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**SECOND SEMESTER 2023-2024**

# Course Handout Part II

Date: 09-01-2024

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* : CHEM F223

## Course Title : Colloid and Surface Chemistry

## Instructor-in-Charge : Dr. Ramakrishnan Ganesan

**1. Scope and Objective of the Course:** This course gives a comprehensive understanding about the intermolecular forces, dynamics, stability and characterization of colloids such as membranes, microemulsions and vesicles. The course will brief about the formulation, characterization and applications of such colloidal systems. The course will give an insight on the electrostatic forces prevailing on surfaces that give rise to stability and surface properties. In addition, this course will provide a brief overview on surface modification, its characterization and applications.

**2. Textbooks:**

**T1: Pallab Ghosh**, ‘Colloid and Interface Science’, 2009.

**T2: Drew Myers**, ‘Surfaces, Interfaces, and Colloids: Principles and Applications’, Wiley, Second Edition, 1999.

**T3: I. N. Levine,** “Physical Chemistry”, 5th Edition, Tata McGraw-Hill, 2011.

**3. Reference books**

**R1: Paul C. Hiemenz and Raj Rajagopalan,** Principles of Colloids and Surface Chemistry, 3rd Edition, Marcel Dekker Inc, USA, 1997.

* ***The syllabus also includes lecture notes***

**4. Course Plan:**

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| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1-2 | Basics; surface free energy | Surfaces, Colloids and Interfaces | T1: Chapter 1; T2: Chapter 1 and 2 |
| 3-6 | Sedimentation, Brownian motion, Osmotic pressure, Gold number | Properties of Colloid Dispersions | T1: Chapter 2 |
| 7-10 | Structural requirements of surface activity, classifications and building blocks of surfactants | Surface activity and surfactant structures | T1: Chapter 3; T2: Chapter 3 |
| 11-13 | Surface mobility in solids, surface tension, interfacial tension, contact angle and their measurements | Surface and interfacial tension | T1: Chapter 4; T2: Chapter 7 and 8; R1: Chapter 6 |
| 14-17 | van der Waals Forces, (Kessom, Debye, and London Interactions) | Intermolecular forces | T1: Chapter 5; T2: Chapter 4; T3: 14.15, 22.10 |
| 18-22 | Charged colloids, Sources of Interfacial Charge, Electrostatic Theory: Coulomb’s Law, Electrokinetic Phenomena | Electrostatic Forces and the Electrical Double Layer | T1: Chapter 5; R1: Chapter 11 and 12 |
| 23-28 | Mechanism for colloid formation, rules and sources of colloidal stability and coagulation, Association colloids (Micelles, vesicles and membranes & catalysis by micelles) | Colloids and colloidal stability | T2: Chapter 10 |
| 29-33 | Formation, mechanistic details of stabilization and relationship between HLB and solubility parameter | Emulsions, microemulsions and foams | T1: Chapter 11 and 12; T2: Chapter 9 |
| 34-37 | Properties of monolayers, Langmuir-Blodgett films, Surface diffusion | Monolayers and thin liquid films | T1: Chapter 8 |
| 38 | Synthesis, surface modification and their applications | Nanomaterials | T1: Chapter 11 |
| 39-40 | Lab components based on some topics discussed in the lectures. | Experiments on (1) contact angle measurements, (2) particle size analysis, and (3) nanoparticle synthesis | Procedures of the experiments will be provided |

**5. Evaluation Scheme:**

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| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Mid-sem Test | 90 min | 30 | 14/03 - 2.00 - 3.30PM | Closed Book |
| Quiz\* | **-** | 10 | Continuous | Closed Book |
| Assignments/seminar presentations/practical components† | **-** | 20 | Will be announced by I/C | Open Book |
| Comprehensive examination | 3 hrs. | 40 | 15/05 FN | Closed Book |

\* All the four quizzes are mandatory.

† Lab component includes experiments like contact angle measurements, particle size analysis, and nanoparticle synthesis.

**6. Chamber Consultation Hour:** To be announced.

**7. Notices:** All notices concerning the course will be displayed **only** on the **CMS**.

**8.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.

**9. Make-up Policy:** Make up would be considered only for very genuine reasons.

**INSTRUCTOR-IN-CHARGE**

**CHEM F223**