Roll No.: _____ Name: _____

THAPAR UNIVERSITY

B.E.- Second Year — Solids and Structures (UES 010)

Mid Semester Examination (22nd September, 2017) — Time: 2 HRS

Instructors: SHG, SHR, KKH, ABD, RG, RKS, GB, NG — Max. Marks: 50

Note: All questions are compulsory, Support your answers with neat sketches wherever required.

Q1 At room temperature (20°C) a 0.5 mm gap exists between the ends of the rods as shown in Figure 1. The rod A is made of aluminium whose area is 2000 mm^2, E = 75 GPa, and α = 23 x 10^{-6} /°C. The rod B is made of steel whose area is 800 mm^2, E = 190 GPa, and α = 17.3 x 10^{-6} /°C. At a later time when the temperature has reached 140°C, determine (a) the normal stress in the Aluminium rod, (b) the change in the length of the aluminium rod. **(12)**

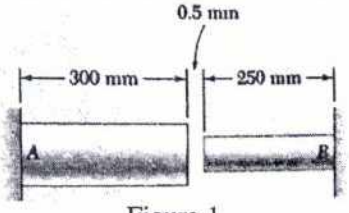

Figure 1

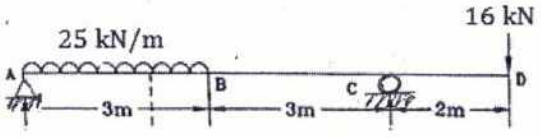

Figure 2

Q2 Draw the shear force and bending moment diagram for the beam as shown in Figure 2. Mark all the salient points. **(12)**

Q3 The lap joint is connected by three 20 mm diameter rivets/bolts as shown in Figure 3. Assume that the axial load, P = 50 kN is distributed equally among the three rivets/bolts, find (a) shear stress in a rivet/bolts; (b) bearing stress between a plate and rivet/bolts, and (c) the maximum average tensile stress in each plate. **(8)**

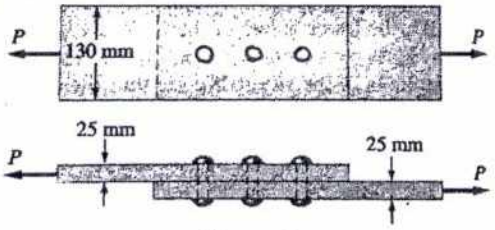

Figure 3

Q4 The following data refer to a mild steel specimen tested in laboratory: **(6)**

(i)	Diameter of the specimen	= 25 mm
(ii)	Length of the specimen	= 300 mm
(iii)	Extension under a load of 15 kN	= 0.045 mm
(iv)	Load at yield point	= 127.65 kN
(v)	Maximum load	= 208.60 kN
(vi)	Length of the specimen after failure	= 375 mm
(vii)	Neck diameter	= 17.75 mm

Determine (a) Young's Modulus (b) Yield point (c) Ultimate stress (d) Percentage of elongation (e) Percentage reduction in area (f) Safe stress adopting a factor of safety of 2.

Q5 A shaft transmit 280 kW of power at 160 rpm. Determine: **(12)**

(a) the diameter of a solid shaft to transmit the required power

(b) the inner and outer diameter of a hollow circular shaft if the ratio of the inner to the outer diameter is 0.7.

(c) the percentage saving in the material on using a hollow shaft instead of a solid shaft

Take the allowable shear stress as 80 MPa.