(viii) What is the Euler's buckling load of a cantilever column of length 5.0 m, modulus of elasticity 2×10^5 N/mm^2 and moment of inertia 5×10^4 mm^4?
(a) 1.0 kN (b) 2.0 kN (c) 3.0 kN (d) 4.0 kN.

(ix) What is the effective length of a propped cantilever column of clear length '*l*'?
(a) 0.8 *l* (b) 1.0 *l* (c) 2.0 *l* (d) 0.65 *l*.

(x) What is the shear stress acting on the principal plane?
(a) Zero
(b) Half of the major principal stress
(c) Twice of the major principal stress
(d) Equal with the applied stress.

Group – B

2. (a) A rigid bar as shown in the fig. 1 below is suspended by three vertical rods in a horizontal position. The cross sectional area of brass bar is 10 mm^2 and modulus of elasticity is 1×10^5 MPa. The steel bars have cross sectional area 5 mm^2 and modulus of elasticity is 2×10^5 MPa. Find out stresses in these bars and the distance '*X*' where the 50 kN load may be applied by keeping the bar horizontal.

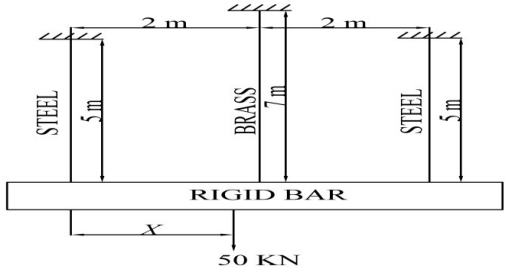

Fig.1

(b) What is proof stress? Describe with a neat sketch.

9 + 3 = 12

3. (a) An element is subjected to pure shear where the shear stress is 50 N/mm^2. Draw a Mohr Circle for the element to identify the principal plane and major and minor principal stresses. What will be the major principal stress if the element is rotated by 10^0 clockwise?

(b) A thin walled balloon having diameters 25 mm and 35 mm along the horizontal and vertical directions, respectively and wall thickness 5 mm is subjected to internal pressure 5 kg/mm^2. Find out the meridonial and hoop stresses if the hoop stress is twice the meridonial stress.

6 + 6 = 12

Group – C

4. (a) Draw the SFD and BMD of the following beams as shown in fig. 2.

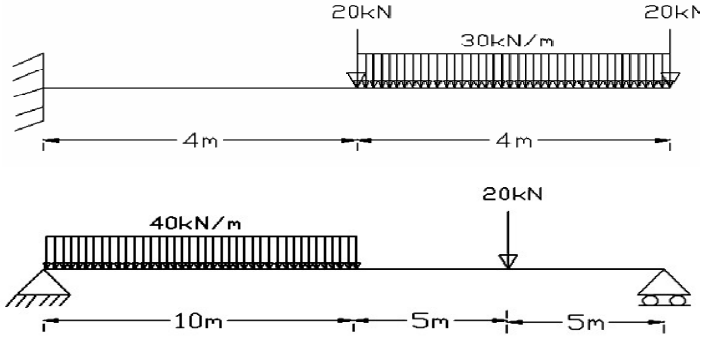

Fig.2

6 + (

5. (a) Write down the assumptions in theory of simple bending. Deri expression for distribution of shear stress diagram over a recta section of width *b* and depth *d*.

(b) A wooden beam 150 mm × 250 mm is simply supported as shown fig. 3. When a concentrated load *W* is placed at a distance '*a*' from t support, maximum bending stress developed is 11.2 N/mm maximum shear stress developed is 0.7 N/mm^2. Determine '*W*' and

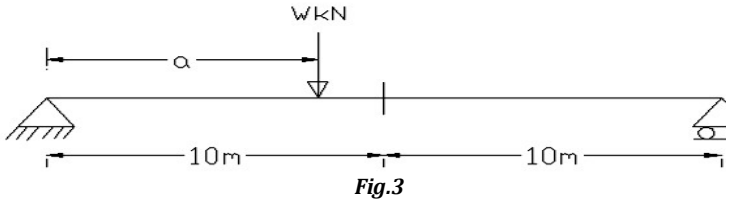

Fig.3

(1 + 5) + (

Group – D

6. (a) Find out the axial forces in members EC, BE, EF and DE of the tr shown in fig. 4 using Method of Joints.

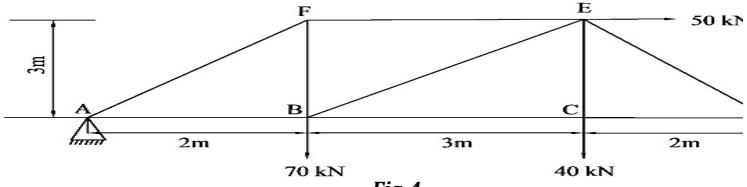

Fig.4

(b) Find out the axial forces in members AB, CD and AD of the truss shown in fig. 5 using Method of Sections.

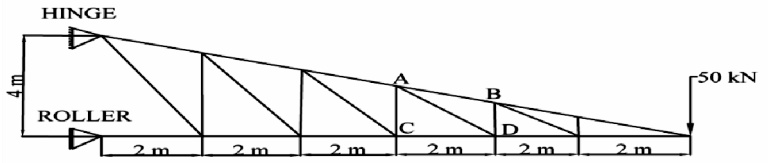

Fig.5

6 + 6 = 12

7. A solid circular shaft of length 3.0 m and diameter 25 mm is fixed at one end and free at the other end. The first 1.5 m length of the shaft is made of steel and the second 1.5 m length is made of brass. Maximum allowable shear stresses are 85 MPa and 40 MPa for steel and brass, respectively. The modulus of rigidity are 2×10^5 MPa and 1.2×10^5 MPa for steel and brass, respectively. Find out the maximum allowable torque acting at the free end of that shaft if its angle of twist is restricted upto 1°.

12

Group – E

8. (a) A simply supported beam of span 20 m carries an udl of 40kN/m throughout as shown in fig. 6. Find slope at the two ends and deflection at the midpoint. Use double integration method. (Given E = 200 kN/mm^2 and I = 1.25×10^9 mm^4.)

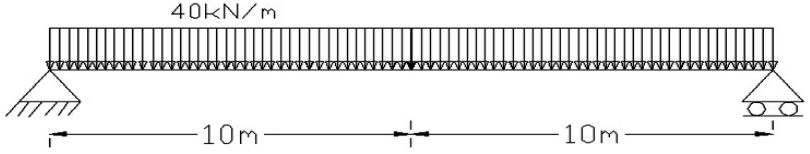

Fig.6

(b) Derive the expression for strain energy stored in a bar due to axial force and in a beam due to shear force.

8 + (2 + 2) = 12

9. (a) Find out the first three bucking loads of a cantilever column using Euler's theory. The column has length '*l*', uniform cross-sectional area 'A' and rigidity 'EI'.

(b) Find out the core of a circular column of diameter '*D*'.

9 + 3 = 12

STRENGTH OF MATERIALS
(CIVL 2102)

Time Allotted : 3 hrs **Full Mark**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practica

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1**

(i) Wherever the bending moment is maximum the shear force is
(a) zero (b) also maximum
(c) minimum (d) does not depend on bending m

(ii) Maximum deflection of a cantilever beam with a point load P free end is
(a) $Pl^3/3EI$ (b) $5Pl^3/384EI$
(c) $Pl^3/48EI$ (d) $5Pl^3/48EI$.

(iii) Section modulus of a rectangular section having width *b* and dep given by
(a) $bd^2/6$ (b) $bd^3/8$ (c) $bd/6$ (d) b

(iv) When a rectangular section of a beam is subjected to a shearing the ratio of maximum shear stress to the average shear stress is
(a) 2.0 (b) 1.75 (c) 1.5 (d)

(v) The relation governing the simple bending of beam is
(a) $\sigma/y = M/E = I/R$ (b) $\sigma/y = M/R = E/I$
(c) $\sigma/E = M/I = y/R$ (d) $\sigma/y = M/I = E/R$.

(vi) What is the elongation of a bar hanging freely from the top unc own self weight
(a) $\delta l^2/2E$ (b) $\delta l^2/2G$ (c) $\delta l^2/3E$ (d) δ

(vii) A solid circular bar of 20 mm diameter is subjected to torsion. permissible shear stress for the material is 120 N/mm^2, find o allowable twisting moment on that shaft.
(a) 0.188 kNm (b) 1.883 kNm
(c) 0.253 kNm (d) 0.318 kNm.