Total No. of printed pages = 6

CE 171204

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Roll No. of candidate | | | | | | | | | | |

2018

B.Tech. 2nd Semester End-Term Examination

STRENGTH OF MATERIALS

(New Regulation)

Full Marks – 70 Time – Three hours

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

Answer Question.No.1 and any *five* from the rest.

1. Select the correct answer : $(10 \times 1 = 10)$

(a) What will be the effect of a tensile force on a body?

(i) Decrease the length of the body

(ii) Increase the length of a body

(iii) Will have no effect on the length

(iv) None of the above

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(b) Strain has ———————— units.

(i) length (ii) volume

(iii) no (iv) area

(c) The resisting force per unit area is called ————————.

(i) Strain (ii) Stress

(iii) Poisson's ratio (iv) Young's Modulus

(d) A fixed support will exert a ———————— and a ———————— moment on the beam.

(i) vertical reaction, fixing

(ii) horizontal reaction, fixing

(iii) no reaction, clockwise

(iv) inclined reaction, fixing

(e) The bending moment profile for a cantilever with only a uniformly distributed load throughout its length will be ————————.

(i) linear (ii) parabolic

(iii) cubic (iv) horizontal

(f) In the equation for power transmission, $P = \frac{2\pi NT}{60}$, what does N stand for?

(i) revolutions of shaft in rpm

(ii) speed of shaft in kmph

(iii) number of shafts

(iv) number of applied torques

(g) A column is a vertical ——— member.

(i) tension (ii) unstable

(iii) compression (iv) none of the above

(h) The equivalent length of a column having both ends hinged is

(i) L/2 (ii) 2L

(iii) L (iv) $L/\sqrt{2}$

(i) Circumferential stress in a cylinder is also called ——— stress.

(i) hoop (ii) longitudinal

(iii) radial (iv) compressive

(j) For elastic bodies, the ratio of stress to strain is ——— and is known as ———.

(i) uniform, Modulus of Elasticity

(ii) constant, Modulus of Elasticity

(iii) constant, Modulus of Rigidity

(iv) constant, Bulk Modulus

2. (a) Write about the concept of stress. What kind of stresses may develop in a body due to the application of an external force? (2 + 2 = 4)

(b) A bar, 26 mm in diameter and 450 mm in length, is acted upon by an axial load of 42 kN. The elongation of the bar and the change in diameter are measured as 0.155 mm and 0.0041 mm respectively. Determine Poisson's ratio and the values of the three moduli. (8)

3. (a) Derive the expressions for elongation of a bar due to a force acting on it and also due to self weight. (3)

(b) From these, deduce the expression for total elongation of the bar due to applied force and self weight. (7 + 2)

4. (a) Write the assumptions of Euler's theory on long columns. (4)

(b) What are the end conditions of long columns as per Euler's theory? What is equivalent length and depending upon the end conditions of long columns, what are the possible values of equivalent length? (4 + 4 = 8)

5. Derive the expressions for Euler crippling load for the following cases: (6 + 6 = 12)

(a) Column with both ends hinged

(b) Column with both ends fixed.

6. (a) A cantilever of length 6 m carries a uniformly distributed load of 10 kN/m for a length of 2 m from the free end and a concentrated load of 30 kN at 2 m from the free end. Draw SFD and BMD for the cantilever. (8)

(b) Also, point out the position and value of the maximum shear force and bending moment. (4)

7. (a) Prove that the volumetric strain in a thin cylinder is the sum of the longitudinal strain and twice the hoop strain. (7)

(b) A boiler of 1.5 m diameter is made of 25 mm thick steel plates. Determine the permissible steam pressure in the boiler if the efficiency of the longitudinal joint of the boiler is 90% and maximum tensile stress in the steel plates is not to exceed 90 MPa. What will be the circumferential stress in the solid plate section at this pressure? Also calculate the longitudinal stress in the plate section through the rivets of the circumferential joint if the efficiency of the joint is 80%. (5)

8. (a) Deduce the expressions for circumferential and longitudinal stress in a thin cylinder subjected to internal pressure. (2 + 2 = 4)

(b) Wall thickness of a cylindrical shell of 900 mm internal diameter and 3 m length is 15 mm. If the shell is subjected to an internal pressure of 2.5 MPa, find, (8)

(i) Maximum intensity of shear stress induced

(ii) Change in the dimensions of the shell.

Take E = 205 GPa and Poisson's ratio as 0.3.

9. (a) What is a shaft and where axe shafts generally used? Give some examples. (3)

(b) A hollow steel shaft transmits 250 kW of power at 160 rpm. The total angle of twist in a length of 5 m of the shaft is 3°. Find the inner and outer diameters of the shaft if the permissible shear stress is 50 MPa. G = 85 GPa. (9)

10. A simply supported beam AB of span 9 m is subjected to concentrated loads of 50 kN and 40 kN at distances of 3m and 6 m respectively from A. A uniformly distributed load of 4 kN/m acts for a distance of 3 m from A. Analyze the beam for shear force and bending moment and draw the SFD and BMD. (8 + 4 =12)
