ST5103- Theory of Elasticity and Plasticity

13 Marks Question Bank

Part-B

Unit-I

1. What are the elastic constants?
2. State the relation between stress and strain.
3. Define principal plane.
4. Define principal stress.
5. Give the equations of equilibrium.
6. Define hook's law.
7. What are Lame's constants?
8. For a material E=210 Gpa, γ=0.3, rate lami's constant, shear modulus, and bulk density.
9. Compare surface force and body force.
10. Write the expression for octahedral stress.
11. Define Cauchy stress principle.
12. Compose compatibility equations in terms of strain and displacements.
13. Investigate the terms isotropy and homogeneous.
14. List the assumptions of linear elasticity.
15. What are the displacement formulation?
16. Illustrate the formula for strain-stress law in matrix form.
17. Predict the equation of stress transformation law in 3-D.
18. Explain stress and strain invariants.
19. Discuss about elasticity.
20. Describe Mohr's stress circle.

Unit-II

1. Differentiate 2D and 3D problems.
2. What are the Cartesian co-ordinates?
3. Describe plane stress problem with example.
4. Describe plane strain problem with example.
5. Prioritize uniform and non-uniform state of stress.

6. Discuss airy's stress function.
7. Write the Cauchy-Riemann equations.
8. Show that 3rd degree polynomial satisfies the governing equations.
9. Express the stress compatibility equation for plane strain case.
10. Discuss the stress compatibility equation for plane stress case.
11. Write the expression for bi harmonic equation in polar coordinates
12. Outline about axis-symmetry problem.
13. Relate Cartesian and polar co-ordinates.
14. Compose the 3-D equilibrium equation in polar co-ordinates.
15. Outline the general solution of compatibility equation.
16. Write the equilibrium equation in 2-D element in polar coordinates.
17. Solve the Biharmonic equation for plane-stress problem.
18. Identify the equations relating to bending of a beam by uniform load.
19. Identify the polynomial equation for 1st & 2 nd degree functions Φ=Ax+By.
20. Create an element and label the stresses acting on in in cartesian co-ordinates.

Unit-III

1. What is the effect of torsion in circular shafts?
2. How do you conduct warping function?
3. Write the concept of membrane analogy.
4. Write down the expression for torsional resistance of a non-circular section in terms of St.venant's working function.
5. A circular section of mean diameter 200mm & wall thickness 2mm is subjected to a torque of 10Nm. Find the maximum shear stress induced in it
6. Find the angle of twist per unit length of a bar of an equilateral triangular c/s of side 20mm when the bar is subjected to a twisting moment. If the maximum shear stress induced is 5 N/mm2, find the value of maximum twisting moment.
7. Give the Green's Formula.
8. List the analogous quantities in membrane analogy
9. Outline the torsional resistances of solid and open sections.
10. Discuss the different analogies available to solve torsion problems.
11. Outline prandtl stress function.
12. Illustrate St. Venant's Theory of torsion.
13. Illustrate warping of torsion.
14. From prandlt's stress functions examine poisson's equation.

15. Investigate that $\Delta^2\psi=0$ where ψ is warping function.
16. Illustrate the max.shear stress and angle of twist per unit length of a thin rectangular section of size b×d.
17. Outline the Prandtl's membrane analogy will be preferred?
18. Write the equations for calculating angle of twist relating to torsion of elliptical cross-section bar.
19. Compose the poisson's equation of prismatic bars of non-circular cross- sections.
20. Investigate torsion along with relation.

Unit-IV

1. What is the basic principle of Rayleigh Ritz method?
2. Name and state the energy theorems.
3. Describe elastic foundation.
4. List the types of elastic foundation
5. Write the differential equation for beam resting on elastic foundation.
6. List method of analysis available for elastic foundation.
7. Discuss elastic line method.
8. Outline idealization of soil medium.
9. List the assumptions made in Winkler theory.
10. Describe about Winkler theory.
11. Predict the effect of foundation on rigid and flexible uniform C/S.
12. Illustrate the Winkler foundation
13. Classify finite beams and infinite beams.
14. Explain the applications of elastic foundation.
15. Investigate the deflection, shear force and bending moment equation for an infinite beam loaded with concentrated load.
16. Investigate the deflection, shear force and bending moment equation for an infinite beam loaded with UDL.
17. Illustrate semi-infinite beams.
18. Assess plates on elastic foundation.
19. Assess the term "end conditioning forces".
20. Predict a beam subjected to elastic foundation.

Unit-V

1. What is the torsional effect in yielding?

2. State the plastic stress strain relationship.
3. Explain soap film analogy.
4. Describe yield criteria.
5. List the assumptions in plasticity.
6. Tell, what do you mean by plasticity?
7. List the yield conditions in plasticity.
8. Describe plastic hinge.
9. Outline St.Venant‟s theory for torsion.
10. Discuss the Tresca‟s yield criteria.
11. Describe the Von-Mises yield criteria.
12. Illustrate sand Heap Analogy.
13. Illustrate residual stresses in torsion.
14. Identify the applications of thick cylinders.
15. Investigate heigh-westergaurd’s stress space.
16. Investigate rankine‟s theory of principal stress.
17. Invent the stress-strain curve for a plastic and elastic material.
18. Invent strain hardening.
19. Justify the important factors affecting plastic deformation?
20. Discuss the relation between spherical and deviatorial stress tensor