C　　　　　　　　　Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code: 51U03

M.E. DEGREE EXAMINATION, MAY 2018

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 unit of modulus of elasticity is same as those of　　　　　　　　CO1- R

   (a) Stress, strain and pressure　　　　　(b) Stress, force and modulus of rigidity

   (c) Strain, force and pressure　　　　　(d) Stress, pressure and modulus of rigidity

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

   (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

6. Define Hooke's law. CO1-U

7. Give the orthogonal trajectories of the curve. 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) The stress field in a body is given by Σx=0.005z; γxy=0.003xy, CO1- App (16) Σy=0.001x; γyz=-0.001xz, Σz=-0.002xy; γzx=0.001y. Check whether it is a compatible strain field.

Or

(b) The state of strain at a point is given by Σx=0.001, Σy=-0.003, CO1- App (16) Σz=0.002, γxy=0.001, γyz=0.0005, γxz=0.002. Determine the strain invariants and the principal strains.

12. (a) Derive the deflection equation for bending a simply supported CO2- Ana (16) beam uniformly loaded over the entire span in terms of Cartesian coordinates.

Or

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

13. (a) Derive the torque equation of a prismatic bar subjected to thrust T, CO3-App (16) according to St.Venant's theory.

Or

(b) Derive the torsion equation of thin-walled hollow section. CO3-App (16)

14. (a) Derive the expression for deflection of a rectangular plate by the CO4 -App (16) principle of virtual work.

Or

(b) Derive the expression for deflection of a cantilever beam by CO4 -App (16) Rayleigh's method.

2

51U03

15. (a) Discuss in detail the various theories of failure normally adopted to find the yield criteria.   CO5 -App   (16)

Or

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

51U03