	L2
2.	How are forming loads calculated in metal forming process?	2	CO1	L2
3.	What is flow stress?	2	CO2	L2
4.	What is the effect of strain rate on metal working?	2	CO2	L2
5.	Which of the following components is manufactured, specifically by metal forming? Give the reasons for it. a) Piston b) Engine block c) Connecting rod d) Crankcase	2	CO3	L4
6.	Analyse the effect of flash gutter in hot forging?	2	CO3	L4
7.	Differentiate direct, indirect extrusion and impact extrusion.	2	CO4	L2
8.	What type of forces are encountered in extruding bars and wire drawing	2	CO4	L2
9.	What is super plastic forming?	2	CO5	L2
10.	What is progressive forming of sheet metal?	2	CO5	L2

Part – B (5 x 13 = 65 Marks)

11.	a)	i) Differentiate linear strain and shear strain.	4		
		ii) Describe the stresses acting on an elemental cube and show that the state of stress at a point is completely described by six stress components	9	CO1	L2
		(OR)			
11.	b)	i) Explain the two-dimensional state of stress with the help of Mohr's circle.	8	CO1	L2
		ii) What is the difference between Slip and Twinning?	5		
12.	a)	Discuss the categories of metal forming based on the on the type of			

		forces applied to the work piece as it is formed into shape.	13	CO2	L
		(OR)			
12.	b)	i) Explain why a true stress-strain curve is frequently called a flow curve.	3		
		ii) Discuss the various idealized flow curves.	5	CO2	L2
		iii) Discuss the residual stresses in metal forming	5		
13.	a)	i) Develop the differential equation for the forging of a plate of constant thickness under conditions of plane strain with Coulomb Friction.	8	CO3	L3
		ii) Discuss the distribution of normal stress and longitudinal stress for compression between plates.	5		
		(OR)			
13.	b)	i) Describe the typical arrangements of rolls for rolling mills.	6		
		ii) Discuss the effect of strip tension on the distribution of roll pressure in the theory of rolling.	7	CO3	L3
14	a)	i) Explain relationship between ram pressure vs ram stroke.	7		
		ii) Determine and comment on the ram pressure for billet lengths: L=75mm, 50mm, 25mm and L=0mm for the following case. A billet 75mm long and 25mm in diameter is to be extruded in a direct extrusion operation with rx=4 (circular die). Take the following data: K=415MPa, n=0.18, a=0.8, b=1.5.	6	CO4	L3
		(OR)			
14,	b)	i) Discuss the various types of defects formed during extrusion of metals.	6		
		ii) Describe the various types of tube drawing with simple sketches.	7	CO4	L3
15.	a)	i) Describe the various sheet metal operations with simple sketches	7		
		ii) Discuss the classification of basic sheet metal operations with simple sketches	6	CO5	L2
		(OR)			
15.	b)	i) Compare high velocity forming and conventional forming.	5		
		ii) Explain the principle and the operation of various methods of explosive forming	8	CO5	L2
		Part – C (1 x 15 = 15 Marks)			
16	a)	i) What is barreling phenomenon in forging?	3		
		ii) Discuss open die forging, impression die forging and precision forging with their products.	8	CO3	L3
		iii) Discuss about isothermal forging.	4		