

**SUBJECT CODE:19PH/PE/CP15**

**M.Sc., DEGREE EXAMINATION NOVEMBER 2022**

**PHYSICS**

**FIRST SEMESTER**

**COURSE : ELECTIVE**  
**PAPER : CRYSTAL PHYSICS**  
**TIME : 3 HOURS**

**MAX. MARKS : 100**

**SECTION - A**

**ANSWER ALL QUESTIONS:**

**(10x3=30)**

1. Define reciprocal lattice.
2. List out the applications of Liquid Crystals.
3. What do you mean by lattice vibration?
4. What is meant by solution growth?
5. Define Thermal conductivity.
6. What is the difference between DTA and TGA?
7. Give the advantages of gel growth method.
8. What is the fundamental principle of XRD?
9. How does anisotropy arise in liquid crystals?
10. Compute the Miller Indices for a plane intersecting at  $x = 1/4$ ,  $y = 1$ , and  $z = 1/2$

**SECTION – B**

**ANSWER ANY FIVE QUESTIONS:**

**(5x5=25)**

11. Prove that in a cubic crystal, the direction  $[hkl]$  is normal to the plane  $(hkl)$ .
12. Show that Bragg's equation could be derived from Laue's equations.
13. Derive the  $\omega$ - $k$  dispersion relationship for a one dimensional monoatomic lattice.
14. Define phonon. Explain Umklapp process.
15. Using a block diagram, explain the working of a differential scanning calorimeter (DSC).
16. With suitable diagrams, explain the experimental procedure to grow crystals by chemical reaction methods employing the gel medium.
17. List out the Optical and electrical properties of Liquid crystals.

**SECTION – C**

**ANSWER ANY THREE QUESTIONS:**

**(3x15=45)**

18. What is cohesive energy? Assuming a suitable model for interatomic forces derive an expression for the cohesive energy of ionic solids.
19. Obtain the expression for the specific heat of solids as per Debye theory and show that in suitable limits it gives Dulong and Petit's law and the  $T^3$ - law
20. Distinguish between the slow cooling and slow evaporation methods of growing crystals. With neat diagram explain the procedure for growing single crystals by low temperature solution growth along with various conditions to be optimized.
21. What is meant by hardness? How is it correlated to other physical properties? Give the theory and the experimental steps adopted for measuring the Vickers hardness number and work hardening coefficient.
22. What are liquid crystals? Explain in detail about classification of liquid crystals.