

2023/2024. ACADEMIC YEAR	
PROGRAM OF STUDY (FOR STUDENTS OF 2ND YEAR)	
Full (Hun) name of the subject: Kolloidika (elmélet+gyakorlat)	
Program: Undivided program (pharmaceutical)	
Schedule: fuul-time	
Short name of the subject:	
English name of the subject: Colloid Chemistry (theory+practice)	
German name of the subject: Kolloidik (Vorlesung+Praktikum)	
Type of registration: obligatory/obligatory elective/elective/criteria requirement	
Neptun code of the subject: GYKGYI072G1A	
Responsible Department: Semmelweis University, Department of Pharmaceutics	
Responsible tutor Angéla Jedlovsky-Hajdú, PhD Krisztina Ludányi, PhD Contact information: Laboratory of Nanochemistry, Department of Biophysics and Radiation Biology, Semmelweis University - phone: +36-20-666-30-40 - email: hajdu.angela@semmelweis.hu Department of Pharmaceutics, Semmelweis University - phone: +36-20-666-33-38 - email: ludanyi.krisztina@semmelweis.hu	Title, academic degree: associate professor, PhD associate professor, PhD
Name of the persons responsible for the teaching of the subject: Dr. Angéla Jedlovsky-Hajdú Dr. Krisztina Ludányi Dr. István Antal Dr. Andrea Kovács Dr. Kristóf Molnár Dr. Bálint Basa Dr. Livia Budai Dr. Budavári Bálint Halmóczy Sarolta Pálos Veronika	Title, academic degree: associate professor, PhD associate professor, PhD full professor, PhD assistant professor, PhD assistant professor, PhD PhD student assistant professor, PhD PhD student PhD student PhD student
Class per week: 2 hours lectures 2 hours practices	Credit point(s): 4 credits
Professional content, intent of acquirement and it's function in order to implement the goals of the program: In the lectures, pharmacy students learn about the basic physical and chemical properties, characteristic (intermolecular and interparticular) interactions of nanometer-sized colloidal particles (macromolecules, micelles and microphases), and the factors influencing the stability and structure of simple and complex colloidal systems.	
Short description of the subject: Colloidal particles, colloidal systems. Properties and stability characterization of macromolecular and association colloidal solutions, colloidal and coarse dispersions. Flocculation, stabilization. Characterization of interfaces, interfacial phenomena, wetting, surface activity. Determination of the size and shape of colloidal particles. Electrokinetic phenomena. Rheology of colloidal systems. Relationship of rheological properties to structure.	

Course data							
Recommend ed term	Contact hours (lecture)	Contact hours (practice)	Contact hours (seminar)	Individu al lectures	Total number of contact hours/sem ester	Normal course offer	Consult ations
3rd semester	2	2			56	<u>Autumn semester*</u> Spring semester Both semesters (* Please underline)	up to the studen ts requir ement

Topics of theoretical classes (pro week):

1. Homogeneous, heterogeneous and colloidal systems: Classification of colloidal systems (lyophobic, lyophilic). Intermolecular and interparticle (electrostatic and steric) interactions. Colloidal dispersed and cohesive systems.
2. Macromolecular colloids: Macromolecular colloids: macromolecules of natural origin and synthetic macromolecular compounds. Solubility of macromolecules, thermodynamic basis of solution formation, determination of polymer molecular weight, size and shape of macromolecules, pharmaceutical relevance. Characterization and interactions of dissolved macromolecules. Polyelectrolytes. Their use from a pharmaceutical point of view.
3. Association colloids: Molecular structure and types of amphiphilic compounds. Equilibrium and thermodynamic conditions of micelle formation. Physicochemical properties of surfactant solutions. Solubilization. Properties of self-organizing systems (large micelles, vesicles).
4. Characterization of interfaces: Composition of boundary layers. Intermolecular forces, interfacial (excess) energy. Thermodynamic instability. Langmuir Blodgett technique nowadays. Capillarity. Wetting phenomena upon contact of condensed phases.
5. Adsorption: Energy changes of adsorption processes, thermodynamic driving force, adsorption enthalpies. Surface excess, adsorbed amount. Characterization, structural analysis and medical use of adsorbents.
6. Electrical properties of interfaces: The structure and potential of the electric double layer. Electrokinetic phenomena. The role of zeta potential in pharmaceutical applications.
7. Colloidal and coarse dispersions: Kinetic stability and particle aggregation. Preparation of dispersions by condensation. Control of the degree of dispersity. Preparation of coarse dispersions by dispersion. Mechanism of steric stabilization. Flocculation with electrolytes.
8. Principles of determining of the size and shape in case of colloidal particles: Diffusion, sedimentation. Influence of particle size distribution on the effectiveness of dosage forms. DLS (dynamic light scattering measurement), NTA (nanotracking analysis), DSC (differential centrifugal sedimentation).
9. Emulsions, microemulsions: Stability, regulation of distribution and coalescence constancy. Regularities of stabilization of emulsions and creams.
10. Suspensions: Properties, adhesion forces. Stability of suspensions.
11. Aerosols, gas dispersions, foams: Properties, examinations.
12. Rheology of colloidal systems: Basic rheological functions. Relationship of rheological properties to structure: ideally flexible, viscous and plastic materials. Flow curves of colloidal systems. Rheological properties of emulsions, suspensions, creams, gels, ointments. Determination and control of viscosity and limit of flow.
13. Modern Colloid Chemistry: Industrial Researches.
14. Written test

<p>Topics of practical classes (pro week):</p> <ol style="list-style-type: none"> 1. Introduction, methods. Aspects of evaluation of measurements, laboratory order 2. Determination of molecular weight of polymers with a capillary viscometer 3. Examination of silica gel, gelatin and agar swelling based on volume and mass increase, effect of pH on gelatin swelling 4. Determination of the critical micelle concentrations of surface active agents by stalagmometry and Donnan's pipette 5. Determination of the isoelectric point of gelatin with a capillary viscometer 6. Determination of critical micelle concentration by conductometric titration 7. Determination of the solubility of benzoic acid 8. Calculation, consultation 9. Written test 10. Preparation and investigation of monomolecular films (Pockels' experiment), Determination of contact angle based on a photograph 11. Preparation of AgI sol and determination of critical coagulant concentration in the presence of NaCl 12. Study of type and conversion of oil-water emulsion 13. Rotational and oscillatory rheometric measurements 14. Retake practice, consultation, Correction/replacement of written tests
<p>Other subjects (both compulsory and optional) relating to the transversal issues of the subject. Possible overlaps between subjects:</p> <p>Physical Chemistry for Pharmacists, Nanotechnology</p> <p>There is no overlap</p>
<p>Schedule of consultations: According to individual student demand, at an agreed time.</p>
<p>Course requirements</p>
<p>Prerequisites:</p> <p>Physical Chemistry for Pharmacists</p> <p>Biophysics II.</p>
<p>Conditions of attending the classes, amount of acceptable absents, way of presentation of leave, opportunity for makeup:</p> <p>Absences can be accepted according to the Examination and Studies Regulation.</p> <p>Up to 25% of the practices (3 practices) can be missed, in the event of an additional absence, the head of the institute/head of subject determines the conditions of signing and the order of replacement.</p>

The grading method; the conditions for getting the signature; the number, topic(s) and date(s) of the mid-term assessments, (reports, term tests), and the process in which they contribute to the final grade; and the possibility of their retake or their upgrading retake (as provided in §§ 25-28 of the STUDY AND EXAMINATION REGULATIONS):

The 2 test written during the semester is based on the lectures and on the practice materials: the first written test must be completed on practice during the week 9th and the second test on lecture on week 14th. Each student completes the first written test in their own practice time. We provide two options per test to replace/improve the written tests. In the case of a correction, the result of the correction overwrites the result of the previous score.

Completing the practices and uploading the reports to the Moodle system:

- Detailed theoretical background of the practices is presented in the lectures.
 - It is not mandatory to complete all the practices, but the uncompleted practices (max. 3 practices) will be evaluated with 0% and will be included in the percentage of the average of practices. The Department provides an opportunity to make up the missing practices at the end of the semester, during the retake practice.
 - The student must arrive for the practice with a pre-prepared report that corresponds to the issued form (address, date, name, principle of measurement in 2-5 sentences).
 - In the practices, the measurement data must be entered in the reports.
 - The practice will be completed when the student has completed the experimental work, entered the measurement data in the report and the instructor confirmed this with a signature and date. Without the signature, the reports cannot be accepted.
 - The lab report is an individual work.
 - Reports are evaluated with % (0-100%).
 - The report containing the title, date, name and group of the student, theoretical background of the practice, measurement data, calculations, results, diagrams, conclusions must be uploaded to the Moodle system by the end of the week following the completion of the practice (Sunday: 24:00) in PDF format. An additional week (with a 30% reduction) is available for uploading reports overdue (Sunday: 24:00). The results of the reports uploaded after that moment will be evaluated 0% (the completion of the practice is accepted, but the result is 0%).
- There is no way to improve practices and reports.

Requirements of signature (as provided for in STUDY AND EXAMINATION REGULATIONS § 29):

At the end of the semester, the subject is completed with a practical mark with at least a sufficient qualification, for which the following conditions must be met:

- the practical reports must be uploaded to Moodle (to the correct group and practice) with the evaluation of the results, at least 50% of the average percentages obtained for the reports must be reached).
- the two written tests must be completed. The result for each test can be worse than 50%, but a minimum of 50% of the average of the two tests must be achieved.

At the end of the semester, the grade is determined as follows:

the percentage result of the two written reports with a double multiplier + the average value obtained for the reports $[(2 \times \text{percentage of the 1st test} + 2 \times \text{percentage of the 2nd test} + \text{percentage of the average of the reports}) / 5]$.

Mark % of average

very good/excellent (5):	90.00-100%
good (4):	80.00-89.99%
fair (3):	63.00-79.99%
sufficient (2):	50.00-62.99%
insufficient (1):	0-49.99%

<p>Number and type of projects students have to perform independently during the semester and their deadlines:</p> <p>Upload laboratory records to the Moodle system on a weekly basis during the semester. The report prepared from the given practice must be uploaded by the end of the following week.</p>
<p>Type of the semester-end examination: signature*/<u>practical grade</u>*/semi-final*/final* (<i>Please underline</i>)</p> <p>Examination requirements: as published by the education-research department on the MOODLE interface by the start of the academic term. The topics of the lectures and practices is the required curriculum.</p>
<p>Form of the semester-end examination: written*/oral*/combined examination/<u>practical examination/the assessment of completing project work (according to STUDY AND EXAMINATION REGULATIONS 30.§)</u>* (<i>Please underline</i>)</p>
<p>The possibility and conditions for offering grades:</p> <p>There is no offering grades.</p>
<p>A list of the basic notes, textbooks, resources and literature that can be used to acquire the knowledge necessary to master the curriculum and to complete the assessments, ****-with exact description about which of them is required to acquire which part of the syllabus (e.g. description based on topics)), as well as the main technical and other aids and study aids that can be used:</p> <ul style="list-style-type: none"> - The lectures are presented in slides in an extracted form, which contain the most important theoretical knowledge. - All material for carrying out the lab experiments and preparing the lab reports would be available on Moodle: protocol template in editable form, sample protocol, lab manuals for the lab practices, including a brief summary of the theoretical background of the experiments, the procedure of the measurements, equations and formulae for calculating the results. <p>Recommended literature</p> <ul style="list-style-type: none"> -Hunter, R.J.: Foundations of Colloid Science, Oxford Univ. Press (2001) -Shaw, D.J.: Introduction to Colloid and Surface Chemistry (1992)
<p>In the case of a subject lasting more than one semester, the position of the teaching/research department on the possibility of parallel enrolment and the conditions for admission****:</p> <p>yes*/no*/on and individual assesment basis* (<i>Please underline</i>)</p>
<p>The course description was prepared by:</p> <p>Angela Jedlovsky-Hajdu (associate professor, PhD) and Krisztina Ludányi (associate professor, PhD)</p>