Scheme – G

Sample Question Paper

Course Name : Civil Engineering Group

Course Code : CE/CS/CR/CV

Semester : Third

Subject Title : Mechanics Of Structures

17311

Marks : 100 **Time: 3 Hours**

Instructions:

1. All questions are compulsory.
2. Illustrate your answers with neat sketches wherever necessary.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.

Q.1 (A) Solve any SIX of the following: **12 Marks**

a. Define: Moment of Inertia, Radius of Gyration.

b. What do you understand by moment arm?

c. Define: Fatigue, Poisson's ratio.

d. Define modulus of elasticity and state its significance.

e. State Rankine's formula with the meanings of all the symbols in it.

f. State Euler's formula and state on what type of column is it applicable.

g. Define Proof resilience and Modulus of resilience.

h. Define Strain Energy

Q.1 (B) Solve any TWO of the following: **08 Marks**

a. State the assumptions in the theory of simple bending.

b. State the shear stress equation and the meanings of symbols used in the equation.

c. State the assumptions in the Euler's theory of long columns.

Q.2 Solve any TWO of the following: **16 Marks**

a. Determine the MI about X-X and Y-Y axes as shown in the following fig. (All dimensions are in mm.)

b.

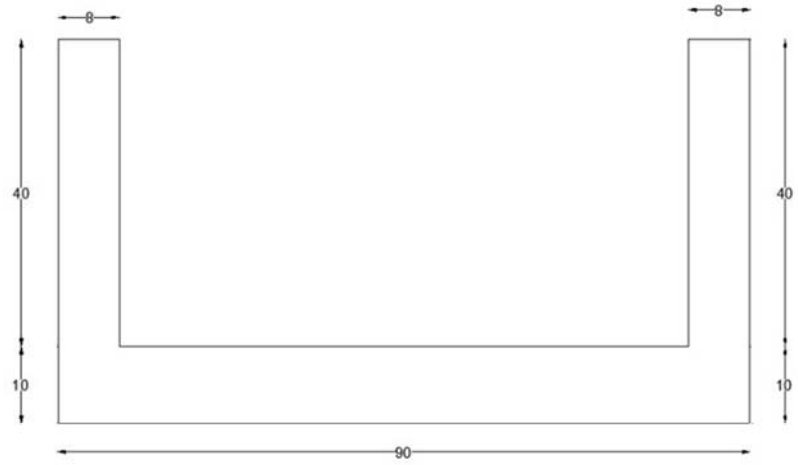


Fig. 1

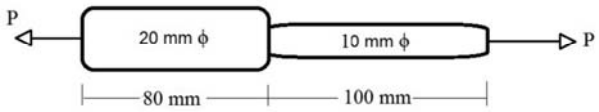
c. A hollow square has inner dimensions a × a and outer dimensions 2a × 2a. Find the moment of inertia about outer side.

d. i. Explain parallel axis theorem

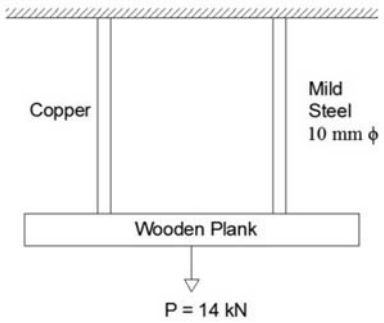
ii. Derive relationship between E, G and K.

Q.3 Solve any TWO of the following: 16 Marks

a. Determine the force and elongation of the compound bar shown in fig. if the maximum stress induced in it is 100 N/mm^2. Both sections are circular. Take E = 200GPa.



b. Determine the diameter of copper bar if a horizontal wooden plank is suspended by two rods, one made up of mild steel and one of copper as shown in figure. The MS bar has diameter 10 mm and the length of both the rods is 1800 mm. The modulii of elasticity of mild steel and copper are 200 GPa and 110 GPa respectively. The total load (P) at the centre of wooden rod is 14 kN. The wooden rod has to be kept horizontal.



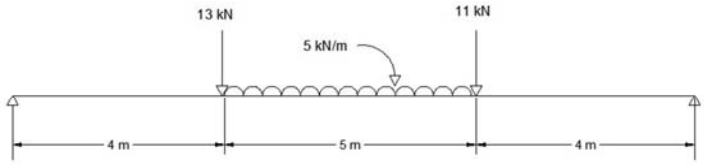
c. Derive the relationship between modulus of elasticity, bulk modulus and Poisson's ratio.

Q.4 Solve any TWO of the following: 16 Marks

a. A rectangular block of size x = 600 mm, y = 800 mm and z = 1000 mm is subjected to triaxial stress system. The stresses in the three mutually perpendicular directions are σ_x = 100 N/mm^2 (Tensile), σ_y = 100 N/mm^2 (Tensile) & σ_z = 100 N/mm^2 (Compressive). Find the net strain in each direction and hence the change in volume of the block. Take E = 200 kN/mm^2 and m = 3.

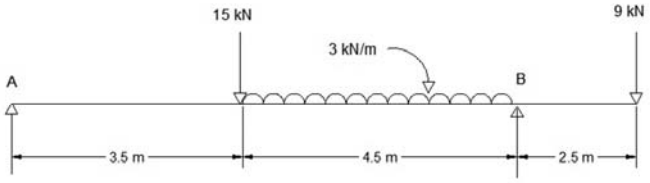
b. In a tensile test carried out on 16 mm dia rod the elongation measured on 100 mm length was found to be 0.1 mm under a load of 40 kN. The change in diameter was found to be 0.0045 mm. determine Young's Modulus and Poisson's ratio for the material. Also determine change in volume of bar at this load.

c. Draw the SF and BM Diagrams of the beam as shown in the fig.



Q.5 Solve any TWO of the following: 16 Marks

a. Draw SFD and BMD for the beam as shown in fig.



b. i. Explain the relationship among loading, Shear force and Bending Moment.

ii. Draw the SF and BM diagram for a cantilever beam of 6 m length, fixed at point A and free at point B. It carries a point load of 6 kN at its free end, 4 kN at a distance of 2 m from the free end. A udl of 2 kN/m is applied all over between the two point loads.

c. The mid span section of a simply supported beam is 120 mm × 240 mm. if the permissible bending stress is 10 MPa, determine:

(i) Modulus of section

(ii) Moment of resistance

(iii) Total Compressive Force on the Cross section

(iv) Total tensile force on the cross section.

Q.6 Solve any TWO of the following: 16 Marks

a. A beam has hollow rectangular cross section with external dimensions 70 mm × 120 mm. The uniform thickness of the section is 10 mm. Draw shear stress variation diagram if the section is subjected to a shear force of 70 kN. Also determine the ratio of maximum shear stress to average shear stress.

b. A hollow steel tube of 200 mm external diameter and 25 mm thickness is 4 m long & used as column. If one end is fixed and other end is hinged, find the load the column can carry. Use Euler's formula and factor of safety 2.5.

c. An unknown weight falls through 10 mm on a collar rigidly attached to the lower end of a vertical bar 3 m long and 600 mm^2 in cross section. If the maximum instantaneous extension is known to be 2 mm, what is the corresponding stress and value of unknown weight? Take E = 200 kN/mm^2.