Total No. of printed pages = 3

CE 171302 NR

Roll No. of candidate

22/12/ 2021

B.Tech. 3rd Semester End-Term Examination

CE

ADVANCED SOLID MECHANICS

(New Regulation)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Note:

1. *Question 1 is compulsory*
2. *Solve any FOUR from Question 2 to Question 7*

1. Choose the correct answers for the following questions: (10 × 1 = 10)

(a) The shear stress on the principal plane is ————

(b) Modulus of rigidity is the ratio of ————

(c) If two shafts of the same length, one of which is hollow, transmit equal torques and have equal maximum stress, then they should have equal ————

(d) The SI unit of stress is ————

(e) The rate of change of bending moment is equal to ———— of the section.

(f) Maximum slope of a cantilever beam having a uniformly distributed load over the entire span is ————

(g) Define Poisson's ratio?

(h) The buckling load for a given material depends on ————

(i) Maximum deflection of a cantilever beam of length L with point load W at the free end is ————

(j) The polar modulus for a solid shaft of diameter D is ————

[Turn over

2. (a) Explain the term stress and strain. Explain the types of stress and strain.

(b) Define bulk modulus. Derive the relation between bulk modulus, modulus of elasticity and Poisson's ratio.

(c) A bar 12 mm diameter is acted upon by an axial load of 20 kN. Calculate the stress and strain produced in the bar. The value of modulus of elasticity is $2\times10^5 N/mm^2$. (5+6+4)

3. (a) What is Hooke's law? Discuss Volumetric Strain.

(b) Explain temperature stresses.

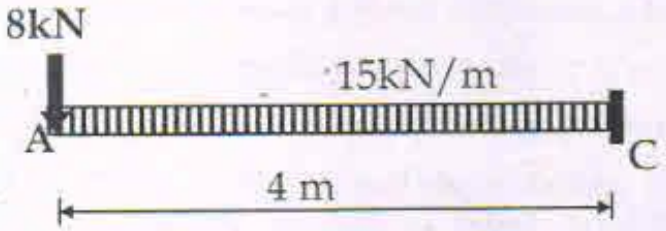
(c) Determine the stress acting on a circular rod of diameter 2 cm and length 200 cm, subjected to an axial pull of 30 kN.

(d) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on guage length of 200 mm is 0.1 mm and change in diameter is 0.004 mm. Calculate the Young's modulus. (3+3+4+5=15)

4. (a) What is point of contraflexure? What is the value of bending moment at the mid span of the simply supported beam if a uniformly distributed load (w/m) is acting over the entire length (L) of the beam?

(b) Write the names of the different supports and what are the types of reactions provided by them.

(c) Draw shear force and bending moment diagram for the given beam.



(2+5+8=15)

5. (a) What are the stresses induced in a thin cylindrical shell subjected to internal pressure? Write the expressions for them.

(b) Explain the term efficiency of the joint. Write the equation for circumferential and longitudinal stress in a cylinder considering the efficiency.

(c) A cylindrical pressure vessel of 1m diameter and length of 2m is subjected to an internal pressure of 2 MPa. If the hoop stress is limited to 42 MPa and the longitudinal stress to 28 MPa, find the minimum thickness required. What will be the change in volume of the cylinder under this pressure? Take E = 200 GPa and poisons ratio as 0.3. (4+3+8=15)

6. (a) What is pure torsion? Define Polar Modulus, torsional stiffness and torsional rigidity.

(b) Find the torque, which a shaft of 100 mm diameter can transmit safely, if the shear stress is not to exceed 100 MPa.

(c) A solid shaft transmits 96 KW at 180 rpm. Determine the suitable diameter of the shaft, if the permissible stress is not to exceed 60 MPa. Also, find the maximum angle of twist in a length of 4m of the shaft. Take G = 80 GPa

(4+4+7=15)

7. (a) Differentiate between column and a strut.

(b) What are the different boundary conditions to derive critical load of column.

(c) Derive the equation for critical load of a column with both ends fixed.

(d) Calculate the critical load for a column having both end hinged if the length of the column is 5m. The column is square column of 400 mm dimension. Take modulus of elasticity, E as 200 GPa. (2+4+6+3=15)