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

CLASS: B. TECH **SEMESTER : VI**
BRANCH: PRODUCTION ENGINEERING **SESSION : SP/2023**

SUBJECT: PE319 MATERIAL DEFORMATION PROCESSES

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a)	Discuss the working of hydrodynamic wire drawing process. Also write the dies materials with its properties to be used in the drawing operation?	[5]	4	2
Q.1(b)	With neat sketch explain the spray forming process? Compare the technicality of spray forming with respect to powder metallurgy and electroslag remelting?	[5]	4	3
Q.2(a)	Illustrate the various types of idealized stress-strain curves with neat sketches.	[5]	2	2
Q.2(b)	A round tensile specimen with an initial gage length of 100 mm and diameter 25 mm, shows after fracture a gage length of 125 mm and a minimum diameter of 19 mm at fracture. If the load corresponding to the 0.2% offset yield is 140 kN, that at the point of the onset of necking is180 kN and that at the point of fracture is 150 kN, solve the following: A. 0.2% offset yield strength. B. Ultimate tensile strength. C. (i) Fracture strength and (ii) applied true fracture strength. D. (i) Engineering strain and (ii) true strain at fracture. E. (i) Reduction of area and (ii) true reduction of area at fracture.	[5]	3	3
Q.3(a)	Summarize the method for calculating friction by the ring compression test with the help of a calibration curve.	[5]	4	2
Q.3(b)	Develop an expression for the pressure of a circular flat disk of uniform thickness being press forged in axial direction with flat dies when the die-workpiece interface is governed by sticking friction. Describe the friction hill for this case with a neat sketch.	[3+2]	5	3
Q.4(a)	Define slip lines with the help of a neat sketch. Deduce the Hencky's slip line equations from the equations of force equilibrium in plane strain condition.	[2+3]	3	3
Q.4(b)	(1) Derive a relationship between back tension and front tension in rolling such that when both tensions are increased, the neutral point remains in the same position. Explain the pressure distribution and longitudinal stress distribution (with neat diagrams) for open die forging of a slab under plane strain condition for the cases of (i) sliding and (ii) sticking friction.	[3+2]	3	2
Q.5(a)	Derive an expression for the drawing stress of a cylindrical wire drawn through a conical die (semi-cone angle α) in terms of the fractional reduction in area considering back tension in the wire. State the assumptions clearly.	[3+2]	3	3

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Q.5(b) The cross-sectional area of a metal wire with diameter of 4 mm, subjected to a back tensile force of 1 kN, is reduced by 50 % by drawing homogeneously at a speed of 2 m/s through a conical converging die with a total included die angle of 12°. The coefficient of friction at the rod–die interface is 0.07. Assuming the flow stress of the metal to be 280 N/mm^2, evaluate the following: [5] 3 4

(1) Drawing load

(2) Power required for the above drawing operation, assuming 100% efficiency of the electric motor supplying the power.

If all the work due to plastic deformation and friction is converted into heat, what would be the temperature rise of the wire? The properties of the steel are as follows: Density = 7850 kg/m^3; and specific heat = 486 J/kg-K:

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