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MDQ/J-21 5516

MATHEMATICAL ASPECTS OF SEISMOLOGY

MM-511 (Opt.-i)

Time : Three Hours] [Maximum Marks : 80

Note : Attempt *Five* questions in all. Q. No. **1** is compulsory. Attempt *one* question from each Section.

1. (a) Define magnitude of an earthquake. **2**

(b) Explain wavelength and wave number. **2**

(c) What is exponential form of a plane wave ? **2**

(d) Which one of body and surface waves has larger amplitude and why ? **2**

(e) Fing the wavelength of the wave :

$$\varphi = a\cos(x+4y-4z-4t).$$ **2**

(f) Explain stationary waves. **2**

(g) Define area source. **2**

(h) Explain Snell's law. **2**

Unit I

2. (a) Write wave equation in cylindrical coordinates and solve that equation. **12**

(b) Find nodal lines in plane of polar coordinates. **4**

3. (a) What is the significance of the equation :

$$\frac{\partial^2 \phi}{\partial z^2} = \frac{1}{c^2}\left(\frac{\partial^2 \phi}{\partial t^2} + a\frac{\partial \phi}{\partial t} + b\phi\right) \quad ?$$

Solve it and interpret the solution in terms of the coefficients a, b and c. **12**

(b) How can progressive waves be represented mathematically ? **4**

Unit II

4. (a) A SV wave is incident at the plane surface of a half-space. How will the partition of energy of incident wave take place in terms of reflected waves ? **12**

(b) Why P waves are called irrotational waves ? Give mathematical justification. **4**

5. What are Stoneley waves ? Derive period equation of these waves and hence discuss their dispersive behaviour. **16**

Unit III

6. A tangential line source is acting in an unlimited elastic solid. Formulate and solve the problem. **16**

7. Solve Lamb's problem for a point source acting on the surface of a semi-infinite elastic solid. **16**

Unit IV

8. What are spherical waves ? Prove that spherical waves can be written as superposition of plane waves. **16**

9. (a) Derive Helmholtz's formula. **8**

(b) What is the difference between focus and epicentre of an earthquake ? Explain the method of finding an epicentre. **8**