Basics of Nano and Soft Matter
Classroom

Syllabus

Sl. No.	Date	Instructors	Topics	Time
NS 1.	12.02. 2016	Prof. G. U. Kulkarni	Concepts and Definitions: nanoscale processes, nanosystems, important nanomaterials, historical account Quantum confinement and Surface effects in nanosystems, Size-dependent properties-optical, electronic, magnetic and reactivity - I	10.00 -11.00 AM 11.30 AM-12.30 PM
NS 2.	19.02. 2016	Dr. S. Krishna Prasad	Overview of Soft Matter Phenomenon of double melting: Plastic crystals and liquid crystals, Classification of liquid crystals: nematic, cholesteric and smectic phases, Order parameters for different phases and their experimental determination, Critical Phenomena	10.00 -11.00 AM 11.30AM – 12.30 PM
NS 3.	26.02. 2016	A) D. S. Shankar Rao B) Dr. Neena S. John	A) Diffraction of X-rays by liquids and liquid crystals, Information obtained from X-ray studies on liquid crystalline materials. Comparison between 2-D and 3-D crystallography B) Synthesis: top-down and bottom-up, hybrid methods	10.00 -11.00 AM 11.30AM – 1.30 PM

NS 4.	11.03. 2016	A) Prof. Krishnamurthy K. S. B) Dr. Neena S. John	A) Optical properties and defects in liquid crystals Electrical and Magnetic properties B) Carbon nanomaterials: fullerenes, nanotubes and graphene; analogues and hybrids – I	10.00 -11.30 AM 12.00 N – 1.00 PM
NS 5.	18.03. 2016	A) Dr. S. Angappane B) Prof. H. L. Bhat,	A) Thin films, metal, semiconductor and organic films B) Deposition techniques and thickness monitoring, growth modes, heterostructures	10.00 -11.00 AM 11.30AM – 1.00 PM
NS 6.	01.04. 2016	A) Dr. Geetha Nair G. B) Dr. S. Krishna Prasad	A) Rheology of gels and liquid crystals B) Applications of liquid crystals	10.00 -11.30 AM 12.00 Noon - 12.30 PM
NS 7.	15.04. 2016	A) Prof. G. U. Kulkarni B) Prof. K. A. Suresh	A) Quantum confinement and Surface effects in nanosystems, Size-dependent properties-optical, electronic, magnetic and reactivity - II B) Surface tension, determination of surface energy, surface roughness, microscopy of solid surfaces, optical microscopy, scanning probe microscopy, spreading of one liquid on another liquid and criteria for spreading. Microemulsions, foam structure, foam drainage and foam stability.	10.00 -11.00 AM 11.30AM – 1.00 PM
NS 8.	22.04. 2016	A) Dr. Neena S. John B) Dr. Veena Prasad	A) Carbon nanomaterials: fullerenes, nanotubes and graphene; analogues and hybrids - II B) Chemistry of conventional and unconventional low molar mass liquid	10.00 -11.00 AM 11.30AM – 12.30 PM

			crystals	
NS 9.	29.04. 2016	A) Dr. C. V. Yelamaggad B) Dr. S. Angappane	A) Basic molecular structural needs for materials exhibiting mesomorphism, Driving forces for liquid crystal phase formation, Influence of Optical Activity, Monomers, Oligomers and Polymers B) Nanolithography- concepts and methods; optical-, electron-, ion- beam lithography, micromolding, nanoimprint lithography, clean room practices	10.00 -11.30 AM 12.00 N - 01.00 PM
NS 10.	06.05. 2016	Dr. P. Viswanath,	Films on liquid substrates – Langmuir films of proteins and other biological substances, phases of monomolecular films, experimental techniques to characterize monolayer, surface manometry, Brewster angle microscopy, Epifluorescence microscopy and Ellipsometry, Films on solid substrates – spin coating, self assembled monolayers, Langmuir-Blodgett films. Wetting and dewetting behavior. Contact angle measurements. Langmuir adsorption isotherm and Gibbs energy of adsorption.	10.00 -11.30 AM

Lab Work (1.30 PM -4.30 PM)

Sl. No.	Date	Instructors	Topics
NSE1.	16.02.2016	Prof. G. U. Kulkarni	Elucidation of the Nanoscale
NSE2.	23.02.2016	Prof. Krishnamurthy K. S.	Temperature variation of birefringence using tilting compensator, Freedericksz transition and determination of elastic constants
NSE3.	01.03.2016	Prof. G. U. Kulkarni Dr. Neena S. John	Synthesis of Ag sol using polyol method, UV-VIS absorption spectroscopy, Simulation of surface plasmon band based on Mie theory
NSE4.	15.03.2016	Dr. D. S. Shankar Rao	Xray Diffraction from layered and columnar structures, importance of 2D crystallography
NSE5.	22.03.2016	Dr. S. Angappane	Scanning Electron Microscopy
NSE6.	29.03.2016	Dr. Neena S. John	Atomic Force Microscopy
NSE7.	05.04.2016	Dr. G. Geetha Nair	Shear flow behaviour of Newtonian and Non-Newtonian fluids
NSE8.	12.04.2016	Dr. S. Krishna Prasad	Permittivity measurements, influence of anisotropy, Dielectric spectroscopy
NSE9.	19.04.2016	Dr. S. Angappane	XRD for nanoparticles and films
NSE10.	26.04.2016	Dr. Veena	(a) Cleaning and drying the laboratory

		Prasad	glassware (b) Purification of LC compounds by recrystallisation technique
NSE11.	03.05.2016	Prof. K. A. Suresh	Determination of the and ellipsometric angles ψ (relative phase difference and amplitude change) for a birefringent film and estimating its thickness using one-zone method.
NSE12.	10.05.2016	Prof. G. U. Kulkarni	Raman: CNT and grapheme
NSE13.	17.05.2016	Dr. C. V. Yelamaggad	Synthesis of 4-n-alkoxybenzoic acids and Schiff bases
NSE14.	24.05.2016	Dr. P. Viswanath	Preparation of thin dye doped smectic and nematic LC films by spin coating. Fluorescence and reflection studies on thin LC films using Olympus metallurgical microscope