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Reg.no: | | | | | | | | | | |

Question Paper Code: 54705

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Fourth Semester

Mechanical Engineering

15UME405 - SRENGTH OF MATERIALS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The deformation of the bar per unit length in the direction of the force is known as CO1- R

   (a) linear strain (b) lateral strain (c) volumetric strain (d) none of these

2. The change in length takes place the strain is known as CO1- R

   (a) Linear strain (b) Lateral strain (c) Volumetric Strain (d) Shear strain

3. The point of contraflexure lies where CO2- R

   (a) Shear forces changes sign (b) Bending moment is zero or changes sign

   (c) Shear force is zero (d) Bending moment is maximum

4. A cantilever is a beam whose CO2- R

   (a) one end is fixed and the other end free

   (b) both ends are fixed

   (c) both ends are simply supported

   (d) none of the above

5. The ratio of strength of a hollow shaft to that of a solid shaft subjected to torsion if both are of the same material and of the same outer diameters, the inner diameter of hollow shaft being half of the outer diameter is CO3- R

   (a) 15/16 (b) 16/15 (c) 7/8 (d) 8/7

6. In the torsion equation $T/J = \tau/R = C\theta/L$, the term J/R is called _____ CO3- R

(a) Shear Modulus (b) Polar modulus (c) Section modulus (d) None of these

7. Euler buckling load for both ends fixed is given by CO4- R

(a) π^2EI/l^2 (b) $2\pi^2EI/l^2$ (c) $4\pi^2EI/l^2$ (d) π^2EI/l^2

8. All short columns fails by_____ CO4- R

(a) Crushing (b) Bending (c) Elongation (d) Twisting

9. The hoop stress of the thin spherical shell with internal fluid pressure p, internal diameter 'd' and thickness 't' is given by CO5- R

(a) $\sigma_1 = p\,d / 4\,t$ (b) $\sigma_1 = 4\,p\,d / t$ (c) $\sigma_1 = 16\,p\,d / t$ (d) $\sigma_1 = p\,d / 16\,t$

10. The change in diameter of a cylindrical shell subjected to internal fluid pressure p, is given by ---------- CO5- R

(a) Ɵd = pd2/ 2tE [1-μ/2] (b) Ɵd = pd2/4tE

(c) Ɵd =pd4/4tE[1-μ] (d) None of the above

PART – B (5 x 2= 10Marks)

11. Define Hooke's law. CO1- R

12. What is uniformly distributed load. CO2- R

13. Define polar modulus.. CO3- R

14. What is effective length of a column? CO4- R

15. For a general two dimensional system write the radius of the Mohr's circle CO5- R

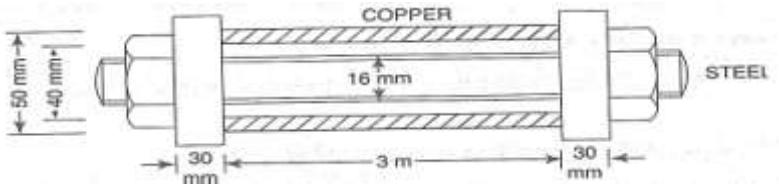
PART – C (5 x 16= 80Marks)

16. (a) A mild steel rod of 25 mm diameter and 400 mm long is encased centrally inside a hollow copper tube of external diameter 35 mm and inside diameter 30 mm. The ends of the rod and tube are rigidly attached and the composite bar is subjected to an axial pull of 40 kN. Determine: (i) the stress in the rod and tube, and (ii) load carried by each bar. Take $E = 2 \times 10^5$ N/mm^2 and for copper = 1×10^5 N/mm^2. CO1 -App (16)

Or

(b) A steel rod of 16-mm diameter and 3 m length passes through a copper tube of 50 mm external and 40 mm internal diameter and of the same length. The tube is closed at each end with the help of 30 mm thick steel plates which are tightened by nuts till the length of the copper tube is reduced by 0.6 mm. the temperature CO1- App (16)

of the whole assembly is then raised by 56^0C. Determine the stresses in the steel and copper before and after the rise of temperature. Assume that the thickness of the steel plates at the ends do not change during tightening of the nuts. E_s = 210 GPa; E_c=100 GPa; $\alpha_s = 12 \times 10^{-6} / {}^0C$; $\alpha_c = 17 \times 10^{-6} / {}^0C$.



17. (a) Draw the SF and BM diagram for a simply supported beam of span 9 m. The beam carries a UDL of 10 KN/m for a distance of 6 m from the left support. Find the maximum value and their position. Give the values at important points in the diagram. CO2- App (16)

Or

(b) A cantilever beam of length 2 m carries a uniformly distributed load of 2 kN/m run over the whole length and a point load of 3kN at the free end. Draw the shear force and bending moment diagrams for the cantilever. CO2 Ana (16)

18. (a) A composite shaft consists of copper rod of 25 mm diameter enclosed in a steel tube of external diameter 45 mm and 5 mm thick. The shaft is required to transmit a torque of 1100 N-m and both the shafts have equal lengths, welded to a plate at each end, so that their twists are equal. If the modulus of rigidity for steel as twice that of copper, find: (i) Shear stress developed in copper (ii) Shear stress developed in steel. CO3- Ana (16)

Or

(b) A close coiled helical spring of 10 cm mean diameter is made up of 1 cm diameter rod and has 20 turns. The spring carries an axial load of 200 N. Determine the shearing stress. Taking the value of modulus of rigidity= $8.4X10^4$ N/mm^2, determine the deflection when carrying this load. Also calculate the stiffness of the spring and the frequency of free vibration for a mass hanging from it CO3- Ana (16)

19. (a) A hollow cast iron column whose outside diameter is 200 mm has a thickness of 20 mm. It is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety of 4. Calculate the slenderness ratio and Euler's and Rankine's critical loads. Take σ_c = 550 N/mm^2, a = 1/1600 and E = 9.4x10^4. CO4- U (16)

Or

(b) Find the Euler crushing load for a hollow cylindrical cast iron column 20 cm external diameter and 25 mm thick if it is 6 m long and is hinged at both ends. Take E = 1.2 x 10^6 N/mm^2. Compare the load with crushing load as given by the Rankine's formula, taking $\sigma_{c=}$ 550 N/mm^2 and constant α = 1/1600; for what length of the column would these two formulae give the same crushing load. CO4 Ana (16)

20. (a) A cylindrical thin drum 800 mm in diameter and 3 m long has a shell thickness of 10 mm. If the drum is subjected to an internal pressure of 2.5 N/mm^2, determine change in diameter, change in length and change in volume of the drum. E = 2 x10^5 N/mm^2 and 1/m = 025. CO5-Ana (16)

Or

(b) A steel cylindrical shell 3 m long which is closed at the ends, has an internal diameter of 1.5 m and a wall thickness of 20 mm. Calculate the circumferential and Longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of 1.0 N/mm^2. Take E= 2 x 10^5 N/mm^2 and 1/m = 0.3. CO5-Ana (16)