18DD1907

M.Sc. EXAMINATION, 2020

(Fourth Semester)

(C Scheme) (Main Only)

MATHEMATICS

MAT616C

Mechanics of Solids–II

Time : 3 *Hours*] [*Maximum Marks* : 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit and the compulsory question.

Compulsory Question

1. (a) Define first and second boundary value problem in terms of Airy stress function. **3**

(b) Explain Spring and Dashpot. **3**

(c) Show that lateral surface of circular beam is stress free. **3**

(d) Explain in short of the following : **3**

(i) Surface waves

(ii) Plane waves.

(e) Define Kantorovich method in one and two-dimensional. **3**

Unit I

2. (a) Explain generalized plane stress. **8**

(b) Derive stresses and displacement components in terms of two analytic function. **7**

3. (a) Construct a biharmonic boundary value problem. **7**

(b) Discuss the arbitraryness in selection of two analytic function. **8**

Unit II

4. (a) Define spring and dashpot and derive constitutive equation for Kelvin model. **7**

(b) Explain strain response under constant stress and vice versa for three parameter solid model. **8**

5. Explain deformation of thick-walled tube, when the material of the tube is elastic in dialatation and Maxwell viscoelastic in distortion. **15**

Unit III

6. (a) Show that maximum shearing stress occurs on the boundary of the cross-section. **7**

(b) Show that shear stress at the corner and centroid are zero and maximum at the middle point for torsion of beam with triangular cross-section. **8**

7. (a) Show that stress vector is normal to the radius vector and also find maximum stress in torsion of circular shaft. **7**

(b) Determine the wavelength and velocity of a system of plane waves given by $\phi = a \sin(\mathrm{A}x + \mathrm{B}y + \mathrm{C}z - \mathrm{D}t)$, where a, A, B, C, D are constant. **8**

Unit IV

8. (a) State and prove theorem of minimum complementary energy. **8**

(b) Explain the deflection of central lines of a beam. **7**

9. Explain Galerkin method in one and two-dimensional. Using Galerkin method, solve the problem : **15**

$$\nabla^2 u = -1, \text{ in the rectangle } |x| \leq a, |y| \leq b,$$

where $u = 0$ on the boundary.