


VIT

Vellore Institute of Technology

Final Assessment Test – November 2025

Course: BMEE304L - Metal Forming and Machining

Class NBR(s): 2174 / 2177 / 2178 / 2182

Slot: B1+TB1

Time: Three Hours

Max. Marks: 100

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

COs	CO Statements
CO1	Develop the yield criterion and workability behaviors of materials.
CO2	Evaluate various bulk and sheet metal forming processes for different functional requirements
CO3	Demonstrate various machine tools and machining operations.
CO4	Analyse the mechanics of metal cutting processes.
CO5	Investigate the heat flow, tool life and tool wear during metal cutting process.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

1. Sketch the flow curves for the following materials and explain them briefly. CO1 BL3
 - (a) Rigid and perfectly plastic
 - (b) Linearly elastic
 - (c) Elastic and perfectly plastic
 - (d) Perfectly plastic (non-strain hardening)
2. A 30 mm thick plate is to be reduced in thickness according to the following schedule: 15, 9, and 4 mm. Compute the total strain based on the initial and final dimensions and the summation of the incremental strains, using : CO1 BL3
 - (a) Conventional strain, and
 - (b) True strain

Also, explain how does this shows an advantage for the use of true strain in metal-forming work?
3. A cup of height of 60 mm is to be drawn from a sheet metal blank having thickness of 4 mm and diameter of 160 mm using a punch with diameter of 85 mm and die. The tensile strength and yield strength of sheet metal blank are 420 MPa and 200 MPa, respectively. Determine: (1) Drawing ratio, (2) Reduction, (3) Drawing force, and (4) Thickness to diameter ratio. CO2 BL5
4. Identify and explain with a neat sketch, the extrusion method of brittle materials extrusion for production of complex shapes with higher deformation levels and better surface finish. CO2 BL3

5. Identify the non-traditional machining process suitable for machining of brittle materials like glass using a high frequency vibrating tool and explain its process principle with a neat sketch and also mention its merits and demerits.

CO5 BL3

6. Explain the following terms associated with the grinding wheel briefly with relevant sketches?

CO3 BL4

(1) Grit, (2) Grade, (3) Structure, (4) Loading, (5) Glazing, (6) Dressing, and (7) Truing

7. Identify and explain the following two gear finishing methods shown in Figure.2 in details and also list out their advantages and limitations.

CO3 BL4

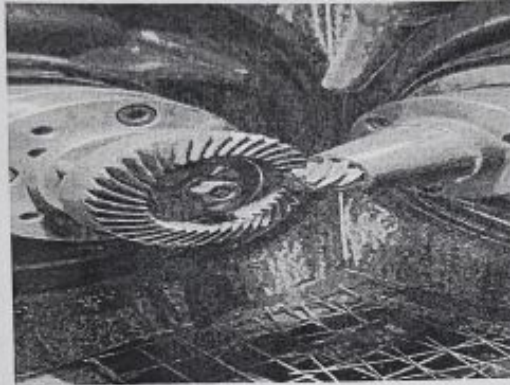


Figure 2. Gear finishing methods

8. Explain the significance and application of indexing and demonstrate the process of cutting 12 teeth on spur gear using Simple indexing method and clearly mention of the following.

CO4 BL4

- Index plate to be selected
- Number of complete revolutions of index crank
- Number of hole where index pin is to be inserted
- Angle of rotation of work-piece after each teeth cut

Index plates with concentric circles of holes:

- Plate: 1 - 15, 16, 17, 18, 19, 20
- Plate: 2 - 21, 23, 27, 29, 31, 33
- Plate: 3 - 37, 39, 41, 43, 47, 49

- 9.a) An orthogonal machining was done on a given mild steel (MS) work piece using single point cutting tool having a rake angle of 12° and lathe-tool dynamometer recorded the following forces during machining.

CO5 BL5

Cutting force = 280 N and Thrust force = 160 N.

If the uncut chip thickness = 0.1 mm and the cut chip thickness = 0.2 mm, Calculate the following using graphical method.

- (1) Shear force; (2) the normal force on the shear plane; (3) Friction force; (4) the normal force on friction plane, and (5) shear angle

OR

- 9.b) A lathe spindle running at 6000 rpm is cutting mild steel work piece with a H.S.S (high speed steel) tool. If the spindle speed is reduced to 4500 rpm, calculate the enhancement in the tool life.

CO5 BL5

Assume:

- (1) For the given work piece-tool combination, $n = 0.125$.
(2) No change in machining environment and other conditions

- 10.a) Explain the following defects that are possible in sheet metal forming and discuss it's reasons and remedial solutions.

CO2 BL3

- (1) Spring back, (2) Tearing, (3) Wrinkling (on flange and walls) (4) Earing, and (5) Orange peel

OR

- 10.b) Identify a high energy rate forming (HERF) process suitable for swaging or expanding tubular shaped parts as shown in Figure.1. Explain the process principle with a neat sketch and list out its advantages and limitations?

CO2 BL2

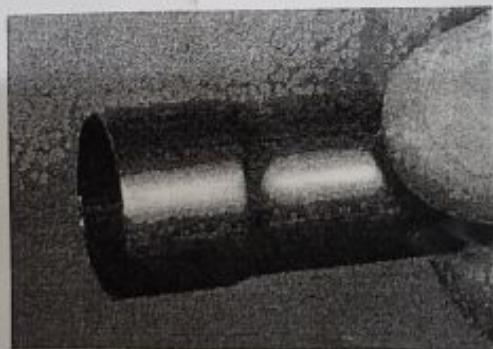


Figure.1. Expanded tubular shaped part

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