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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)

|  |  |  |
| --- | --- | --- |
| 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) $∇^{2}ɸ=0$  | (b)$ ∇^{2}ɸ=-2Gθ$  | (c)$ ∇^{2}ɸ=-2Kθ$  | (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) |
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