



**Second Semester 2020 - 2021**  
**Course Handout**

**Date: 16/01/2021**

*In addition to Part I (General Handout for all courses appended to the Time Table) this portion further specific details regarding the course.*

**Course No. : CHE F498 (3 0 3)**  
**Course Title : Colloids and Interface Engineering**  
**Instructor-in-charge : NANDINI BHANDARU**

**Scope and Objective of the Course:**

This course deals with the application aspects of colloids chemistry and engineering aspects of fluid-fluid and fluid-solid interfaces. Being an interdisciplinary course, its main focus is to present fundamental knowledge of colloids and interfaces to the students. This course underlines that how this knowledge can be used to enhance the efficiency in any application involving surface active agents. Based on the basic principles of chemistry, physics, thermodynamics, fluid mechanics and mass transfer this course covers some frontiers of chemical engineering.

**Text book(s) [TB]**

1. P. C. Hiemenz, and R. Rajagopalan, Principle of colloid and surface chemistry, 3rd edition, Mercel Dekher, N.Y. 1997.
2. Pallab Ghosh, Colloid and Interface Science, 1<sup>st</sup> Edition, PHI Learning, 2009.

**Reference book(s) [RB]:**

1. Tharwat F. Tadros, Applied Surfactants Principles and Applications, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2005.
2. Drew Myers, Surfaces, Interfaces and Colloids, 3<sup>rd</sup> Edition, Wiley, 2006.
3. M. J. Rosen, Surfactants and Interfacial Phenomena, Wiley-Interscience Publication, New York, 2004.

**Course Plan / Schedule:**

Lec. No.	Learning Objectives	Topics to be Covered	Chapter in the Text Book
1	Introduction	Overview of colloidal systems, interfaces and surface	Chapter1 (TB1)
2-6	Surface & Interface tension	Surface and interfacial tension, surface free energy, Surface active agent: Surfactant, Surface Pressure, surface excess and Gibbs equation, Theory of surface tension, contact angle, and wetting. Adsorption at fluid-fluid and fluid-solid interfaces	Chapter 6, 7 (TB1)
7-12	Interfacial & Capillary Phenomena	Laplace equation, Kelvin equation, Young-Laplace equation, Capillary rise, kinetics of capillary rise, Wicking, Capillarity and porosimetry, liquid displacement from capillaries	Chapter 6, 7 (TB1)



13-14	Measurement Techniques	Measurement techniques of surface tension, Interface tension, contact angle, zeta potential, particle size.	TBA
15-20	Colloidal Systems	Colloidal stability. Kinetic theory of colloidal systems: sedimentation, centrifugation, diffusion, Intermolecular forces relevant to colloidal systems: Electrostatic and van der Waals forces. DLVO theory and its applications.	Chapter 2,11, 12 (TB1)
21-23	Association Colloids	Structure of micelles; Thermodynamics of micellization; Solubilization; Mixed micellar properties	Chap 8 (TB1)
24-26	Emulsion, Micro emulsion and foams	Preparation, mechanistic details of stabilization of emulsions; classification and stability of microemulsions; preparation and stability of foams	Chap 8 (TB1), Chap 9 (TB2)
27-32	Advanced Interfacial phenomena	Interfacial rheology and transport process; Surface modification processes and Thin liquid films	Chap 7 & 8 (TB2)
33-36	Nanomaterials	Classification of nanomaterials; Self-assembly; Nanofluidics; Functional coatings; Lithographic techniques	Chap 11 (TB2)
37-39	Industrial Applications	Overview of industrial applications of various interfacial phenomena in the industries.	TBA
40-42	Seminar	Individual presentations by students on PROJECTS	NA

### **Evaluation scheme:**

Sl. No .	Evaluation Component	Duration (Minutes)	Weightage%	Date & Time	Nature
1	Mid Semester Test	90	30 %	02/03 3.30 - 5.00PM	OB
2	Class Test (2)	15	10 %	Evenly spaced throughout the semester	
3	Assignment (1)	TBA	10%		
4	Project Seminar (1)	TBA	15 %		
5	Comprehensive Exam	120	35 %	05/05 AN	OB

#### **All these components are OPEN BOOK**

- A student will be likely to get “NC”, if he / she doesn’t appear / appear for the sake of appearing for the evaluation components / scoring zero in pre-comprehensive total.
  - **Chamber consultation hour and mode** will be announced in the class.
  - The **notices**, if any, concerning the course, will be displayed in CMS /Google Classroom.
  - **Make-up** will be granted for **genuine cases only**. Prior permission of IC is compulsory.
- **Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.**

**Nandini Bhandaru**  
Instructor-in-charge | CHE F498

