Reg. No. :

Question Paper Code : X86765

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2021
Second Semester
Manufacturing Engineering
MF5202 – THEORY OF METAL FORMING
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Transformations are vital in analyses of stress and strain. Justify.
2. Why is Bauschinger effect not an issue, provided there are no reversals of stress in the problem under study ?
3. Illustrate the elastic and plastic strain of a material under uniaxial stress.
4. Why are aluminium alloy forgings primarily used in the automotive and aerospace industries ?
5. Brief on a recent development in the research on metal forming of magnesium alloys.
6. What is the means to avoid plastic flow localization that leads to buckling or fracture of the tube during hydroforming process ?
7. How does Chevron cracking occur ? Mention any two conditions that promote this defect.
8. What is the main cause of anisotropy of plastic properties associated with drawing process ?
9. In sheet metal forming, the control of the friction level has a significant role. Why ?
10. When is the barreling effect more pronounced in forging operations ?

PART – B **(5×13=65 Marks)**

11. a) Show that the values of principal stresses given by Mohr's circle agree with those obtained mathematically by setting to zero the derivatives of the stress with respect to the transformation angle.

(OR)

b) Describe the assumptions of plasticity theory highlighting the models of elastic and plastic deformation.

12. a) Explain the design considerations in forming and the formability of the laminated sheets with suitable sketches.

(OR)

b) Describe the workability theory in bulk forming processes that involves stress and strain states and fracture criteria.

13. a) Describe the factors that need to be investigated to improve the formability of the parts in hydrodynamic deep drawing assisted by radial pressure.

(OR)

b) Explain the procedure for evaluation of deflection and strains in a typical component with the aid of an experimental setup for water hammer forming.

14. a) Describe the powder preform forging process highlighting the required tooling, influencing process parameters and applications.

(OR)

b) With the aid of a schematic, explain the laser beam forming process with the irradiation pattern highlighting the temperature radiant mechanism.

15. a) Explain the wear mechanisms associated with sheet metal forming process.

(OR)

b) With regard to the formability of laminated lightweight metallic materials, explain the following :

i) Determination of the forming limit curves. **(7)**

ii) Role of incremental forming. **(6)**

PART – C **(1×15=15 Marks)**

16. a) Explain the stress-state during sheet metal stamping with the necessary equations and how plastic deformation can lead to failure in metal stamping.

(OR)

b) Discuss the significant technical and technological progress in the scope of extrusion of metals and alloys as well as metallic composite materials.

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