Code: CE3T3

II B.Tech - I Semester–Regular/Supplementary Examinations
November 2019

MECHANICS OF SOLIDS-I
(CIVIL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks
11x 2 = 22 M

1.
a) Distinguish between limit of proportionality and elastic limit.
b) Define direct stress and shear stress.
c) What are sagging and hogging bending moments?
d) List the various types of loads to which a beam can be subjected?
e) Define neutral plane and neutral axis.
f) What is meant by pure bending?
g) What is strain energy?
h) List out the assumptions made in the derivation of torsion equation.
i) Draw the shear stress distribution for shafts of solid circular cross section.
j) What is a spring? Name the important types of springs.
k) A system has ‘n’ springs arranged in parallel. What would be the spring constant of combination if each spring of the arrangement has stiffness K?

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2. a) Derive the relationship between young's modulus (E), shear modulus (G) and poisson's ratio (μ). 8 M

b) A brass tube of 60 mm outside diameter completely encloses a steel bar of 40 mm diameter. The composite system measures 300 mm in length and carries an axial thrust which induces a thrust equal to 50 N/mm^2 in the brass tube. Determine: (i) stress developed in steel bar; (ii) magnitude of compressive force and (iii) change in length of composite bar. Take E_S = 210 GPa and E_{Br} = 105 GPa.

8 M

3. a) Derive the relationship between load intensity, shear force and bending moment. 8 M

b) Draw the SFD and BMD for the following both sides overhanging beam shown in Fig.1 indicating values at salient points. 8 M

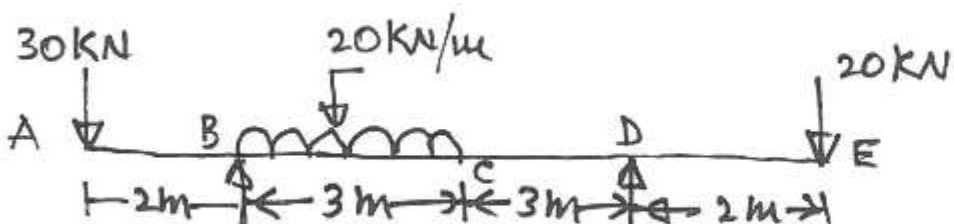

Fig.1

4. a) A simply supported beam AB of span length 4 m supports a uniformly distributed load of intensity 4 kN/m spread over the entire span and a concentrated load 2 kN placed at a distance of 2m from the left end A. The beam is constructed of rectangular cross-section with width 10 cm and depth 20 cm. Determine the maximum tensile and compressive stress developed in the beam due to bending.

8 M

b) A square concrete block of 2 m side is acted upon by a vertical downward load of 100kN. The point of application of load lies on x-axis but eccentric about y-axis at a distance of 100mm about y-axis on the left hand side. Calculate the maximum and minimum stresses developed.

8 M

5. a) The following data pertains to I-section bracket with unequal flanges:

Top flange: 250 mm × 50 mm thick; Bottom flange = 150 mm × 50 mm thick; Web: 250 mm deep × 50 mm thick. Draw the shear stress variation diagram across the section indicating values at important points if the section is subjected to shear force of 1 kN. 10 M

b) Set up an expression for the strain energy due to bending for a simply supported beam of span ‘L’ carrying uniformly distributed load of ‘w’ per unit run over the entire span. The beam is of uniform cross section and constant flexural rigidity. Also determine the magnitude of strain energy if beam length L = 6 m, load intensity w = 10 kN/m, Young’s modulus = 200 GPa and moment of inertia I = 1500 cm^4.

6 M

6. a) Two shafts of the same material and same length are subjected to same torque. The first shaft is of solid circular section and second shaft is of hollow circular section with internal diameter 0.6 times the external diameter. Compare the weights of the two shafts if the maximum shear stress developed in each of them is same 8 M

b) A closed coil helical spring of mean diameter 75 mm, spring constant 80 kN/m has 8 coils. Calculate: (i) suitable diameter of the spring wire if the shear stress is not to exceed 250 MPa; (ii) Maximum axial load the spring can carry. Take modulus of rigidity of spring material as 80 GPa. 8 M