

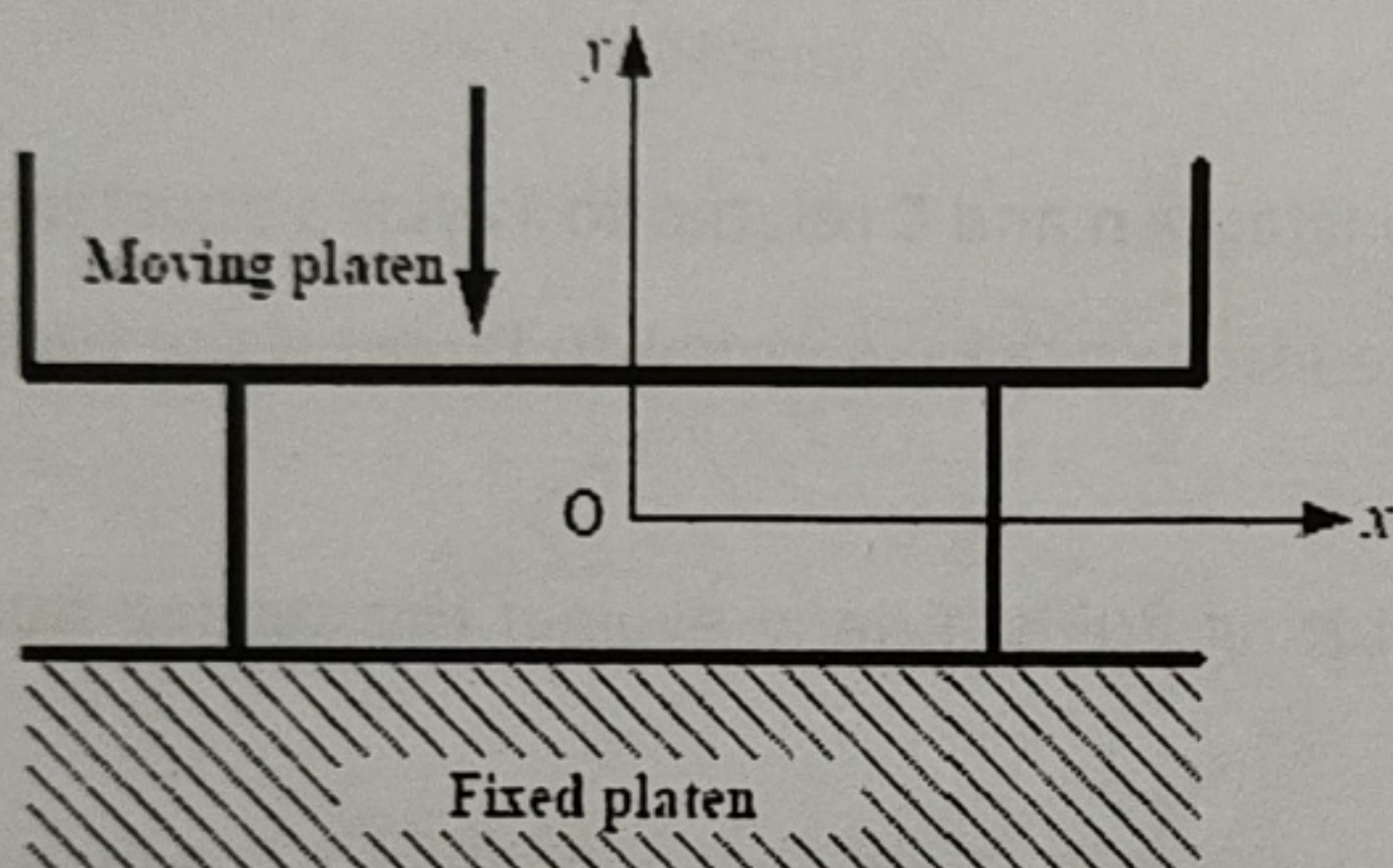


- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

Answer ALL Questions

(10 X 10 = 100 Marks)

1. Figure below shows forging of a steel with yield stress ($\sigma_y = 300$ MPa). The strain in the z direction is zero. If the entire block starts yielding at $\sigma_x = 40$ MPa (Compressive) and $\tau_{xy} = 0$, calculate the stress component σ_y using Tresca's yield criteria (Maximum shear stress criterion)



2. A 24 mm thick plate is decreased in thickness according to the following schedule: 12, 6, 3 mm. Compute the total strain based on initial and final dimensions and the summation of the incremental strains, using

- (a) Conventional strain
- (b) True strain

How does this show an advantage for the use of true strain in metal-forming work?

3. A cup is to be drawn using a deep drawing process with a height of 75 mm and an inner diameter of 100 mm using a 2mm thick sheet. Determine the drawing ratio, reduction, and thickness to diameter ratio if the blank diameter is (a) 225 mm or (b) 175 mm. Evaluate the feasibility of fabricating the cup in both cases.

4. Classify the cutting models with respect to the angle between the cutting edge of the tool and the direction of tool motion with the help of neat sketches.

5. The following observations were made during an orthogonal cutting operation.

- a. Tool rake angle - 12°
- b. Coefficient of friction - 0.8
- c. Chip thickness - 2 mm
- d. Width of cut - 15 mm

- e. Cutting speed – 36 m/min
f. Feed rate – 1.2 mm/rev.

g. Shear strength of the metal – 650 N/mm²
Determine the following data.

- ☒ i) Shear angle
- ☒ ii) Chip thickness ratio
- ☒ iii) Shear force
- ☒ iv) Friction angle
- ☒ v) Cutting force
- ☒ vi) Power consumed by the cutting tool.

b. An engineer wants to establish the numerical value of the constants n and C related to Taylor's Tool life equation. In trial 1, when he used a cutting speed of 100 m/min, the tool life was 25 minutes. In trial 2, when he used a cutting speed of 80m/minute, the tool life was 50 minutes.

(a) Compute the values of the constants n and C related to Taylor's equation.

(b) What cutting speed should he instruct the workmen to target if the tool life is to be 30 min?

7. Elaborate on the functions of cutting fluids. Briefly explain the cutting fluid used in a machine shop.

8. Explain in detail the electric discharge machining process using a neat schematic diagram.

9.a) Discuss the various configurations of rolling mills with neat sketch. Explain the advantages and limitations of using small-diameter rolls in flat rolling.

OR

9.b) Select the appropriate metal-forming process that results in the following defects.

- i. Internal pipes
- ii. Chevron cracks

Explain its causes and remedies in detail.

10.a) Elaborate on the significance of reconditioning abrasive wheels in machining. Explain with neat sketches the problems associated with the uninterrupted or prolonged use of the grinding wheel with a brief demonstration of their remedial measures.

OR

10.b) Suggest a gear generation method for creating the internal teeth in a hollow circular blank. Show the workpiece-tool schematic and explain it in detail.