Course Syllabus

1	**Course title**	Colloid and Surface Chemistry
2	**Course number**	303442
3	**Credit hours**	3
	Contact hours (theory, practical)	3 (theory)
4	**Prerequisites/corequisites**	Physical chemistry 2 (341)
5	**Program title**	Chemistry
6	**Program code**	N/A
7	**Awarding institution**	N/A
8	**School**	Science
9	**Department**	Chemistry
10	**Course level**	Senior
11	**Year of study and semester (s)**	4
12	**Other department (s) involved in teaching the course**	----
13	**Main teaching language**	English
14	**Delivery method**	x Face to face learning ☐Blended ☐Fully online
15	**Online platforms(s)**	☐Moodle Microsoft Teams ☐Skype ☐Zoom ☐Others……
16	**Issuing/Revision Date**	Jan / 2024

17 Course Coordinator:

Name **Abeer Al Bawab**: Contact hours: Monday/Wed. 10-12

Office number: CM 34 Phone number: 0796661601

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18 Other instructors:

Name: N/A	Office number N/A
Phone number: N/A	Email: N/A

19 Course Description:

As stated in the approved study plan.

Introduction to colloid and surface chemistry; system stability; instruments used in colloid and surface chemistry; sedimentation and diffusion; viscosity; surface tension; and light scattering; colloidal structure in surfactant solution; emulsions and microemulsions and their applications.

20 Course aims and outcomes:

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A- Aims

Course Aims:

- To provide students with a comprehensive understanding of colloid and surface chemistry principles.
- To explore the biological and technological significance of colloids and their applications.
- To develop analytical and practical skills in the characterization and manipulation of colloidal dispersions.

Course Outcomes:

1. Introduction to the Nature of Colloidal Solutions:
   - Explore the forces involved in colloidal stability.
   - Classify different types of colloidal systems.
   - Understand the link between colloids and surfaces, emphasizing wetting properties and industrial importance.
2. Characterization of Colloidal Dispersions:
   - Understand the nature of the colloidal state and its significance.
   - Identify lyophilic and lyophobic colloids.
   - Demonstrate knowledge of the preparation and purification of special colloidal suspensions.
3. Microscopic Colloidal Behavior:
   - Explain Brownian motion, diffusion, and their role in colloidal systems.
   - Analyze the stability and instability of colloids through coagulation and flocculation.
   - Evaluate the impact of polymers on colloid stability.
4. Determination of Particle Size:
   - Utilize various methods for determining particle size, including microscopy, sedimentation, and light scattering.
   - Summarize different sizing methods and their applications.
5. Flow Behavior:
   - Define rheological quantities such as viscosity and elasticity.
   - Analyze Newtonian and Non-Newtonian flow behavior and the parameters affecting viscosity.
6. Surface Tension and Wetting:
   - Derive the Laplace pressure and explain surface tension and surface energy.
   - Demonstrate methods for determining the surface tension of liquids.
   - Understand capillary rise, the Kelvin equation, and surface energy of solids.
7. Thermodynamics of Adsorption:
   - Explain basic surface thermodynamics.
   - Derive the Gibbs adsorption isotherm and determine surfactant adsorption densities.
8. Surfactants and Self-Assembly:
   - Introduce surfactants and their common properties.
   - Analyze the thermodynamics of surfactant self-assembly.
   - Understand the structures formed during surfactant self-assembly.
9. Emulsions and Microemulsions:
   - Identify conditions required for emulsion and microemulsion formation.
   - Explore applications of emulsions in polymerization, photographic emulsions, and food science.
10. Van der Waals Forces and Colloid Stability:
    - Trace the historical development of van der Waals forces and the Lennard-Jones potential.
    - Understand the DLVO theory of colloid stability and the factors influencing flocculation

B- Students Learning Outcomes (SLOs):

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Student Learning Outcomes:

By the end of the course, students should be able to:

1.Understanding the concept of colloid science and describing and differentiate between lyophilic and lyophobic colloids

2. Apply various methods to characterize colloidal dispersions and determine particle size

3.Analyze microscopic colloidal behavior, including Brownian motion and coagulation

4. Understand the rheological behavior of colloidal systems and the factors affecting viscosity

5. Explain the forces involved in colloidal stability and their role in different types of colloidal systems.

6. Derive and apply the concepts of surface tension, Laplace pressure, and surface energy

7. Apply basic surface thermodynamics to understand adsorption and surfactant behavior

8. Analyze the thermodynamics of surfactant self-assembly and describe self-assembled structures.

9. Evaluate the conditions required for emulsion and microemulsion formation and their applications

10. Explain the historical development of van der Waals forces and DLVO theory and their role in colloid stability

CLO / CLOs of the course	SLO (1)	SLO (2)	SLO (3)	SLO (4)	SLO (5)	SLO (6)	SLO (7)	SLO (8)	SLO (9)	SLO (10)
CLO (1)	✓									
CLO (2)		✓								
CLO (3)			✓							
CLO (4)				✓						
CLO (5)					✓					
CLO (6)						✓				
CLO (7)							✓			
CLO (8)								✓		
CLO (9)									✓	
CLO (10)										✓

Upon successful completion of this course, students will be able to

1. Understanding the concept of colloid science and describing and differentiate between lyophilic and lyophobic colloids.
2. Apply various methods to characterize colloidal dispersions and determine particle size.
3. Analyze microscopic colloidal behavior, including Brownian motion and coagulation.
4. Understand the rheological behavior of colloidal systems and the factors affecting viscosity.
5. Explain the forces involved in colloidal stability and their role in different types of colloidal systems.
6. Derive and apply the concepts of surface tension, Laplace pressure, and surface energy.
7. Apply basic surface thermodynamics to understand adsorption and surfactant behavior.
8. Analyze the thermodynamics of surfactant self-assembly and describe self-assembled structures.
9. Evaluate the conditions required for emulsion and microemulsion formation and their applications.
10. Explain the historical development of van der Waals forces and DLVO and their role in colloid stability.

21. Topic Outline and Schedule:

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
1	1.1	Nature of colloidal state	CLO-1	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	1.2	Types of colloidal systems	CLO-1	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Pashly and Hunter

	1.3	The link between colloids and surfaces	CLO-1	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Pashly and Hunter
2	2.1	Lyophilic & lyophobic colloids	CLO-1	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	2.2	The force involved in colloidal stability	CLO-2	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	2.3	Preparation of special colloidal suspensions	CLO-2	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
Week	**Lecture**	**Topic**	**Student Learning Outcome**	**Learning Methods (Face to Face/Blended/ Fully Online)**	**Platform**	**Synchronous / Asynchronous Lecturing**	**Evaluation Methods**	**Resources**
3	3.1	Biological and technological significance of colloids	CLO-2	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	3.2	Purification procedures	CLO-2	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	3.3	Maintaining clean surfaces & Wetting properties and their	CLO-2	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter

		industrial importance						
4	4.1	Brownian motion and diffusion	CLO-3	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	4.2	**Determination** of Particle Size	CLO-4	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	4.3	Microscopy & **Sedimentation** methods	CLO-4	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
5	5.1	Electrical pulse counting Light scattering methods	CLO-3	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	5.2	**Coagulation** and flocculation-stability and instability	CLO-3	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	5.3	Effect of polymer on colloid stability	CLO-3	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
6	6.1	**Introduction to** surfactants &	CLO-8	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly

		Common properties of surfactant solutions						and Hunter
	6.2	Thermodynamics of surfactant self-assembly	CLO-8	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	6.3	-Self-assembled surfactant structures -Surfactants and detergency	CLO-8	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
7	7.1	The conditions required to form emulsions and Microemulsions	CLO-9	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	7.2	Emulsion **polymerization** and the production of latex paints	CLO-9	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	7.3	**Photographic** emulsions & -Emulsions in food science	CLO-9	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
8	8.1	Flow Behavior & Definitions of rheological quantities	CLO-5	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter

		& Viscosity/ elasticity/ Deformation / shear stress / shear rate						
	8.2	Parameters which change the viscosity; Temperature / shear rate/ time/ pressure	CLO-5	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	8.3	Newtonian and Non-Newtonian flow behavior	CLO-5	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
9	9.1	Surface Tension and Wetting	CLO-6	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	9.2	The equivalence of the force and energy description of surface tension and surface energy	CLO-6	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	9.3	Derivation of the Laplace pressure	CLO-6	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter

10	10.1	Methods for determining the surface tension of liquids Capi llary rise and the free energy analysis	CLO-6	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	10.2	The Kelvin equation	CLO-6	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	10.3	The surface energy and cohesion of solids & The contact angle	CLO-6	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
Week	**Lecture**	**Topic**	**Student Learning Outcome**	**Learning Methods (Face to Face/Blended/ Fully Online)**	**Platform**	**Synchronous / Asynchronous Lecturing**	**Evaluation Methods**	**Resources**
11	11.1	Thermody namics of adsorption	CLO-7	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	11.2	Basic surface thermodyna mics	CLO-7	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	11.3	Derivation of the Gibbs adsorption isotherm	CLO-7	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
12	12.1	Students presentation		**Face to Face**	Power point + VLC	NA	Attendance + HW +	Textbook by Pashly

							Quizzes + Exam	and Hunter
	12.2			**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	12.3			**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
13	13.1			**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	13.2			**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	13.3			**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
14	14.1	Historical devlopment of van der Waals forces and the Lennard-Jones potential	CLO-10	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	14.2	Historical developmen t of van der Waals forces and the Lennard-Jones potential (2)	CLO-10	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter

	14.3	Van der Waals Forces and Colloid Stability		**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
15	15.1	Van der Waals forces between macroscopic bodies	CLO-10	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	15.2	Flocculation	CLO-10	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter
	15.3	The DLVO theory colloid stability	CLO-10	**Face to Face**	Power point + VLC	NA	Attendance + HW + Quizzes + Exam	Textbook by Pashly and Hunter

22 Evaluation Methods:

Opportunities to demonstrate achievement of the SLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	SLOs	Period (Week)	Platform
Homework	10	All	All	2 + 7 + 13	Face to Face
Presentation	10	All	All	Week 10	Face to Face
Mid	30	Half materials	Half	7	Face to Face
Final	50	All	All	15	Face to Face

23 Course Requirements

(e.g: students should have a computer, internet connection, webcam, account on a specific software/platform…etc): in specific lectures computer and internet connection

24 Course Policies:

(each item are applied according to the university rules)

A- Attendance policies: Regular attendance is essential for satisfactory completion of this course *only percent of 20% lectures' absence is allowed from face-to-face lectures.*

B- Absences from exams are allowed but with excesses and submitting assignments should be on time: (Instructors must offer reasonable assistance in making up missed work in case the student has reasonable excuse)

C- Health and safety procedures: NA

D- Honesty policy regarding cheating, plagiarism, misbehavior: Students are always advised to follow the instructions of the lectures and the exam.

E- Grading policy: personally (Grade System by Prof.)

F- Available university services that support achievement in the course: Data Show and smart boards

25 References:

A- Required book(s), assigned reading and audio-visuals:

Textbook: 1) Principles of colloid and surface chemistry by Pashly

2) Fundamentals of colloid and surface chemistry by Hunter

Videos and audio from the instructor and from outside resources.

B- Recommended books, materials, and media:

26 Additional information:

Name of Course Coordinator: -Prof Abeer Al Bawab ---Signature: ------

Abeer Al-Bawab

Date: Jan 10 2024 -

Head of Curriculum Committee/Department: ---------- Signature: ----------

Head of Department: ---------- Signature: ----------

Head of Curriculum Committee/Faculty: ---------- Signature: ----------

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Dean: ---------- Signature: ----------
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