

Ex/SC/MATH/PG/DSE/TH/04/A27/2025

MASTER OF SCIENCE EXAMINATION, 2025

(2nd Year, 1st Semester)

MATHEMATICS

PAPER : DSE/04/A27

(Solid Mechanics—II)

Time : Two Hours

Full Marks : 40

Symbols/Notations have their usual meanings.

Answer any **four** questions :

10×4=40

1. Deduce the equation of motion in vector form in an elastic medium. Also show that the disturbances in an elastic medium can be described with the aid of two special types of waves;

one of these travels with velocity $C_1 = \sqrt{\frac{\lambda + 2\mu}{\rho}}$ and the other

with velocity $C_2 = \sqrt{\frac{\mu}{\rho}}$. 10

2. A uniform pressure varying harmonically with time is acting radially on the surface of a spherical cavity of radius a in an infinite elastic medium. Determine the displacement at any point of the medium. 10

3. Deduce Pochhammer frequency equation for longitudinal vibration of an infinite circular cylindrical rod. 10

(2)

4. Deduce the Rayleigh-Lamb frequency equations for (i) symmetric and (ii) anti-symmetric mode of vibration of an infinite isotropic elastic plate. 10

5. Show that the plane wave solution of the form :

$$\vec{u} = \vec{d} F(\vec{r} \cdot \vec{N} - ct)$$

to the equation of motion

$$\rho \frac{\partial^2 \vec{u}}{\partial t^2} = (\lambda + \mu) \vec{\nabla}(\vec{\nabla} \cdot \vec{u}) + \mu \nabla^2 \vec{u}$$

is possible, if (i) either $\vec{d} = \pm \vec{N}$ or

(ii) $\vec{d} \cdot \vec{N} = 0$ and $\rho = \mu c^2$ and explain the cases. 10

6. What is Rayleigh surface wave? Deduce the equation of face velocity c of Rayleigh wave. 10

★ ★ ★