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Total No. of Pages : 02

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B.Tech.(AE) (2012 to 2017) (Sem.–3)

MECHANICS OF MATERIALS

Subject Code : BTAE-301

M.Code : 54109

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Answer briefly :

a. Define shear stress and shear strain.

b. What is hook's law and up to what limit is it valid?

c. What will be change in modulus of elasticity of a material when stress is doubled, and load is increased by factor of 4, the area remains same?

d. What do you mean by free expansion?

e. Define point of contraflexure.

f. What is relationship between shear force and bending moment?

g. What is modulus of rigidity?

h. State maximum principle stress theory.

i. Write the limitations of Euler's theory?

j. What are thick and thin cylinders?

SECTION-B

2. Derive the relationship for expansion due to self-weight in bar of tapering section.

3. A copper rod, 25 mm diameter is encased in steel tube 30 mm internal diameter and 35 mm external diameter. The ends are rigidly attached. The composite bar is 500 mm long abd is subjected to an axial pull of 30 kN. Find the stresses induced in the rod and the tube. Take E for the steel = 2×10^5 N/mm^2 and E for copper as 1×10^5 N/mm^2.

4. A piece of material is subjected to three perpendicular tensile stresses. The strains in three directions are in ratio of 3:4:5. If the Poisson's ratio is 0.286, find the ratio of the stress and their values if the greatest is 60 N/mm^2.

5. A beam ABCD 20 m long is loaded as shown in figure given below. The beam is supported at B and C and has overhang of 2 m to the left of the support B and an overhang K meters to the right of support C which is in the right-hand half of the beam. Determine the value of K if the mid-point of the beam is point of inflexion and for this arrangement plot B.M. and S.F. diagrams.

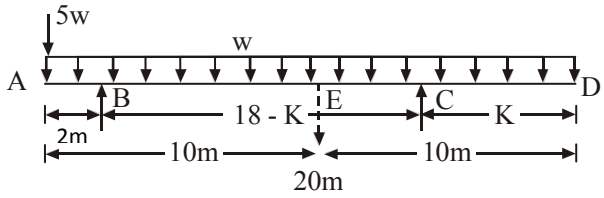

FIG.1

6. A beam of rectangular cross-section is to be cut from a circular log of diameter d. What should be the ratio of depth to width for maximum strength in pure bending? Hence calculate the depth and width of the strongest beam that can be cut out of a cylindrical log of wood whose diameter is 600 mm.

SECTION-C

7. A bolt is subjected to an axial pull of 12 kN together with transverse shear force of 6 kN. Determine the diameter of the bolt according to :

   a. Maximum principal stress theory

   b. Maximum shear stress theory

   c. Strain energy theory

   d. Shear strain energy theory.

   Given elastic limit in tension 300 N/m^2. FOS = 3. Poisson's ratio 0.3

8. Derive the Euler's formula for long columns having when one end is fixed and other end is free.

9. A steel shaft of 3 cm diameter and 1 m long is rigidly fixed at the ends. A twisting moment of 600 Nm is applied at a distance of 250 mm from one end. Calculate the :

   a. Fixing couple at ends

   b. Maximum shear stress

   c. Angle of twist of section where twisting moment has been applied. Take $N = 0.82 \times 10^5$ N/mm^2.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.