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

Question Paper Code: 44705

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

Fourth Semester

Mechanical Engineering

14UME405 - STRENGTH OF MATERIALS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The ratio between the change in volume and original volume of the body is called _____ strain

   (a) tensile (b) compressive (c) shear (d) volumetric

2. The internal resistance which the body offers to meet the load or external force is called

   (a) stress (b) pressure (c) strain (d) none of these

3. The strength of the beam mainly depends on

   (a) Bending moment (b) c.g of the section
   (c) Section modulus (d) its weight

4. In a cantilever with uniformly distributed load the shearing force varies following a

   (a) Linear law (b) Parabolic law
   (c) Either (a) or (b) (d) None of these

5. In case of a laminated spring the load at which the plates become straight is called

   (a) working load (b) safe load (c) proof load (d) none of these

6. _____ are called cantilever elliptical springs

(a) Semi elliptical springs (b) Quarter elliptical springs
(c) Both (a) and (b) (d) none of these

7. The amount of deflection of a beam subjected to some type of loading depends upon

(a) cross-section (b) bending moment
(c) either (a) or (b) (d) both (a) and (b)

8. The slope and defelction at a section in a loaded beam can be found out by which of the following methods

(a) Double integration method (b) Moment area method
(c) Macaulay's method (d) any of the above

9. Which of the following are usually considered as thin cylinders

(a) Boilers (b) Tanks
(c) Steam pipes (d) All of the above

10. Vessels used for storing fluid under pressure are called

(a) cylinders (b) spheres (c) shells (d) none of these

PART - B (5 x 2 = 10 Marks)

11. What is Hooke's Law?

12. Write the equation for the simple bending theory.

13. Distinguish between closed coil helical spring and open coil helical spring.

14. Define crippling load.

15. Define principal planes and principal stresses.

PART - C (5 x 16 = 80 Marks)

16. (a) The ultimate stress for a hollow steel column which carries an axial load of 2Mn is 500 N/mm^2. If the external diameter of the column is 250mm, determine the internal diameter .Take the factor of safety as 4.0. (16)

Or

(b) A rod of 250 cm long and diameter 3.0cm is subjected to an axial pull of 30 KN. If the modulus of elasticity of the material of the rod is $2x\ 10^5$ N/mm^2 Determine 1. Stress 2. Strain 3. the elongation of the rod. (16)

17. (a) A beam of size 150 mm wide, 250 mm deep carries a uniformly distributed load of w kN/m over entire span of 4 m. A concentrated load 1 kN is acting at a distance of 1.2 m from the left support. If the bending stress at a section 1.8 m from the left support is not to exceed 3.25 N/mm^2 find the load w. (16)

Or

(b) A Simply supported beam 6 metre span carries udl of 20 KN/m for left half of span and two point loads of 25 KN end 35 KN at 4 m and 5 m from left support. Find maximum SF and BM and their location drawing SF and BM diagrams. (16)

18. (a) It is required to design a closed coiled helical spring which shall deflect 1mm under an axial load of 100 N at a shear stress of 90 Mpa. The spring is to be made of round wire having shear modulus of 0.8×10^5 Mpa. The mean diameter of the coil is 10 times that of the coil wire. Find the diameter and length of the wire. (16)

Or

(b) The stiffness of close coiled helical spring is 1.5 N/mm of compression under a maximum load of 60 N. The maximum shear stress in the wire of the spring is 125 N/mm^2. The solid length of the spring (when the coils are touching) is 50 mm. Find the diameter of coil, diameter of wire and number of coils. C = 4.5. (16)

19. (a) A cantilever of length 2 m carries a uniformly distributed load of 2.5 KN/m run for a length of 1.25 m from the fixed end and a point load of 1 KN at the free end. Find the deflection at the free end if the section is rectangular 12 cm wide and 24 cm deep and $E=1 \times 10^4$ N/mm^2. (16)

Or

(b) Determine the section of a hollow C.I. cylindrical column 5 m long with ends firmly built in. The column has to carry an axial compressive load of 588.6 KN. The internal diameter of the column is 0.75 times the external diameter. Use Rankine's constants. a = 1 / 1600, σ_c= 57.58 KN/cm^2 and F.O.S = 6. (16)

20. (a) A Thin cylindrical shell 3 m long has 1m internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also the change in the dimensions of the shell, if it is subjected to an internal pressure of 1.5 N/mm^2 Take $E = 2 \times 10^5$ N/mm^2 and poison's ratio =0.3. Also calculate change in volume. (16)

Or

(b) A closed cylindrical vessel made of steel plates 5 mm thick with plane ends, carries fluid under pressure of 6 N/mm^2 The diameter of the cylinder is 35cm and length is 85 cm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and Volume of the cylinder. Take E $=2.1x10^5$ N/mm^2 and 1/m = 0.286. (16)
