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

Question Paper Code: 54705

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018
Fourth Semester
Mechanical Engineering

15UME405 - SRENGTH OF MATERIALS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. The unit of strain is CO1- R

(a) Nmm (b) N/mm (c) mm (d) No unit

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 unit of shear force is CO2 -R

(a) Nm (b)N (c)N/m (d)N/m^2

4. When a rectangular beam is loaded transversely, the maximum tensile stress is developed on the CO2 -R

(a) top layer (b) bottom layer

(c) neutral axis (d) every cross-section

5. When the shaft is subjected to a twisting moment, every cross-section of the shaft will be under CO3- R

(a)Tensile stress (b) compressive stress

(c)shear stress (d) bending stress

6. A closely-coiled helical spring is cut into two halves, the stiffness of the resulting spring will be CO3- R

(a) same (b) double (c) half (d) one-fourth

7. A column that fails due to direct stress is called CO4 -R

(a) short column (b) long column (c) weak column (d) medium column

8. The unit of deflection is CO4- R

(a)Nmm (b)N/mm^2 (c)N/mm (d)mm

9. The hoop stress in a thin cylindrical shell is CO5 -R

(a) longitudinal stress (b) compressive stress

(c) radial stress (d) circumferential stress

10. A body is subjected to two normal stresses 20 kN/m^2(tensile) and 10 kN/m^2 (compressive) acting perpendicular to each other. The maximum shear stress is CO5 -R

(a) 5 kN/m^2 (b)10kN/m^2 (c)15 kN/m^2 (d) 20kN/m^2

PART – B (5 x 2= 10Marks)

11. When a material is said to be perfectly elastic? CO1 -R
12. What is meant by point of contra-flexure? CO2- R
13. Why hollow circular shafts are preferred when compared to solid circular shafts? CO3- R
14. What do you mean by slenderness ratio? CO4- R
15. Define hoop stress. CO5 -R

PART – C (5 x 16= 80Marks)

16. (a) A steel rod of 20 mm diameter passes centrally through a copper tube 50 mm external diameter and 40 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projecting parts of the rod. If the temperature of the assembly is raised by 50^0C, calculate the stress developed in copper and steel. Take E for steel and copper as 200 GN/m^2 and 100 GN/m^2 and α for steel and copper as 12 X 10^{-6} per ^{0}C and 18 X 10^{-6} per ^{0}C respectively. CO1-App (16)

Or

(b) A metallic bar 300 mm X 100 mm X40 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 the block. Take E= $2X10^5$ N/mm^2 and Poisson's ratio=0.25. CO1-App (16)

17. (a) Draw the shear force and bending moment diagram for a simply supported beam of length 9 m and carrying a uniformly distributed load of 10 kN/m for a distance of 6 m from the left end. Also calculate the maximum B.M on the section. CO2-App (16)

Or

(b) A timber beam of rectangular section of length 8 m is simply supported. The beam carries a UDL of 12 KN/m run over the entire length and a point load of 10 KN at 3 meters from the left support. If the depth is two times the width and stress in the timber is not to exceed 8 N/mm^2.Find the suitable dimensions of the section. CO2 -Ana (16)

18. (a) A hollow shaft, having an inside diameter 60% of its outer diameter, is to replace a solid shaft transmitting the same power at the same speed. Calculate the percentage saving in material, if the material to be used is also the same. 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 beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Find: deflection under each load, maximum deflection and the point at which maximum deflection occurs. Given E=$2X10^5$ N/mm^2 and I= $85X10^5$ mm^4. CO4 -U (16)

Or

(b) A column of timber section 15 cm X 20 cm is 6 meters long both ends being fixed. If the Young's modulus for timber= 17.5 kN/mm^2, determine: Crippling load and Safe load for the column if factor of safety=3. CO4-Ana (16)

20. (a) A cylindrical thin drum 80 cm in diameter and 3 m long has a shell thickness of 1 cm. 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. Take young's modulus $2x10^5 N/mm^2$.Poissons ratio 0.3 CO5- U (16)

Or

(b) The principal tensile stresses at a point across two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined at 30^0 to the axis of the minor principal stress. Use only Mohr's circle method. CO5- U (16)