BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: B. TECH **SEMESTER : V**
BRANCH: PIE **SESSION : MO/2025**

SUBJECT: PE319 MATERIAL DEFORMATION PROCESSES

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

				CO	BL
Q.1	I.	Classify forging processes based on (a) temperature, (b) process, and (c) equipment	[2]	CO1	BL2
	II.	Explain and discuss the microstructure of a plate prior to, during and post a hot rolling process with the help of a neat schematic.	[2]	CO1	BL3
	III.	Differentiate between direct and indirect extrusion with the help of neat schematics.	[1]	CO1	BL2
Q.2	I.	Explain the states of stresses in (a) rolling, (b) backward extrusion and (c) bending processes with the help of neat schematics.	[3]	CO1	BL4
	II.	List the applications of conform extrusion.	[1]	CO1	BL1
	III.	State the advantages of hydrostatic extrusion.	[1]	CO1	BL1
Q.3	I.	Justify the statement – 'The stress at any point can be completely described by six independent stress components in spite of nine stress components'	[2]	CO2	BL5
	II.	The displacement u_1, u_2 and u_3 are given as: $u_1 = \left(2{x_1}^2 + 6/x_1 + 9{x_2}^2\right) \times 10^{-6}$, $u_2 = (2/x_1 + 1/x_2 + x_1x_2) \times 10^{-6}$ and $u_3 = 0$, Determine the strains ε_{11}, ε_{22} and ε_{12} at the point (5,3).	[2]	CO2	BL3
	III.	Explain any one of the idealized stress-strain curves.	[1]	CO2	BL2
Q.4		The stress at a point inside a continuum is given by the stress matrix (units of MPa): $\sigma = \begin{bmatrix} 1 & -1 & 0 \\ -1 & -5 & 0 \\ 0 & 0 & 4 \end{bmatrix}$	[5]	CO2	BL4
	I.	Evaluate the normal and shear stress components on a plane whose normal vector is in the direction of the vector $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$			
	II.	Estimate the principal stresses.			
Q.5	I.	If a strain-hardening metal obeys Hollomon true stress–strain relation, then necking in a tensile specimen occurs when $\varepsilon_u = n$, where ε_u is the uniform true strain and n is the strain hardening coefficient – Justify with derivation.	[3]	CO2	BL5
	II.	A metal yields in a uniaxial state of stress when the uniaxial stress reaches 200MPa. Judge whether the metal will yield, if the metal follows Tresca yield criterion, when the stress is described by the matrix (units of MPa): $\sigma = \begin{bmatrix} 25 & 40 & 0 \\ 40 & 20 & 30 \\ 0 & 30 & 20 \end{bmatrix}$	[2]	CO2	BL5

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