Programme: M. Sc. Part-II (Chemistry)
Title of the Course: Colloids and Surface Science
Course Code: PCO-505
Number of Credits:03 **Effective from AY: 2019-20**

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures/ hours
Course Objectives:	To Introduce surface properties of materials and forces at different interfaces. To introduce the concept of micelles, microemulsions. To introduce different adsorption models.	
Course Outcomes:	Students should be in a position to understand surface phenomenon and properties of interfaces. Students should be in a position to understand electrochemical phenomenon at interfaces. Students should be in a position to apply these concepts during the lab course in physical chemistry	
Content:	**1. Liquid Surfaces and Interfaces** 1.1 General Introduction. Microscopic picture of liquid surface. 1.2 Surface tension and its measurement. Curved liquid surfaces. 1.3 The Kelvin equation and capillary condensation. 1.4 Nucleation Theory. 1.5 The surface excess. Gibbs energy and surface tension. The surface tension of pure liquids. Gibbs adsorption isotherm. **2. Electrokinetic Phenomena and Surface Forces** 2.1 Electrocapillarity – theory and measurement. 2.2 Charged surfaces such as mercury, silver iodide and oxides. Measurement of surface charge densities. 2.3 Electrokinetic phenomena: concept of zeta potential. 2.4 Surface forces – Van der Waals forces between molecules. Surface energy and Hamaker constant. 2.5Measurement of surface forces. The DLVO theory and beyond. 2.6 Contact angle and its measurements. The line tension. Wetting and wetting transitions. **3. Solid Surfaces** 3.1 Surface stress and surface tension. Determination of surface energy. Surface steps and defects 3.2 Solid – solid interfaces 3.3 Microscopy of Solid surfaces: Optical microscopy, Electron Microscopies, Scanning Probe Microscopy (STM, AFM). 3.4 Diffraction Methods. **4. Adsorption** 4.1 Types of adsorption and adsorption times. Classification of adsorption isotherms. 4.2 Thermodynamics of adsorption.	7 hr 9 hr 6 hr 6 hr

	4.3 Adsorption Models. The potential theory of Polanyi. 4.4 Experimental aspects of adsorption from gas phase. 4.5 Adsorption on porous solids. 4.6 Adsorption from solution. **5. Surfactants, Micelles, Emulsions and Thin films** 5.1 Classification of surfactants. 2.2 Spherical micelles: cmc and influence of temperature. Thermodynamics of micellization. Structure of surfactant aggregates 5.3 Macroemulsions: properties, formation and stabilization. Evolution and aging. Coalescence and demulsification. 5.4 Microemulsions: size of droplets. Elastic properties of surfactant films. Factors influencing the structure of microemulsions.	8 hr
Pedagogy:	Mainly lectures / tutorials. Seminars/assignments/ presentations/ self-study or a combination of some of these could also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	**Text Book** 1. H J Butt, K. Graf and M. Kappl, Physics and Chemistry of Interfaces, Wiley-VCH, 2006. 2. A.W. Adamson and A.P.Gast, Physical Chemistry of Surfaces, New York John Wiley & Sons, 1976. 3. D. Myers, Surfaces, interfaces, and colloids—principles and applications. VCH Publishers, New York, 1991, 4. R. D. Vold and M.J. Vold, Colloid and Interface Chemistry, Addison-Wesley Publishing Company, 1983.	