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

Question Paper Code: 54705

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2022

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 unit of stress in SI unit is CO1-R

   (a) N/mm^2 (b) KN/mm^2 (c) N/m^2 (d) any one of these

2. The deformation per unit length is called CO1-R

   (a) tensile stress (b) compressive stress (c) shear stress (d) strain

3. When a cantilever beam is loaded with concentrated loads, the bending moment diagram will be a CO2-R

   (a)horizontal straight line (b) vertical straight line

   (c) inclined straight line (d) parabolic curve

4. The maximum bending moment of a cantilever beam lies at CO2-R

   (a) the free end (b) the fixed end (c) middle of its length (d) ¼ from fixed end

5. A spring used to absorb shocks and vibration is CO3-R

   (a) conical spring (b) torsional spring (c) leaf spring (d) disc spring

6. The polar moment of inertia of a solid circular shaft of diameter (D) is CO3-R

   (a) $\prod D^3/16$ (b) $\prod D^3/32$ (c) $\prod D^4/32$ (d) $\prod D^4/64$

7. The columns whose slenderness ratio is less than 80 are known as CO4-R

   (a) Short columns (b) long columns (c) weak columns (d) medium columns

8. Euler's formula holds good only for CO4-R

(a) short columns (b) long columns

(c) both short and long columns (d) weak columns

9. A thin spherical shell of diameter (d) and thickness (t) is subjected to internal pressure (p) the stress in the shell material is CO5-R

(a) Pd/t (b) Pd/2t (c) Pd/4t (d) Pd/8t

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= 10Marks)

11. Define hooke's law? CO1-R

12. What are the various types of loading? CO2-R

13. Write the torsion equation? CO3-R

14. What is meant by slenderness ratio? CO4-R

15. What are principal planes and principal stresses? CO5-R

PART – C (5 x 16= 80Marks)

16. (a) A hollow cylinder 1.5 m long has an outside diameter of 45mm and inside diameter 25mm.If the cylinder is carrying a load of 25KN.Find the stress in the cylinder .Also find the deformation of the cylinder Take $E=100\times10^3$ N/mm^2 CO1-App (16)

Or

(b) A steel rod of 25mm diameter is enclosed centrally in a copper hollow tube of external diameter 40mm and internal diameter 30mm. The composite bar is then subjected to an axial pull of 4500N. If the length of each bar is equal to 130mm determine CO1-App (16)

1. The stress in the rod and tube
2. Load carried by each bar (Take $E_b=2.1\times10^5$N/mm^2 $E_c=1.1\times10^5$ N /mm^2)

17. (a) A cantilever beam of length 3m carries a UDL of 2KN/m over a length of 2m from the free end . Draw the shear force and bending moment diagram for the cantilever. And find out the point of failure. CO2-Ana (16)

Or

(b) A simply supported beam of 7m span has a load of 12 KN/m uniformly distributed over 3m. It is 1.5m away from the right. In addition it has a point load of 8KN at 2.5m from the left hand support.Draw the shear force and bending moment diagram for the simply supported beam and determine the point where maximum bending moment occurs. CO2-Ana (16)

18. (a) A hollow shaft is to transmit 300kw at -80 rpm .If the shear stress is not to exceed 50N/mm2 and diameter ratio is 3/7.find the external and internal diameter. If the twist is 1.2^0 and length is 2m. Assuming maximum torque is 20% greater than mean. Take C =80×10^3 N/mm^2. CO3-Ana (16)

Or

(b) A closed coil helical spring made out of 8mm diameter wire has 18 coils. Each coil is of 80mm mean diameter. If the maximum allowable stress in the spring is 140N/mm^2, Determine the allowable load on the spring, elongation of the spring and stiffness of the spring Take C=82×10^3N/mm^2. CO3-Ana (16)

19. (a) A hollow alloy tube 5m long with external and internal diameter equal to 40mm and 25mm respectively was found to extend by 6.4mm under a tensile load of 60KN. Find the buckling load for the tube. When used as a column with both ends pinned. Also find the safe compressive load for the tube, with a factor of safety of 4. CO4-U (16)

Or

(b) A hollow cast iron column whose outside diameter is 200 mm has a thickness of 20 mm. The length of the column is 4.5 m with both of its fixed. Calculate the safe load for the column using Rankine's formula. Also calculate the ratio of Euler's crippling load to that of Rankine's critical load. Take factor of safety as 4. f_c = 550 N/mm^2, α = 1/1600 and E = 94 kN/mm^2. CO4-Ana (16)

20. (a) A hollow cylindrical drum 750mm in diameter and 2.5m long has a shell thickness of 10 mm. If the drum is subjected to an internal pressure of 2.6N/mm^2 Determine CO5-U (16)

1 Change in diameter

2 Change in length and

3 Change in volume

(Take E=2.1×10^{5}N/mm^2 and poisons ratio (1/m) =0.3)

Or

(b) A thin spherical shell 750mm diameter and 8mm thick is filled with water at 1.8N/mm^2. Determine the change in dimensions of the spherical shell (Take E=2×10^{5}N/mm^2 and 1/m =0.3) CO5-U (16)