ET-502(A)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

December, 2016

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ET-502(A) : STRENGTH OF MATERIALS

Time : 3 hours   Maximum Marks : 70

Note : *Answer any **five** questions. Use of scientific calculator is permitted. Assume any missing data suitably.*

1. (a) Briefly discuss the nature of a fixed support. With the help of a neat sketch, show various types of reactions in such a support in a plane structure.   4

    (b) A stepped bar, made of aluminium, is held between two supports. The bar is 900 mm in length at 38°C. Its 600 mm length has a diameter of 50 mm while the rest of the length is of 25 mm diameter. Determine the thermal stresses in the bar portions at a temperature of 21°C, if the supports are unyielding in nature. 'E' and 'α' for aluminium are 74 kN/mm^2 and 23.4×10^{-6} °K^{-1} respectively. The symbols have their usual meaning.   10

2. (a) Draw a neat sketch showing the stress – strain relationship of mild steel. Label various points/portions in it. *4*

(b) The values of Young's modulus and Rigidity modulus of a material are 20·8 GPa and 8 GPa respectively. If a spherical ball of diameter 150 mm made of this material is immersed in water to a depth of 120 mm, find the change in volume of the ball. *10*

3. (a) What do you understand by 'strain energy' ? Explain briefly. *4*

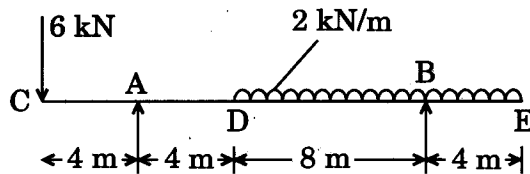(b) Draw SFD and BMD for the beam shown in Figure 1. *10*

Figure 1

4. (a) Write the assumptions of theory of simple or pure bending. *4*

(b) A timber beam of a rectangular section is simply supported over a span of 5 m. It carries a uniformly distributed load of 15 kN/m over the entire span. Find the width and depth of the beam, if the bending stress is limited to 8 N/mm^2. The depth to width ratio may be taken as 1·5. *10*

5. (a) Draw a neat sketch showing shear stress distribution in a beam of an I-section shape. *4*

(b) A simply supported beam of rectangular cross-section 120 mm × 200 mm (depth) has a span of 4 m. Find the intensity of a UDL, to be applied over full span of the beam, which can be carried safely by the beam if the maximum bending stress and maximum shear stress are not to exceed 10 N/mm^2 and 0·6 N/mm^2 respectively. *10*

6. (a) Explain what type of stress would be produced in a circular shaft which is subjected to a torque only. *4*

(b) A circular steel shaft transmits 105 kW at 160 rpm. If the shaft is of 100 mm diameter, find the torque on the shaft and the maximum shear stress induced. Take modulus of rigidity of the material as 8 × 10^4 N/mm^2. *10*

7. (a) Write the assumptions made in Euler's theory for columns. *4*

(b) Derive a relation for the Euler's crippling load for a column which has both of its ends hinged. *10*

8. Write short notes on any *two* of the following topics : 2×7=14

   (a) Equivalent Length of a Column

   (b) Thin Cylindrical Shells

   (c) Forces in a Masonry Dam

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