CBCS Scheme

USN | | | | | | | | | | |

15CV/CT32

Third Semester B.E. Degree Examination, June/July 2017
Strength of Materials

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define : (i) Poisson's ratio (ii) Volumetric strain (iii) Temperature stresses **(06 Marks)**

b. A steel bar of 20 mm diameter is subjected to tensile load test. Determine stress, strain, Young's modulus, % elongation from the following data:
Gauge length – 200 mm, Extension at a load of 100 kN – 0.147 mm, Total elongation 50 mm. Also determine the % decrease in cross sectional area of the specimen if the diameter of the rod at failure is 16 mm. **(10 Marks)**

OR

2 a. Derive the relationship between Young's modulus and shear modulus with usual notation. **(06 Marks)**

b. A steel tube 45 mm external diameter and 3 mm thick encloses centrally a solid copper bar 30 mm diameter. The bar and the tube are rigidly connected together at their ends at a temperature of 30°C. Find the stresses developed in each material when heated to 180°C. Take $E_S = 200\,GPa$, $\alpha_S = 10.8\times10^{-6}/°C$; $E_C = 110\,GPa$, $\alpha_C = 17\times10^{-6}/°C$ **(10 Marks)**

Module-2

3 a. Derive Lami's equation for thick cylinders. **(06 Marks)**

b. The state of stress at a point in a strained material is as shown in the Fig. Q3 (b)
Determine (i) Principal stresses and principal planes (ii) Max shear stress and its plane
(iii) Sketch the stress diagram showing stresses and planes. **(10 Marks)**

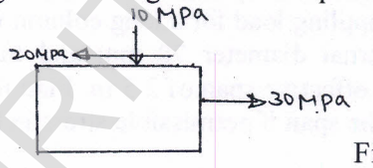

Fig. Q3(b)

OR

4 a. Derive expressions for normal stress and tangential stress for a member subject to uniaxial loading. **(06 Marks)**

b. A shell 3.25 m long, 1 m diameter is subjected to internal fluid pressure of 1 MPa. If the thickness of the shell is 10 mm. Find Hoop stress, longitudinal stress, max shear stress and change in diameter and length. Take $E = 2\times10^5$ MPa, $\frac{1}{m} = 0.3$. **(10 Marks)**

Module-3

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

b. A simply supported beam is subject to a point load of 15 kN together with udl of 15 kN/m applied as shown in Fig. Q5 (b). Draw SFD and BMD. Find also point of zero shear and its corresponding BM. **(10 Marks)**

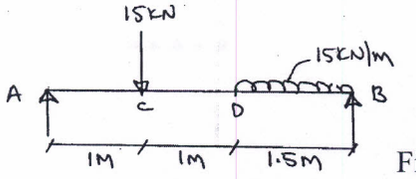

Fig. Q5 (b)

OR

6 a. Show that max BM for a simply supported beam of length l carrying udl of intensity W/unit length is $\frac{Wl^2}{8}$. **(06 Marks)**

b. Draw SFD and BMD for the load diagram, shown in Fig. Q6 (b). Mark the values at salient points. **(10 Marks)**

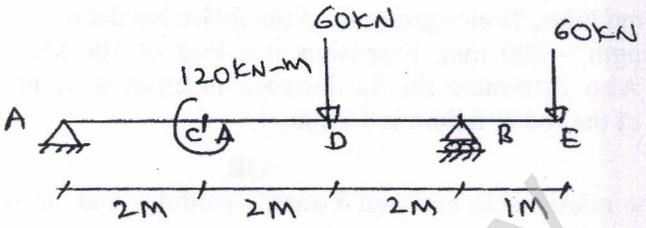

Fig. Q6 (b)

Module-4

7 a. Derive the bending equation, $\frac{M}{I}=\frac{f}{y}=\frac{E}{R}$ with usual notation. **(06 Marks)**

b. A hallow tube of 6 m length with external diameter 60 mm and thickness 10 mm is subject to minimum crippling load. Find Euler's critical load for this column : (i) When both ends are fixed. (ii) When one end fixed other end hinged. Assume E = 200 GPa. **(10 Marks)**

OR

8 a. Derive expression for crippling load for a long column when both ends are hinged. **(06 Marks)**

b. A circular pipe of external diameter 70 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2.5 m. Find the max concentrated load that can be applied at the centre of the span if permissible stress in the tube is 150 N/mm^2. **(10 Marks)**

Module-5

9 a. Derive the torque equation $\frac{T}{I_P}=\frac{f_S}{R}=\frac{C_\theta}{l}$ with usual notation. **(06 Marks)**

b. State the theories of failures. Explain briefly any two of the theories. **(10 Marks)**

OR

10 a. State the assumption made in the theory of pure torsion. **(06 Marks)**

b. A hallow shaft has to transmit 600 kW power at 80 rpm. The maximum torque developed may exceed the mean torque by 40%. Design a suitable section if the working stress is 90 MPa. Take diameter ratio as 0.8. What will be the angular twist measured over a length of 2 m if C = 84 GPa? **(10 Marks)**

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