Total No. of Questions – [09] Total No. of Printed Pages: 02

G.R. No.	

DECEMBER 2018 / ENDSEM
F. Y. M. TECH. (Civil- Structures) (SEMESTER - I)
COURSE NAME: Theory of Elasticity
COURSE CODE: CVPB11181
(PATTERN 2018)

P118-111(ESE)

Time: [**3 Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4 OR Q.5, Q.6 OR Q.7, Q.8 OR Q.9**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data wherever required**

Q.1) a) Discuss the State of stain at a point in an elastic body. Describe the relations of strain-displacement in a Cartesian coordinate system. [3 marks]

OR

b) The Stress components at a point in a body are given by

$$\sigma_x = 3xy^2z + 2x, \quad \sigma_y = 5xyz + 3y \quad \sigma_z = x^2y + y^2z$$

$$\tau_{xy} = 0 \quad \tau_{yz} = \tau_{xz} = 3xy^2z + 2xy$$

Determine whether these components of stress satisfy the equilibrium equations or not as the point (4, -2, 2). If not then determine the suitable body force required at this point so that these stress components are under equilibrium. [3 marks]

Q.2) a) Explain orthotropic material and isotropic material. Describe the relations between elastic constants [3 marks]

OR

b) What is Airy's stress function? Show that the Airy's stress function for 2D problem satisfies the bi-harmonic equation? [3 marks]

Q.3) a) Derive the expressions for strain components in polar coordinates [2 marks]

OR

b) Differentiate the plane stress and plane strain problems in polar coordinate system. Give examples. [2 marks]

Q.4) a) Write a short note on stress concentration problem in solid mechanics. If a flat plate with a circular hole is subjected to tensile force, then its theoretical stress concentration factor is? [6 marks]

b) Discuss the failure theories? How does the maximum shear stress yield theory compare to the maximum distortional energy yield theory? [8 marks]

OR

OR

Q.5) a) Write a short note on Kirsch's problem. In which of the following case stress concentration factor is ignored? Explain why?

i) Ductile material under static load
ii) Ductile material under fluctuating load
iii) Brittle material under static load
iv) Brittle material under fluctuating load [6 marks]

b) Explain the significance of failure theory in theory of elasticity. A circular bar is subjected to an axial force and shear force, the difference between two principle stresses is 120 MPa. Based on maximum shear stress theory what is the factor of safety, if elastic limit of the bar is 300 MPa? [8 marks]

Q.6) a) Give a brief account of classification of plates? Write the assumptions made in theory of thin plates? [7 marks]

b) Write the stress resultant in theory of thin plate. [7 marks]

OR

Q.7) Derive the equations of equilibrium for the beam case and compare it with small deflections of laterally loaded plates. [14 marks]

Q.8) a) How does the plate analysis is different than a beam analysis? Enlist the various methods of plate analysis. Discuss the Navier solution in brief. [14 marks]

OR

Q.9) a) Draw an element of plate in Cartesian system and show the stresses acting on it in their positive senses. Make the sign convention clear. [7 marks]

b) What is the importance of moment – curvature relationship in the structural analysis of the plates? [7 marks]