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 **Reg. No. :**

**Question Paper Code: 44014**

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

Fourth Semester

Civil Engineering

14UCE404 - MECHANICS OF SOLIDS - II

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. In case of solid shaft the strain energy in torsion per unit volume is equal to

(a) *τ2 / 2C* (b) *τ2 / 4C* (c) *τ2 / 6C* (d) *τ2 / 8C*

2. Area under load-deflection curve gives

(a) Strain energy (b) Maximum stress (c) Rigidity (d) Modulus of elasticity

3. A beam of length 6 m carries a point load 120 kN at its centre. The beam is fixed at both ends. The fixing moment at the ends is

 (a) 40 kNm (b) 90 kNm (c) 120 kNm (d) 150 kNm

4. The static indeterminacy value for propped cantilever beam is

 (a) 3 (b) 1 (c) 2  (d) 4

5. According to I.S. code in actual design, maximum permissible deflection is limited to

(a) (span / 200)(b) (span / 325) (c) (span / 525) (d) (span / 500)

6. In a fixed beam, slope and deflection at fixed support will be

(a) Maximum(b) Zero (c) Not equal to zero (d) Minimum

7. Radius of gyration of circular column of diameter *d* is

 (a) *d/4* (b) *d2/4*  (c) *d/2* (d) *d2/16*

8. A cylinder can be assumed as a thin cylinder when the diameter to thickness ratio is

 (a) <20 (b) >20 (c) 10 (d) negligible

9. In a thick cylinder the Stress distribution across the wall thickness will be

(a) Linear (b) Parabolic (c) Hyperbolic (d) Cubic

10. The neutral axis of the cross-section a beam is that axis at which the bending stress is

 (a) Equal (b) Less (c) More (d) Infinity

PART - B (5 x 2 = 10 Marks)

11. Quote Maxwell’s reciprocal theorem.

12. What is a fixed beam?

13. List the methods for finding out the slope and deflection at a section.

14. Define ‘core’ of a section.

15. Define unsymmetrical bending.

PART - C (5 x 16 = 80 Marks)

16. (a) The external diameter of a hollow shaft is twice the internal diameter. It is subjected

to pure torque and it attains a maximum shear stress $τ$. Show that the strain energy stored per unit volume of the shaft is $ \frac{5τ^{2}}{16 C} $. Such a shaft is required to transmit 5000 *kW* at 100 *rpm* with uniform torque, the maximum stress not exceeding 80 *MN/m2*. Determine the shaft diameter and the energy stored per m3. Take C = 90 *GN/m2*

 (16)

Or

(b) A solid bar is 20 mm dia. And 0.8 m long. It is subjected to a torque of 30 Nm. Calculate the maximum shear stress and the strain energy stored. Take G=90GPa. (16)

17. (a) A fixed beam carries point loads as shown in figure. Analyse the beam and draw the S.F and B.M diagrams. (16)



Or

(b) A fixed beam *AB* of span *L* and it is carrying UDL of intensity *w/m* over the whole span. Draw BMD and SFD from fundamental principles. (16)

18. (a) For the beam shown in figure, find the deflection at C and slope at D. I = 40 x 107 mm4 , E = 200 GPa. (16)



Or

(b) A cantilever beam of length 4 *m* is subjected to a point load of 10 *kN* at 2 *m* from fixed end. If the section is rectangular 100 *mm* wide and 200 *mm* deep. Find the deflection at free end. Take *E* = 2 x 105 *N/mm2*. (16)

19. (a) A hollow cylindrical cast iron column of 150*mm* external diameter and 15*mm*

thickness ,3*m* long and is hinged at one end and fixed at the other end (i) Compare the crippling loads given by Euler’s and Rankine’s formulae (ii) for what length the critical load by Euler’s and Rankine’s formulae will be equal. Take E = 8 x 104 N/mm2, $σ$c = 550 *N/mm2*and a = $\frac{1}{1600}$. (16)

Or

(b) A Cylindrical shell 3 meters long has 1 metre internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of

 15 kg/cm2. Take E = 2.0 × 106 kg/cm2 and Poisson's ratio = 0.3. (16)

20. (a) Calculate the thickness of metal necessary for a cylindrical shell of internal dia.

 160 mm to withstand an internal pressure of 25 MN/m2, if maximum permissible

 tensile stress is 125 MN/m2. (16)

Or

(b) A pipe of 400 *mm* internal diameter and 100 *mm* thick contain a fluid at a pressure of 10 *N/mm2*. Find the maximum and minimum hoop stress across the section and also draw the stress distribution diagram. (16)