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 **Reg. No. :**

**Question Paper Code: 44075**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

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. Engineering stress-strain curve and True stress-strain curve are equal up to

(a) Proportional limit (b) Elastic limit (c) Yield point (d) Tensile strength point

2. The Combined effect of external forces acting on a body is called

(a) Stress (b) Strain (c) Load (d) None of these

3. 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

4. The neutral axis of a section is an axis, at which the bending stress is

 (a) Zero (b) Maximum (c) Minimum (d) Infinity

5. The ratio of strength of solid to hollow shafts, both having outside diameter D and hollow having inside diameter D/2, in torsion, is

(a) 1/16 (b) 1/4 (c) 1/2 (d) 15/16

6. 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

7. The shear force distribution for a beam carrying uniformly varying load throughout its span follows

 (a) a straight line path (b) a circular path (c) a parabolic path (d) an elliptical path

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. Vessels used for storing fluid under pressure are called

(a) Cylinders (b) Spheres (c) Shells (d) None of these

10. A body is subjected to two normal stresses 20 *kN/m2* (tensile) and 10 *kN/m2* (compressive) acting perpendicular to each other. The maximum shear stress is \_\_\_\_\_\_\_

(a) 5 *kN/m2* (b) 10 *kN/m2* (c) 15 *kN/m2* (d) 20 *kN/m2*

 PART - B (5 x 2 = 10 Marks)

11. Define resilience.

12. What do you mean by the point of contra flexure?

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

14. Define crippling load.

15. What is the use of Mohr’s circle?

 PART - C (5 x 16 = 80 Marks)

16. (a) A steel tube of 20*mm* internal diameter and 30*mm* external diameter encases a copper rod of 15*mm* diameter to which it is rigidly joined at each end. If the temperature of the assembly is raised by 80*˚C*. Calculate the stresses produced in the tube. *ES*=2x105*N/mm2*, *EC*=1x105*N/mm2*, Co-efficient of linear expansion of steel and copper are 11x10-6 per *˚C* and 18x10-6 per *˚C.* (16)

Or

 (b) A steel rail is 12.6 *m* long and is laid at a temperature of 24*°C*. The maximum temperature expected is 44*°C*.

 (i) Estimate the minimum gap to be left between two rails so that temperature stresses do not develop

 (ii) Calculate the thermal stresses developed in the rails if (1) no expansion joint is provided (2) if a 2*mm* gap is provided for the expansion. (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/mm2 find the load w. (16)

Or

 (b) A beam is supported on its fulcrum at the point A which is at mid span, and forces

acts. Calculate a) force F for the beam to be in equilibrium, b) the new position of the 23 N force when F is decreased to 21 N, if equilibrium is to be maintained. (16)

18. (a) 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

 125N/mm2. 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)

 Or

 (b) A solid cylinder of diameter d carries an axial load P. Show that its change in

diameter is 4Pν/ πEd. (16)

19. (a) A cantilever beam with a span of 3 *m* carries a point load of 35 *kN* at a distance of 2*m* from the fixed end. Determine the slope and deflection at the free end and at the point where the load is applied. Take *I* = 11924 *cm4* and *E* = 200 *GN/m2*. (16)

Or

 (b) Derive the equation of the deflection curve for a simple beam AB loaded by a

 couple M0 at the left-hand support (figure 3). Also, determine the maximum

 deflection . (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/mm2 Take E = 2x105 N/mm2 and poison’s ratio =0.3. Also calculate change in volume. (16)

Or

(b) A piece of material is subjected to two perpendicular tensile stress of 100 *MPa* and 60 *MPa*. Determine the plane on which the resultant stress has maximum obliquity with the normal also find the resultant stress on this plane. (16)