

## PH 543: PHYSICS OF LIQUID CRYSTALS (4-0-0: 4)

### **Classification of Liquid Crystals**

Symmetry structure and classification of liquid crystal, polymorphism in thermotropics, reentrant phenomenon in liquid crystals, blue phases, polymer liquid crystals, distribution functions and other parameters, macroscopic and microscopic order parameters, measurement of order parameters, magnetic resonance, electron spin resonance, Raman scattering and X-ray diffraction.

### **Theories of Liquid Crystalline Phase Transition**

Nature of phase transitions and critical phenomenon in liquid crystals, hard particle, Maier-Saupe and van der Waals theories for nematic-isotropic and nematic-smectic A transitions, Landau theory, essential ingredients applications to nematic-isotropic and nematic-smectic A transitions and transitions involving smectic phases.

### **Continuum Theory**

Curvature elasticity in nematic smectic A phases, distortions due to magnetic and electric fields, magnetic coherence length, freedeicksz transitions, field induced cholesteric nematic transition

### **Dynamical Properties of Nematic**

The equations of nemato-dynamics, laminar flow, molecular motions, optical properties of cholesterics, optical properties of ideal helices, agent influencing the pitch, liquid crystal display.

### **Ferroelectric Liquid Crystals**

The properties of smectic C continuum description smectic C- smectic A transition applications. Discotic liquid crystals: Symmetry and structure, mean field description of discotic liquid crystals, continuum description, lyotropic liquid crystals and biological membrane. Applications of liquid crystals.

### **Text Books and References:**

1. S. Chandrasekhar, "Liquid crystals", Cambridge University Press
2. G. Vertogen and W. H. de Jeu, "Thermotropic liquid crystals: Fundamentals", Springer
3. P. G. de Gennes and J. Prost, "The physics of liquid crystals", Clarendon Press
4. P. J. Collings and M. Hird, "Introduction to liquid crystals: Physics and Chemistry", Taylor and Francis
5. D. Yang and S. Wu, "Fundamentals of Liquid Crystal Devices", Wiley
6. S. T. Lagerwall, "Ferroelectric and Antiferroelectric Liquid Crystals", Wiley-VCH