Ex./ARCH/CE/T/123/2017

BACHELOR OF ARCHITECTURE EXAMINATION, 2017

(1st Year, 2nd Semester)

Structural Mechanics - II

Time : Three hours Full Marks : 100

Answer any ***four*** questions.

1. (a) Define Hooke's law. 3

   (b) Explain working stress method showing the salient features of stress-strain curve. 7

   (c) A Z-shaped rigid bar ABCD, shown in Fig.1 is suspended by a pin at B and loaded by a vertical force P. At A a 10mm diameter steel tie rod AF connects the section to a firm ground support at F. Use E = 200 GPa. Determine the vertical deflection at D. 10

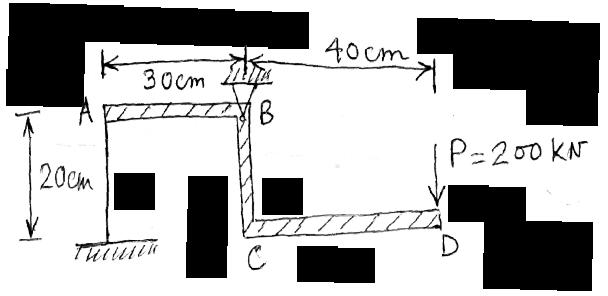

Fig. 1

(Turn over)

(d) A solid circular steel rod 6mm in diameter and 500 mm long is rigidly fastened to the end of a square brass bar 25 mm on a side and 400 mm long, the geometric axes of the bars lying along the same line. An axial tensile force of 5 KN at each of the extreme ends. Determine the total elongation of the assembly. For steel E = 200 GPa and for brass E = 90 GPa. 5

2. (a) A rigid body AB of weight Q hangs on three vertical wires symmetrically situated with respect to the center of gravity C of the body. Determine the tensile forces in the wires if the middle wire is of steel and the two others of copper. 10

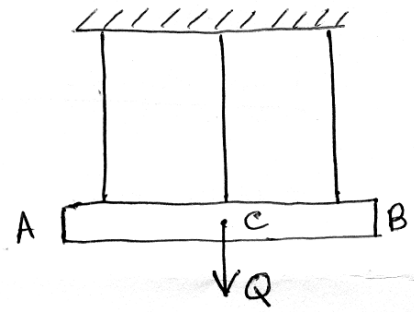

Fig. 2

(b) Define thermal stress and strain. 3

(c) What stresses will be produced in the bars of the system represented in Fig.3 if the temperature of all the bars be raised from “to” to “t” ? 12

5. (a) In case of pure bending in a beam,

prove the $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{r}$

All the terms denote usual meaning. Clearly write all the basic assumptions. 10

(b) A beam of circular cross section is 18 cm in diameter. It is simply supported at each end and loaded by two concentrated loads of 80 KN each, applied 90 cm from the ends of the beam as shown in Fig.8. Determine the maximum bending stress in the beam. 10

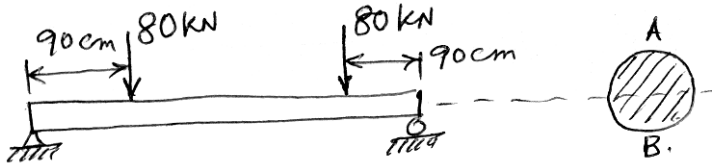

Fig. 8

(c) Determine the section modulus of the following section 5

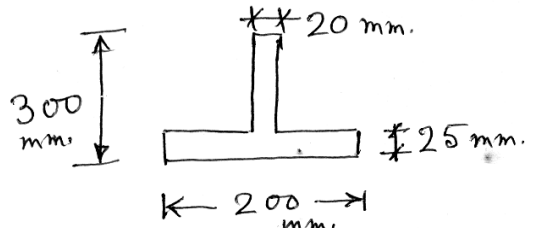

Fig. 9

—— X ——

(e) A single rivet is used to join two plates as shown in Fig. 5. If the diameter of the rivet is 20 mm and the load P is 30 KN. What is the average shearing stress developed in the rivet ? 5

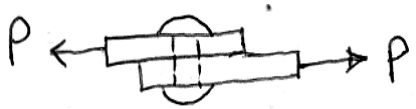

Fig. 5

4. (a) Draw the S.F. and B.M. diagrams and determine the maximum shearing force and bending moment in the simply supported beam as shown in Fig. 6. 12

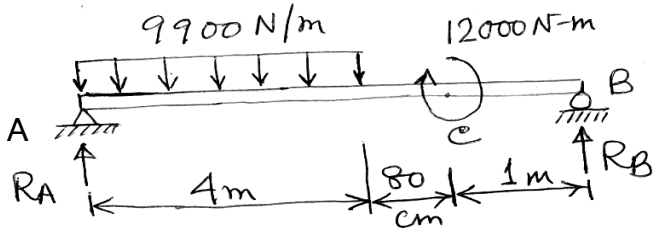

Fig. 6

(b) Draw the S.F. and B.M. diagram 13

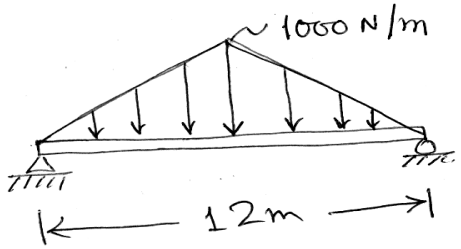

Fig. 7

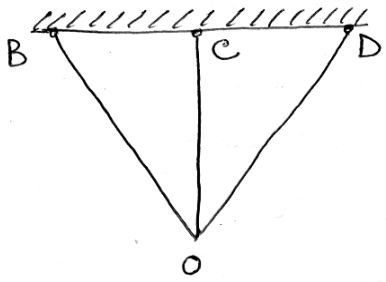

Fig. 3

3. (a) Define Poison's ratio. 2

(b) Define shear stress. 2

(c) In case of combined stresses what is principal stresses and maximum shearing stresses. Explain elaborately with sketches. 6

(d) A plane element is subject to the stresses indicated in Fig.4. Determine principal stresses and the maximum shearing stress together with their orientations. 10

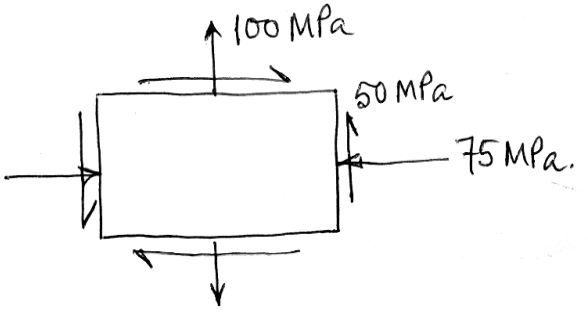

Fig. 4