

Roll No. ....

(07/21-II)

**9213**

**M. Sc. (2 Year) EXAMINATION**

(For Batch 2013 to 2016 Only)

(Fourth Semester)

**MATHEMATICS**

**MMT-5403**

**Mechanics of Solids-II**

*Time : Three Hours*

*Maximum Marks : 80*

**Note :** The question paper has consists of three Sections. Candidate will be required to attempt all the Sections as per instruction.

**Section A**

**Note :** Attempt all the parts.

1. (a) Define principle direction in the state of plane stress.

(2-40/15)B-9213

P.T.O.

- (b) Show that displacement of thick-walled tube under external and internal pressure is  $Ar+B/r$ .
- (c) Define the following terms :
- Viscous material
  - Viscoelastic materials
  - Correspondence principle of linear viscoelasticity
- (d) Explain the following :
- Creep phenomenon
  - Relaxation Phenomenon
- (e) Define the following terms :
- Principle of superposition
  - Exponential form of harmonic wave.
- (f) Define the following terms :
- Lines of shearing stress
  - Torsional rigidity
  - Stress function

- (g) State :
- Theorem of minimum potential energy
  - Theorem of minimum complementary energy.
  - Define Kantorovich method in one- and two-dimensional.

### Section B

**Note :** Attempt any *five* questions.

- Derive general solution of biharmonic equation.
- Discuss the arbitrariness in selection of two analytic function.
- Define spring and dashpot and derive constitutive equation for Kelvin model.
- Explain Creep and Relaxation phenomenon of Standard Linear Solid model.



6. Show that in the torsion of an elliptic cylinder :

$$\tau = 2\mu\alpha\beta\sqrt{a^2 - e^2x^2} / (a^2 + b^2)$$

and maximum shearing stress occurs on the ends point of minor axis.

7. Explain why dilatational wave are called primary wave or P-wave while rotational wave are called secondary wave or S-wave.
8. State and prove reciprocal theorem of Betti and Rayleigh or Betti's reciprocal theorem or theorem of work and reciprocity.
9. Explain Ritz method in one- and two-dimensional.

### Section C

**Note :** Attempt any two questions.

10. Derive displacement and stress for thick-walled tube under external and internal pressure.

B-9213

4

11. Explain deformation of thick-walled tube, when the material of the tube is elastic in dilatation and standard linear solid viscoelastic in distortion.

12. Explain propagation of Rayleigh wave.

13. Using method of Kantorovich, solve the B.V.P. :

$$\nabla^2\psi = -2 \text{ in } R$$

$$\psi = C \text{ on } C$$

C being the boundary of R, where R is the rectangle  $|x| \leq A, |y| \leq B$ .

B-9213

5

130