C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 51U03

M.E. DEGREE EXAMINATION, APRIL 2019

First Semester

Structural Engineering

15PSE103 - THEORY OF ELASTICITY AND PLASTICITY

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 1= 5 Marks)

1. The planes which pass through the point in such a manner that resultant stress across them is totally a normal stress are known as CO1- R

   (a) Principal plane (b) Principal stress (c) Shear plane (d) Shear stress

2. The solution of 2D problems may be obtained by introducing a function "ϕ" known as CO2 -U

   (a) Airy's stress function (b) Potential function

   (c) Stress function (d) None of these

3. Rayleigh Ritz method is based on the principle of _____ CO3- U

   (a) Law of conservation of energy (b) Law of conservation of momentum

   (c) All of the above (d) None of the above

4. The equation for torsion of prismatic bar of non-circular cross section is CO4 -R

   (a) $\nabla^2\phi = 0$ (b) $\nabla^2\phi = -2G\theta$

   (c) $\nabla^2\phi = -2K\theta$ (d) None of these

5. Von-Mises yield criteria is based upon _____ theory CO5- U

   (a) Distortion Energy (b) Maximum Strain

   (c) Maximum shear stress (d) Maximum Principal strain

PART – B (5 x 3= 15 Marks)

6. Define lateral strain and longitudinal strain. CO1-U
7. Give the Cauchy-Riemann equations. CO2-U

8. Give the complex torsion function. CO3-U

9. State the principle of potential energy. CO4-U

10. What are residual stresses in plastic bending? CO5-U

PART – C (5 x 16= 80 Marks)

11. (a) Prove that the biharmonic equation for the plane stress condition is Delta4=$d^4/dx^4 + 2(d^4/dx^2dy^2) + d^4/dy^4$. CO1- App (16)

Or

(b) Derive on expression of stress of bending of a cantilever loaded at the end. CO1- App (16)

12. (a) Show that the Airy's stress function $\phi=A(xy^3-3/4\ xyh^2)$ represents stress distribution in a cantilever beam loaded at the free end with load P. Find the value of A if $\tau xy=0$ at y=+- h/2 where b and h are width and depth respectively of the cantilever. CO2- App (16)

Or

(b) Derive the two-dimensional bi-harmonic equation in terms of Cartesian coordinates. CO2- App (16)

13. (a) Derive the torsion equation of a hollow cylinder. CO3-App (16)

Or

(b) Derive the torque equation of a thin rectangular section. CO3-App (16)

14. (a) Explain the finite element concept in detail. CO4- U (16)

Or

(b) Derive the expression for strain energy of a rectangular plate by Rayleigh-Ritz method. CO4 -App (16)

15. (a) Detail the experimental verification of St.Venant's Theory of plastic flow in detail. CO5-U (16)

Or

(b) What are the theories of failures explain in detail with neat sketches. CO5-U (16)