Reg. No. : .....

Name : .....

(Pages : 2)

D – 4670

Fifth Semester B.Tech. Degree Examination, January 2018
(2013 Scheme)
13.504 : MECHANICS OF MATERIALS (M)

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions.

1. Define state of stress at a point.
2. Distinguish normal and tangential stresses.
3. Draw stress-strain graph of mild steel under a uniaxial tension test.
4. What is meant by plane strain ?
5. Obtain differential equations of equilibrium for plane state of stress.
6. Draw the distribution of radial and circumferential stress in the case of a thick cylinder subjected to internal pressure alone.
7. What is meant by elastic strain energy ?
8. Write Castigliano's first theorem.
9. Distinguish between symmetrical and unsymmetrical bending.
10. What is meant by shear flow ? **(10×2=20 Marks)**

PART – B

Answer **any one** from **each** Module.

MODULE – I

11. For the state of stress at a point characterized by the components (in 1000 kPa) $\sigma_x = 12$, $\sigma_y = 4$, $\sigma_z = 10$, $\tau_{xy} = 3$, $\tau_{yz} = 30$, $\tau_{xz} = 0$; Find principal stresses and their directions. **20**

OR

12. If a displacement field is given by $u_x = kxy$, $u_y = kxy$ and $u_z = 2k(x + y)z$; obtain the strain matrix. What is the strain along the direction $n_x = n_y = n_z = 1/\sqrt{3}$? **20**

P.T.O.

MODULE – II

13. Check whether the following stress function $\Phi = A(xy^2 - xyk^3)$ where A and k are constants is an acceptable Airy's stress function for the 2-dimensional problem; if permissible, obtain the state of stress at [1, 2, 3]. **20**

OR

14. Obtain an expression for the radial and circumferential stresses of a rotating disc (ω) of uniform thickness 't' and radius r = 'b'. Assume the density of material as ρ. **20**

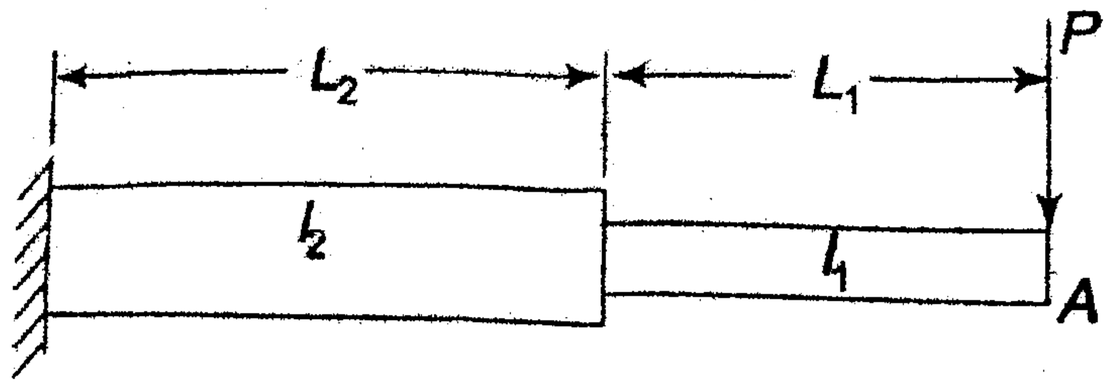
MODULE – III

15. Derive expression for elastic strain energy for the cases of (a) axial force (b) bending moment (c) shear force and (d) twisting moment. **20**

OR

16. a) State and prove Castigliano's first theorem. **10**

b) Determine the deflection at the free end using strain energy method. **10**



MODULE – IV

17. Explain St. Venant's method to solve torsion of general non-circular cross sections of shafts. **20**

OR

18. Locate the shear centre ('e') of the beam section shown below : **20**