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**C Reg. No. :**

**Question Paper Code: 51P63**

M.E. DEGREE EXAMINATION, NOV 2017

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)

|  |  |  |  |  |  |  |  |  |  |  |
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| 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 “ɸ” known as | | | | | | CO2 -U | | | |
|  | (a) Airy’s stress function | | | (b)Potential function | | | | | | |
|  | (c) Stress function | | | (d) None of the above | | | | | | |
| 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 | | | | | | CO4 -R | | | |
|  | (a) | | (b) | | (c) | | (d)None | | | |
| 5. | Maximum principal stress theory is otherwise known as \_\_\_\_\_\_\_\_\_\_ | | | | | | CO5- U | | | |
|  | (a) Rankine’s Theory | | | (b) Haigh’s Theory | | | | | | |
|  | (c) Tresca’s Theory | | | (d) None of the above | | | | | | |
|  | PART – B (5 x 3= 15 Marks) | | | | | | | | | |
| 6. | Define principal plane. CO1-U | | | | | | | | | |
| 7. | Give the property of the analytic functions. CO2-U | | | | | | | | | |
| 8. | Give the Green’s formula. CO3-U | | | | | | | | | |
| 9. | State the principle of virtual work. CO4-U | | | | | | | | | |
| 10. | Give Maxwell’s relation. CO5-U | | | | | | | | | |
|  | PART – C (5 x 16= 80 Marks) | | | | | | | | | |
| 11. | (a) | Prove that the biharmonic equation for the plane stress condition is Delta4=d⁴/dx⁴ + 2(d⁴/dx²dy²) +d⁴/dy⁴. | | | | | | CO1- Ana | (16) | |
|  |  | Or | | | | | |  |  | |
|  | (b) | Derive on expression of stress of bending of a cantilever loaded at the end. | | | | | | CO1- App | (16) | |
|  |  |  | | | | | |  |  | |
| 12. | (a) | Prove that the following Airy’s stress functions and examine the stress distribution represented by them:  a) ф=Ax²+By², b)ф=Ax³ ,c)³ф=A(x⁴‐3x²y²). | | | | | | CO2- Ana | (16) | |
|  |  | Or | | | | | |  |  | |
|  | (b) | Derive the two‐dimensional bi-harmonic equation in terms of polar 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) | A rectangular‐section beam has a depth of 20cm and a width of 10cm.The beam is made of steel with identical properties in tension and compression. The material has a yield stress σ₀=315MPa, E=210GPa,H=700MPa.The beam has yielded upto a depth of 5cm. Determine the magnitude of bending moment applied to the beam. | | | | | | CO5 -App | (16) | |
|  |  | Or | | | | | |  |  | |
|  | (b) | Detail the experimental verification of St.Venant’s Theory of plastic flow in detail. | | | | | | CO5-U | (16) | |
|  |  | | | | | | | | | |