IIT Mandi
Proposal for a New Course

Course number   : CY-523
Course Name   : Colloids and Interface Science and Technology
Credit Distribution : 3-0-0-3
Intended for   : PG
Prerequisite   : B.Sc./B.Tech. with Chemistry as a subject or consent of the instructor
Mutual Exclusion   : None

1. Preamble:

This course provides the students an understanding of colloidal behaviour, interparticle interactions and interfaces with brief introduction to possible applications of these concepts such as self-assembly, functional materials, nano-composites, super-hydrophobicity, super-glue, etc. which are gaining booming interest in recent years.

2. Course Modules with quantitative lecture hours:

Module 1: Introduction to Colloids (8 Hours)
Introduction: applications and importance of colloid chemistry, definition, classification and physical properties of colloids, colloids in nature, stability of colloids, electrostatic, steric and electrosteric stabilization, synthesis of colloids, self-assembly, micelles, reverse micelles, critical micellar concentration and its determination, interfaces, commonly observed interfacial phenomena, applications, phase diagram, structure and rheology of surfactant solutions

Module 2: Interactions in Colloids (6 Hours)
Origin of van der Waals interactions, van der Waals interactions between particles, Hamaker constant, effect of medium on van der Waals interactions, van der Waals forces in nature.

Module 3: Colloid Polymer Interactions (4 Hours)
Colloid-polymer mixtures, phase diagram, polymer-solvent interaction, effect of polymer addition on colloidal dispersion, factors affecting phase behavior, depletion interactions, steric interactions.

Module 4: Electrical Double Layer Interactions (6 Hours)
Surface charge origin, electrical double layer, Helmholtz model, Gouy Chapman model, Debye Huckel approximation, structure of double layer, DLVO theory.

Module 5: Electrokinetics and Particles at Interfaces (4 Hours)
Electrokinetic phenomenon, electrophoretic mobility, zeta potential, Schultz-Hardy rule, colloidal particles at interface, contact angle, HLB.

Module 6: Characterization of Colloids (6 Hours)

Dynamic and static light scattering – Light scattering by objects, Scattering by small and large particles, experimental aspects of light scattering, dynamic light scattering, particle size, particle shape, particle surface functionalization, response to stimuli, particle density, surface area, surface charge, viscosity

Module 7: Advanced Functional Colloids and Interfaces (8 Hours)

Applications of colloids and interface science in superhydrophobic surface, functional coatings, nanocomposites, detergents, personal care products, pharmaceuticals, food, textile, paint and petroleum industries, Particle adsorption to interfaces, energy of attachment, wetting, interaction forces, microstructure and rheology of particle laden interfaces, emulsions and foams.

Laboratory/practical/tutorial Modules: NA

3. Text books:

1. P. C. Hiemenz and R. Rajagopalan, Principles of Colloid and Surface Chemistry, Third Edition Revised and Expanded, CRC Press Taylor & Francis Group, USA, 1997.
2. J. C. Berg, An Introduction to Interfaces and Colloids: The Bridge to Nanoscience, World Scientific, Singapore, 2010.

4. References:

1. J. Israelachvili, Intermolecular and Surface Forces, Third Edition, Academic Press (Elsevier), San Diego, 2011.
2. Principles of Colloid and Surface Chemistry, Paul C. Hiemenz, Marcel Dekker, any edition starting with the 2nd edition, 1986.
3. Interfacial Forces in Aqueous Media, Carel J. van Oss, Marcel dekker or Taylor & Francis, 1994.
4. R. J. Hunter, Foundations of Colloid Science Oxford University Press, New York, 2005.
5. Related journal articles

5. Similarity with the existing courses:
(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	Nil	-	-	-

6. Justification of new course proposal if cumulative similarity content is >30%:

NA