Total No. of Questions—**8**] [Total No. of Printed Pages—**6**

Seat No.	

[5459]-118

S.E. (Mechanical Sandwich/Auto) (I Sem.) EXAMINATION, 2018

STRENGTH OF MATERIALS

(2015 PATTERN)

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

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

(*ii*) Solve Q. **1** *or* **2**, Q. **3** *or* **4**, Q. **5** *or* **6**, Q. **7** *or* **8**.

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

(*iv*) Draw diagrams wherever necessary.

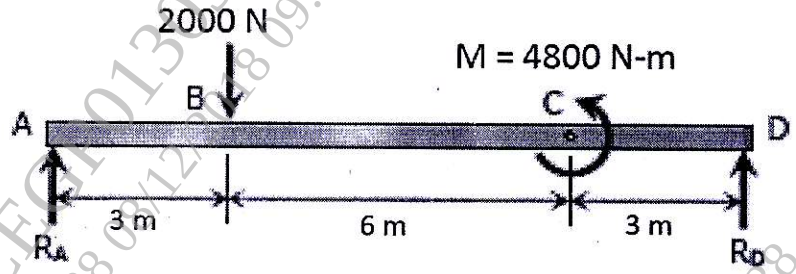
(*v*) Use of scientific calculator is allowed.

(*vi*) Assume suitable data wherever necessary.

1. (*a*) A domestic ceiling fan of mass 50 kg is attached to one end of hollow steel pipe (vertical) while other end is fixed in slab (celling) of a house. The length of the pipe is 200 mm and outside diameter is 20 mm. Determine the inside diameter of the pipe if the engineering strain is limited to 0.0001. Elastic modulus of steel is 200 GPa. [6]

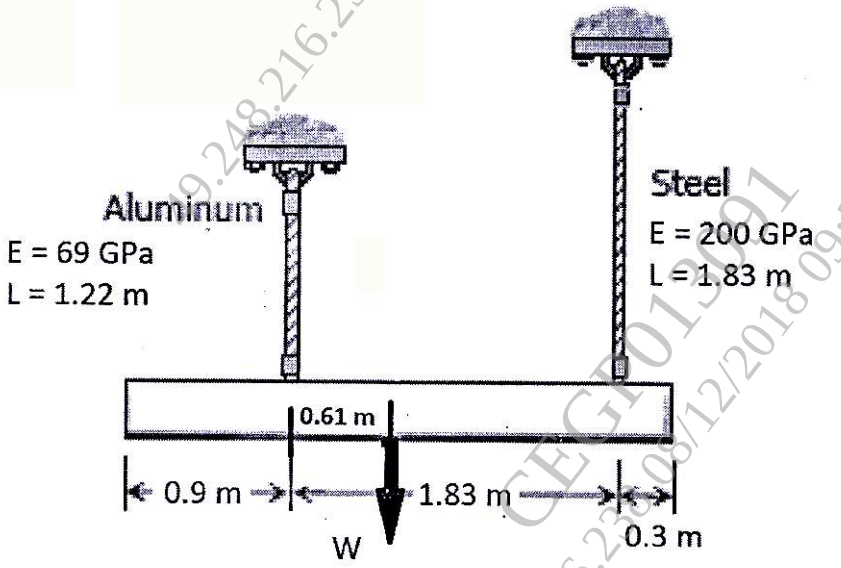
P.T.O.

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

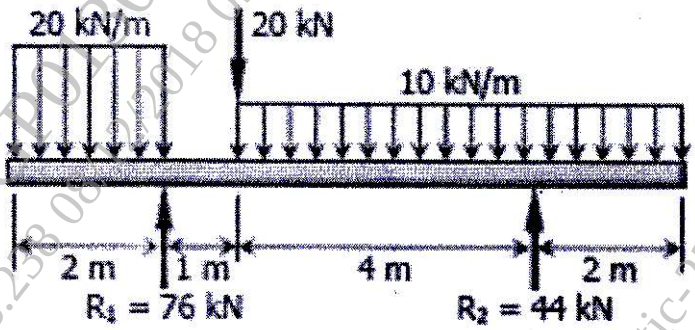


Or

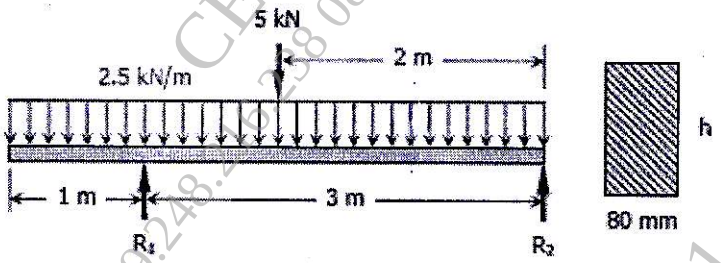
2. (*a*) A uniform weight W is to be attached to two rods whose lower ends are on the same level using a horizontal bar as shown in Fig below. Determine the ratio of the areas of the rods so that the bar attached to rods will remain horizontal. [6]



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



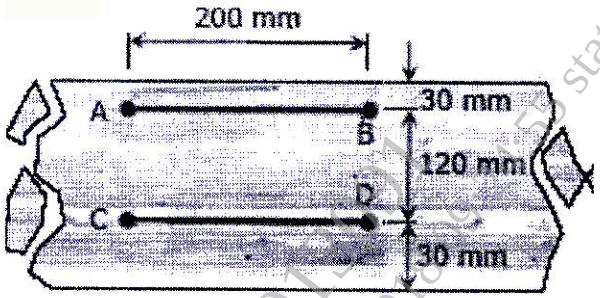
3. (*a*) Determine the minimum height *h* of the beam as shown in figure below, if the flexural stress is not to exceed 20 MPa. [6]



(*b*) A flat steel bar, 25.4 mm wide by 6.35 mm thick and 1 m long is bent by couples applied at the ends so that the midpoint deflection is 25.4 mm. Compute the stress in the bar and magnitude of the couples. Take E = 200 GPa. [6]

Or

4. (*a*) In a laboratory test of a beam loaded by end couples, the fibers at layer AB in Fig. shown below are found to increase 60×10^{-3} mm whereas those at CD decrease 100×10^{-3} mm in the 200-mm-gauge length. Using E = 70 GPa, determine the flexural stress in the top and bottom fibers. [6]



(*b*) A cantilever beam of 1 m length is carrying UDL of 10 N/m over entire length. If the maximum deflection is limited to 1.2.5 mm, find the required flexural modulus EI of the beam. Also find the slope of beam. [6]

5. (*a*) Determine the maximum torque that can be applied to a hollow circular steel shaft of 100-mm outside diameter and an 80-mm inside diameter without exceeding a shearing stress of 60 MPa or a twist of 0.5 deg/m. Use G = 83 GPa. [6]

(*b*) A steel bar of rectangular cross-section 70 mm × 110 mm and pinned at each end is subject to axial compression. If the proportional limit of the material is 185 MPa and E = 210 GPa, determine the minimum length for which Euler's equation may be used to determine the buckling load. [7]

Or

6. (*a*) A solid circular shaft is required to transmit 100 kW while turning at 26 rev/s. The allowable shearing stress is 100 MPa. Find the required shaft diameter. [6]

(*b*) A rectangular steel bar 70 mm × 90 mm in cross-section, pinned at each end and subjected to axial compression. The bar is 2.6 m long and E = 210 GPa. Determine the buckling load using Euler's formula and corresponding stress. [7]

7. Stressed element in a machine component is subjected to 150 MPa tensile stress in *x* direction, 50 MPa compressive stress in *y* direction and 100 MPa shear stress clockwise on *x* face. Compute the values and orientation of the principal stresses and maximum shear stress using graphical method proposed by Mohr. Mohr's circle must be drawn on GRAPH paper using appropriate scale.

(*Note*-Analytical solution and solution without GRAPH paper will not be evaluated.) [13]

Or

8. Compute factors of safety, based upon the distortion energy theory, for stress elements at A and B of the member shown in the figure below. The bar is made of steel with yield strength of 280 MPa and is loaded by the forces F = 0.55 kN, P = 4.0 kN, and T = 25 N-m. [13]