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

Question Paper Code: 44705

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

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. Strain energy is the
   (a) energy stored in a body when strained within elastic limits
   (b) energy stored in a body when strained upto the breaking of a specimen
   (c) maximum strain energy which can be stored in a body
   (d) proof resilience per unit volume of a material

2. A vertical column has two moments of inertia (i.e. Ixx and Iyy). The column will tend to buckle in the direction of the
   (a) axis of load (b) perpendicular to the axis of load
   (c) maximum moment of inertia (d) minimum moment of inertia

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. When a solid shaft is subjected to torsion, the shear stress induced in the shaft at its center is

(a) Zero (b) minimum (c) maximum (d) average

6. 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

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 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

9. If a body is acted upon by pure shear stresses on two mutually perpendicular planes, the planes inclined at 45^0 are subjected to _____stress.

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

10. The extremeties of any diameter on Mohr's circle represent

(a) Normal stresses on plane at 45^o (b) principle stresses
(c) normal and shear stresses on plane (d) Shear stresses on plane at 45^o

PART - B (5 x 2 = 10 Marks)

11. Define resilience.

12. List the assumptions followed in simple bending equation.

13. What is Wahl's factor?

14. Define crippling load.

15. Define principal planes and principal stresses.

PART - C (5 x 16 = 80 Marks)

16. (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)

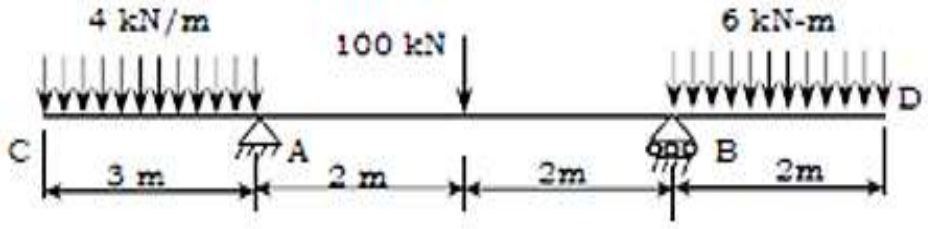
Or

(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) Analyze the given structure and draw the shear force and bending moment diagram. (16)



18. (a) A solid circular shaft transmits 75 *kW* power at 200 *rpm*. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in a shaft length of 2*m* and shear stress is not to exceed 50 *N/mm*^{2}. Take *G* = 100 *kN/mm*^{2}. (16)

Or

(b) A close coiled helical spring is to have a stiffness of 1.5*N/mm* of compression under a maximum load of 60*N*. The maximum shearing stress produced in the wire of the spring is 125*N/mm*^{2}. The solid length of the spring is 50*mm*. Find the diameter of coil, diameter of wire and number of coils. *C*=$4.5x10^4$*N/mm*^{2} . (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 X 10^4 N/mm^2. (16)

Or

(b) Derive the equation of the deflection curve for a cantilever beam AB supporting a load P at the free end (figure 2). Also, determine the deflection B and angle of rotation Bat the free end. (16)

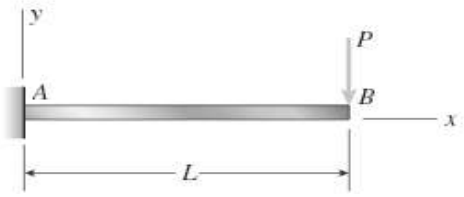


Figure 2

20. (a) 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)

Or

(b) A cylindrical pressure vessel is fabricated from steel plating that has a thickness of 20 mm. The diameter of the pressure vessel is 450 mm and its length is 2.0 m. Determine the maximum internal pressure that can be applied if the longitudinal stress is limited to 140 MPa, and the circumferential stress is limited to 60 MPa. (16)