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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

MATERIAL SCIENCE AND ENGINEERING

V SEMESTER

ML9301-Theory and applications of metal forming

(Regulation 2008)

Time: 3 Hours

Answer ALL Questions

Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. What do you understand by a yield criteria?
2. Why are principle stress axes always the same as principle strain axes in an orthotropic material?
3. What is the role of flow stress in metal working?
4. Distinguish between formability and workability.
5. What are the major limitations of open die forging process?
6. List the any four rolling defects.
7. Under what circumstances is indirect extrusion preferable to direct extrusion?
8. How is stretch forming differ principally from sheet metal drawing?
9. What are the methods of making seamless tube?
10. List any two merits and limitations of electromagnetic forming.

Part – B (5 x 16 = 80 marks)

11. (i) Explain the yield criteria (i) simple tension, (ii) Biaxial tension (6)
ii) The state of the stress at a point of a cylindrical specimen is as follows:
 $\sigma_x = 70 \text{ MPa}$
 $\sigma_y = 120 \text{ MPa}$
 $\lambda_{xy} = 35 \text{ MPa}$
If the yield strength of the material and uniaxial tension test is 125MPa
(i) Determine the principle stress (5)
(ii) Determine whether yielding will occur according to Trescas's and Von-Misses yield criteria. (5)
12. a) i) What is the effect of temperature rise in metal working? (6)
ii) Explain with a sketch plane strain and plane stress condition in metal working. (10)

(OR)

- b) i) How are metal forming process classified? (6)
ii) Discuss with suitable illustration the influence of temperature and friction in metal working. (10)
13. a) i) Sketch the forces acting strip forging. (6)
ii) A cylindrical specimen of 150 mm diameter and 100 mm length is upset in open die forging to a height of 50 mm at room temperature. Assume coefficient friction as 0.2, material constant as 1030 MPa and strain hardening coefficient as 0.17. Estimate; (i) flow stress needed to induce deformation.
(ii) the average pressure at the end of the stroke. (10)

(OR)

- b) i) What are the assumptions made in the analysis of simple rolling process? (6)
ii) Explain with a sketch the roll arrangements of four –high rolling mill. (10)
14. a) i) What are the important variables affecting the extrusion? (6)
ii) Sketch and explain the extrusion defects indicating major causes and its remedies. (10)

(OR)

- b) i) Explain the principle of hydrostatic extrusion. (6)
ii) Derive a relationship for a theoretical maximum reduction per pass in rod drawing for strain hardening material. (10)
15. a) i) How are sheet metal blanking differ from bending? (6)
ii) Sketch and explain a simple die for angle bending indicating how the bending load be evaluated. (10)

(OR)

- b) i) What are the uses of forming –limit diagram? (6)
ii) Describe with illustrate sketch anyone method of high-energy- rate forming. (10)