

**M.E. METALLURGICAL ENGINEERING FIRST YEAR FIRST
SEMESTER - 2025**

Subject: MATERIALS PROCESSING

Time: 3 hours

Full Marks = 100

(Answer *Question No 1* and *Any Five* from the rest)

1. Answer any four:

(5 × 4 = 20)

- a. Explain the Concept of Plane Stress and Plane Strain Conditions Using Tensor Notation.
- b. Write down the condition to represent the triaxial state of stress. Explain whether hydrostatic stress causes yielding or not.
- c. Distinguish Between Simple Shear and Pure Shear Stress States and Provide Examples of Each.
- d. Derive the Tresca yield criteria and why it is less accurate as compare to von-mises yield criteria?
- e. Discuss the implications of plastic deformation in the context of metalworking processes.

2.

(6 + 6 + 4 = 16)

How do you classify the metal working process? Give example in each case. Draw a schematics of different forging operation. List the variables that influence the ability of metals to flow during forging.

3.

(16)

Describe with neat sketches the classification of rolling mill. State their advantages, limitations and applications.

4.

(8 + 8 = 16)

- a. How do the various factors influence the force required to cause extrusion or discuss the variables in extrusion determining the extrusion pressure?
- b. Given mean flow stress of 20 MPa, diameter of extrusion chamber and extrusion rod are 150 mm and 15 mm respectively. Determine the thrust required for extrusion? Neglect the redundant work and coefficient of friction.

5.

(6 + 10 = 16)

- a. Write a short note on Variables in wire Drawing.
- b. Discuss the different types of residual stress patterns may present in cold drawn rod and wire. How the amount of deformation (% reduction) influence the residual stress distribution throughout the cross-section of the wire or rod?

6. (4 + 4 + 4 + 4 = 16)
Discuss in brief how following defect forms in different fabrication processes and how they can be avoided:

- I. Cold shut or fold
- II. Edge cracking
- III. Alligatoring type of fracture
- IV. Wrinkling

7. (8 + 8 = 16)
- a. Discuss different surface preparation techniques which are essentially required for coating. Compare and contrast the anodic and cathodic coating processes of metals.
 - b. Select a specific application (e.g., gears, crankshafts, or cutting tools) and propose a suitable surface heat treatment process for it. Justify your choice based on the material, operating conditions, and desired surface properties.