KINGDOM OF SAUDI ARABIA
Ministry of Education
Al-Imam Mohammad Ibn Saud Islamic University
College of Sciences
Department of Chemistry

المملكة العربية السعودية
وزارة الـتـعـلـيـــم
جامعة الإمام محمد بن سعود الإسلامية
كلية العلوم
قسم الكيمياء

SYLLABUS

A. Course Description

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Language
CHM	345	**Colloids and Surface Chemistry**	4	2	2	1	8	CHM 242	6	**English**

This course gives knowledge about Colloidal State of matter: Classification, preparation and physical properties, Electro kinetic phenomena; Colloidal electrolytes and their uses, Emulsion; preparation, properties, stability and use. Surface Chemistry: Solid surfaces and their characterization; Adsorption on solid surfaces: technique for measurement of adsorption from gas phase and solution; Langmuir, Freundlich and BET adsorption isotherm: Enthalpy of adsorption; Adsorption on liquid surface. Gibb's adsorption equation; Surface film; Electro-capillary phenomena.

At the end of this course the student will be able to:

- Describe the basic principles of colloids preparation, purification, theory of stability, instability and main types of stabilization.
- Outline the electro-kinetic and optical properties of colloids.
- Define surface chemistry and adsorption desorption process.
- List techniques for measurement of adsorption from gas phase and solution.
- Analyze data and results through analytical thinking, with evaluation of the gained information.
- Operate laboratory instruments, and diagram and illustrate experimentally obtained data.

B. References: Required Textbook & Internal Website

I shall use

- ***Principle of Colloids and Surface Chemistry.*** Duncan J. Shaw, (4th Ed.), Liverpool Polytechnic, ISBN 07506 11820.

Students are required to purchase the textbook/materials (it is an obligation). The book contains the lecture notes as well as activities for the students to take part in; the book serves as a workbook. Other references:

- ***Colloid Science: Principles, Methods and Applications***, Terence Cosgrove, Blackwell, 2005,ISBN: 978-1-4443-2020-6
- ***Principle of Colloids and Surface Chemistry***, Paul C. Hiemenz, Raj Rajagopalan,(3rd Ed.), CRC, 1997,ISBN 9780824793975

Google Classroom Webpage: http://www.imamm.org/

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C. Topics Outline

Disclaimer: **Disclaimer:** this is a very fast-paced course. There will be little time—if any—for review. What follows is an approximate outline of the pace of the course. We may go faster or slower, contingent on the class response. The tentative list of topics to cover:

a. Theory:

1. History, component, dispersed phase, dispersion medium, micelles, aggregation, classification, Lyophilic , Lyophobic properties, Tyndall effect, Brownian movement, Adsorption, Electrical charge, Zeta potential, electrophoresis. Preparation, dispersion method, Bredig's Electric Arc, mechanical dispersion, Ultrasonic Dispersion, peptization dispersion, Condensation or Aggregation Methods, Lowering of solubility by exchange of solvent, Passing vapours of an element into a liquid, Excessive cooling, Preparation of colloidal sol by chemical methods. Purification, Dialysis, Electrodialysis, Ultra-filtration, Ultra-centrifugation; Application and chemical impact, Removal of dirt from sewage, Leather tanning, Laundry, medicine, Colloid Chemistry

2. Sedimentation: driving force, liquid resistance, frictional coefficient, Stoke's law, sedimentation rate. Brownian motion, random walk, Brownian displacement equation, Diffusion, rate of diffusion, Fick's first law, diffusion coefficient, average translational kinetic energy, Einstein's equation. Ultracentrifuge, centrifugal force, sedimentation velocity, sedimentation coefficient, sedimentation coefficient, sedimentation-diffusion equilibrium, Charge effects. Colligative properties, Osmotic pressure, Van's Hoff's law The Donnan membrane effect, viscosity.

3. Light scattering: Tyndall effect, turbidity, size and shape, Debye scattering, Rayleigh scattering, Molar Masses, Doppler Broadening; Ultramicroscope. micro electrophoresis, particle charge, resolution Electronmicroscope, the resolving power, the limit of resolution,

4. Theory of stability, instability, main types of stabilization, Van der Waals attractive interactions, Hamaker constants; DLVO Theory, Electrostatic stability, Electric double layer, resultant (total) potential, conditions for colloid stability, thermodynamic and kinetic aspects

5. Introduction, Bulk, surface, Adsorption, adsorbate, adsorbent, Desorption, Occlusion, absorption, Physisorption, Chemisorption, surface area, Temperature, pressure, Applications Adsorption at Solid Liquid interface, Adsorption at Solid Gas interface, specific surface area. Adsorption isotherm, thermodynamic consideration, equilibrium, Henry's equation, Freundlich isotherm, Langmuir isotherm, Potential theory of adsorption, Dubinin-Radushkevich, The BET theory, Capillary condensation, Pores classification, surface tension

b. Practical:

Safety and Laboratory equipments and measurements and How to make a report, Preparation of colloid solutions and measure their optical properties. Determination of the flocculation value of $Fe(OH)_3$ sol, Emulsion and emulsifying agent and determination of stability, Determination of the type of emulsion, Determination of critical micelle concentration of sodium dodecyl sulphate (SDS) from the measurement of conductivities, Viscosity: Part 1: Determination of the time of flow for a given pure solvent., Part 2: Determination the radius of a molecule (glycerol)., Determination of the molecular mass of polyvinyl chloride from viscosity, Surface Tension of Liquids, Determination the surface adsorption of amyl alcohol (or tween 80) from aqueous solutions using capillary rise method. Determination of the adsorption isotherm of oxalic acid on bone charcoal., Determination of Heat of Adsorption of Acetic Acid on Charcoal, Analysis of the experimental data obtained in Lab 11 and Lab 13.

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D. Exams & Grading System

The semi-official dates of the exams for this course, with all the caveats, that the word "semi-official" entails, can be found here:

– **Midterm 1:** 6th or 7th week   &**Midterm 2:**11th or 12th week

– **Quizzes& Homework: During the semester**

Your course grade will be based on Final Exam, Midterms, Homework, Quizzes, Participation, Attendance and Project.

Midterm 1: 10 %	**Midterm 2:** 10 %	**Laboratory:** 30%	**Final Exam:** 40 %
Quizzes; Homework & Attendance & Participation:10 %			

Grading distribution:

A+: [95, 100], A: [90, 95), B+: [85, 90), B: [80, 85), C+: [75, 80), C: [70, 75), D+: [65, 70), D: [60, 65), F: [0, 60).

E. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

Executive Rules for Study Regulations and Examsgoo.gl/ykm7t3

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