CBCS SCHEME

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

15CV/CT32

Third Semester B.E. Degree Examination, Aug./Sept.2020
Strength of Material

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive an expression for circular bar of uniformly varying cross - section. **(08 Marks)**

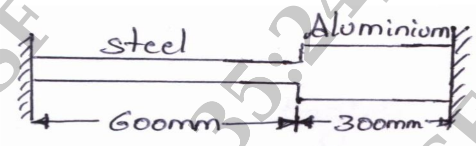
b. A composite section comprises a steel tube 100mm internal diameter 120mm, externally fitted inside a brass tube of 140mm internal diameter and 160mm external diameter. The assembly is subjected to a compressive load of 500kN. Find the load carried by the tube and the stresses generated in them. The length of tube is 1500mm. Take $E_{steel} = 200 \times 10^3$ N/mm^2 and $E_{brass} = 100 \times 10^3$ N/mm^2. What is the change in length of tube? **(08 Marks)**

OR

2 a. Derive the relationship between Bulk modulus (K) , Young's modulus (E) and Poisson's ratio (μ). **(08 Marks)**

b. A composite bar made of aluminum and steel is held between two supports as shown in fig. Q2(b). What will be the stress in bars? When temperature falls by 20^0C, given that the bars were initially stress – free. The supports are unyielding. Cross – sectional area of steel bar is 200mm^2 and that of aluminum is 300mm^2. **(08 Marks)**

Fig.Q2(b)

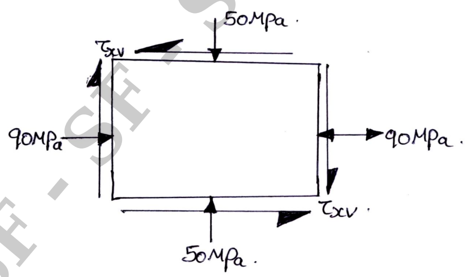


Module-2

3 a. Derive an expression for maximum normal stress on a plane inclined at an angle 'θ', subjected to two dimensional stress systems. **(08 Marks)**

b. For the two – dimensional stressed element, shown in fig. Q3(b), determine the value of i) Minimum principal stress ii) Shear stress iii) The normal stress on the plane of maximum shear iv) The maximum shear stress if major principal stress is 100 MPa. **(08 Marks)**

Fig.Q3(b)



OR

4 a. Derive Lame's equation for thick cylinder. **(08 Marks)**

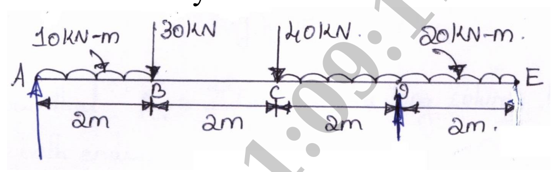
b. A thick cylinder of internal diameter 160mm is subjected to an internal pressure of 25N/mm^2. If the allowable stress in the material is 120N/mm^2, find the required wall thickness of the cylinder. **(08 Marks)**

Module-3

5 a. With a neat sketch, explain types of beams , types of loads and types of supports. **(08 Marks)**

b. For the beam, shown in fig. Q5(b), draw the shear force and bending moment diagram and locate the point of contra flexure if any. **(08 Marks)**

Fig.Q5(b)

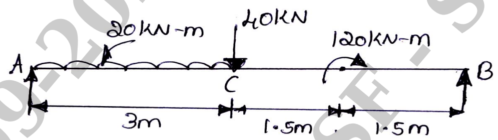


OR

6 a. Derive the relation between UDL , SF and BM. **(06 Marks)**

b. Draw SFD and BMD for the beam shown in Q6(b). Determine the maximum BM and its location. Locate the points of contraflexure. **(10 Marks)**

Fig.Q6(b)



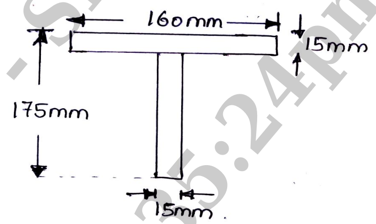
Module-4

7 a. Derive the general Bending equation

$\frac{M}{I} = \frac{E}{R} = \frac{f}{Y}$. **(08 Marks)**

b. A cross section of beam is as shown in fig. Q7(b). the shear force on the section is 400 kN. Estimate the shear stress at various points and plot the shear stress distribution diagram.

Fig.Q7(b)



(08 Marks)

OR

8 a. Show that $P_{cr} = \frac{\pi^2 EI}{\ell^2}$ for a long column hinged at both ends. **(08 Marks)**

b. A solid round bar of 60mm diameter and 2.5m long is used as a strut. Find the safe compressive load for the strut if i) Both ends are hinged ii) Both ends are fixed. **(08 Marks)**

Module-5

9 a. Derive $\left[\frac{T}{I_\rho} = \frac{f_s}{R} = \frac{C\theta}{L}\right]$. **(08 Marks)**

b. Define the followings in theories of failures in brief : i) Rankines theory ii) Tresca's theory iii) Beltrami & Haieghs theory iv) St. Venants theory. **(08 Marks)**

OR

10 a. A hallow shaft having internal diameter 40% of external diameter, transmits 562.5kW power of 100 rpm. Determine the cross – section dimension of the shaft if shear stress is not to exceed 60MPa and twist in a length of 2.5m should not exceed 1.3^0, Maximum torque transmitted is 25% , higher than average torque Rigidity modulus = 90 GPa. **(08 Marks)**

b. A solid circular shaft that transmits 250 kN at 100 rpm. If the shear stress is not to exceed 75 MPa. What should be the diameter of the shaft? If this shaft is to be replaced by a hallow one, whose diameter ratio is 0.6. Determine the size and percentage saving in weight , the maximum shear stress being is same. **(08 Marks)**