

Fifth Semester B.E. Degree Examination, June/July 2014
Design of Machine Elements – I

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer FIVE full questions, selecting at least TWO questions from each part.
 2. Use of design data handbook is permitted.

PART – A

1. a. Draw the stress-strain diagrams for a ductile material and a brittle material and show the salient points on them. (05 Marks)
 b. For the stress element shown in Fig.Q1(b), find the principal stresses and directions. (06 Marks)



Fig.Q1(b)

- c. Determine the maximum normal stress and shear stress for the figure shown in Fig.Q1(c). (09 Marks)

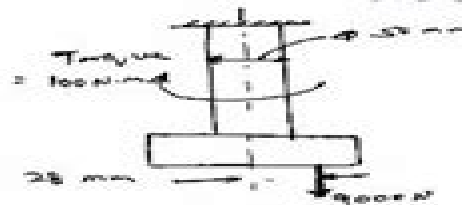


Fig.Q1(c)

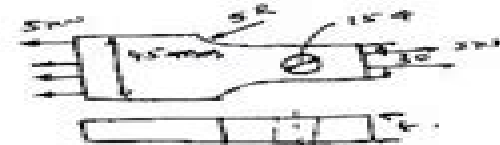


Fig.Q2(b)

2. a. Explain the following theories of failure:
 (i) Maximum shear stress theory (ii) Distortion energy theory. (05 Marks)
 b. A flat plate subjected to a tensile force of 5 kN is shown in Fig.Q2(b). The plate material is grey cast iron having $\sigma_{ultimate} = 200$ MPa. Determine the thickness of the plate. Factor of safety is 2.5. (08 Marks)
 c. A weight 600 N drops through a height of 20 mm and impacts the center of 300 mm long simply supported circular cross section beam. Find the diameter of the beam and the maximum deflection, if the allowable stress is limited to 90 MPa. Neglect the inertia effect and take $E = 200$ GPa. (07 Marks)
3. a. Derive Soderberg's equation for ductile material. (05 Marks)
 b. A hot rolled steel rod is subjected to a torsional load that varies from +330 N-m clockwise to 110 N-m counter clockwise and an applied bending moment varies from +440 N-m to -220 N-m. The rod is of uniform cross-section. Determine the required rod diameter. The material has an ultimate tensile strength of 550 MPa and a yield strength of 410 MPa. Design based on a factor of safety of 1.5. Take the endurance limit as half the ultimate strength. (15 Marks)

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