Total No. of Questions—8] [Total No. of Printed Pages—4+2

Seat No.	

[4757]-1018

S.E. (Mechanical/Automobile) (Second Semester)

EXAMINATION, 2015

STRENGTH OF MATERIALS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Answer *four* questions out of **8**.

(*ii*) Solve Q. No. **1** *or* Q. No. **2,** Q. No. **3** *or* Q. No. **4,** Q. No. **5** *or* Q. No. **6,** Q. No. **7** *or* Q. No. **8**.

(*iii*) All the four questions should be solved in one answer-book; attach extra supplements if required.

(*iv*) Draw diagrams wherever necessary.

(*v*) Use of scientific calculator is allowed.

(*vi*) Assume suitable data wherever necessary.

1. (*a*) A steel bar 25 mm diameter and length 250 mm is pulled by 0.001 mm by application of tensile load. Find the diameter of the bar if the linear strain is to be reduced by 10% without changing the load. [6]

P.T.O.

(*b*) Draw SFD and BMD for the beam loaded as shown in figure below. [6]

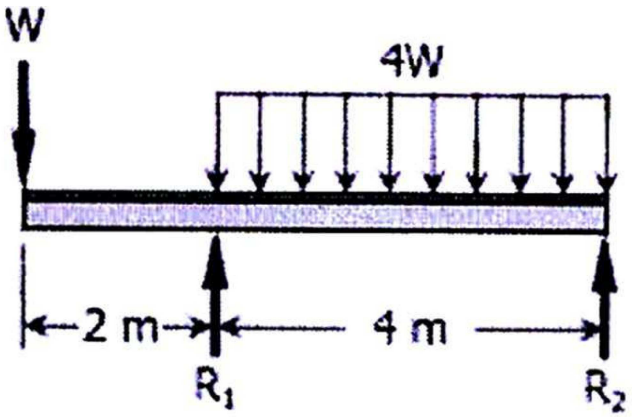

Fig. 1

Or

2. (*a*) A steel bar of 35 mm diameter and length 350 mm is pulled by 0.002 mm by application of tensile load. If the diameter of the bar is changed to 30 mm find the change in length for the same load. [6]

(*b*) Draw SFD and BMD for the beam loaded as shown in figure below. [6]

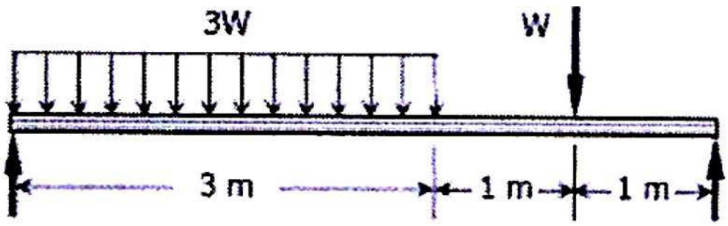

Fig. 2

3. (*a*) A rectangular steel bar, 15 mm wide by 30 mm high and 6 m long, is simply supported at its ends. If the density of steel is 7850 kg/m^3, determine the maximum bending stress caused by the self-weight of the bar. [6]

(*b*) Determine the deflection at the free end of a cantilever of length 4 m carrying a uniformly distributed load of 12 kN/m over a length of 3 m from fixed end. [6]

Take EI = 2 × 10^{13} N/mm^2.

Or

4. (*a*) Determine the minimum height *h* of the beam shown in figure below if the flexural stress is not to exceed 20 MPa. [6]

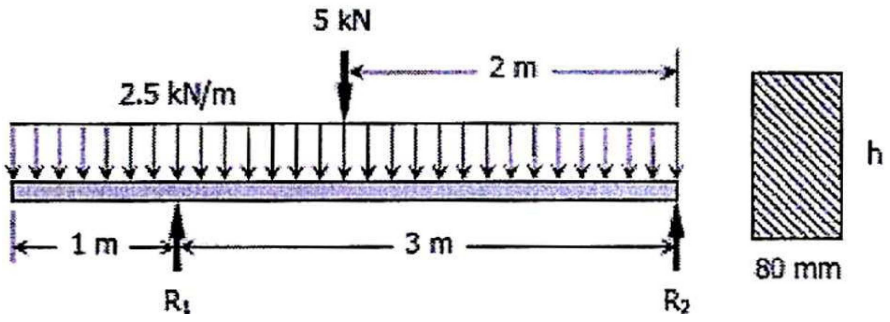

Fig. 3

(*b*) For the problem described in question 3(*b*) determine the slope at the free end of the cantilever. [6]

5. (*a*) A hollow steel shaft 1 m long is required to transmit a torque of 10 kN-m. The total angle of twist in this length is not to exceed 1° and the allowable shearing stress is 100 MPa. Determine the inside and outside diameter of the shaft if G = 100 GPa. [6]

(*b*) Determine the ratio of the buckling strenghts of a solid steel column to that of a hollow column of same material and having same cross-sectional area. The internal diameter of hollow column is half of its external diameter. Both the columns are of the same length and are pinned at both ends. [7]

Or

6. (*a*) A steel bar of rectangular cross-section 33 mm × 66 mm and pinned at each end is subject to axial compression. If the proportional limit of the material is 330 MPa and E = 222 GPa, determine the minimum length for which Euler's equation may be used to determine the buckling load. [6]

(*b*) A hollow shaft of diameter ratio 3/5 is required to transmit 482 kW at 125 rpm. The shearing stress in the shaft must not to exceed 65 N/mm^2 and the twist in a length of 2 m not to exceed 1 degree. Calculate minimum external diameter of shaft which would satisfy these conditions.[7] Take $G = 8 \times 10^4$ N/mm^2.

7. A solid circular shaft is subjected to a bending moment of 8 kNm and a torque of 12 kNm. In a uniaxial test the shaft material gave the following results : Modulus of elasticity = 200 GN/m^2, Stress at yield point = 300 N/mm^2, Poisson's ratio = 0.3, Factor of safety = 3. Estimate the least diameter of the shaft using :

(*i*) Maximum principal stress theory

(*ii*) Maximum principal strain theory and

(*iii*) Shear strain energy theory. [13]

Or

8. A material is subjected to two mutually perpendicular direct stresses of 92 MPa tensile and 29 MPa compressive, together

with a shear stress of 22 MPa. The shear couple acting on planes carrying the 92 MPa stress is clockwise in effect. Calculate :

(*i*) magnitude and nature of the principal stresses;

(*ii*) magnitude of the maximum shear stresses in the plane of the given stress system;

(*iii*) direction of the planes on which these stresses act. [13]