**A** **Reg. No. :** | | | | | | | | | | |

## Question Paper Code: 54705

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

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. Hooke's law is valid up to CO1- R

   (a) elastic limit (b) yield point (c) proportional limit (d) ultimate point

2. The stress at which elongation of a material is quite large as compared to the increase in load is known as CO1- R

   (a) ultimate point (b) yield point (c) elastic limit (d) rupture point

3. The variation of shear force due to a uniformly distributed load is by CO2- R

   (a) cubic law (b) parabolic law (c) linear law (d) uniform law

4. Maximum bending moment in a cantilever carrying a point load at the free end occurs at the CO2- R

   (a) free end (b) mid span (c) fixed end (d) none of these

5. The variation of shear stress in a circular shaft subjected to torsion is CO3- R

   (a) linear (b) parabolic (c) hyperbolic (d) uniform

6. For two shafts joined in series, the____ in each shaft is the same. CO3- R

   (a) shear stress (b) angle of twist (c) torque (d) none of these

7. If the load on a column is increased to a value that on its removal the deflection remains, the load is known as CO4- R

(a) critical load (b) crippling load (c) buckling load (d) all of these

8. In a long column with one end fixed and the other free, if the slenderness ratio increases, the critical stress CO4- R

(a) increases (b) decreases (c) remains same (d) none of these

9. The initial hoop stress in a thin cylinder when it is wound with a wire under tension is CO5- R

(a) zero (b) tensile (c) compressive (d) bending

10. In thick cylindrical pressure vessels, the variation of the radial stress is CO5- R

(a) parabolic (b) uniform (c) linear (d) cubic

PART – B (5 x 2= 10 Marks)

11. Define factor of safety. CO1- U

12. What are the different types of beams? CO2- U

13. What do you mean by equivalent torque? CO3- U

14. What is slenderness ratio of column? CO4- U

15. How do you distinguish between thin and thick pressure shells? CO5- U

PART – C (5 x 16= 80 Marks)

16. (a) A metallic bar 300 mm x 100 mm x 40 mm is subjected to a force of 5 kN (tensile), 6 kN (tensile) and 4 kN (tensile) along x, y and z directions respectively. Determine the change in the volume of theblock.Take E=2 x$10^5$ N/$mm^2$ and Poisson's ratio = 0.25. CO1- App (16)

Or

(b) A tensile load of 50 kN is suddenly applied to a circular bar of 5 cm diameter and 4 m long. If the value of E=2x$10^5$ N/$mm^2$, determine CO1- App (16)

(i) stretch in the rod

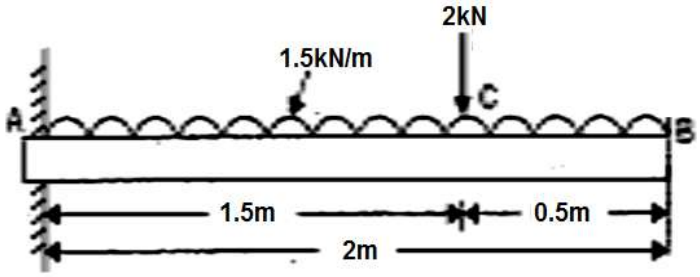
(ii) stress in the rod

(iii) strain energy absorbed by the rod.

17. (a) A cantilever of length 6m carries point loads of 20 kN, 15 kN, and 10 kN at 2 m, 4 m and 6 m from the fixed end. Draw the shear force (SF) and bending moment (BM) diagram for the cantilever beam and determine the point of failure. CO2- Ana (16)

Or

(b) Draw the shear force and bending moment diagram of the cantilever beam shown in figure and find the point where maximum B.M.occurs. CO2- Ana (16)




18. (a) A hollow shaft of 300 mm outer diameter and 250 mm inner diameter runs at 120 rpm. The maximum torque exceeds the mean by 30% and the maximum permitted shear stress is 60 $N/mm^2$. Calculate the power transmitted and angle of twist, if the length of the shaft is 3 m. Take modulus of rigidity as $9x10^4$ $N/mm^2$. CO3- App (16)

Or

(b) A close coiled helical spring of 5 mm diameter wire has 16 coils of 100 mm inner diameter. If the maximum shear stress is limited to 150 MPa. Find the stiffness of the spring. Take G=85 GPa. CO3- App (16)

19. (a) A column of timber section 15 cm x 20 cm is 6 meter long both ends being fixed. If the Young's modulus for the timber 17.5 $kN/mm^2$, determine CO4- App (16)

(i) Crippling load

(ii) Safe load for a column if factor of safety = 3.

Or

(b) Find Euler's crippling load for the hollow cylindrical cast iron column of 20mm inner diameter and 25mm thick and 6m long hinged at both ends. Compare the load with crushing load calculated from Rankine's formula, $\sigma_c$ =550 N/mm$^2$ ,Rankine's constant = 1/1600 and E= 1.2 x $10^5$ N/mm$^2$. CO4- App (16)

20. (a) A closed cylindrical vessel made of steel plates 4 mm thick with plane ends, carries fluid under a pressure of 3 N/mm$^2$. The diameter of cylinder is 25 cm and length is 75 cm, Calculate the longitudinal and hoop stresses in the cylinder wall and determine the changes in diameter, length and volume of the cylinder. Take E as 2.1x$10^5$ N/mm$^2$ and $\mu$=0.286. CO5- App (16)

Or

(b) A cylindrical pipe of diameter 1.5 m and thickness 1.5 cm is subjected to an internal fluid pressure of 1.2 N\mm$^2$.determine:
(i) Longitudinal stress developed in the pipe, and
(ii) Circumferential stress developed in pipe. CO5- App (16)