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Question Paper Code: 32962

M.E DEGREE EXAMINATION, NOV 2016

Elective

Structural Engineering

01PSE505 – THEORY OF ELASTICITY AND PLASTICITY

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Define principal plane.
2. Why do we call strain as a tensor quality?
3. Express the stress compatibility equation for plane stress case.
4. Write the bi-harmonic equation in polar co-ordinates.
5. State St.Venant's theory.
6. What is warping function?
7. State Maxwell-Betti Reciprocal theorem.
8. Explain any two energy theorems.
9. What is meant by Yield criteria?
10. Draw the stress, strain diagram for an elastic work hardening material.

PART - B (5 x 14 = 70 Marks)

11. (a) The stress field in a body is given by

$$\begin{aligned}\epsilon_x &= 0.005z & Y_{xy} &= 0.003xy \\ \epsilon_y &= 0.001x & Y_{yz} &= -0.001xz \\ \epsilon_z &= -0.002xy & Y_{zx} &= 0.001y\end{aligned}$$

check whether it is compatible strain field. (14)

Or

(b) (i) Derive the equilibrium equations in three dimension cartesian coordinate system. (7)

(ii) If an elastic body is isotropic and homogeneous. Show that the linear stress strain relationship can be expressed in terms of only two elastic constants. (7)

12. (a) A circular disc of 80mm diameter and 5mm thick is subjected to diametral compression. If the applied load is 800N, determine the stress distribution in the disc at the center. (14)

Or

(b) Derive the deflection equation for the bending of a cantilever loaded at the end in terms of Cartesian co-ordinates. (14)

13. (a) Derive the torque equation of a prismatic bar subjected to twist T , according to St.Venant's theory. (14)

Or

(b) Discuss the effect of shear and torsion

(i) Elliptical cross section (7)

(ii) Triangular cross section of bar (7)

14. (a) Derive the expression for deflection of a rectangular plate by the principle of virtual work. (14)

Or

(b) Explain the finite element method with basic steps involved. (14)

15. (a) A solid circular shaft of 90mm radius is subjected to a twisting couple so that the outer 40mm deep sheet of the shaft yields plastically. If the yield stress in shear for the shaft material is 150Mpa , determine the value of twisting couple is applied and associated angle of twist. $G = 80\text{Gpa}$. (14)

Or

- (b) Discuss in detail the various theories of failure normally adopted to find the yield criteria. (14)

PART - C (1 x 10 = 10 Marks)

16. (a) Derive the two dimensional biharmonic equations in terms of polar coordinates. (10)

Or

- (b) Assuming proper stress functions and derives expressions for stresses in a cantilever beam of narrow rectangular section with moment at the free end. (10)
