Ref. No.: Ex/Met/PC/B/T/412/2024

B.E Metallurgical and Material Engineering 4th Year 1st Semester Exam 2024

Subject: Fabrication Processes

Time: 3 hours **Full Marks = 100**

(Answer any **six** from **Question no 1** to **7, Question no 8** is **compulsory**)

Q No.	Questions	Marks	CO
1	**a.** Define hydrostatic stress and deviatoric stress. How do these stress components contribute to the overall deformation of a material during metalworking? **b.** Explain the concept of a triaxial state of stress. Under what conditions does a material experience triaxial stress, and how does it influence the material's behavior?	8 + 6 = 14	CO1
2	**a.** Choose a material used in metalworking and evaluate its plastic stress-strain curve. Discuss the key features of the curve and how they influence the selection of metalworking parameters. **b.** When a compressive force of 4 MN is applied on the top surface of a well lubricated cube (dimension 80 mm x 80 mm x 80 mm), it causes plastic flow. What force would be required to produce flow if the other faces of the cube are constrained by die force of 1 MN and 2 MN?	7 + 7 = 14	CO2
3	**a.** Discuss the principles of rolling mill control. Explain how variables such as forces, temperature, and roll speed are controlled to achieve desired outcomes in the rolling process. **b.** Compare and contrast metalworking and shaping processes. Highlight the advantages and disadvantages of processes such as forging, rolling, and extrusion. Discuss how the choice of process is influenced by material properties.	7 + 7 = 14	CO3
4	**a.** Discuss the calculation of front and back tension in a rolling mill. Explain how these tensions are determined to control the material flow through the mill and ensure uniform product thickness. **b.** Discuss how the factors including die angles, and reduction ratios influence draw stress and the overall success of the wire drawing process.	6 + 8 = 14	CO4

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5	**a.** Discuss common defects encountered in wire and tube drawing processes. Explain the causes of defects like surface scratches or irregularities and propose strategies for defect identification and resolution. **b.** Discuss how residual stresses can become defects in fabricated products.	8 + 6 = 14	CO5
6	**a.** Explain the criteria for selecting metalworking techniques based on material properties and working conditions. Provide examples of materials with different properties and discuss suitable metalworking techniques for each. **b.** In a wire drawing operation, a 10 mm diameter stainless steel wire drawn to 8 mm. Determine the drawn stress required for this drawing operation. The flow stress is given by $\sigma=K\varepsilon^n$, where K = 1250 MPa and n is 0.28.	8 + 6 = 14	CO6 CO4
7	**a.** Discuss the influence of metallurgical structure on the extrusion process. Explain how material properties and microstructural features affect the success of extrusion and the quality of extruded products. **b.** Given mean flow stress of 20 MPa, diameter of extrusion chamber and extrusion rod are 150 mm and 15 mm respectively. Determined the thrust required for extrusion? Neglect the redundant work and coefficient of friction.	8 + 6 = 14	CO6 CO4
8	**Answer any four:** **a.** For successful close die forging two conditions must be fulfilled - explain? **b.** What is redundant work? How can it be minimized? **c.** Write a short note on manufacture of Seamless pipes and tubes **d.** "It not possible to reduce thickness of a strip below a certain limit"- Justify the statement. **e.** How is it possible to compensate spring back during bending of metal sheet?	4 × 4 = 16	CO2 CO3 CO4 CO5 CO6