STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI
COURSE PLAN (June - November 2026)

Department : Physics
Name/s of the Faculty : Dr. Asisi Janifer. M
Course Title : Crystal Physics
Course Code : 23PH/PE/CP15
Shift : II

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	Acquire knowledge on the Classical theory of nucleation	**K1**
CO2	Describe the various dynamic lattice of elastic vibrations in mono and diatomic lattices and models of heat capacities.	**K2**
CO3	Apply various growth techniques to develop a crystal with precisions.	**K3**
CO4	Analyse the structural, optical and electrical properties of the grown sizeable crystal	**K4**
CO5	Investigate the applications using liquid crystals technology	**K5, K6**

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods
Jun 22, 2026 (Day Order 6)	Crystal Theory 1	1.1 Importance of crystal growth – Classification of crystal growth	K1-K6	2	CO1-CO5	Chalk and talk, presentation	AI based Quiz and group

		methods					discussion
Jun 23 – July 1, 2026 (Day Order 1- 6)		Nucleation Theory - Kinds of nucleation – Homogeneous nucleation Heterogeneous nucleation - secondary nucleation 1.2 Classical theory of nucleation: Gibbs Thomson equations for vapour and solution – Kinetic theory of nucleation –	K1-K6	5	CO1-CO5	Black board and presentation	Formative analysis
July 2 – July 8, 2026 (Day Order 1- 6)		Becker and Doring concept on nucleation rate – Energy of formation of a spherical nucleus and cylindrical nucleus - Crystal System and Symmetry.	K1-K6	5	CO1-CO5	Lecture and presentation	Group Discussion
July 9 – 16, 2026 (Day Order 1- 6)	Lattice Dynamics 2	2.1 Theory of elastic vibrations in mono and diatomic lattices - Phonons – Dispersion relations - Phonon momentum. Heat Capacity Vibrational modes - Einstein model -	K1-K6	4	CO1-CO5	Lecture and presentation	Peer Assessment
July 17 – 24, 2026 (Day Order 1- 6)		Density of modes in one and three dimensions -	K1-K6	4	CO1-CO5	Lecture and presentation	Slip test

		Debye Model of heat capacity. 2.2 Anharmonic effects: Explanation for Thermal expansion,					
July 25 – 28, 2026 (Day Order 1- 3)	3. Growth techniques	Conductivity and resistivity– Umklapp process. 3.1 Gel growth technique: Chemical reaction method	K1-K6	5	CO1-CO5	Lecture and demonstration session in research lab	Third Component 1: THEORY TEST Units 1 and 2 [15 marks] – K5
July 29 – Aug 3, 2026	**C.A. Test - I**						
Aug 4 - 6, 2026 (Day Order 4 - 6)		Single and double diffusion method – Chemical reduction method – Complex and decomplexion method	K1-K6	3	CO1-CO5	Black board and presentation	Formative analysis
Aug 7 – 14, 2026 (Day Order 1- 6)		3.2 Melt growth: Bridgman method - Czochralski technique – Growth apparatus – seed preparation – pulling rate – shape of crystal melt interface – Growth process	K1-K6	5	CO1-CO5	Lecture and demonstration session	Case studies and crystal growth in groups

Aug 17 - 24, 2026 (Day Order 1- 6)		3.3 Vapour growth: Physical Vapour Transport (PVT) – Processes of sublimation and condensation principle – Chemical Vapour Transport – Criteria for the choice of transport reaction	K1-K6	5	CO1-CO5	Black board and presentation	Group Discussion
Aug 25 – Sep 2, 2026 (Day Order 1- 6)	4 Crystal Characterization	4.1 X Ray diffraction (XRD) - Thermal analysis - methods of thermal analysis - thermogravimetric analysis (TGA) - Differential thermal analysis (DTA) - Differential Scanning Calorimetry (DSC)	K1-K6	5	CO1-CO5	Lecture and presentation	Third Component 2: Poster Presentation with Literature Review report – [15 marks] All units - K4
Sep 3 – 11, 2026 (Day Order 1- 6)		4.2 Mechanical studies - methods of hardness testing (qualitative) - Vickers hardness testing - correlation of microhardness with other properties	K1-K6	5	CO1-CO5	Lecture and demonstration session in research lab	Quiz
Sep 15-17, 2026 (Day Order 1 - 3)		estimation of hardness number and work	K1-K6	2	CO1-CO5	Lecture and video	Slip test

	5: Liquid Crystals	hardening coefficient (n) 5.1 Liquid Crystals: Classification-isotropic-nematic, smectic-cholestic phases,				session	
Sep 18 –23, 2026	**C.A. Test - II**						
Sep 24 - 28, 2026 (Day 4 – 6)		Phase transition of liquid phases	K1-K6	5	CO1-CO5	Lecture and presentation	Quiz
Sep 29 – Oct 7, 2026 (Day Order 1 - 6)		Properties- optical, electric and magnetic fields,	K1-K6	5	CO1-CO5	Lecture and presentation	Third Component 3 : Gaussian-based mini-project Unit 5 [20 marks] - K5
Oct 8 - 14, 2026 (Day Order 1 - 6)		Application of liquid crystals	K1-K6	5	CO1-CO5	Lecture and presentation	Slip test
Oct 15 - 21, 2026 (Day Order 1- 4)	**REVISION**						