Or

Derive the velocity equation for Rayleigh waves propagating along the plane free boundary of a half-space. Also show that the particle motion is elliptic retrograde.

13. State and prove theorem of minimum complementary energy.

Or

(a) Discuss the problem of deflection of an elastic membrane by transverse load.

(b) Using Ritz's method, find the extremum of problem :

$$I = \int_0^1 \left(y'^2 + y^2 \right) dx;\ y(0) = 0,\ y(1) = 1$$

Subject Code—0368-X

M. Sc. EXAMINATION

(Prior 2011 Re-appear)

(Fourth Semester)

MATHEMATICS

MAL-643

Mechanics of Solids-II

Time : 3 *Hours* *Maximum Marks :* 100

Section A

Note : Attempt any *Seven* questions. **7×7=49**

1. What do you mean by Plane stress ? Derive the field equations for a plane stress problem.

2. Derive general solution of a Biharmonic equation $\nabla^4 \phi = 0$.

3. Define physical models for elastic and viscous materials. Derive the stress-strain relations for a Kelvin model.

4. Discuss the relation between creep compliance and relaxation modulus.

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

$$\tau = 2\mu\alpha \frac{ab}{a^2 + b^2} \sqrt{a^2 - e^2 x^2} \; ;$$

where $e = \frac{1}{a}\sqrt{a^2 - b^2}$ and maximum shearing stress occurs on the end points of minor axes.

6. Write a short note on lines of shearing stress.

7. Explain P, SV and SH-waves of seismology.

8. State and prove reciprocal theorem of Betti and Rayleigh.

9. Discuss the problem of deflection of an elastic string by transverse load.

10. Use Galerkin method to find an approximate solution of the problem :

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

$\phi = 0$ on the boundary of R,

where R is rectangle $|x| \le a, |y| \le b$.

Section B

Note : Attempt all the questions. **3×17=51**

11. Assuming plane strain conditions, obtain the expressions for the stresses in terms of two analytic functions.

Or

Derive the stress-strain relations for a standard linear solid model. Discuss its creep and relaxation phases.

12. Discuss the torsional problem of a cylinder with cross-section of equilateral triangle.