CBCS Scheme

USN

15CV/CT32

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018

Strength of Materials

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing one full question from each module.*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

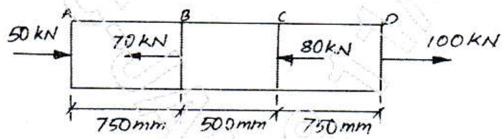
Module-1

1 a. Draw stress versus strain curve for mild steel specimen subjected to axial tension indicating the salient points. **(03 Marks)**

b. Derive the expression for elongation of tapering circular bar due an axial load P. Use standard notations. **(06 Marks)**

c. A circular bar of uniform cross sectional area of $1000mm^2$ is subjected to forces as shown in fig. Q1(c). If Young's Modulus for the material is 200GPa, determine the total deformation. **(07 Marks)**

Fig.Q1(c)



OR

2 a. Define the four Elastic constants. **(04 Marks)**

b. A compound bar consists of a steel rod of 20mm diameter rigidly fitted into a copper tube of 20mm internal dia and 5mm thickness. Determine the stresses induced in the different materials when the compound bar is subjected to an axial tensile load of 50kN.
Take Es = 200GPa and Ec = 120 GPa. **(06 Marks)**

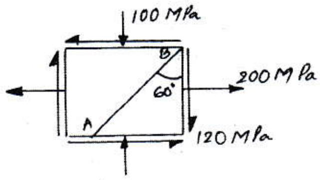
c. A steel bar is 20m long at a temperature of 20^0C. Find the free expansion of the rod, if the temperature is raised to 65^0C. Take E = 200GPa, $\alpha = 12 \times 10^{-6}/^0C$. Find the thermal stress produced when i) free expansion of the rod is completely prevented ii) the rod is permitted to expand by 5.8mm only. **(06 Marks)**

Module-2

3 a. Show that the shear stress on the principal plane is zero. **(06 Marks)**

b. At a point in a strained material the stresses acting are as shown in fig. Q3(b). Determine the
i) Principal stresses and their planes ii) Maximum shear stresses and their planes
iii) Normal and shear stresses on the inclined plane AB. **(10 Marks)**

Fig.Q3(b)



OR

4 a. Derive Lame's equations for radial and hoop stresses for thick cylinder subjected to internal and external fluid pressures. **(06 Marks)**

b. A closed cylindrical steel vessel of 4mm plate thickness with plane ends carries fluid under a pressure of 3MPa. The diameter of cylinder is 25cm and length is 75cm. Calculate the longitudinal and hoop stresses in the cylinder wall. Also determine the change in diameter, length and volume of cylinder. Take E = 210GPa, $\mu = 0.286$. **(10 Marks)**

Module-3

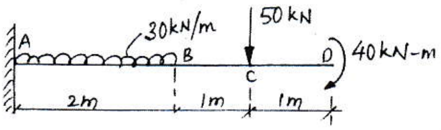
5 a. Derive the relationships between load intensity, shear force and bending moment. **(06 Marks)**

b. For a simply supported beam subjected to a UDL of intensity W/unit length throughout plot the SFD and BMD and prove that maximum Bending moment is $\frac{W\ell^2}{8}$. **(10 Marks)**

OR

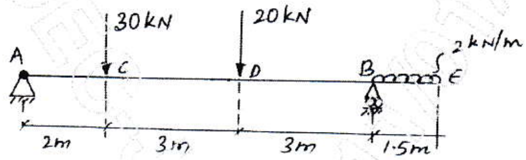
6 a. For the cantilever beam shown in fig.Q6(a), plot the SFD and BMD. **(06 Marks)**

Fig.Q6(a)



b. For the overhanging beam shown in fig.Q6(b), plot the SFD and BMD. Locate points of contra flexure if any. **(10 Marks)**

Fig.Q6(b)



Module-4

7 a. List the assumptions in theory of Simple bending. **(04 Marks)**

b. Define : i) Section modulus ii) Modulus of rupture iii) Moment of resistance. **(03 Marks)**

c. A T – beam with a flange of 100mm × 20mm and with a web of 20mm × 100mm is used as a simply supported beam over a span of 8m. It carries a UDL of 1.5kN/m throughout. Determine the maximum compressive and maximum tensile stresses and plot the variation across the depth of the beam. **(09 Marks)**

OR

8 a. Derive the Euler's equation for buckling load on an elastic column with both ends pinned or hinged. **(06 Marks)**

b. A hollow rectangular cast iron column has external dimensions of 150mm × 200mm and all round metal thickness of 25mm. The column is 5m long with both ends fixed. If E for column material is 120GPa, compute the critical value of load on this column by Euler's formula. Compare the value of load obtained by Rankine's formula. Take f_e = 500MPa and $\alpha = \frac{1}{1600}$. **(10 Marks)**

Module-5

9 a. Derive the torsion equation with usual notations. **(08 Marks)**

b. State the different theories of failure. Explain any two briefly. **(08 Marks)**

OR

10 a. Prove that a hollow circular shaft is stiffer and stronger than a solid circular shaft in torsion which have same material , length and weight. **(10 Marks)**

b. A solid shaft transmits 20kW of power, rotating at 2rps. Determine the required diameter of the shaft if the shearing stress is not to exceed $40MN/m^2$ and angle of twist is limited to 6^0 in a length of 3m. Take $G = 83 \times 10^3 N/mm^2$. **(06 Marks)**

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