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**Second Semester 2021 - 2022**

**Course Handout**

**Date: 15/01/2022**

*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 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, 1st 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, 3rd Edition, Wiley, 2006.
3. M. J. Rosen, Surfactants and Interfacial Phenomena, Wiley-Interscience Publication, New York, 2004.

**Course Plan / Schedule:**

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| --- | --- | --- | --- |
| **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:**

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| **Sl. No.** | **Evaluation Component** | **Duration**  **(Minutes)** | **Weightage%** | **Date & Time** | **Nature of Component** |
| 1 | Mid Semester Test | 90 | 30 % | 16/03 11.00am to12.30pm | OB |
| 2 | Class Tests (2) | 15 | 20 % | Evenly spaced throughout the semester | OB |
| 4 | Project Seminar (1) | TBA | 15 % | OB |
| 5 | Comprehensive Exam | 120 | 35 % | 19/05 AN | OB |

* 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 ǀ CHE F498**