Interfacial Engineering - Video course

COURSE OUTLINE

The course deals with interfacial phenomena and their applications.

The basic concepts of interface and its properties are introduced and their genesis explained from a fundamental scientific viewpoint.

Qualitative and quantitative aspects of interfacial properties and phenomena are both addressed.

Contents:

Concept and definition of interface, Physical surfaces, Surface tension, Kinetics of molecules in the surface, Vapor pressures over curved surfaces.

Excess pressure inside bubbles, Solubility of small droplets, Effect of curvature on surface tension, Total surface energy.

Surface entropy, Molecular theories of surface energy, Interfacial tension, Interfacial entropy.

Cohesion and adhesion, Spreading of one liquid on another, Kinetics of spreading.

Spreading from solids, Relations between surface and interfacial tensions.

Gibbs' treatment, Antonoff 's relationship, Oil drops on water.

Theory of contact angles, Magnitudes of contact angles of liquids on solids, Spreading coefficients, Adhesion of liquids to solids.

De-wetting by surface active agents, Contact between two liquids and a solid, Measurements of surface and interfacial tensions.

Distribution potentials, Diffusion potentials, Interfacial and surface potentials, Properties of monolayers, Surface pressure, Surface viscosity.

Compressional moduli of monolayers, Shear elastic moduli, Yield values of monolayers, Diffusion in monolayers.

Fibers from monolayers, Reactions in monolayers and emulsions, Complex formation in monolayers, Penetration into monolayers.

Mass transfer across interfaces, Colloids, Emulsions, Foams, Polyaphrons, Crystallization, Froth flotation, Detergency.

COURSE DETAIL

S.No	Topics	No. of Hours
1	Introduction.	1
2	Surface tension and kinetics of surface molecules.	1

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Chemical Engineering

Pre-requisites:

Transport Phenomena, Chemical Engineering Thermodynamics, Mass Transfer.

Additional Reading:

1. Evans, D.F., Wennerstrom, H., The Colloidal Domain, Wiley-VCH, (1999).
2. Myers, D., Interfaces and Colloids, Wiley-VCH, Inc., (1999).
3. Israelachvili, J.N., Intermolecular and Surface Forces, Academic Press, (1991).
4. Davis, H.T., Statistical Mechanics of Phases, Interfaces, and Thin Films, Wiley-VCH, (1996).

Coordinators:

Prof. A.N. Bhaskarwar
Department of Chemical EngineeringIIT Delhi

3	Effect of curvature on physical properties, General Kelvin Equation.	2
4	Surface energy and entropy, and molecular theories.	2
5	Interfacial tension and entropy.	2
6	Cohesion and adhesion, Spreading of one liquid on another.	2
7	Kinetics of spreading, Spreading from solids.	2
8	Relations between surface and interfacial tensions, Gibbs' treatment, Antonoff 's relationship.	1
9	Oil drops on water, Theory of contact angles, Magnitudes of contact angles of liquids on solids.	2
10	Spreading coefficients, Adhesion of liquids to solids, De-wetting by surface active agents, Contact between two liquids and a solid.	1
11	Measurements of surface and interfacial tensions.	4
12	Measurements of contact angles and spreading coefficients.	2
13	Distribution potentials, Diffusion potentials, Interfacial and surface potentials, Components of surface potential due to an electrically neutral monolayer, Gouy theory.	6
14	Properties of monolayers, Surface pressure, Surface viscosity, Compressional moduli of monolayers, Shear elastic moduli, Yield values of monolayers, Diffusion in monolayers, Fibers from monolayers.	7
15	Reactions in monolayers and emulsions, Complex formation in monolayers, Penetration into monolayers.	3
16	Mass transfer across interfaces.	2
17	Disperse phase systems: Colloids, Emulsions, Foams, Polyaphrons; Surface and Interfacial Processes:Crystallization, Froth flotation, Detergency.	2
	Total	42

References:

1. Davies, J.T., Rideal, E.K., Interfacial Phenomena, Academic Press, (1963).
2. Sebba, F., Foams and Biliquid Foams, Aphrons, Wiley, (1987).
3. Alberty, R.A., and Daniels, F., Physical Chemistry , Wiley, (1975).
4. Slattery, J.C., Interfacial Transport Phenomena, Springer, (1990).