| Course Type | Course Code | Name of Course | L | T | P | Credit |
|---|---|---|---|---|---|---|
| DE | NCHD505 | Interfacial and Colloidal Phenomena | 3 | 0 | 0 | 3 |

| **Course Objective** |
|---|
| To impart knowledge on fundamentals of interfacial and colloidal phenomena and colloidal interactions between surfaces, particles and surfactants. |
| **Learning Outcomes** |
| Students will gain insight into interfacial and colloidal phenomena and will be able to solve problems encountered in chemical engineering systems. |

| Unit No. | Description of Lectures | Lecture Hrs. | Learning Outcomes |
|---|---|---|---|
| 1. | **Introduction:** Introduction to colloids, interfaces, surfactants and emulsions, micelle formation. | **3** | Introduction to colloids interfaces and surfactants |
| 2. | **Molecular interaction :** Cohesive energy,Lennard Jones potential Charge- Charge, dipole-Charge interactions, Dipole-Dipole interactions van der Waals forces (Keesom, Debye, and London interactions), | **6** | Introduction to molecular interactions and van der wals forces |
| 3. | **Inter-particle forces:** Inter-particle forces for various geometries, Concept of disjoining pressure, Basics of surface tension, Surface and interfacial tension, surface free energy, | **6** | Introduction to interparticle forces and its manifestation through disjoining pressure and surface tension forces |
| 4. | **Surface tension Measurement and Statics:** surface tension for curved interfaces, surface excess and Gibbs equation, theory of surface tension and contact angle and wetting. | **6** | Fundamentals of concept of surface tension measurement techniques and allied theories |
| 5. | **Interface shape under Equilibrium and Flow dynamics**: Young Laplace equation derivation through energy minimization, Interfacial flow, Marangoni flow | **6** | Fundamentals of interfacial shape and flow dynamics |
| 6. | **Surfactants:** Thermodynamics of surfactants, micelles and mixed micellar formations. | **6** | Theoretical knowledge on tthermodynamics of interfaces |
| 7. | **Electrokinetic phenomena:** Electrical phenomena at interfaces, electrical double layer. | **6** | Theoretical knowledge on electro kinetic flows |
| 8. | **Advanced materials:** Advanced and functional interfaces – superhydrophobicity, functional coatings, structural colors, nano– adhesives, nanocomposites. | **3** | Exposure to Advanced and functional interfaces |

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| | **Total** | **42** | |

**Textbooks:**

1. Israelachvilli J.N. (2011) , *Intermolecular And Surface Forces*, Elsevier
2. Hiemenz, P. C., and Rajagopalan, R. (1997), *Principles of Colloid and Surface Chemistry*, Marcel Dekker.
3. Myers, D. (1991), *Surfaces, Interfaces, and Colloids: Principles and Applications*, Wiley.

**Reference books:**

1. Masliyah, J. H. and Bhattacharjee S. (2005),*Electrokinetic and Colloid Transport Phenomena*, Wiley.
2. Rosen, M. J. (2004), *Surfactants and Interfacial Phenomena*, Wiley-Interscience