

Roll No. ....

Total Pages : 03

**CMDQ/M-20** **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 epicentre of an earthquake. 2
- (b) Explain wave profile. 2
- (c) Derive the relation between wavenumber and velocity of a wave. 2
- (d) What is difference between body waves and surface waves ? 2
- (e) Find the wavenumber of the wave : 2  
$$\phi = a \sin(5x + 4y + 6z - 4t)$$
- (f) Explain earthquake magnitude. 2
- (g) Give layered structure of the Earth. 2
- (h) Define area source. 2

### **Section I**

2. (a) Write wave equation in spherical coordinates. Obtain stationary type solution of this equation when there is an axial symmetry. **10**
- (b) Explain plane waves. **6**
3. (a) Define dispersion and derive relation between group velocity and phase velocity. **8**
- (b) State principle of superposition and using that explain stationary waves. **8**

### **Section II**

4. Given that P wave is incident at the plane boundary between two liquid half-spaces. Derive reflection and refraction coefficients by making use of Snell's law. Describe special cases also. **16**
5. Define a surface wave. Find the condition of existence of the Love waves. Prove that these waves are dispersive. **16**

### **Section III**

6. Solve two-dimensional Lamb's problem of area source in an unlimited elastic solid. **16**

7. Formulate a three-dimensional Lamb's problem for a point source acting on the surface of an elastic solid half-space and obtain the solution in terms of displacements. **16**

#### **Section IV**

8. Derive Sommerfield's integral. **16**
9. (a) Explain release of energy during an earthquake. **8**  
(b) Derive Poisson's formula. **8**