BULLETIN

UNIVERSITY OF DEBRECEN

ACADEMIC YEAR 2021/2022

FACULTY OF PHARMACY

Coordinating Center for International Education

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CHAPTER 1
INTRODUCTION

The aim of the University of Debrecen is to become a university of medical sciences committed to the prevention and restoration of health of the people, not only in its region but in the entire country. In the past two decades both medical science and health care have entered a new era: the medical science of the 21st century. Molecular medicine is opening up and new possibilities are available for the diagnosis, prevention, prediction and treatment of the diseases. One can witness such a progress in medical sciences that has never been seen before. Modern attitudes in health care should be enforced in practice, including therapeutical approaches that consider the explanation and possible prevention of diseases, and attempt to comprehend and take the human personality into consideration. These approaches demand the application of the most modern techniques in all fields of the medical education.

All curricula wish to meet the challenges of modern times and they embody some very basic values. They are comprehensive; they take into consideration the whole human personality (body and soul) in its natural and social surroundings; and they are based upon the best European humanistic traditions. Moreover, all curricula prepare students for co-operation and teamwork.

With respect to education, both students and teachers are inspired to acquire higher levels of professionalism, precision, and problem solving skills, upon which the foundations of specialist training and independent medical practice can be built. This approach enables the assimilation of new scientific developments, facilitating further education and the continuous expansion of knowledge. The interplay of these factors ensures the ability to understand and handle the changing demands of health care.

With respect to research, the faculty members continuously acquire, internalize and subsume new knowledge, especially concerning the genesis, possible prevention and treatment of diseases. Moreover, new information aimed at improving, preserving and restoring the health of the society is also absorbed. The University of Debrecen is already internationally recognized in the fields of both basic and clinical research, and the clinicians and scientists of the University are determined to preserve this achievement. Special attention is given to facilitate and support the close co-operation of researchers representing basic science and clinical research, and/or interdisciplinary studies.

With respect to therapeutic practice, the main objective is to provide high quality, effective, up to date and much devoted health care to all members of the society, showing an example for other medical institutions in Hungary. One of the primary tasks is to continuously improve the actual standards of the diagnostic and therapeutic procedures and techniques, and to establish regional or even nationwide protocols.

With respect to serving the community, all faculty members wish to play a central role in shaping the policies of the health service; both within the region and in Hungary. They also want to ensure that sufficient number of medical doctors, dentists and other health care experts with university education is provided for the society.

With respect to the development, all employees strive for reinforcing those features and skills of the lecturers, scientists, medical doctors, health care professionals, collaborators and students which are of vital importance in meeting the challenges of medical education, research and therapy of the 21st century. These include humanity, empathy, social sensitivity, team-spirit, creativity, professionalism, independence, critical and innovative thinking, co-operation and management.

The organizational structure, including the multi-faculty construction of the institution, is a constantly improving, colorful educational environment, in which co-operation is manifest between the individual faculties and colleges, the various postgraduate programs as well as the molecular- and medical biology educations.

HIGHER EDUCATION IN DEBRECEN

A Brief History

1235: First reference to the town of Debrecen in ancient charters.
1538: Establishment of the “College of Reformed Church” in Debrecen.
1567: Higher education begins in the College.
1693: Declaration of Debrecen as a “free royal town”.
1849: Debrecen serves as the capital of Hungary for 4 months.
1912: Establishment of the State University of Debrecen comprising the Faculties of Arts, Law, Medicine and Theology.
1918: Inauguration of the Main Building of the Medical Faculty by King Charles IV of Hungary.
1921: The Medical Faculty becomes operational.
1932: Completion of buildings of the campus.
1944: Although during the Second World War, Debrecen became the capital of Hungary again (for 100 days), the University itself is abandoned for a while.
1949: The only year when the University has five faculties.
1950: The Faculty of Law idles; the Faculty of Science is established.
1951: The University is split up into three independent organizations: Academy of Theology, Medical School, Lajos Kossuth University of Arts and Sciences.
1991: The “Debrecen Universitas Association” is established.
1998: The “Federation of Debrecen Universities” is founded.
2000. The federation is transformed into the unified “University of Debrecen” with all the relevant faculties and with some 20,000 students.

Debrecen is the traditional economic and cultural center of Eastern Hungary. In the 16th century Debrecen became the center of the Reformed Church in Hungary and later it was referred to as the "Calvinist Rome". The 17th century was regarded as the golden age of the city because Debrecen became the mediator between the three parts of Hungary: the part under Turkish occupation, the Kingdom of Hungary and the Principality of Transylvania. For short periods of time, Debrecen served twice as the capital of Hungary. Nowadays, with its population of approximately a quarter of a million, it is the second largest city in Hungary.

Debrecen is a unique city: although it has no mountains and rivers, its natural environment is rather interesting. One of the main attractions and places of natural uniqueness in Hungary is Hortobágy National Park, known as “puszta" (“plain”), which begins just in the outskirts of Debrecen. This is the authentic Hungarian Plain without any notable elevations, with unique flora and fauna, natural phenomena (e.g. the Fata Morgana), and ancient animal husbandry traditions. The region is unmatched in Europe, no matter whether one considers its natural endowments or its historic and ethnographic traditions. A very lovely part of Debrecen is the “Nagyerdő” (“The Great Forest”), which is a popular holiday resort. Besides a number of cultural and tourist establishments, luxurious thermal baths and spas, Nagyerdő accommodates the University campus too.

The history of higher education in Debrecen goes back to the 16th century when the College of the Reformed Church was established. The University Medical School of Debrecen has its roots in this spiritual heritage. It was in the year of the millennium of the establishment of Hungary (1896) when the foundation of the present University was decided. The University of Debrecen was established in 1912, initially having four faculties (Faculties of Arts, Law, Medicine and Theology). The University was officially inaugurated by King Charles IV of Hungary on October 23rd, 1918.

The educational activity at the University started in 1924, although the construction of the whole University was completed only in 1932. In 1951 the Faculty of Medicine became a self-contained, independent Medical University for training medical doctors.

The special training of dentists began in 1976. As a further development the University Medical School established the Health College of Nyíregyháza in 1991. In 1993, as part of a nationwide program, the University was given the rights to issue scientific qualifications and new Ph.D. programs were also launched. Several new programs (e.g. the training of molecular biologists, pharmacists, general practitioners) were commenced in the ’90s. The Faculty of Public Health was established in 1999, while the Faculty of Dentistry was founded in 2000.
The Faculty of Medicine celebrated the 90th anniversary of its foundation in October 2008 with a highly successful international scientific conference.

Education at the University of Debrecen
Debrecen, the second largest city of Hungary, is situated in Eastern Hungary. Students enrolled in the various programs (e.g. Medicine, Dentistry, Pharmacy, Public Health, Molecular Biology, etc.) study on a beautiful campus situated in the area called “Great Forest”.
The Hungarian Government gives major priorities to the higher education of health sciences in its higher education policy. One of these priorities is to increase the ratio of college level training forms within the Hungarian higher education system. The governmental policy wishes to implement conditions in which the whole health science education system is built vertically from the lowest (post-secondary or certificate) to the highest (PhD-training) levels. In fact, this governmental policy was the reason behind the establishment of the new Health Science Education Center within the Federation of Debrecen Universities (DESZ), based partially on the intellectual resources of the University of Debrecen. The new programs – with specialized training for paramedics – will help to correct the balance of the Hungarian labor-market that became rather unsettled in the past few decades.
The Act of Higher Education (1993) has restored the rights of the medical universities to award postgraduate degrees and residency, and permission was also given to license Physicians’ procedures. This kind of training required a new structure, a new administrative apparatus, and a suitable training center. The new residency programs were commenced in 1999.
The introduction of the credit system, starting in September 2003, has been mandatory in every Hungarian university, helping the quantitative and qualitative evaluation of the students’ achievements. Admission requirements for Hungarian students are defined at national level, and they are applicable for every student wishing to be enrolled into the Medicine or Dentistry programs.
International students must pass an entrance exam in biology and (depending on their preference) in physics or chemistry. In some special cases it may be possible for the candidates to apply for transfer to higher years on the basis of their previous studies and achievements. International students study in English language. Entrance for certain courses of the Health College is also possible on the basis of a special evaluation (scoring) and an entrance interview.
The syllabuses and classes of all courses correspond to European standards. The total number of contact hours in medical education is over 5,500, which can be divided into three main parts: basic theoretical training (1st and 2nd year), pre-clinical subjects (3rd year) and clinical subjects (4th and 5th year) followed by the internship (6th year). The proportion of the theoretical and practical classes is 30% to 70%; whereas the students/instructors ratio is about 8/1. The first two years of dentistry education are similar to the medicine program, but the former contains a basic dental training that is followed by a three-year-long pre-clinical and clinical training. Besides the medicine and dentistry programs, there are several other courses also available, including molecular biology. The various Health College courses include more and more new curricula.
The Medicine program delivered in English and intended for international students was commenced in 1987; whereas the Dentistry and Pharmacy programs for international students started in 2000 and 2004, respectively. The curriculum of the English language Medicine program meets all the

requirements prescribed by the European medical curriculum, which was outlined in 1993 by the Association of Medical Schools in Europe. Compared to the Hungarian program, the most important differences are:
-Hungarian language is taught,
-More emphasis is laid upon the tropical infectious diseases (as parts of the “Internal Medicine” and “Hygiene and Epidemiology” courses).
Otherwise, the English language curriculum is identical with the Hungarian one. The 6th year of the curriculum is the internship that includes Internal Medicine, Pediatrics, Surgery, Obstetrics and Gynecology, Neurology, and Psychiatry. The completion of these subjects takes at least 47 weeks, although students are allowed to finish them within a 24-month-long period. The successfully completed internship is followed by the Hungarian National Board Examination. Just like the rest of the courses, the internship is also identical in the Hungarian and English programs.
A one-year-long premedical (Basic Medicine) course, which serves as a foundation year, is recommended for those applicants who do not possess sufficient knowledge in Biology, Physics and Chemistry after finishing high school.
After graduation, several interesting topics are offered for PhD training, which lasts for three years. If interested, outstanding graduates of the English General Medicine and Dentistry programs may join these PhD courses (“English PhD-program”). Special education for general practitioners has been recently started and a new system is in preparation now for the training of licensed physicians in Debrecen.

The accredited PhD programs include the following topics:
-Molecular and Cell Biology; Mechanisms of Signal Transduction
-Microbiology and Pharmacology
-Biophysics
-Physiology-Neurobiology
-Experimental and Clinical Investigations in Hematology and Hemostasis
-Epidemiological and Clinical Epidemiological Studies
-Cellular- and Molecular Biology: Study of the Activity of Cells and Tissues under Healthy and Pathological Conditions
-Immunology
-Experimental and Clinical Oncology
-Public Health
-Preventive Medicine
-Dental Research

The PhD-programs are led by more than 100 accredited, highly qualified coordinators and tutors.

Medical Activity at the Faculty of Medicine
The Faculty of Medicine is not only the second largest medical school in Hungary, but it is also one of the largest Hungarian hospitals, consisting of 40 departments; including 22 different clinical departments. It is not only the best-equipped institution in the area but it also represents the most important health care facility for the day-to-day medical care in its region.
There are also close contacts between the University and other health care institutions, mainly (but not exclusively) in its closer region. The University of Debrecen has a Teaching Hospital Network consisting of 27 hospitals in Israel, Japan and South Korea.
It is also of importance that the University of Debrecen has a particularly fruitful collaboration with the Nuclear Research Institute of the Hungarian Academy of Sciences in Debrecen, allowing the coordination of all activities that involve the use of their cyclotron in conjunction with various

diagnostic and therapeutic procedures (e.g. Positron Emission Tomography 'PET').

Scientific Research at the Faculty of Medicine

Scientific research is performed both at the departments for basic sciences and at the laboratories of clinical departments. The faculty members publish about 600 scientific papers every year in international scientific journals. According to the scientometric data, the Faculty is among the 4 best of the more than 80 Hungarian research institutions and universities. Lots of scientists reach international recognition, exploiting the possibilities provided by local, national and international collaborations. Internationally acknowledged research areas are Biophysics, Biochemistry, Cell Biology, Immunology, Experimental and Clinical Oncology, Hematology, Neurobiology, Molecular Biology, Neurology, and Physiology. The scientific exchange program involves numerous foreign universities and a large proportion of the faculty members are actively involved in programs that absorb foreign connections (the most important international collaborators are from Belgium, France, Germany, Italy, Japan, the UK and the USA).

CHAPTER 2
PHARMACIST-TRAINING AT THE UNIVERSITY OF DEBRECEN

Pharmacist-training at the University of Debrecen

The establishment of the Faculty of Pharmacy at the University of Debrecen serves continuous development, change, renewal, and also reputation and prestige both nationally and internationally. At the University of Debrecen the organization and formation of pharmacist-training was started by Professor Géza Mezey in 1995, as a result of which in 1996 the teaching of the first year was launched in the field of pharmacist-training at the those days separately functioning Lajos Kossuth University of Sciences and Debrecen University of Medical Sciences. For the establishment and building of the Institute of Pharmaceutical Sciences (2001) the outstanding cooperation, effort, compromise approach, and continuous support of the management of the former Debrecen University of Medical Sciences and Lajos Kossuth University of Sciences were inevitable. Without these and the active assistance and collaboration of the colleagues and the university's management, the Faculty of Pharmacy could not have been in its current form and developed for the 100th year jubilee anniversary of establishment of the University of Debrecen. The coordination and improvement of the pharmacist-training was further concentrated into the hands of Professor Géza Mezey, the director of the Institute of Pharmaceutical Sciences (2001), until his death (17October, 2001).

The main building of the present Faculty of Pharmacy, where the Center's Pharmacy and the Dean's Office had been placed, was handed over in 2001 and the new building fully satisfies in every way the widespread supply of medicinal products towards the departments of the University of Debrecen and meets the requirements of pharmacist-training according to the standards of the European Union. Without the previous and present management of the University, the devoted help and cooperation of the departments belonging to the Faculty of General Medicine and the former Faculty of Natural Sciences at Lajos Kossuth University of Sciences where the acquisition of the basic subjects of Chemistry and Biology is ensured for the students of Pharmacy, the pharmacist-training would not have become possible at the University of Debrecen. The Hungarian anthem was first played in 2001 as this was the first year when pharmacist degrees were awarded at the ceremonial council meeting of the University of Debrecen. With the support and guidance of the management of that time and of he president of the Medical and Health Science Center, the draft for the accreditation of the Institute of Pharmaceutical Sciences to become a faculty was prepared. In 2003 it was approved by the Hungarian Accreditation Committee and from this year on the Faculty of Pharmacy started to operate as a separate organizational unit at the University of Debrecen, as its eleventh faculty. One of the fundamental prerequisites for the Institute of Pharmaceutical Sciences to become a faculty was to establish at least five independent departments. The University fulfilled this basic requirement by the founding of the Department of Pharmaceutical Technology (1996), Pharmacology (1998), Pharmaceutical Management and Organization (1999), Biopharmacy (2000), Pharmaceutical Chemistry (2001), Clinical Pharmacology (2001), and thus increased the number of its departments to six. In 2011 the number of departments at the Faculty of Pharmacy increased again as TEVA and the University of Debrecen Medical and Health Science Center's Faculty of Pharmacy founded the "of Industrial Pharmaceutics" that strengthens the practical education for the students during the training of pharmacist doctors.

The Faculty of Pharmacy successfully joined the University's Ph.D. training within the framework of the scheduled programs of the doctorate schools.

After successfully turning into faculty, we prepared the thematics of the English language pharmacist-training, and successfully launched the English language training (2004) for the foreign students of Pharmacy – which has already had considerable traditions at the fields of medical doctor and dentist training at the University of Debrecen. There are more and more foreign students

applying for the English language program, at present the number per year exceeds 25 persons.
Being grateful for the efforts of Professor Géza Mezey, the Faculty commemorates him with honor through the Dr. Géza Mezey Foundation named after him. The Advisory Board of the Géza Mezey Foundation and the Dean of the University of Debrecen’s Faculty of Pharmacy have been awarding commemorative medals each year since 2003 for outstanding scholastic records, outstanding contributions to the student scientific society, and also as the acknowledgement of effective education.

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	Ms.	Katalin Várnagy M.Sc., Ph.D., D.Sc.
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		Mihály Purgel Ph.D.
		Antal Udvardy Ph.D.
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	Ms.	Natália Dr. Timáriné Marozsán Ph.D.
Research Fellow	Ms.	Csilla Enikő Czégéni Ph.D.
Assistant Lecturer, Academic Advisor	Ms.	Réka Gombos Ph.D.
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	Ms.	Dóra Buzetzky Ph.D.
	Ms.	Virág Kiss Ph.D.
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Departmental Engineer		Mihály Szatmári M.Sc.
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		Máté Csontos M.Sc.
		Dávid Horváth M.Sc.
	Ms.	Enikő Madarasi M.Sc.
		Tamás Sándor Miklósi M.Sc.
		Dávid Nyul M.Sc.
	Ms.	Krisztina Andrea Orosz M.Sc.
	Ms.	Vanda Papp M.Sc.
	Ms.	Csenge Tamara Szolnoki M.Sc.
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Head of Department	István Szabó Ph.D., C.Sc.

CHAPTER 10
OTHER DEPARTMENTS

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Reference Services	Ms.	Edit Görögh M.Sc., Ph.D.
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	Ms.	Ildikó Gerő M.A.
	Ms.	Mariann Gulyásné Szitás M.A.
	Ms.	Judit Kovács, M.A.
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	Ms.	Zsuzsa Lívia Mezei M.A.
		László Répás M.A.
		Benjamin Schutz M.A.
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		Ágoston Nagy Ph.D.
	Ms.	Katalin Varga M.Sc.

CHAPTER 11
UNIVERSITY CALENDAR FOR PHARMACY PROGRAM
2021/2022 ACADEMIC YEAR

CRASH COURSE HUNGARIAN LANGUAGE: August 23 – September 3, 2021

OPENING CEREMONY: September 5, 2021

1st SEMESTER

Year	Course	Examination Period
Basic Medicine Course	September 6 – December 10, 2021 (14 weeks)	December 13, 2021 – January 28, 2022 (7 weeks)
1st year Pharmacy 2nd year Pharmacy 3rd year Pharmacy 4th year Pharmacy	September 6 – December 10, 2021 (14 weeks)	December 13, 2021 – January 28, 2022 (7 weeks)
5th year Pharmacy	July 19- September 17, 2021 (2 months state exam practice) September 21 – December 11, 2020 (12 weeks)	December 13, 2021 – January 21, 2022 (6 weeks)

2nd SEMESTER

Year	Course	Examination Period
Basic Medicine Course	February 7 – May 13, 2022 (14 weeks)	May 16 -June 10, 2022 (4 weeks)
Basic Medicine Course II.	January 10 – June 17, 2022 (23 weeks)	June 20 – July 8, 2022 (3 weeks)
1st year Pharmacy 2nd year Pharmacy 3rd year Pharmacy 4th year Pharmacy	February 7 – May 13, 2022 (14 weeks)	May 16 – July 1, 2022 (7 weeks)
5th year Pharmacy	January 24 – May 27, 2022 (4 months state exam practice)	

SUMMER PRACTICE

Year	Date in 2022
2nd and 3rd year Pharmacy practice	July 4 – July 29, 2022 or August 1 – August 26, 2022 (4 weeks)

CHAPTER 12
ACADEMIC PROGRAM FOR THE BASIC MEDICINE COURSE

Basic Medicine Course (BMC, Premedical Studies)
Duration of studies: 1 year (2 semesters)

The one-year premedical Basic Medicine Course is recommended to those students who do not have sufficient knowledge in Biology, Physics and Chemistry from high school. The requirements in these premedical science subjects are rigorous, thus it is recommended that students who need a period of preparation prior to beginning the General Medicine, Dentistry or Pharmacy Program join the Basic Medicine Course. Students successfully completing the course are directly admitted to their chosen program. In addition to the Basic Medicine Course starting each September, our University launches an Intensive BMC in January as well.

Class Behavior

Students must not use cell phones to talk or text during class. Cell phones must be switched off or kept in silence mode during class. In seminars, students will be expected to participate in seminar discussions. Students are encouraged to ask questions related to the topic of the lectures discussed, and participate in solving problems related to the topic of the seminar. Some professors will ask for students to volunteer information, but some professors call on students randomly. It is, thus, a good idea to come to class prepared so as not to be embarrassed in front of the class. Students should not disrupt the class by talking to each other. If one continues to disrupt the class, the student may be asked to leave. The usage of electronic devices, textbooks and any form of interaction between students during the tests is strictly forbidden. Electronic devices (cell phones, tablets, dictionaries, etc.), except for approved simple calculators, must not be within the reach (in pocket, in the desk, etc.) of students during tests. It is the students' responsibility to stow these items before the test begins without specific warning by the supervising teachers. Violation of these above mentioned regulations results in an immediate and unconditional dismissal from the program.

Requirements

The 2-semester course consists of lectures and seminars. Attending lectures is strongly recommended, attendance of seminars is compulsory and recorded. Everyone must attend the seminars with the group designated by the Registrar's Office.

Absence can significantly affect your understanding and can have serious implications of progression in your studies. One might have a maximum of three seminar absences per semester to have the opportunity to get exemption. Students missing 4 seminars per semester cannot be exempted from the End of Semester Examination (ESE) or Final Examination (FE), regardless of their score reached on the Self Control Tests. Students missing 5 or more seminars per semester are dismissed from the course. Missed seminars cannot be made up, unless one obtains prior permission to be absent.

The knowledge of students will be tested 4 times during each semester using a written test system by **Self Control Tests (SCT).** The first semester is ended with an **End of Semester Examination** (ESE) covering the topics of all lectures and seminars of the first semester. Three dates will be set for the ESE during the winter examination period. Unsuccessful students may repeat the ESE twice (B and C chances). Students repeating the course must successfully pass the first semester either with exemption or at least with a score of 45% of ESE, otherwise their studies will be terminated. The ESE is not compulsory for non-repeater students and even who fail may

continue their study in the second semester, however, they lose their chance to receive bonus points. Exam exemptions and bonus point policy are to improve the students' performance on SCTs and give them a chance to get exemption of the FE (described below) even with SCT scores lower than 30% in the first semester. Exact details of the exemption of ESE:
- one's average score of the three best first semester SCTs is at least 45%, AND
- (s)he successfully completed all the SCTs at least with 30% score, AND
- (s)he has a maximum of 3 seminar absences for each subject in the first semester.

The course ends with a **Final Exam (FE)** covering the whole material of the first and second semesters. A minimum of four FE dates will be set during the summer examination period. Unsuccessful students may repeat the FE twice (B and C chances, and the latter ends up with an oral examination part). Exemption from FE is offered for students who achieve excellent academic performance during their studies on the following base:
- the average score of the six best SCTs (out of 8) of the two semesters is at least 45%, AND
- passed all the SCTs with at least 30%, AND
- (s)he has a maximum of 3 seminar absences for a given subject per semester.

OR

- the average of the ESE score taken 3 times plus the scores of the 3 best SCTs in the 2nd semester is at least 45%, AND
- passed all the SCTs with at least 30%, AND
- (s)he has a maximum of 3 seminar absences for each subject per semester.

Bonus points will be added to the FE score (in %) of eligible students and calculated as follows:

The average of the ESE score three times and the best 3 2nd semester SCTs **OR** the average of the best 6 SCTs	Bonus points
40.00-40.99	1
41.00-41.99	2
42.00-42.99	3
43.00-43.99	4
44.00-44.99	5

Students who could not meet the above described conditions for exemption during the two semesters must sit for the FE from the whole material of the first and second semesters. The participation shall be preceded by ID confirmation (i.e. student's card, passport or driving license) before all forms of tests.
Self Control Tests, End of Semester Exams, and Final Exams will be assessed as follows.

Percentage (%)	Mark
0 - 44.99:	fail (1)
45.00 - 64.99:	pass (2)
65.00 - 74.99:	satisfactory (3)
75.00 - 84.99:	good (4)
85.00 - 100:	excellent (5)

Absence for any reason counts as 0%.

Course coordinator: Dr. Beáta Lontay, Department of Medical Chemistry

Subject: **INTRODUCTION TO BIOLOGY I.**
Year, Semester: Basic Medicine Course, 1st
Number of teaching hours:
Lecture: **56**
Seminar: **28**

1st **week:**
Lecture:
The chemistry of life 1
Proteins, carbohydrates and lipids 1.
Proteins, carbohydrates and lipids 2.
Proteins, carbohydrates and lipids 3.

2nd **week:**
Lecture:
Proteins, carbohydrates and lipids 4.
Nucleic acids
Cells: the working units of life 1.Prokaryotes*
Cells: the working units of life 2.

3rd **week:**
Lecture:
Cells: the working units of life 3.
Cells: the working units of life 4.
Cells: the working units of life 5.
Cell membranes 1.

4th **week:**
Lecture:
Cell membranes 2.
Cell membranes 3.
Cell membranes 4.
Energy, enzymes and metabolism 1.

5th **week:**
Lecture:
Energy, enzymes and metabolism 2.
Energy, enzymes and metabolism 3.
Energy, enzymes and metabolism 4.
Pathways that harvest chemical energy 1.

6th **week:**
Lecture:
Pathways that harvest chemical energy 2
Pathways that harvest chemical energy 3.
Pathways that harvest chemical energy 4.
Pathways that harvest chemical energy 5.

7th **week:**
Lecture:
Cellular signaling and communication 1.
Cellular signaling and communication 2.
Cell cycle and cell division 1.
Cell cycle and cell division 2.

8th **week:**
Lecture:
Cell cycle and cell division 2.
Cell cycle and cell division 2.
Inheritance, genes and chromosomes 1.
Inheritance, genes and chromosomes 2.

9th **week:**
Lecture:
Inheritance, genes and chromosomes 3.
Inheritance, genes and chromosomes 4.
Inheritance, genes and chromosomes 5.
Inheritance, genes and chromosomes 6.

10th **week:**
Lecture:
Inheritance, genes and chromosomes /Pop. Gen 7
DNA and its role in heredity 1.
DNA and its role in heredity 2.
DNA and its role in heredity 3.

11th **week:**
Lecture:
From DNA to protein: gene expression 1.
From DNA to protein: gene expression 2.
From DNA to protein: gene expression 3.
From DNA to protein: gene expression 4.

12th **week:**
Lecture:
From DNA to protein: gene expression 4.
From DNA to protein: gene expression 5.
Gene mutation and molecular medicine 1.
Gene mutation and molecular medicine 2.

13th **week:**
Lecture:

Gene mutation and molecular medicine 3.
Gene mutation and molecular medicine 4.
Regulation of gene expression 1. (Prokaryotic reg.)
Regulation of gene expression 2. (Eukaryotic reg.)

Lecture:
Regulation of gene expression 3.(Eukaryotic reg.)
Regulation of gene expression 4. .(Eukaryotic reg.)
The mechanism of evolution 1.
The mechanism of evolution 2.

14th **week:**

Contact person: Dr. András Penyige, Associate Professor, Department of Human Genetics
Recommended book: Sadava-Hillis-Heller-Berenbaum: Life, Sinauer-Macmillam

Subject: **INTRODUCTION TO BIOLOGY II.**
Year, Semester: Basic Medicine Course, 2nd
Number of teaching hours:
Lecture: **42**
Seminar: **28**

1st week:
Lecture:
Tissues, Organs and Organ Systems 1.
Tissues, Organs and Organ Systems 2.
Tissues, Organs and Organ Systems 3.

2nd week:
Lecture:
Physiology, Homeostasis and Temperature Regulation.
Blood, a fluid tissue 1.
Blood, a fluid tissue 2.

3rd week:
Lecture:
Circulatory systems 1.
Circulatory systems 2.
The human circulatory system 1.

4th week:
Lecture:
The human circulatory system 2.
The lymphatic system.
Natural Defenses against Disease 1.

5th week:
Lecture:
Natural Defenses against Disease 2.
Natural Defenses against Disease 3.
Nutrition, Digestion and Absorption 1.

6th week:
Lecture:
Nutrition, Digestion and Absorption 2.
Nutrition, Digestion and Absorption 3.
Nutrition, Digestion and Absorption 4.

7th week:
Lecture:
Gas exchange in Animals.
Human respiration.
Salt and Water Balance and Nitrogen Excretion 1.

8th week:
Lecture:
Salt and Water Balance and Nitrogen Excretion 2.
Hormones 1.
Hormones 2.

9th week:
Lecture:
Hormones 3.
Hormones 4.
Hormones 5.

10th week:
Lecture:
Neurons and Nervous system 1.
Neurons and Nervous system 2.
Neurons and Nervous system 3.

11th week:

Lecture:
Neurons and Nervous system 4.
Neurons and Nervous system 5.
Sensory systems 1.

12th **week:**
Lecture:
Sensory systems 2.
Effectors: making Animals move 1.
Effectors: making Animals move 2.

13th **week:**
Lecture:
Effectors: making Animals move 3.
Animal reproduction and Animal Development 1.
Animal reproduction and Animal Development 2.

14th **week:**
Lecture:
Animal reproduction and Animal Development 3.
The human Reproduction System and Sexual Behavior.

Contact person: Dr. Norbert Szentandrássy, Department of Physiology
Recommended book: Sadava, Hills, Heller, Berenbaum: Life (10th edition)

Subject: **INTRODUCTION TO PHYSICS I.**
Year, Semester: Basic Medicine Course, 1st
Number of teaching hours:
Lecture:56
Seminar: 28

1st **week:**
Lecture:
Introduction, requirements. Standards of length, mass, time. Significant figures. Prefixes. Conversion of units. Coordinate systems, trigonometry. Radians, vectors and scalars, geometry, equation solving, problem solving, graphing. Functions, calculator usage

2nd **week:**
Lecture:
Motion in one dimension, displacement, velocity, acceleration, motion diagrams.
Freely falling objects.

3rd **week:**
Lecture:
Vectors and their properties. Components of vectors. Displacement, velocity and acceleration in two dimensions.
Motion in two dimensions. Projectile motion.

4th **week:**
Lecture:
The laws of motion. Newton's First, Second and Third Law.
Applications of Newton's Laws. Forces of friction.

5th **week:**
Lecture:
Energy. Work. Kinetic energy and the work-energy theorem. Gravitational potential energy. Spring potential energy. System and energy conservation. Power. Work done by varying forces.

6th **week:**
Lecture:
Momentum and impulse. Conservation of momentum.Collisions. Elastic and inelastic collisions.
Angular speed and angular acceleration. Rotational motion under constant angular acceleration.

7th **week:**
Lecture:
Centripetal acceleration. Newtonian gravitation. Kepler's laws.
Torque and the two conditions for equilibrium. The center of gravity.

8th **week:**

Lecture:
Rotational kinetic energy. Angular momentum. States of matter. Deformation of solids. The Youngs's, shear and bulk modulus. Density and pressure. Variation of pressure with depth. Pressure measurements.

9th week:
Lecture:
Buoyant forces and Archimedes's principle. Fluids in motion.
HP equation, Circulation, blood pressure measurement, transport phenomena, diffusion, osmosis, calculations with cont. eq + HP eq.

10th week:
Lecture:
Temperature and the zeroth law of thermodynamics. Thermometers and temperature scales. Thermal expansion of solids and fluids. Macroscopic description of an ideal gas. The kinetic theory of gases.
Energy in thermal processes. Heat and internal energy.

11th week:
Lecture:
Specific heat. Calorimetry. Latent heat and phase change.
The first law of thermodynamics.The second law of thermodynamics. Entropy. Refrigerators and heat pumps.

12th week:
Lecture:
Elastic potential energy. Hook's law. Simple harmonic motion. Motion of a pendulum.
Waves. Frequency, amplitude and wavelength. Interference of waves. Reflection of waves

13th week:
Lecture:
Sound. Energy and intensity of sound waves. Doppler effect
Ultrasound. Shock waves, standing waves. The ear and the principles of hearing.

14th week:
Lecture:
Interactive seminar and preparation for the ESE.

Contact person: Dr. Zoltán Varga, Associate Professor, Department of Biophysics
Recommended book: Serway-Vuille: College Physics, Brooks/Cole

Subject: **INTRODUCTION TO PHYSICS II.**
Year, Semester: Basic Medicine Course, 2nd
Number of teaching hours:
Lecture: **56**
Seminar: **28**

1st week:
Lecture:
Properties of electric charges. Insulators and conductors. Coulomb's law. Electric field. Electric field lines. Electric flux and Gauss's law.

2nd week:
Lecture:
Electrical energy and capacitance. The parallel plate capacitor. Combinations of capacitors. Energy stored in capacitors. Capacitors with dielectric.

3rd week:
Lecture:
Electric current. Current and voltage measurements in circuits. Resistance and Ohm's law. Resistivity, temperature variation of resistance. Semiconductors and superconductors. Electrical activity of the heart. Defibrillators.

4th week:
Lecture:

Direct current circuits. Resistors in parallel and series. Kirchhoff's rules and complex DC circuits. RC circuits. Conduction of electrical signals by neurons.

5th week:
Lecture:
Magnetism. Magnetic field. Earth's magnetic field. Magnetic force on current carrying conductors. Toque on current loop and electric motors. Magnetic field of a long straight wire and Ampere's law. Magnetic field

6th week:
Lecture:
Induced emf and magnetic flux. Faraday's law of induction. Motional emf. Lenz's law. Generators. Self-inductance RL circuits.

7th week:
Lecture:
Alternating current. Resistors, capacitors and inductors in AC circuits. The transformer. Properties of electromagnetic waves. The spectrum of electromagnetic waves.

8th week:
Lecture:
The nature of light. Reflection, refraction and dispersion. Prisms. The rainbow. Huygen's principle. Total internal reflection and its medical applications.

9th week:
Lecture:
Lenses and mirrors. Flat mirrors. Images formed by spherical mirrors. Thin lenses. Images formed by lenses. Lens aberrations.

10th week:
Lecture:
Wave optics. Conditions for interference, polarization of light. Diffraction. The camera, the simple magnifier, the compound microscope, the telescope and the eye.

11th week:
Lecture:
Quantum physics. Blackbody radiation. Photoelectric effect. Particle theory of light. The production and attenuation of X-ray. Characteristic X-ray.

12th week:
Lecture:
Atomic physics. Early model of the atom. Quantum mechanics and the hydrogen atom. The spin magnetic quantum numbers. Lasers and holography.

13th week:
Lecture:
Some properties of the nuclei. Binding energy. Radioactivity, the decay processes. Medical application of radioactivity. Nuclear reactions. Nuclear fission and fusion. Positron and other antiparticles.

14th week:
Lecture:
Preparation for the final exam.

Contact person: Dr. Zoltán Varga, Associate Professor, Department of Biophysics
Recommended book: Serway-Vuille: College Physics, Brooks/Cole

Subject: **INTRODUCTION TO MEDICAL CHEMISTRY I.**

Year, Semester: Basic Medicine Course, 1st
Number of teaching hours:
Lecture: **56**
Seminar: **28**

1st week:
Lecture:
Introduction to Chemistry. Symbols of the elements. Physical and chemical properties
The SI system of measurement

2nd week:
Lecture:
The atomic theory. Structure of the atom, nuclear arithmetic
Mixtures and chemical compounds. Chemical formulas. Naming chemical compounds.

3rd week:
Lecture:
Atomic, molecular and molar mass relationships. Percent composition and empirical/molecular formulas. Chemical equations, stoichiometry

4th week:
Lecture:
Summary of general chemistry 1
Test #1

5th week:
Lecture:
The electromagnetic spectrum. Atomic spectra. The Bohr model of hydrogen atom. The quantum mechanical model of the atom.
Electron configurations and the periodic table. Classification of the elements

6th week:
Lecture:
Periodic properties
Chemical bonds: metallic, ionic, and covalent bon. Electron-dot structures

7th week:
Lecture:
VSEPR and valence bond theory
Intermolecular forces

8th week:
Lecture:
Summary of general chemistry 2
Test #2

9th week:
Lecture:
The gaseous state
Liquid and solid state, phase changes. The chemistry of water

10th week:
Lecture:
Solutions. Electrolytes and nonelectrolytes
Chemical equilibrium

11th week:
Lecture:
Summary of general chemistry 3
Test #3

12th week:
Lecture:
Acids and bases 1
Acids and bases 2

13th week:
Lecture:
Thermochemistry: internal energy and state functions. Enthalpy. Hess's law
Redox reactions. Activity series of the elements. Galvanic cells

14th week:
Lecture:
Summary of general chemistry 4
Test #4

Subject: **INTRODUCTION TO MEDICAL CHEMISTRY II.**

Year, Semester: Basic Medicine Course, 2nd
Number of teaching hours:
Lecture: **56**
Seminar: **28**

1st week:
Lecture:
The main-group elements. s-, p-, d-block metals
Nonmetals: hydrogen, halogens and noble gases

2nd week:
Lecture:
Nonmetals: oxygen and sulfur

Nonmetals: nitrogen, phosphorus and carbon

3rd **week:**
Lecture:
Test #5
Covalent bonding in organic compounds. Classification of organic compounds

4th **week:**
Lecture:
Alkanes. Nomenclature and isomerism of alkanes
Reactions of alkanes. Cycloalkanes

5th **week:**
Lecture:
Unsaturated hydrocarbons
Aromatic compound: structure and properties

6th **week:**
Lecture:
Heteroaromatic compounds. Reactions of benzene and its derivatives
Organic halogen compounds

7th **week:**
Lecture:
Summary of organic chemistry 1
Test #6

8th **week:**
Lecture:
Alcohols and phenols
Ethers, thioethers.

9th **week:**
Lecture:
Organic sulfur compounds
Aldehydes, ketones and quinones

10th **week:**
Lecture:
Nitrogen containing organic compounds: aliphatic amines
Nitrogen containing organic compounds: heterocyclic nitrogen compounds. Amines of biological importance

11th **week:**
Lecture:
Summary of organic chemistry 2
Test #7

12th **week:**
Lecture:
Carboxylic acids
Substituted carboxylic acids. Carboxylic acid derivatives: esters and amides

13th **week:**
Lecture:
Carboxylic acid derivatives: halides and anhydrides; salts and detergents
Stereochemistry

14th **week:**
Lecture:
Summary of organic chemistry 3
Test #8

Contact person: Dr. Endre Kókai, Department of Medical Chemistry
Recommended books: McMurry, Fay: Chemistry (7th edition)
Erdődi, Csortos: Organic chemistry for premedical students (2010)

Subject: **HUNGARIAN LANGUAGE FOR BMC STUDENTS**
Year, Semester: Basic Medicine Course 2nd
Number of teaching hours:
Practical: **36**

1st week:
Practical: 1. lecke, 2. lecke I. rész

2nd week:
Practical: 2. lecke II. rész

3rd week:
Practical: 3. lecke

4th week:
Practical: 4. lecke, 5. lecke I. rész

5th week:
Practical: 5. lecke II. rész, 6. lecke I. rész

6th week:
Practical: 6. lecke II. rész, 7. lecke (Összefoglaló) + midterm test
Self Control Test

7th week:
Practical: 8. lecke

8th week:
Practical: 9. lecke

9th week:
Practical: 10. lecke

10th week:
Practical: 11. lecke, 12. lecke

11th week:
Practical: 13. lecke

12th week:
Practical: 14. lecke (Összefoglalás) + end term test
Oral exam

Reading materials:
Gerő Ildikó-Kovács Judit: Színesen magyarul. 2017.

CHAPTER 13
ACADEMIC PROGRAM FOR THE SHORT BASIC MEDICINE COURSE

Intensive Basic Medicine Course (Intensive BMC, Premedical Studies)
Duration of studies: 1 semester

The six-month intensive premedical Basic Medicine Course is recommended to those students who do not have thorough knowledge in Biology, Physics and Chemistry from high school. The requirements of these condensed premedical science subjects are very rigorous, thus preparation prior to the beginning the General Medicine, Dentistry or Pharmacy Program is recommended. Students successfully completing the course are directly admitted to their chosen program. The Intensive Basic Medicine Course starts in January.

Class Behavior

Students should not use cell phones to talk or text during class. Cell phones must be switched off or kept in silence mode during class. In seminars, students will be expected to participate in seminar discussions. Students are encouraged to ask questions related to the topic of the lectures discussed, and participate in solving problems related to the topic of the seminar. Some professors will ask for students to volunteer information, but some professors call on students randomly. It is, thus, a good idea to come to class prepared so as not to be embarrassed in front of the class. Students should not disrupt the class by talking to each other. If one continues to disrupt the class, the student may be asked to leave. The usage of electronic devices, textbooks and any form of interaction between students during the tests is strictly forbidden. Electronic devices (cell phones, tablets, dictionaries, etc.), except for approved simple calculators, must not be within the reach (in pocket, in the desk, etc.) of students during tests. It is the students' responsibility to stow these items before the test begins without specific warning by the supervising teachers. Violation of these above mentioned regulations results in an immediate and unconditional dismissal from the program.

Requirements

The course consists of lectures and seminars. Attending lectures is strongly recommended, attendance of seminars is compulsory and recorded. Everyone must attend the seminars with the group designated by the Registrar's Office.

Absence can significantly affect your understanding and can have serious implications for progression in your studies. One might have a maximum of six seminar absences to have the opportunity to get exemption. Students missing 7-8 seminars cannot be exempted from the Final Examination (FE), regardless of their score reached on the Self Control Tests. Students omitting 9 or more seminars are dismissed from the course. Missed seminars cannot be made up unless one obtains prior permission to be absent.

The knowledge of the students will be tested 6 times during the entire course using a written test system by **Self Control Tests (SCT).** The course ends with a **Final Exam (FE)** from the whole material of the course and a minimum of four FE dates will be set during the summer examination period. Unsuccessful students may repeat the FE twice (B and C chances, and the latter ends up with an oral examination part). Exam exemption and bonus point policy are used to improve the students' performance on SCTs. Exact details of these policies will be described below.

Exemption from FE is offered for students who achieve excellent academic performance during their studies under the following circumstances:
- the average score of the five best SCTs (out of 6) is at least 45%, AND
- passed all the SCTs with at least 30%, AND

- (s)he has a maximum of 6 seminar absences for a given subject.

Bonus points will be added to the FE score of eligible students and calculated as follows:

The average of the best 6 SCTs	Bonus points
40.00-40.99	1
41.00-41.99	2
42.00-42.99	3
43.00-43.99	4
44.00-44.99	5

Students who could not meet the above described conditions for exemption must sit for the FE from the whole material of the course. The participation shall be preceded by ID confirmation (i.e. student's card, passport or driving license) before all forms of tests. Self Control Tests, End of Semester Exams, and Final Exams will be assessed as follows.

Percentage (%)	Mark
0 - 44.99:	fail (1)
45.00 - 64.99:	pass (2)
65.00 - 74.99:	satisfactory (3)
75.00 - 84.99:	good (4)
85.00 - 100:	excellent (5)

Absence for any reason counts as 0%.

Course coordinator: Dr. Beáta Lontay, Department of Medical Chemistry

Subject: **INTRODUCTION TO BIOLOGY**
Year, Semester: Intensive Basic Medicine Course
Number of teaching hours:
Lecture: **92**
Seminar: **92**

1st **week:**
Lecture: Small molecules and the chemistry of life 1.
Small molecules and the chemistry of life 2.
Proteins, carbohydrates and lipids 1.
Proteins, carbohydrates and lipids 2.

2nd **week:**
Lecture: Proteins, carbohydrates and lipids 3.
Nucleic acids and the origin of life.
Cells: the working units of life 1.
Cells: the working units of life 2.

3rd **week:**
Lecture: Cells: the working units of life 3.
Cells: the working units of life 4.
Bacterial cell structure
Cell membranes 1.

4th **week:**
Lecture: Cell membranes 2.
Cell membranes 3.
Energy, enzymes and metabolism 1.
Energy, enzymes and metabolism 2.

5th **week:**
Lecture: Pathways that harvest chemical energy 1.
Pathways that harvest chemical energy 2.
Pathways that harvest chemical energy 3.
The cell cycle and cell division 1.

6th **week:**
Lecture: The cell cycle and cell division 2.
The cell cycle and cell division 3.
The cell cycle and cell division 4.
Inheritance, genes and chromosomes 1.

7th **week:**
Lecture: Inheritance, genes and chromosomes 2.
Inheritance, genes and chromosomes 3.
Inheritance, genes and chromosomes 4.
Inheritance, genes and chromosomes 5.

8th **week:**
Lecture: DNA and its role in heredity 1.
DNA and its role in heredity 2.
DNA and its role in heredity 3.
DNA and its role in heredity 4.

9th **week:**
Lecture: From DNA to protein: gene expression 1.
From DNA to protein: gene expression 2.
From DNA to protein: gene expression 3.
From DNA to protein: gene expression 4.

10th **week:**
Lecture: Gene mutation and molecular medicine 1.
Gene mutation and molecular medicine 2.
Gene mutation and molecular medicine 3.
Gene mutation and molecular medicine 4.

11th **week:**
Lecture: Regulation of gene expression 1.
Regulation of gene expression 2.
Regulation of gene expression 3.
Regulation of gene expression 4.

12th **week:**
Lecture: The cellular signalling and communication 1.
The cellular signalling and communication 2.
The mechanism of evolution 1.
The mechanism of evolution 2.

13th **week:**
Lecture: Tissues, organs and organ systems 1-4.

14th **week:**
Lecture: Physiology, Homeostasis and Temperature Regulation
Blood, a fluid tissue 1-2. Circulatory systems.

15th **week:**
Lecture: The human circulatory system 1-3.
Immunology: gene expression and natural defences 1.

16th **week:**
Lecture: Self control test.
Immunology: gene expression and natural defences 2.
Nutrition, Digestion and Absorption 1-2.

17th **week:**
Lecture: Energy balance, vitamins and minerals.
Gas exchange in Animals.
Human Respiration.
Salt and Water Balance Nitrogen Excretion 1.

18th **week:**
Lecture: Salt and Water Balance Nitrogen Excretion 2.
Hormones 1-3.

19th **week:**
Lecture: Hormones 4.
Neurons and Nervous system 1.
Self Control Test
Neurons and Nervous system 2.

20th **week:**
Lecture: Neurons and Nervous system 3-5.
Sensory systems 1.

21st **week:**
Lecture: Sensory systems 2.
Effectors: How animals get things done 1-3.

22nd **week:**
Lecture: Animal reproduction and Animal Development 1-2.
The human reproduction system1-2.

23rd **week:**
Lecture: Self Control Test

Academic advisors: Dr. András Penyige, Department of Human Genetics
Dr. Norbert Szentandrássy, Department of Physiology
Recommended book: Sadava, Hills, Heller, Berenbaum: Life (10th edition)

Subject: **INTRODUCTION TO BIOPHYSICS**
Year, Semester: Intensive Basic Medicine Course
Number of teaching hours:
Lecture: 92
Seminar: 138

1st **week:**
Lecture 1-2: Introduction to modern physics. Standard of lengths, mass, time. Conversion of units. Useful mathematics. Trigonometry. Motion in one dimension, displacement, velocity, acceleration, motion diagrams.

2nd **week:**
Lecture 3-4: Freely falling objects. Vectors and their properties. Components of vectors. Displacement, velocity and acceleration in two dimensions. Motion in two dimensions. Relative velocity.

3rd **week:**
Lecture 5-6: The laws of motion. Newton's First, Second and Third Law. Application of Newton's Laws. Forces of friction.

4th **week:**
Lecture 7-8: Kinetic energy and the work-energy theorem. Gravitational potential energy. Spring potential energy. System and energy conservation. Power. Work done by varying forces.

5th **week:**
Lecture 9-10: Momentum and impulse. Conservation of momentum. Collisions. Elastic and inelastic collisions.

6th **week:**
Lecture 11-12: Angular speed and angular acceleration. Rotational motion under constant angular acceleration. Centripetal acceleration. Newtonian gravitation. Kepler's laws.

7th **week:**
Lecture 13-14: Torque and the two conditions for equilibrium. The center of gravity. Rotational kinetic energy. Angular momentum.

8th **week:**
Lecture 15-16: States of matter. Deformation of solids. The Youngs's, shear and bulk modulus. Density and pressure. Variation of pressure with depth. Pressure measurements. Buoyant forces and Archimedes's principle.

9th **week:**
Lecture 17-18: Temperature and the zeroth law of thermodynamics. Thermometers and temperature scales. Thermal expansion of solids and fluids. Macroscopic description of an ideal gas. The kinetic theory of gases.

10th **week:**
Lecture 19-20: Energy in thermal processes. Heat and internal energy. Specific heat. Calorimetry. Latent heat and phase change. The first law of thermodynamics.

11th **week:**
Lecture 21-22: The second law of thermodynamics. Entropy. Refrigerators and heat pumps. Elastic potential energy. Hook's law. Simple harmonic motion. Motion of a pendulum.

12th **week:**
Lecture 23-24: Waves. Frequency, amplitude and wavelength. Interference of waves. Reflection of waves. Sound. Energy and intensity of sound waves. Shock waves, standing waves, standing waves. Doppler effect. The ear and the principles of hearing.

13th **week:**
Lecture 26-27: Properties of electric charges. Insulators and conductors. Coulomb's law. Electric field. Electric field lines. Electric flux and Gauss's law.

14th **week:**
Lecture 28-29: Electrical energy and capacitance. The parallel plate capacitor. Combinations of capacitors. Energy stored in capacitors. Capacitors with dielectric.

15th **week:**
Lecture 30-31: Electric current. Current and voltage measurements in circuits. Resistance and Ohm's law. Resistivity, temperature variation of resistance. Semiconductors and superconductors. Electrical activity of the heart. Defibrillators.

16th **week:**
Lecture 32-33: Direct current circuits. Resistors in parallel and series. Kirchhoff's rules and complex DC circuits. RC circuits. Conduction of electrical signals by neurons.

17th **week:**
Lecture 34-35: Magnetism. Magnetic field. Earth's magnetic field. Magnetic force on current carrying conductors. Torque on a current loop and electric motors. Magnetic field of a long straight wire and Ampere's law. Magnetic field between two parallel conductors. Magnetic field of loops and solenoids.

18th **week:**
Lecture 36-37: Induced emf and magnetic flux. Faraday's law of induction. Motional emf. Lenz's law. Generators. Self-inductance RL circuits.

19th week:
Lecture 38-39: Alternating current. Resistors, capacitors and inductors in AC circuits. The transformer. Properties of electromagnetic waves. The spectrum of electromagnetic waves.

20th **week:**
Lecture 40-41: The nature of light. Reflection, refraction and dispersion. Prisms. The rainbow. Huygen's principle. Total internal reflection and its medical applications.

21st **week:**
Lecture 42-43: Lenses and mirrors. Flat mirrors. Images formed by spherical mirrors. Thin lenses. Images formed by lenses. Lens aberrations. Wave optics. Conditions for interference, polarization of light. Diffraction. The camera, the simple magnifier, the compound microscope, the telescope and the eye.

23rd **week 44-45:** Quantum physics. Blackbody radiation, photoelectric effect, generation of X-ray.
Some properties of the nuclei. Binding energy. Radioactivity, the decay processes. Medical application of radioactivity.

Academic advisor: Dr. Attila Jenei, Department of Biophysics and Cell Biology
Recommended book: Serway, Vuille: College Physics (11th edition)

Subject: **INTRODUCTION TO MEDICAL CHEMISTRY**
Year, Semester: Intensive Basic Medicine Course
Number of teaching hours:
Lecture: 92
Seminar: 92

1st **week:**
Lecture: Introduction to Chemistry. Symbols of the elements. Physical and chemical properties

The SI system of measurement

2^{nd} **week:**
Lecture:
The atomic theory. Structure of the atom, nuclear arithmetic
Mixtures and chemical compounds. Chemical formulas. Naming chemical compounds

3^{rd} **week:**
Lecture:
Atomic, molecular and molar mass relationships
Percent composition and empirical/molecular formulas. Chemical equations, stoichiometry

4^{th} **week:**
Lecture:
Summary of general chemistry 1
Test #1

5^{th} **week:**
Lecture:
The electromagnetic spectrum. Atomic spectra. The Bohr model of hydrogen atom. The quantum mechanical model of the atom.
Electron configurations and the periodic table. Classification of the elements

6^{th} **week:**
Lecture:
Periodic properties
Chemical bonds: metallic, ionic, and covalent bond. Electron-dot structures

7^{th} **week:**
Lecture:
VSEPR and valence bond theory
Intermolecular forces

8^{th} **week:**
Lecture:
The gaseous state
Liquid and solid state, phase changes. The chemistry of water

9^{th} **week:**
Lecture:
Solutions. Electrolytes and nonelectrolytes
Summary of general chemistry 2
Test #2

10^{th} **week:**
Lecture:
Chemical equilibrium
Acids and bases 1

11^{th} **week:**
Lecture:
Acids and bases 2
Thermochemistry: internal energy and state functions. Enthalpy. Hess's law

12^{th} **week:**
Lecture:
Redox reactions. Activity series of the elements. Galvanic cells
Summary of general chemistry 3
Test #3

13^{th} **week:**
Lecture:
The main-group elements. s-, p-, d-block metals
Nonmetals: hydrogen, halogens and noble gases

14^{th} **week:**
Lecture:
Nonmetals: oxygen and sulfur
Nonmetals: nitrogen, phosphorus and carbon

15^{th} **week:**
Lecture:
Covalent bonding in organic compounds.
Classification of organic compounds.
Alkanes. Nomenclature and isomerism of alkanes
Reactions of alkanes. Cycloalkanes

16^{th} **week:**
Lecture:
Unsaturated hydrocarbons
Summary of organic chemistry 1
Test #4

17^{th} **week:**
Lecture:
Aromatic compounds: structure and properties
Heteroaromatic compounds. Reactions of benzene and its derivatives

18^{th} **week:**
Lecture:

Organic halogen compounds
Alcohols and phenols

19th **week:**
Lecture:
Ethers, thioethers. Organic sulfur compounds
Aldehydes, ketones and quinones

20th **week:**
Lecture:
Summary of organic chemistry 2
Test #5
Nitrogen containing organic compounds 1: aliphatic amines

21st **week:**
Lecture:
Nitrogen containing organic compounds 2: heterocyclic nitrogen compounds. Amines of biological importance
Carboxylic acids

22nd **week:**
Lecture:
Substituted carboxylic acids. Carboxylic acid derivatives 1: esters and amides
Carboxylic acid derivatives 2: halides and anhydrides; salts and detergents

23rd **week:**
Lecture:
Stereochemistry
Summary of organic chemistry 3
Test #6

Contact person: Dr. Krisztina Tar, Department of Medical Chemistry
Recommended books: McMurry, Fay: Chemistry (7th edition)
Erdődi, Csortos: Organic chemistry for premedical students (2010)

CHAPTER 14
ACADEMIC PROGRAM FOR CREDIT SYSTEM

ACADEMIC PROGRAM FOR CREDIT SYSTEM

The introduction of the credit system became compulsory in every Hungarian university, including the University of Debrecen by September, 2003. The aim of the credit system is to ensure that the students' achievements can be properly and objectively evaluated both quantitatively and qualitatively.

A credit is a relative index of cumulative work invested in a compulsory, a required elective or a freely chosen subject listed in the curriculum. The credit value of a course is based upon the number of lectures, seminars and practical classes of the given subject that should be attended or participated in (so called "contact hours"), and upon the amount of work required for studying and preparing for the examination(s). Together with the credit(s) assigned to a particular subject (quantitative index), students are given grades (qualitative index) on passing an exam/course/class. The credit system that has been introduced in Hungary meets the standards of the European Credit Transfer System (ECTS). The introduction of the ECTS promotes student mobility, facilitates more effective organization of students' exchange programs aimed at further education in foreign institutions, and allows recognition of the students' work, studies and achievements completed in various foreign departments by the mother institution. Credit-based training is flexible. It provides a wider range of choice, enables the students to make progress at an individual pace, and it also offers students a chance to study the compulsory or required subjects at a different university, even abroad. Owing to the flexible credit accumulation system, the term "repetition of a year" does not make sense any longer. It should be noted, however, that students do not enjoy perfect freedom in the credit system either, as the system does not allow students to randomly include subjects in their curriculum or mix modules. Since knowledge is based on previous studies, it is imperative that the departments clearly and thoroughly lay down the requirements to be met before students start studying a subject.

The general principles of the credit system are the following:

1. Students can be given their degree if, having met other criteria as well, they have collected 300 credits during their studies. Considering the recommended curriculum, this can be achieved in five years.

2. According to the credit regulations, students should obtain an average of 30 credits in each semester.

3. The criterion of obtaining 1 credit is to spend 30 hours (including both contact and non-contact hours) studying the given subject.

4. Credit(s) can only be obtained if students pass the exam of the given subject.

5. Students accumulate the required amount of credits by passing exams on compulsory, required elective and freely chosen subjects. Completion of every single compulsory credit course is one of the essential prerequisites of getting a degree. Courses belonging to the required elective courses are closely related to the basic subjects, but the information provided here is more detailed, and includes material not dealt with in the frame of the compulsory courses. Students do not need to

take all required elective courses, but they should select some of them wisely to accumulate the predetermined amount of credits from this pool. Finally, a certain amount of credits should be obtained by selecting from the freely chosen courses, which are usually not related to the basic (and thus mandatory) subjects, but they offer a different type of knowledge.

6. Total of 300 credits should be accumulated by completing the compulsory and required elective courses (285 credits), and freely chosen courses (15 credits).

7. According to the qualification requirements, professional (compulsory and required elective) courses fall into three modules. The basic module provides the theoretical basis of medicine, and ensures that the necessary practical skills are developed. The preclinical module lays down the foundations of clinical knowledge, while in the clinical module the students are taught clinical medicine, and they attend practical classes to ensure proper command of the medical procedures. The credits accumulated in the different modules for compulsory and required courses should show the following distribution: basic module: 110-116, preclinical module: 50-58, and clinical module: 150-170 credits.

8. The pilot curricula show the recommended pacing of compulsory courses. If these courses are carefully supplemented with credits obtained from the necessary number of required elective and freely chosen courses, students can successfully accumulate the credits required for their degree within 10 semesters.

9. In the case of two-semester subjects, when students have to pass a final exam, they get higher credits in the semester of the final examination since preparation for a final examination takes up more non-contact hours from the students' time.

10. There are 12 compulsory final examinations in the curriculum; therefore one final exam is worth at least 10 credits.

11. The diploma work is worth 10 credits.

12. Regulations concerning the training of students in the credit system prescribe a minimum amount of credits for certain periods as outlined in the Rules and Regulations for English Program Students.

13. Although Physical Education and Summer Internship are not recognized by credits, they have to be completed to get the final degree (see the rules outlined in the Information section about the conditions).

14. Evaluation of the students' achievements needed for grants or applications is described in Rules and Regulations for English Program Students.
15. Further information is available in the Rules and Regulations for English Program Students.

We very much hope that the system of training will contribute to the successful completion of your studies.
We wish you good luck with your university studies.

This curriculum applies to those who started their studies on Pharmacy Program in the academic year 2021-22.
For the previous years' curriculum please visit the university website: www edu.unideb.hu

Compulsory courses for the 1. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	General Chemistry Practice	GYAKE04P1			42	AW5	3	None
1	General Chemistry Theory	GYAKE03P1	42	28		ESE	5	None
1	Hungarian Crash Course	AOG261008			36	AW5	0	None
1	Hungarian Language I/1.	GYHUN01P1			24	AW5	2	None
1	Latin Language I.	GYLAT03P1			28	AW5	1	None
1	Mathematics	GYMAT03P1	28		28	ESE	5	None
1	Pharmaceutical Biology I.	GYBIO03P1	21		28	ESE	6	None
1	Pharmacy Propedeutics	GYPPO02P1	28			ESE	2	None
1	Physics	GYFIZ02P1	14		28	ESE	5	None

Compulsory courses for the 1. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Biophysics	GYBIF06P2	14	13	15	ESE	4	Mathematics, Physics
2	Hungarian Language I/2.	GYHUN04P2			28	AW5	2	Hungarian Crash Course, Hungarian Language I/1.
2	Inorganic and Qualitative Analytical Chemistry Practice	GYSZK04P2		14	70	AW5	3	General Chemistry Theory, General Chemistry Practice
2	Inorganic and Qualitative Analytical Chemistry Theory	GYSZK03P2	42			ESE	3	General Chemistry Theory
2	Latin Language II.	GYLAT04P2			28	AW5	1	Latin Language I.
2	Organic Chemistry Practice I.	GYKSZ04P2		14	42	AW5	3	General Chemistry Theory, General Chemistry Practice
2	Organic Chemistry Theory I.	GYKSZ03P2	56			ESE	3	General Chemistry Theory, General Chemistry Practice
2	Pharmaceutical Anatomy	GYANA02P2	42		28	ESE	3	Pharmaceutical Biology I.
2	Pharmaceutical Biology II.	GYBIO04P2	35		28	FE	4	Pharmaceutical Biology I.
2	Physical Chemistry I.	GYFKE03P2	28	28		ESE	4	Mathematics, Physics, General Chemistry Theory

Compulsory courses for the 2. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Botany Practice	GYGYN04P3			28	AW5	1	Pharmaceutical Biology I.
1	Botany Theory	GYGYN03P3	28			ESE	2	Pharmaceutical Biology I.
1	Colloid and Surface Chemistry Practice	GYKOLL04P3			28	AW5	1	Physical Chemistry I., General Chemistry Practice
1	Colloid and Surface Chemistry Theory	GYKOLL03P3	28			ESE	2	Physical Chemistry I.
1	Human Physiology I.	GYHEL03P3	28	14		ESE	4	Pharmaceutical Anatomy, Pharmaceutical Biology I.
1	Hungarian Language II/1.	GYHUN02P3			28	AW5	2	Hungarian Language I/2.
1	Organic Chemistry Practice II.	GYKSZ08P3			56	AW5	3	Organic Chemistry Theory I., Organic Chemistry Practice I.
1	Organic Chemistry Theory II.	GYKSZ07P3	56			FE	4	Organic Chemistry Theory I., Organic Chemistry Practice I.
1	Pharmaceutical Biochemistry I.	GYBIK03P3	36		4	ESE	4	Biophysics, Organic Chemistry Theory I., Pharmaceutical Biology II.
1	Physical Chemistry II.	GYFKE04P3			28	AW5	2	Physical Chemistry I., General Chemistry Practice
1	Quantitative Analytical Chemistry I.	GYKVA04P3	28	28		ESE	4	Inorganic and Qualitative Analytical Chemistry Theory, Physical Chemistry I.

Compulsory courses for the 2. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Human Physiology II.	GYHEL07P4	28	9		FE	4	Human Physiology I.
2	Human Physiology II. Practical	GYHEL08P4			22	AW5	2	Human Physiology I.
2	Hungarian Language II/2.	GYHUN05P4			28	AW5	2	Hungarian Language II/1.
2	Pharmaceutical Biochemistry II.	GYBIK04P4	44		5	FE	6	Pharmaceutical Biochemistry I.
2	Pharmaceutical Technology Theory I.	GYTEC09P4	28			ESE	2	Colloid and Surface Chemistry Theory and Practice, Physical Chemistry II.
2	Pharmaceutical Technology Practice I. (Prescription Writing I.)	GYTEC18P4			56	AW5	2	Colloid and Surface Chemistry Theory and Practice, Physical Chemistry II.
2	Pharmacognosy Practice I.	GYGND06P4			56	AW5	3	Botany Theory, Botany Practice, Organic Chemistry Theory II., Organic Chemistry Practice II.
2	Pharmacognosy Theory I.	GYGND05P4	28			ESE	2	Botany Theory, Botany Practice, Organic Chemistry Theory II., Organic Chemistry Practice II.
2	Public Pharmacy practice after 2nd year (Personnel and objective requirements of Pharmacy and Preparation of pharmaceutical dosage forms)	GY_NYGY_2ND YEAR			120	SIGN	0	has to be completed before the 3rd year
2	Quantitative Analytical Chemistry Practice II.	GYKVA06P4			70	AW5	3	Quantitative Analytical Chemistry I., General Chemistry Practice
2	Quantitative Analytical Chemistry Theory II.	GYKVA05P4	14			FE	3	Quantitative Analytical Chemistry I., Inorganic and Qualitative Analytical Chemistry Practice

Compulsory courses for the 3. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Clinical Biochemistry I.	GYKPA03P5	28		14	AW5	4	Pharmaceutical Biochemistry II, Human Physiology II.
1	Medical Hungarian I.	GYHUN03P5			28	AW5	2	Hungarian Language II/2.
1	Pharmaceutical Chemistry Practice I.	GYGKE06P5			28	AW5	2	Organic Chemistry Theory II., Organic Chemistry Practice II.
1	Pharmaceutical Chemistry Theory I.	GYGKE05P5	42			ESE	4	Organic Chemistry Theory II., Organic Chemistry Practice II.
1	Pharmaceutical Neurobiology	GYNEU02P5	38	14	14	ESE*	3	Human Physiology II., Pharmaceutical Biochemistry II.
1	Pharmaceutical Psychology	GYPSY06P5	28			ESE	2	Human Physiology II.
1	Pharmaceutical Technology Practice II. (Industrial Practice I.)	GYTEC22P5			56	AW5	2	Pharmaceutical Technology Theory I.,Pharmaceutical Technology practice I. (Prescription Writing I.)
1	Pharmaceutical Technology Practice II. (Prescription Writing II.)	GYTEC20P5			56	AW5	2	Pharmaceutical Technology Theory I., Pharmaceutical Technology Practice I. (Prescription Writing I.)
1	Pharmaceutical Technology Theory II.	GYTEC11P5	28			ESE	3	Pharmaceutical Technology Theory I., Pharmaceutical Technology Practice I. (Prescription Writing I.)
1	Pharmacognosy Practice II.	GYGND08P5			56	AW5	3	Pharmacognosy Theory I., Pharmacognosy Practice I.
1	Pharmacognosy Theory II.	GYGND07P5	28			FE	4	Pharmacognosy Theory I., Pharmacognosy Practice I.

Compulsory courses for the 3. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Clinical Biochemistry II.	GYKPA04P6	56	8	28	FE	8	Clinical Biochemistry I.
2	Immunology	GYIMM06P6	28	6	14	ESE*	4	Clinical Biochemistry I.
2	Medical Hungarian II.	GYHUN06P6			28	FE	2	Medical Hungarian I.
2	Pharmaceutical Chemistry Practice II.	GYGKE08P6			28	AW5	2	Pharmaceutical Chemistry Theory I., Pharmaceutical Chemistry Practice I.
2	Pharmaceutical Chemistry Theory II.	GYGKE07P6	56			FE	6	Pharmaceutical Chemistry Theory I., Pharmaceutical Chemistry Practice I.
2	Pharmaceutical Technology Practice III. (Industrial Practice II.)	GYTEC26P6			56	AW5	2	Pharmaceutical Techn. Theory II., Pharmaceutical Techn. Practice II. (Prescription Writing II.), Pharmaceutical Technology Practice II. (Industrial Practice I.)
2	Pharmaceutical Technology Practice III. (Prescription writing III.)	GYTEC24P6			56	AW5	2	Pharmaceutical Techn. Theory II., Pharmaceutical Techn. Practice II. (Industrial Practice I.), Pharmaceutical Technology Practice II. (Prescription Writing II.)
2	Pharmaceutical Technology Theory III.	GYTEC13P6	28			ESE	3	Pharmaceutical Technology Theory II., Pharmaceutical Techn. Practice II. (Prescription Writing II.), Pharmaceutical Techn. Practice II. (Industrial Practice I.)
2	Public Pharmacy practice after 3rd year (Preparation of pharmaceutical dosage forms, management-quality assurance, dispensing, pharmaceutical business administ)	GY_NYGY_3RD YEAR			120	SIGN	0	has to be completed before the 4th year

Compulsory courses for the 4. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Medical Microbiology I.	GYMIK09P7	28	10	10	ESE	5	Immunology, Clinical Biochemistry II.
1	Pharmaceutical and Bioanalytical Chemistry I.	GYGMB09P7	28	14		ESE	4	Quantitative Analytical Chemistry Theory II., Pharmaceutical Chemistry Theory II.
1	Pharmaceutical bioanalytics and biotechnology I.	GYBTEC02P7	28			ESE	5	Quantitative Analytical Chemistry Theory II., Pharmaceutical Chemistry Theory II.
1	Pharmaceutical Technology practice IV. (Industrial practice III.)	GYTEC28P7			42	AW5	2	Pharmaceutical Technology Theory III., Pharm. Techn. Pract. III. (Prescription Writing III.), Pharm. Techn. Pract. III. (Industrial practice II.)
1	Pharmaceutical Technology Theory IV.	GYTEC15P7	28			FE	3	Pharmaceutical Technology Theory III., Pharm. Techn. Pract. III. (Prescription Writing III.), Pharm. Techn. Pract. III. (Industrial practice II.)
1	Pharmacology Practice I.	GYHAT05P7			56	AW5	2	Pharmaceutical Chemistry Theory and Practice II., Pharmacognosy Theory and Practice II., Clinical Biochemistry II.
1	Pharmacology Theory I.	GYHAT04P7	56			ESE	4	Pharmaceutical Chemistry Theory and Practice II., Pharmacognosy Theory and Practice II., Clinical Biochemistry II.
1	Preventive Medicine and Public Health	GYMEG10P7	28	22	8	ESE	3	Immunology, Clinical Biochemistry II.

Compulsory courses for the 4. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Bioethics	GYETI06P8	28			ESE	1	Pharmaceutical Technology Theory IV., Pharmaceutical Technology Practice IV. (Industrial Practice III.)
2	Clinical Basics	GYKLI04P8	56	28		ESE	3	Preventive Medicine and Public Health
2	Industrial Pharmaceutical Technology	GYIPGY01P8	28		14	ESE	2	Pharmaceutical Technology Theory IV., Pharmaceutical Technology Practice IV. (Industrial Practice III.)
2	Medical Microbiology II.	GYMIK09P8	14	14		FE	5	Medical Microbiology I.
2	Pharmaceutical and Bioanalytical Chemistry II.	GYGMB10P8	28		56	FE	6	Pharmaceutical and Bioanalytical Chemistry I.
2	Pharmaceutical bioanalytics and biotechnology II.	GYBTEC04P8	28		56	FE	5	Pharmaceutical Bioanalitics and biotechnology I.,Pharmaceutical and Bioanalytical Chemistry I.
2	Pharmaceutical Management and Organisation	GYMAN02P8	28			ESE	2	Pharmaceutical Technology Theory IV., Pharmaceutical Technology Practice IV. (Industrial Practice III.)
2	Pharmacology Practice II.	GYHAT08P8			56	AW5	3	Pharmacology Theory I. and Pharmacology Practice I.
2	Pharmacology Theory II.	GYHAT06P8	56			FE	3	Pharmacology Theory I. and Pharmacology Practice I.

Compulsory courses for the 5. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Biopharmacy	GYBFA02P9	28		28	ESE*	6	Med. Microbiology II., Pharmacology Theory II., Pharmacology Practice II., Pharm. Techn. Theory IV., Pharm. Techn. Practice IV. (Indust. Practice III.)
1	Clinical Pharmacology	GYKFA04P9	28			ESE*	2	Pharmacology Theory II. and Pharmacology Practice II.
1	Clinical Pharmacy	GYKGY04P9	28	42		ESE*	4	Preventive Medicine and Public Health
1	Drug Interactions Theory	GYINT02P9	28			ESE	4	Pharmacology Theory II., Pharmacology Practice II., Medical Microbiology II.
1	Pharmaceutical Care	GYGYG02P9	28			ESE	3	Pharmacology Theory II. and Pharmacology Practice II., Pharmaceutical Techn. Theory IV.
1	Pharmaceutical Communication Skills	GYGKO02P9	14	4		ESE	2	Pharmaceutical Technology Theory IV., Pharmacology Theory II. and Pharmacology Practice II.
1	Pharmacovigilance	GYFAV02P9	19	9		ESE	2	Pharmacology Theory II.
1	Quality Control	GYMIN02P9	28			ESE	2	Pharmaceutical Techn. Theory IV. and Pharmaceutical Techn. Practice IV. (Industrial Practice III.), Pharmaceutical Management and Organization
1	Radiopharmacy Practice	GYRAD04P9			14	AW5	1	Pharmaceutical Technology Theory IV. and Pharmaceutical Technology Practice IV. (Industrial Practice III.)
1	Radiopharmacy Theory	GYRAD03P9	14			ESE	1	Pharmaceutical Technology Theory IV. and Pharmaceutical Technology Practice IV. (Industrial Practice III.)

Required elective courses for the 1. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Computer Science	GYINF48P1			28	AW5	3	None
1	Library System	GYKON41P1			10	AW5	1	None

Required elective courses for the 1. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	First Aid and Reanimation	GYELS42P2	7		7	AW5	1	None

Required elective courses for the 2. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Biocosmetics	GYBKO42P8	14			ESE	1	None
1	Introduction to Scientific Research	GYTKU42P3	14			AW5	2	None

Required elective courses for the 2. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Modern biophysical methods in biology and medicine	AOMOD42T4	24			AW5	2	Biophysics
2	Modern Techniques Allowing the Investigation of Physiological Phenomena	AOKOR42T4	20			AW5	2	Human Physiology I.
2	Problem Based Learning in Physiology	AOPEL42T4			28	AW5	3	Human Physiology I.
2	The Regulatory Role of the Cell Membrane in Physiological and Pathological Conditions	AOSEM42T4	20			AW5	2	Human Physiology I.

Required elective courses for the 3. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Illicit drugs	GYKAB42P7	28			ESE	1	Organic Chemistry Theory II.
1	Molecular Mechanism of Diseases of Great Populations	AOG167605	25			AW5	2	Pharmaceutical Biochemistry II.

Required elective courses for the 3. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Chemical Biology	GYKEB42P8	14			ESE	1	Organic Chemistry Theory II.
2	Introduction to Pharmacoeconomy and - epidemiology	GYEKO42P6	10	2		ESE	2	Pharmaceutical Technology Theory II.
2	Pharmaceutical Excipients	GYSEA42G6	14			AW5	1	Pharmaceutical Techn. Theory II., Pharmaceutical Techn. Practice II.

Required elective courses for the 4. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Environmental Analytical Chemistry	GYKOR02P8	42			AW5	3	Quantitative Analytical Chemistry Theory II., Pharmaceutical Chemistry Theory II., Pharm. Chemistry Practice II.
1	Introduction to Financial Management for Pharmacists	GYGAZD42P5	12	5		ESE	2	Pharmaceutical Technology Theory II.
1	Nanopharmaceutics	GYNANO42P8	14			ESE	1	Pharmaceutical Technology Theory III
1	Nutritional Therapy	GYTTE42P7	14			AW5	1	Pharmaceutical Techn. Theory III., Pharmaceutical Biochem. II., Pharm. Techn. Pract. III.(Indust. Pract. II.), Pharm. Techn. Pract. III. (Prescr. Writing III.)

Required elective courses for the 4. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Basic Knowledge of Surgical Biomaterials for Students of Pharmacy	GYSEE02P8	8	16	8	AW5	3	Pharmaceutical Technology Theory I., Human Physiology II.
2	Dietary supplements and general nutrients	GYEKI42P8	28			ESE	2	Pharmacology Theory I., Pharmacology Practice I.
2	Pharmaceutical Computer Administration	GYADM42G8	28			AW5	1	Pharmaceutical Techn. Theory II., Pharmaceutical Techn. Practice II. (Prescription Writing II.), Pharmaceutical Technology Practice II. (Industrial Practice I.)
2	Polymorphism of Pharmaceuticals	GYGPO208	28			ESE	2	Pharmaceutical Techn. Theory II., Pharmaceutical Techn. Practice II. (Prescription Writing II.), Pharmaceutical Technology Practice II. (Industrial Practice I.)

Required elective courses for the 5. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Galenic Preparations	GYKOU04P9	28			ESE	2	Pharmaceutical Technology Theory IV., Pharmaceutical Technology Practice IV. (Industrial Practice III.)
1	Industrial Pharmaceutical Practice	GYSZI47P9			28	AW5	3	Pharmaceutical Techn. Theory IV, Pharmaceutical Techn. Pract. IV, Pharmacology Theory II., Pharmacology Practice II.,
1	Juristic Knowledge for Pharmacists	GYJOG42P9	14			ESE	1	Pharmaceutical Management and Organisation
1	Operating System of the Pharmaceutical Industry	GYGMR42P9	14			ESE	1	Pharmaceutical Techn. Theory IV., Pharmaceutical Techn. Practice IV. (Industrial Practice III.)
1	Phytopharmacology	GYFFA42P9	24			ESE	1	Pharmacology Theory II., Pharmacology Practice II., Pharmacognosy Theory II., Pharmacognosy Practice II.
1	State Exam Practice I. Pharmacy dispensing	GYZVG42P9			120	AW3	3	None
1	State exam practice I. Prescription Pharmacy	GYZVG43P9			120	AW3	3	None
1	Synthetic Chemistry Practice	GYSZI48P9			28	AW5	3	Pharmacology Theory II., Pharmacology Practice II.
1	Thesis Consultation	GYDIP43P9			28	AW5	5	None
1	Toxicology	GYSZT49P9			28	AW5	3	Pharmacology Theory II., Pharmacology Practice II.
1	Veterinary Hygiene	GYAEU42P9	28			ESE	2	Pharmacology Theory II., Pharmacology Practice II., Medical Microbiology II.

Required elective courses for the 5. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	State exam practice II. – Pharmaceutical management, Quality Assurance	GYZV48P10			60	AW3	2	State Exam Practice I. Pharmacy Dispensing, State Exam Practice I. Prescription Pharmacy
2	State exam practice II. (Pharmaceutical business administration)	GYZVG50P10			60	AW3	1	State Exam Practice I. Pharmacy Dispensing, State Exam Practice I. Prescription Pharmacy
2	State Exam Practice II. Institutional Pharmacy or Galenic Laboratory	GYZVG47P10			120	AW3	3	State Exam Practice I. Pharmacy Dispensing, State Exam Practice I. Prescription Pharmacy
2	State Exam Practice II. Pharmacy Dispensing	GYZVG44P10			120	AW3	3	State Exam Practice I. Pharmacy Dispensing, State Exam Practice I. Prescription Pharmacy
2	State Exam Practice II. Prescription Pharmacy	GYZVG45P10			120	AW3	3	State Exam Practice I. Pharmacy Dispensing, State Exam Practice I. Prescription Pharmacy
2	Thesis	GYDIP44P10			28	AW5	5	Thesis Consultation

Freely Chosen Courses

Department	Subject	Neptun code	Crd	Sem	Hours	Exam	Prerequisites of taking the subject	Coordinator
Department of Anatomy, Histology and Embryology	Selected Problems of the Neural Control: Modelling of Single Neurons and Neural Networks	AOG108504-K1	1	2	12	AW5	Pharmaceutical Anatomy	Ervin Wolf M.Sc., Ph.D.
Department of Anatomy, Histology and Embryology	Functional Anatomy of the Visual System	AOG108204-K1	1	2	16	AW5	Pharmaceutical Anatomy	Zoltán Kisvárday M.Sc., Ph.D., D.Sc.
Department of Anatomy, Histology and Embryology	Advanced Histology	AOG107803-K8	1	1	16	AW5	Pharmaceutical Anatomy	Szabolcs Felszeghy Ph.D., D.D.S.
Department of Behavioural Sciences	Inborn Sociality - Socialized Individuality: A New Concept	AOG358902-K8	2	-	30	AW5	None	Péter Molnár M.D., D.Sc.
Department of Behavioural Sciences	The Basic Problems of Medicine	AOG358601	1	1	20	AW5	None	Attila Bánfalvi M.A., Ph.D., C.Sc.
Department of Behavioural Sciences	Madness and Psychiatry (Philosophical Approach)	AOG359602	1	2	20	AW5	None	Attila Bánfalvi M.A., Ph.D., C.Sc.
Department of Behavioural Sciences	Theory of Psychoanalysis and Its Influence on the Concept of Human Being in Medicine	AOG359501-K8	1	1	20	AW5	None	Attila Bánfalvi M.A., Ph.D., C.Sc.
Department of Behavioural Sciences	Psychic Trauma	AOG3511102-K1	1	2	20	AW5	None	Attila Bánfalvi M.A., Ph.D., C.Sc.
Department of Behavioural Sciences	Theoretical and Methodological Questions of Patient Satisfaction Studies	AOG359308	1	2	15	AW5	None	Csilla Kemény M.A., Ph.D.
Department of Behavioural Sciences	Yoga and Meditation I.	AOG3512001-K1	1	1	30	AW5	None	Péter Molnár M.D., D.Sc.
Department of Behavioural Sciences	Intercultural Health Care	AOG3511605-K1	2	2	30	AW5	None	Péter Molnár M.D., D.Sc.

Department	Subject	Neptun code	Crd	Sem	Hours	Exam	Prerequisites of taking the subject	Coordinator
Department of Behavioural Sciences	Yoga and Meditation II.	AOG351040 1-K1	2	2	30	AW5	None	Péter Molnár M.D., D.Sc.
Department of Behavioural Sciences	Becoming a Doctor: Thematic Self-awareness Group	AOG359005 -K10	2	2	30	AW5	None	Péter Molnár M.D., D.Sc.
Department of Biochemistry and Molecular Biology	Biochemistry of Apoptosis	AOG167406	1	-	20	AW5	Pharmaceutical Biochemistry	Zsuzsa Szondy M.D., Ph.D., D.Sc.
Department of Foreign Languages	Hungarian Language Elective General II.	AOG269102 -K1	2	2	28	AW5	Hungarian Crash Course	László Répás M.A.
Department of Foreign Languages	Hungarian Language Elective General I.	AOG268901 -K1	2	1	28	AW5	Hungarian Crash Course	László Répás M.A.
Department of Foreign Languages	Hungarian Language Elective - Medical I.	AOG26108A 1-K1	2	1	30	AW5	None	László Répás M.A.
Department of Foreign Languages	Hungarian Language Elective - Medical II.	AOG26108A 2-K1	2	2	30	AW5	Completion of Hungarian Language Elective Medical I.	László Répás M.A.
Department of Foreign Languages	Latin Medical Terminology I.	AOG261100 2	1	2	30	AW5	Latin Language	László Répás M.A.
Department of Foreign Languages	Hungarian Language Elective General III.	AOG269203	2	1	28	AW5	Hungarian Language I/2.	Katalin Rozman M.A.
Department of Foreign Languages	Hungarian Language Elective General IV.	AOG269304	2	2	28	AW5	Hungarian Language II/1.	Katalin Rozman M.A.
Department of Foreign Languages	Hungarian Language Elective General V.	AOG269605	2	1	28	AW5	Hungarian Language II/2.	Katalin Rozman M.A.
Department of Foreign Languages	Hungarian Language Elective General VI.	AOG269706	2	2	28	AW5	Hungarian Language III/1., Medical Hungarian I.	Katalin Rozman M.A.
Department of Medical Microbiology	Interpretive Clinical Bacteriology and Virology	AOG428108	1	2	14	AW5	Medical Microbiology II.	József Kónya M.D., Ph.D., D.Sc.
Department of Medical Microbiology	Introduction to Medical Mycology	AOG421020 7	1	1-2	14	AW5	Medical Microbiology II.	László Majoros M.D., Ph.D.
Department of Medical Microbiology	Clinical Mycology	AOG421010 7	1	1-2	12	AW5	Medical Microbiology II.	László Majoros M.D., Ph.D.

Department	Subject	Neptun code	Crd	Sem	Hours	Exam	Prerequisites of taking the subject	Coordinator
Department of Medical Microbiology	Antimicrobial agents in dentistry	AOG4291206	1	1-2	12	AW5	Succesful 1st semester exam of Medical/Pharmaceutical Microbiology; min. 5, max. 10 students	László Majoros M.D., Ph.D.
Department of Medical Microbiology	Orofacial infection in dentistry	AOG4291306	1	1-2	12	AW5	Succesful 1st semester exam of Medical/Pharmaceutical Microbiology; min. 5 max. 10 students	László Majoros M.D., Ph.D.
Department of Medical Microbiology	Interesting Issues of Medical Parasitology	AOG4210207	1	1	12	AW5	Medical Microbiology I.	
Department of Pharmaceutical Chemistry	Antimalarial drugs: Preclinical and Clinical Aspects	GYAMD01P5	0	1	14	AW5	Organic Chemistry	Anikó Borbás Ph.D., D.Sc.
Department of Pharmaceutical Technology	Research methodology in Pharmacy	GYRMPP01P7	3	1-2	42	AW5	None	Ildikó Bácskay D.Pharm., Ph.D.
Department of Pharmaceutical Technology	Selected Innovative Research in Europe	GYIEU01P4	1	2	15	AW5	None	Ildikó Bácskay D.Pharm., Ph.D.
Division of Cell Biology	Selected Topics in Cell Biology	AOG157403-K1	1	-	16	AW5	Cell Biology	György Vereb M.D., Ph.D., D.Sc.
Division of Clinical Laboratory Science	Platelet Function and Platelet Function Disorders	AOG632006	1	2	12	AW5	Clinical Biochemistry	

CHAPTER 15
PUBLIC PHARMACY PRACTICES AND STATE EXAM PRACTICES

Public Pharmacy Practice after 2nd and 3rd year

Syllabus for the practice in a public pharmacy after second and third year

Duration of practice: 4 weeks, 8 hours daily, from which 2 hours may be spent preparing individually.
The student is required to gain proficiency in the following areas during his /her practice at a public pharmacy, and subsequently acquire knowledge about pharmacy operation including dispensing medication, preparing medication, validation and quality assurance, and the overall operation of the pharmacy.

Main requirements for the student:
Before practice he/she should accept and sign the non-disclosure document.
Absence from practice must be authentically justified based on the rules of the place of training. Absences must be made up.
He/she is expected to follow the guidance of the pharmacist in charge of the training.

Skills expected from the student after the completion of practice:
practical application of the theoretical knowledge obtained during his / her studies
he / she is expected to know the premises and the assets of the public pharmacy and be able to get information from manuals and scientific journals used during his / her work
he / she is expected to learn about the work activities of a public pharmacy
he / she is required to have an appropriate working relationship with the co-workers at the pharmacy
he / she is expected to know the rules and regulations pertaining to the operation of pharmacies
he/ she is required to explore the possibilities of communicating with patients

The student's tasks during the practice:
Under the supervision of the pharmacist in charge of the training he / she participates in the following activities:

1. Preparation of medicine.
In the process he / she is required to learn:
How to prepare magistral / individual formulations according to the rules and to recognize incompatibilities
The legal possibilities of changing the original prescription
The rules of labelling and their application (identifiability of manufacturer and patient, application, administration, shelf-life)
Documentation of preparation, and administrative obligations
Storage of materials, processing of basic formulations and subsequent administrative obligations
Formulations of the compendium and FoNo

2. Operation and quality assurance. In the process he / she is required to learn for the basic knowledgements:
administrative work in the pharmacy

standard procedures for workflow
how to check and document workflow
the rules pertaining to the examining and sampling incoming medications, documentation of examinations

3. Drug dispense. In the process he / she is required to learn for the basic knowledgements:
how to check the content and layout of the prescription
the database of nutrition complements and medicinal formulae
adequate application of the computer program. He / she is expected to get acquainted with the process and documentation of drug dispensing, and communication with patients
the notion of pharmacy care and its practical ramifications

4. Medicine ordering. In the process he / she is required to learn for the basic knowledgements:
how to order medicine
about narcotics and activities involving their handling
the rules pertaining to hazardous waste

Evaluation:
Keeping an electronic notebook: description of one syllabus-related practical problem in half / one page in every two weeks.
The pharmacist in charge of the training checks the work and description every second week and evaluates it using a five-grade system. He /She sends the electronic notebook to the Dean's Office according to the rules of the place of training.
At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in written form and evaluates the student based on a three-grade system. He / she sends it to the Dean's Office in a printed and signed form according to the rules of the training place.

Student evaluation:
After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training facility.

State Exam Practice II. Pharmaceutical Business Administration

1. Syllabus for the practice in a public pharmacy before final examination
Duration of the practice is 2+3 months, 8 hours daily, from which two hours may be spent on preparing individually.
Pharmacy students should gain experience on the following areas in a general pharmacy during their practice and subsequently acquire knowledge about pharmacy operation including: dispensing medication, preparing medication, validation and quality assurance, and the overall operation of the pharmacy.

Main requirements for the student:
He/she should accept and sign the non-disclosure document.
Absence from practice must be authentically justified based on the rules of the place of training. Absences must be made up.
He/she is expected to follow the guidance of the pharmacist in charge of the training.

The expected skills made on the student after completion of the practice:
practical application of the theoretical knowledge obtained during his / her studies,
the knowledge of the practical application of the rules and regulations concerning the operation of pharmacies,
he / she is required to have an appropriate working relationship with the co-workers at the pharmacy
he/ she is expected to communicate with the patients in an appropriate way,
he / she is required to appropriately inform and give advice in connection with the patients' questions regarding self-healing and preparations without prescription (drugs and other products),
He / she is required to identify „problematic patients" from the point of view of communication and to handle situations properly with help.

The student's tasks during the practice:
Under the supervision and instructions of the pharmacist in charge of the training he / she participates in the following activities:

1. Drug Dispense. In the process he / she is required to solve the following problems:
how to check the content and layout of the prescription
the application of the rules regarding the replacement of drugs, ordering of drugs on the basis of international non-proprietary name,
appropriate patient information knowing the effects and adverse effects of drugs,
recognition and evaluation of the characteristic interactions based on database (drug-drug, drug-food, drug-food supplement),
characteristic/obligatory cases and methods of medical information and consultation,
duties in connection with the known/identified adverse effects of drugs,
adherence control and means of correction, common uses,
the typical cases of self-healing, the dispensing of the preparations without prescription that can be applied for this purpose,
the possibilities and rules of access to data regarding the patients' previous medication (OEP database),
the database of nutrition complements and medicinal formulae
proper application of the labelling and dispensing computer program.

2. Preparation of medicine. In the process he / she is required to solve the following problems:
How to prepare magistral / individual formulations according to the rules and to recognize incompatibilities
The legal possibilities of changing the original prescription
The rules of labelling and their application (identifiability of manufacturer and patient, application, administration, shelf-life)
Documentation of preparation, and administrative obligations
Storage of materials, processing of basic formulations and subsequent administrative obligations
Formulations of the compendium and FoNo

3. Operation, quality assurance. In the process he / she is required to solve the following problems:
administrative work in the pharmacy
the rules concerning the staff of the pharmacy; qualification, labor law requirements,
standard procedures for workflow
how to check and document workflow
the rules pertaining to the examining and sampling incoming medications,
documentation of examinations

4. Medication management. In the process he / she is required to solve the following problems:
aspects of inventory management,
how to order medicine
duties in case of waste products, returned items, damage,
withdrawal of products from circulation,
duties regarding shift of prices,
closings: daily, weekly, periodic as well as schedule of OEP reports,
importance and practice of supervision of prescriptions,
about narcotics and activities involving their handling,
the rules pertaining to hazardous waste.

Evaluation:

Keeping an electronic workbook: the description of one practical problems in half/one page in every two weeks. One of them should describe a question related to the patient (dispensing drugs), the other topic can be chosen from the three other areas (preparation of medicine, operation, medication management). The descriptions made during the practice should be concerned with all the areas of the activities at a pharmacy. The pharmacist in charge of the training checks the work and description every week and evaluates it using a five-grade system. He / She sends the electronic notebook to the Dean's Office according to the rules of the place of training.
The student is required to make a 10-15-minute-long presentation for the co-workers of the pharmacy from a professional scientific journal recommended by the pharmacist in charge of the training (the documentation of which will be kept in the workbook) on one occasion. The presentation will take place on a date agreed on by the training location and the student.
At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in written form and evaluates the student based on a three-grade system. He / she sends it to the Dean's Office in a printed and signed form according to the rules of the training place.

After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training facility.

2. Syllabus for the practice in a hospital pharmacy before final examination

Duration of the practice is 1 month, 8 hours daily, from which two hours may be spent on preparing individually.
Pharmacy students should gain experience on the following areas in a hospital pharmacy during their practice regarding the characteristics of supplying medicine: system of in-patient care and medicines financing, medication management (acquisition and selling), preparation of individual and multi-dose medicine, therapeutic consultation, system of quality assurance.
Main requirements for the student:
He/she should accept and sign the non-disclosure document.
Absence from practice must be authentically justified based on the rules of the place of training. Absences must be made up.

Skills expected from the student after the completion of practice:
practical application of the theoretical knowledge obtained during his / her studies
the knowledge of the practical application of the rules and regulations concerning the operation of

pharmacies,
appropriate communication with the co-workers at the pharmacy and the qualified and unqualified employees of the hospital,
appropriate communication with the in-patients.
The student's tasks during the practice:
He/she is required to participate in the following activities settled down in the regulations regarding hospital pharmacies (41/2007 Eü M) under the supervision and instruction of the pharmacist in charge of the training:

1. Ordering medicines / storage / dispensing to departments. In the process he / she is required to learn:
various ways of supplying medicines: „central procurement", private tenders, supplying medicines in addition to procurement,
the IT system of medication management,
the ways of fulfilling the medicine claims of the departments / patients,
registry of controlled preparations,
procedure of fulfilling the individual import and „off-label" claims.

2. Individual and multi-dose sterile and non-sterile preparation of medicine. In the process he / she is required to learn:
the FoNo and manual drug making,
cytotoxic preparations, preparation of mixture infusion,
the possible solutions for individual needs.

3. Therapeutic consultant tasks. In the process he / she is required to learn:
therapeutic protocols (the circle of medicines which can be selected primarily),
the informational activity of the pharmacy; medicine-substitution, mistakes in connection with medication, side effects, monitoring, signalling, and reporting interactions.

4. Operation / quality assurance. In the process he / she is required to learn:
the place of the pharmacy in the in-patient institutional hierarchy,
the financing system of the in-patient care; HBCS, the place of the medicine in the HBCS,
the planning and documentation of dispensing in the in-patient departments,
the special techniques for subsidizing medication (itemized financing, individual equity, charities),
the aim and management of establishing a list of basic medicines,
the reason for medicine shortages and the handling of it,
duties in connection with the medicines of clinical medicine trials,
the participation of the pharmacy in hospital board meeting and work-groups (pharmacotherapeutic, nutritional, etc.),
job descriptions, duties and competences,
plans for further trainings, the system of pharmaceutical reporters and professional meetings.

Evaluation:
Keeping an electronic workbook: the description of one practical problems in a half/one page in every two weeks. One of them should describe a therapeutic question in direct connection with the patient, the other topic can be chosen from the three other areas (supplying medicine, making of drugs, operation, making of drugs). The descriptions made during the practice should be concerned with all the areas of the activities in a pharmacy. The instructing pharmacist checks the work and description weekly and evaluates them on a scale of 5. He/she should send the electronic workbook

to the Dean's Office in accordance with the rules of the training location.
The student is required to make a 10-15-minute-long presentation for the co-workers of the pharmacy from a professional scientific journal recommended by the pharmacist in charge of the training (the documentation of which will be kept in the workbook) on one occasion. The presentation will take place on a date agreed on by the training location and the student.
At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in written form and evaluates the student based on a three-grade system. He / she sends it to the Dean's Office in a printed and signed form according to the rules of the training place.

Student evaluation:
After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training facility.

State Exam Practice II. Pharmaceutical Management, Quality Assurance

1. Syllabus for the practice in a public pharmacy before final examination
Duration of the practice is 2+3 months, 8 hours daily, from which two hours may be spent on preparing individually.
Pharmacy students should gain experience on the following areas in a general pharmacy during their practice and subsequently acquire knowledge about pharmacy operation including: dispensing medication, preparing medication, validation and quality assurance, and the overall operation of the pharmacy.

Requirements for the student:
Accept and sign the non-disclosure document.
Absence from practice must be authentically justified based on the rules of the place of training. Absences must be made up.
He/she is expected to follow the guidance of the pharmacist in charge of the training.

The expected skills made on the student after completion of the practice:
practical application of the theoretical knowledge obtained during his / her studies,
the knowledge of the practical application of the rules and regulations concerning the operation of pharmacies,
he / she is required to have an appropriate working relationship with the co-workers at the pharmacy
he/ she is expected to communicate with the patients in an appropriate way,
he / she is required to appropriately inform and give advice in connection with the patients' questions regarding self-healing and preparations without prescription (drugs and other products),
He / she is required to identify „problematic patients" from the point of view of communication and to handle situations properly with help.

The student's tasks during the practice:
Under the supervision and instructions of the pharmacist in charge of the training he / she participates in the following activities:

1. Drug Dispense. In the process he / she is required to learn:
how to check the content and layout of the prescription
the application of the rules regarding the replacement of drugs, ordering of drugs on the basis of international non-proprietary name,

appropriate patient information knowing the effects and adverse effects of drugs,
recognition and evaluation of the characteristic interactions based on database (drug-drug, drug-food, drug-food supplement),
characteristic/obligatory cases and methods of medical information and consultation,
duties in connection with the known/identified adverse effects of drugs,
adherence control and means of correction, common uses,
the typical cases of self-healing, the dispensing of the preparations without prescription that can be applied for this purpose,
the possibilities and rules of access to data regarding the patients' previous medication (OEP database),
the database of nutrition complements and medicinal formulae
proper application of the labelling and dispensing computer program.

2. Preparation of medicine. In the process he / she is required to learn:
How to prepare magistral / individual formulations according to the rules and to recognize incompatibilities
The legal possibilities of changing the original prescription
The rules of labelling and their application (identifiability of manufacturer and patient, application, administration, shelf-life)
Documentation of preparation, and administrative obligations
Storage of materials, processing of basic formulations and subsequent administrative obligations
Formulations of the compendium and FoNo

3. Operation, quality assurance. In the process he / she is required to learn:
administrative work in the pharmacy
the rules concerning the staff of the pharmacy; qualification, labor law requirements,
standard procedures for workflow
how to check and document workflow
the rules pertaining to the examining and sampling incoming medications,
documentation of examinations

4. Medication management. In the process he / she is required to learn:
aspects of inventory management,
how to order medicine
duties in case of waste products, returned items, damage,
withdrawal of products from circulation,
duties regarding shift of prices,
closings: daily, weekly, periodic as well as schedule of OEP reports,
importance and practice of supervision of prescriptions,
about narcotics and activities involving their handling,
the rules pertaining to hazardous waste.

Evaluation:
Keeping an electronic workbook: the description of one practical problems in half/one page in every two weeks. One of them should describe a question related to the patient (dispensing drugs), the other topic can be chosen from the three other areas (preparation of medicine, operation, medication management). The descriptions made during the practice should be concerned with all the areas of the activities at a pharmacy. The pharmacist in charge of the training checks the work and description every week and evaluates it using a five-grade system. He / She sends the electronic

notebook to the Dean's Office according to the rules of the place of training.
The student is required to make a 10-15-minute-long presentation for the co-workers of the pharmacy from a professional scientific journal recommended by the pharmacist in charge of the training (the documentation of which will be kept in the workbook) on one occasion. The presentation will take place on a date agreed on by the training location and the student.
At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in written form and evaluates the student based on a three-grade system. He / she sends it to the Dean's Office in a printed and signed form according to the rules of the training place.

Student evaluation:
After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training facility.

2. Syllabus for the practice in a hospital pharmacy before final examination
Duration of the practice is 1 month, 8 hours daily, from which two hours may be spent on preparing individually.
Pharmacy students should gain experience on the following areas in a hospital pharmacy during their practice regarding the characteristics of supplying medicine: system of in-patient care and medicines financing, medication management (acquisition and selling), preparation of individual and multi-dose medicine, therapeutic consultation, system of quality assurance.

Requirements for the student:
Accept and sign the non-disclosure document.
Absence from practice must be authentically justified based on the rules of the place of training. Absences must be made up.
Skills expected from the student after the completion of practice:
practical application of the theoretical knowledge obtained during his / her studies
the knowledge of the practical application of the rules and regulations concerning the operation of pharmacies,
appropriate communication with the co-workers at the pharmacy and the qualified and unqualified employees of the hospital,
appropriate communication with the in-patients.

The student's tasks during the practice:
He/she is required to participate in the following activities settled down in the regulations regarding hospital pharmacies (41/2007 Eü M) under the supervision and instruction of the pharmacist in charge of the training:

1. Ordering medicines / storage / dispensing to departments. In the process he / she is required to learn:
various ways of supplying medicines: „central procurement", private tenders, supplying medicines in addition to procurement,
the IT system of medication management,
the ways of fulfilling the medicine claims of the departments / patients,
registry of controlled preparations,
procedure of fulfilling the individual import and „off-label" claims.

2. Individual and multi-dose sterile and non-sterile preparation of medicine. In the process he / she

is required to learn:
the FoNo and manual drug making,
cytotoxic preparations, preparation of mixture infusion,
the possible solutions for individual needs.

3. Therapeutic consultant tasks. In the process he / she is required to learn:
therapeutic protocols (the circle of medicines which can be selected primarily),
the informational activity of the pharmacy; medicine-substitution, mistakes in connection with medication, side effects, monitoring, signalling, and reporting interactions.

4. Operation / quality assurance. In the process he / she is required to learn:
the place of the pharmacy in the in-patient institutional hierarchy,
the financing system of the in-patient care; HBCS, the place of the medicine in the HBCS,
the planning and documentation of dispensing in the in-patient departments,
the special techniques for subsidizing medication (itemized financing, individual equity, charities),
the aim and management of establishing a list of basic medicines,
the reason for medicine shortages and the handling of it,
duties in connection with the medicines of clinical medicine trials,
the participation of the pharmacy in hospital board meeting and work-groups (pharmacotherapeutic, nutritional, etc.),
job descriptions, duties and competences,
plans for further trainings, the system of pharmaceutical reporters and professional meetings.

Evaluation:

Keeping an electronic workbook: the description of one practical problems in a half/one page every two weeks. One of them should describe a therapeutic question in direct connection with the patient, the other topic can be chosen from the three other areas (supplying medicine, making of drugs, operation, making of drugs). The descriptions made during the practice should be concerned with all the areas of the activities in a pharmacy. The instructing pharmacist checks the work and description weekly and evaluates them on a scale of 5. He/she should send the electronic workbook to the Dean's Office in accordance with the rules of the training location.
The student is required to make a 10-15-minute-long presentation for the co-workers of the pharmacy from a professional scientific journal recommended by the pharmacist in charge of the training (the documentation of which will be kept in the workbook) on one occasion. The presentation will take place on a date agreed on by the training location and the student.
At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in written form and evaluates the student based on a three-grade system. He / she sends it to the Dean's Office in a printed and signed form according to the rules of the training place.

Student evaluation:
After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training facility.

CHAPTER 16
ACADEMIC PROGRAM FOR THE 1ST YEAR

Department of Foreign Languages

Subject: **HUNGARIAN CRASH COURSE**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Practical: **36**

1st week:
Seminar:
Practical: 1st day: 1. lecke, 2. lecke I. rész (Greetings, the alphabet, numbers 0-20, colours, everyday expressions, nationalities) - **2nd day:** 2. lecke II. rész, 3. lecke (languages, numbers 21-29, names of places, the days of the week, numbers 30-100, the time, *hány óra van?*) - **3rd day:** 4. lecke, 5. lecke I. rész (Test Your Knowledge 1, adjectives and adverbs, verbs expressing activities 1) - **4th day**: 5. lecke II. rész, 6. lecke (times of day, *hány órakor?*, numbers 1000-1000000000, verbs expressing activities 2, everyday expressions, ordinal numbers) - **5th day:** 7. lecke, 8. lecke (Revision 1, everyday objects, food and drink, adverbs of frequency)

2nd week:
Practical: 1st day: 9. lecke, 10. lecke I. rész (Food, drink, fruit, vegetables, the menu, ordering in a restaurant, shopping in the market, the uses of *tessék*, the weather) - **2nd day:** 10. lecke II. rész, 11. lecke (the seasons and months, clothes, Test Your Knowledge 2) - **3rd day:** 12. lecke, 13. lecke I. rész (body parts, adjectives and descriptions, accessories, jobs, places) - **4th day:** 13. lecke II. rész, 14. lecke (personal details and filling in a form, family relations, revision 2) - **5th day**: End course exam. Oral exam.

Requirements

9.00 - 10.30: language classes
10.30 - 11:00 break
11.00 - 12.30: language classes

Assessment: five grade evaluation (AW5).
Evaluation: Based on a written final test (80 %) + class participation + daily word quizzes (20 %) . Passing the oral exam is a minimal requirement for the successful completion of the Hungarian Crash Course. The oral exam consists of a role-play from a list of situations covered in the coursebook. A further minimal requirement is the knowledge of 200 words.

STUDENTS WHO DO NOT ATTEND THE HUNGARIAN CRASH COURSE DUE TO THEIR OWN FAULT OR FAIL THE ORAL EXAM HAVE TO TAKE AN EXTRA COURSE FOR AN ADDITIONAL FEE OF 500 USD DURING THE FIRST SEMESTER.

Subject: **HUNGARIAN LANGUAGE I/1.**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Practical: **24**

1st week:
Practical: Revision

2nd week:
Practical: introducing yourself, registration form, expressing *like doing something*, *a lot – a little*, dialogue in a café, conjugation of verbs

3rd week:
Practical: regular verbs in plural, sights and buildings, buying ice-cream and refreshments, buying an entrance ticket

4th week:
Practical: different means of transport, conjugation of verbs, the ending *–val/-vel*, *something/somewhere*, the conjugation of *come / go / be*

5th week:
Practical: *this / this is / this is a / an*, orientation, shops and stores, ordering, the conjugation of *eat and drink, do you feel like?, there is no / there are no*

6th week:
Practical: Revision
Self Control Test (Mid-term test)

7th week:
Practical: understanding a chat, question words, invitation, connectives: *because, but, and, if, or*, buying a cinema ticket, *what number? which one in order?*

8th week:
Practical: timetable, *where ... to*?, the ending *–ra/-re*, *not ... but*, the future: *will be*

9th week:
Practical: *where?, -n/-on/-en/-ön*, at the market, at the bakery, at the post office

10th week:
Practical: *where .... from?, -ról/-ről, where, where ... to?,* dialogue in a taxi, buying a train ticket, prefixes: *be-, ki-, le-, fel-, vissza-*

11th week:
Practical: Revision

12th week:
Practical: End-term test
Self Control Test (Written and oral test)

Requirements

Requirements of the course:
Attendance
Attending language classes is compulsory. If a student is late it is considered as an absence. Students can miss only 10 percent of the classes that is maximum 2 occasions. The teacher evaluates active participation in each class. Students are not supposed to share coursebooks in the classes therefore if they fail to bring the coursebook to the class for the second time the attendance is refused.

Testing, evaluation
In each Hungarian language course, students must sit for 2 written language tests and an oral exam. Students must appear at the lecture hall at least 15 minutes before the exam. If students are late, they are not allowed to write the test.
A further minimum requirement is the knowledge of 200 words per semester divided into 10 word quizzes. There are five word quizzes before and another five after the midterm test. If a student fails or misses any word quizzes he / she cannot take the written test. A word quiz can be postponed by a week and students can take it only with their own teacher. Students can get bonus points (5-5%) by taking two extra quizzes containing 20 sentences each, before the midterm and end term tests. The sentences are taken from the units of the coursebook.
The oral exam consists of a role-play from a list of situations covered in the coursebook. If students

fail the oral exam, they fail the whole course. The results of the written tests and the oral exam are combined and averaged.
Based on the final score the grades are given as follows.

Final score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the final score of the written tests is below 60, the student can take a written remedial exam once covering the whole semester's material.

Coursebook:
See the website of the Department of Foreign Languages: **ilekt.med.unideb.hu.**
Audio files to the course book, oral exam topics and vocabulary minimum lists are also available on the website.

Subject: **LATIN LANGUAGE I.**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Introduction to Pharmaceutical Terminology and the Latin Alphabet

2nd week:
Practical: Pharmaceutical substances, Grammatical Gender in Latin

3rd week:
Practical: Anatomical Planes and Directions

4th week:
Practical: Prescription Structure and Types, Latin Numerals 1-20

5th week:
Practical: The Human Body (I), Ingredients on Prescriptions

6th week:
Practical: The human body (II)

7th week:
Practical: Revision for the Midterm test

8th week:
Practical: Dosage Forms, Preparation Names in FoNo

9th week:
Practical: Numerals 21-100, Clinical Terminology of Body parts

10th week:
Practical: Pharmacy Preparations and Containers

11th week:
Practical: Body regions, Adjective Formation

12th week:
Practical: Numerals 200-2000, Declension of Numerals and Adjectives

13th week:
Practical: Revision for the End-term test

14th week:
Practical: Evaluation and closing of the

semester

Requirements

Requirements of the course:
Attendance
Attending language classes is compulsory. If a student is late it is considered as an absence. Students can miss only 10 percent of the classes that is maximum 2 occasions.
The teacher evaluates active participation in each class. Students are not supposed to share coursebooks in the classes therefore if they fail to bring the coursebook to the class for the second time attendance is refused.

Testing, evaluation
In each Latin language course, students must sit for 2 written language tests. Students must appear at the lecture hall at least 15 minutes before the exam. If students are late, they are not allowed to write the test.
A further minimum requirement is the knowledge of 300 words per semester. There is a written word quiz in the first 5-10 minutes of the class, every week. If a student fails 4-4 successful word quizzes till the mid-term and the end-term tests he/she is not allowed to sit in for the test. If a student does not have at least 8 successful word quizzes he / she has to take a vocabulary exam that includes all 300 words. A word quiz can be postponed by a week and students can take it only with their own teacher. Students can obtain bonus points (5-5%) by taking all the word quizzes successfully.
Based on the final score the grades are given as follows.

Final score	Grade
0 – 59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the final score is below 60, the student can take a remedial exam once covering the whole semester's material.

Coursebook:
See the website of the Department of Foreign Languages: **ilekt.med.unideb.hu.**
Minimum vocabulary lists and further details are also available on the website.

Department of Human Genetics

Subject: **PHARMACEUTICAL BIOLOGY I.**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **21**
Practical: **28**

1st week:
Lecture: 1. Introduction into cell biology. The most important organic and inorganic compounds of the living cells I. 2. he most important organic compounds of the living cells II.
Practical: 1. Introduction of the subject, methods of studying, compulsory and recommended literature. Getting acquainted, lab safety education. Microscopy I. Theoretical background, components of a microscope. Basics of electron microscopic techniques.

2nd week:
Lecture: 3. Structural and functional characteristics of the bacterial cell. Biosynthesis of the bacterial cell wall and the antibiotics that inhibit this process. 4. The most important morphological and functional characteristics of the eukaryotic cell. The animal cell.
Practical: 2. Microscopy II. The principles of phase contrast, dark field and polarization microscopy. Setting up the microscope. Practicing the use of light microscope.

3rd week:
Lecture: 5. The most important morphological and functional characteristics of plant and fungal cell. 6. Molecular structure and function of biological membranes. The eukaryotic and prokaryotic cell boundary.
Practical: 3. Chemical structure of proteins, nucleic acids, and carbohydrates and their biological significance.
Self Control Test (Test on Microscopy in extra time)

4th week:
Lecture: 7. Transport across membranes. 8. The cytoskeleton: microtubules, microfilaments and intermediate filaments.
Practical: 4. Comparison of the prokaryotic and eukaryotic cell. Eukaryotic cell types, organelles, cell components. Study of electron micrographs.

5th week:
Lecture: 9. Endocytosis, exocytosis, cell surface receptors. 10. Intracellular compartments and protein sorting.
Practical: 5. Chemical structure of lipids and their biological significance. The structure of membranes. Transport across membranes. Study of electron micrographs.

6th week:
Lecture: 11. Extracellular matrix, cell junctions and cell adhesion molecules. 12. Energy, catalysis, and biosynthesis.
Practical: 6. The GERL system. Endocytosis. Study of electron micrographs.
Self Control Test (1st self-control test in extra time)

7th week:
Lecture: 13. The mitochondrion and the biological oxidation. 14. The chloroplast and the photosynthesis.
Practical: 7. Cytoskeleton, cell junctions and extracellular matrix. Study of electron micrographs. Reaction catalysis.

8th week:
Lecture: 15. The cell nucleus. 16. Chromatin and chromosomes.
Practical: 8. Photosynthesis, glycolysis, fermentation, terminal oxidation. Study of electron micrographs.

9th week:
Lecture: 17. Replication of prokaryotic and eukaryotic DNA.
Practical: 9. Cell nucleus, chromatin and chromosomes. Cell division I. Study of electron micrographs.

10th week:
Lecture: 18. Transcription in prokaryotes.
Practical: 10. Isoelectric point of ovalbumin and optimum pH of the ß-galactosidase. Examination on the use of light microscope.
Self Control Test (2nd self-control test in extra time)

11th week:
Lecture: 19. Translation in prokaryotes and eukaryotes.
Practical: 11. General principles of cytological staining. Ionic dyes. Staining of wool: a model

experiment. Differential staining of the nucleus and cytoplasm. Examination on the use of light microscope.

12th week:
Lecture: 20. Cell signalling. General principles. 21. Signal transduction pathways.
Practical: 12. Cytochemical reactions. Detection of DNA and polysaccharides. Examination on the use of light microscope.

13th week:
Lecture: No lecture scheduled.
Practical: 13. Immunocytochemical reactions. Demonstration of immunoglobulin producing lymphocytes. Selective staining of mitochondria by enzyme-cytochemical reactions. Examination on the use of light microscope.

14th week:
Lecture: No lecture scheduled.
Practical: 14. DNA replication, transcription, translation. Signalling.
Self Control Test (3rd self-control test in extra time)

Requirements

Pharmaceutical Biology I. (first semester subject) is a prerequisite of Pharmaceutical Biology II. (second semester subject).

Conditions of signing the lecture book:

1, Attendance
Concerning attendance, the rules laid out in the EER of the University are clear. The presence of students at laboratory practices and seminars is obligatory and will be recorded. The professor refuses his/her signature in the student's Lecture Book for the semester's course-work in the case of over four weeks of absence, even if the student has an acceptable excuse. If the student is absent from more than two practices or seminars (taken together), the semester will be accepted only if they pass an examination based on the material covered by the laboratory classes and seminars of the semester (lab test).
Successful accomplishment of the laboratory practices will be controlled by signing the laboratory notes. If 3 or more practices will not be accepted, the lecture book will not be signed. These students must sit for a written exam from the laboratory material.
The presence of students on at least 30% of lectures is obligatory and will be recorded. The professor refuses his/her signature in the student's Lecture Book for the semester's course-work if the student was absent from more than 14 lectures, even if the student has an acceptable excuse.

2, Self-control tests
During the semesters there will be 3 self control tests offered. Participation in at least two of them is required for the signature. Based on the % average of the three tests a final grade will be offered according to the next table:

Percentage (%)	Mark
50.00 - 61.99	pass (2)
62.00 - 69.99	satisfactory (3)
70.00 - 79.99	good (4)
80.00 – 100	excellent (5)

3, Microscopy exam
The students also have to show up their knowledge in handling and setting the light microscope on

an oral exam during the practices and also have to write a knowledge test about microscopy (passing limit is 50%). Both oral and written microscopy test have to be successfully completed for the signature. Unsuccessful exams can be repeated two times during the semester.

Exemption requests:
Applications for exemption (based on previous studies in other universities) should be submitted during the first two weeks of the semester. Requests are not accepted after that deadline! Exemption is granted only, if the student can pass an "Assessment of knowledge" test. The passing limit is 50%.

Rules concerning repeaters:
Attendance of labs and seminars for those repeaters who have a signed lecture book from the previous year (i.e. they failed, or they are repeaters because they have never taken Pharmaceutical Biology I. exam) is dispensable. Students should register for the subject electronically during the first weeks of the semester. They can take the three midterm tests in order to qualify for an offered mark based on these tests, or test bonuses and they take the regular exam at the end of the semester. Students, who did not earn a signature in the previous year have to register and attend the labs and seminars and they are considered as the other students registering the course at the first time.

End of semester examination (ESE)
There will be a written examination at the end of the first semester which covers all the material of the semester taken in the lectures, seminars, and laboratory practices (for a detailed list see the University Bulletin). The examination questions include multiple choice, and short essay questions, figures, definitions, etc. The marks are based on the student's performance, expressed in percentage (%) as shown in the table below:

Percentage (%)	Grade
0 - 49.99	fail (1)
50.00 - 61.99	pass (2)
62.00 - 69.99	satisfactory (3)
70.00 - 79.99	good (4)
80.00 - 100	excellent (5)

The percentage values include the student's performance at the ESE as well as the bonus percentage they have obtained by taking the three mid-semester tests.
The following table shows the bonus percentage based on the average result of the semester tests Absence counts as 0%. Bonuses are calculated only in the year of acquisition.

Average of the 3 tests (%)	Bonus %
40.00 - 43.99	1
44.00 - 47.99	2
48.00 - 51.99	3
52.00 - 55.99	4
56.00 - 59.99	5

60.00 - 63.99	6
64.00 - 67.99	7
68.00 - 71.99	8
72.00 - 75.99	9
76.00 - 79.99	10

ESE grade may be considered as part of the final exam mark upon the request of the student (see Pharmaceutical Biology II.).
The slides of the lectures and up-to-date information can be found at
https://elearning.med.unideb.hu, username and password is your network-id (same as Neptun-id) and password. You will be able to check the content after the Neptun has registered you to the subject.
Departmental homepage: https://humangenetics.unideb.hu

Department of Inorganic and Analytical Chemistry

Subject: **GENERAL CHEMISTRY PRACTICE**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Practical: **42**

1st week:
Practical:
General introduction to the laboratory rules and laboratory work. Safety training. Introduction to laboratory pieces of equipment. The use of gas burners. Overview of pieces of the received laboratory equipment.

2nd week:
Practical:
Mass and volume measurements: weighing on analytical and standard laboratory balances; introduction to volume measurement devices (pipette, burette, volumetric flask). Calibration of volumetric measuring equipment (pipette or volumetric flask). Calculation the standard error between the measured and nominal values.

3rd week:
Practical:
Introduction to solution preparation: grinding, use of mortal, pestle, volumetric flask. Preparation of a standard solution from a crystalline salt. Introduction to a density measurement. The use of the pycnometer. Determination of the density of the prepared solution by the help of the pycnometer. Calculating the weight percent composition of the prepared solution.

4th week:
Practical: Introduction to separation methods: decantation, centrifuging, filtration. Purification of solids. Theoretical background heating, cooling and the use of hot water bath. Purification of a benzoic acid sample contaminated with sodium chloride. Preparation of a double salt from simple salts and basic laboratory procedures.

5th week:
Practical: Writing the general mid-term test based on the studied material of the laboratory practice and seminar until week 4. Determination of the composition of mixture of potassium chloride and potassium chlorate. Review of different methods used to temperature measurements. Introduction to the measurements of melting point of the solid substances. Determination of the melting point of the

purified benzoic acid sample. Determination of the contamination percentage of the purified benzoic acid sample.

6th week:
Practical: Demonstration of acid-base titration. Preparation of a standard solution of NaOH. Concentration determination of the standard NaOH solution by acid-base titration. Determination of the molar weight of the recrystallized sample of benzoic acid by acid-base titration. Comparing the result with the literature value and calculating the standard error between the given and measured data. Purified benzoic acid due in.

7th week:
Practical: Laboratory work with gases: introduction to the use of gas cylinders, simple gas generator, Kipp's apparatus. Studying the chemical and physical properties of gases. Demonstration of hydrogen preparation. The hydrogen explosion test. Preparation of oxygen in a laboratory gas generator and burning of sulphur in oxygen. Study of the observations during the reaction (oxidation product of sulphur). Determination of molecular weight based on the ideal gas law.

8th week:
Practical: Practice the basic laboratory techniques considering the preparation of a salt. Preparation of salts from its metal. Studies of reactions involving gas formation and precipitation.

9th week:
Practical: Quantitative study of a precipitation reactions to determine the stoichiometric composition of water insoluble precipitates using the method of continuous variation. Dependence of reaction rate of concentration of reactants. Studying the factor affecting the reaction rates. Determination of the reaction rate and the rate law of the studied reaction. Metal salts preparations due in.

10th week:
Practical: Theoretical background of liquid-liquid extractions and demonstration of the separation techniques. Introduction to buffer systems, buffer capacity by studying a particular buffer system (acetic acid/acetate ion buffer; ammonium ion/ammonia buffer). Hydrolysis of salts to study the acid-base properties of ionic and covalent compounds in aqueous solutions or in reactions with water. Writing of the ionic equations based on the observed chemical reactions.

11th week:
Practical: General test from week 5 to week 10. General introduction to electrochemistry. Study of redox reactions. Prediction of the direction of spontaneous processes based on standard potentials. Factors affecting the order of the deposition of different metals during electrolysis (study of Daniell cell). Return of the received pieces of laboratory equipment.

12th week:
Seminar: Calculation of pH of strong acids and strong bases.

Requirements

The objective of the laboratory work is to introduce first-year students of different background to laboratory work, the use of basic laboratory equipment, simple laboratory operations and measurements. In addition, students are expected to prepare certain simple chemicals and run various basic experiments to familiarize themselves with chemical laboratory work. The seminar involves solving exercises and problems connected to stoichiometry, concentration measurement and pH calculation. The laboratory practice will be hwld in 11 weeks. The lab manual will be made available to the students gradually during the semester as an English translation of the Hungarian original. The preparatory material to be studied before laboratory work is over-viewed before each experiment description in this manual. The weekly syllabus lists the particular topics covered and gives a full description of the experiments. The word ‘demonstration’ in the syllabus refers to experiments that the instructors carry out for the students. Students should come to lab sessions fully prepared. Students should learn the core theoretical background of the experiments (reading the material once is insufficient) and solve the pre-lab exercises in the lab manual every week before the lab session. The sections ‘Laboratory notes’ and ‘Review exercise and problems’ should be completed during the laboratory session. After each session the instructors overview the lab notes and make corrections if necessary. Students can ask questions regarding the laboratory preparation material during the seminar each week before the lab session. Each week the laboratory session begins with a short test (not more than 15 minutes) based exclusively on the preparatory material of that week and the previous week and the results of the experiments carried out the previous week. During the semester, students are required to write two general tests (week 8 and week 14) which are based on the course material for weeks 1-8 and 9-14, respectively. Grading is based on a five-level scale: 1 (fail), 2 (pass), 3 (average), 4 (good), 5 (excellent). The final course grade is given based on the results of these tests, the quality of the laboratory notes and the quality of laboratory work. The average score from both the short tests and the general tests must be above 2.00 to avoid a ‘fail’ final course grade. Students with ‘fail’ final course grade due to inadequate laboratory work have to retake the course the next year. Students with ‘fail’ final course grade due to low test results can re-take a comprehensive test exam in the examination period. It is not allowed to miss any laboratory practices/seminars. If a student misses one lab practice, medical certification is needed. If a student misses two or more lab practices/seminars even for any medical reasons, the student’s lecture book won’t be signed and she or he has to retake the course next year.

Subject: **GENERAL CHEMISTRY THEORY**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **42**
Seminar: **28**

1st week:
Lecture: Classification of natural sciences, history and development of chemistry. The concept of chemical change. The SI system of units, the most important physical quantities and units. Conservation of mass and energy. The law of definite proportions, the law of multiple proportions, law of combining gas volumes, Avogadro’s law. Dalton’s atomic theory. Relative atomic and molecular weights. Amount of substance and the definition of mole. Notations for elements and compounds, symbol, empirical formula, molecular formula, structure, isomerism.
Seminar: Determination of atomic weight, molecular weight, empirical formula, molecular formula, amount of substance. Determination of empirical formula based on weight percent composition and on elemental analysis.

2nd week:
Lecture: Valency and oxidation number. Oxidation number in inorganic compounds. Types of chemical reactions. Latin names of compounds. Experimental background of the atomic theory, discovery of the nucleus. Discovery and basic properties of subatomic particles (electron, proton, neutron). Isotopes.

Seminar: General introduction to the units of concentration. Interconversion of units. Calculation problems connected to solution preparation. Introduction of the SI system. Mass concentration, molarity, mass percent composition, molar percent composition.

3rd week:
Lecture: Types and properties of radioactive radiation. Laws of radioactive decay, decay series. Medical and other practical importance of

radioactive isotopes. The mass defect. Einstein's equation on mass-energy equivalence. Nuclear energy, nuclear fission and fusion. Quantized changes in the energy states of atoms. The photon hypothesis. The Bohr model of the atom. Characteristics of electromagnetic radiation, atomic line spectra, X-ray radiation.
Seminar: Review exercises concerning on the first two weeks. Interconversion of concentration units. Density measurements. Mixing equations.

4th week:
Lecture: The dual nature of matter. Heisenberg's uncertainty principle. Schrödinger's equation and its application for the hydrogen atom. Quantum numbers and their importance. The shape of atomic orbitals. Characterization of polyelectronic atoms. Principles of the periodic table.
Seminar: Theoretical background of crystallization. Exercises calculation problems of crystallization.

5th week:
Lecture: Electronegativity, ionization energy, electronaffinity, atomic and ionic radii and their change across the periodic table. The ionic bond. Calculation of the lattice energy. Metallic bonding.
Seminar: Theoretical backgrounds of gas and solids. Composition of solid and gas mixtures. Introduction to basic chemical equations. Stoichiometric calculations based on chemical equations. Preparation of salts, calculation of theoretical and percent yield. Dissolving of metal mixtures in acids.

6th week:
Lecture:
The covalent bond. Basic characteristics of the molecular orbital (MO) theory and its application for diatomic molecules. The valence shell electron pair repulsion (VSEPR) model. The shape of molecules, bond angles, bond orders, hybridization. Polarity of covalent bonds, polar and nonpolar molecules.

Seminar: Acid-base equilibria. Theory of acid-base reactions and titrations. Exercises based on acid-base titrations. Stoichiometric calculations based on chemical equations. Determination of molar weight based on titration results.

7th week:
Lecture:
Intermolecular forces. London forces, dipole-dipole interaction. Hydrogen bond and its importance in inorganic and organic chemistry. General characterization of molecular, ionic, metallic, and network atomic solids.

Seminar: Review exercises in stoichiometry and concentration calculations.

8th week:
Lecture:
Classification and structure of chemical systems. General characterization of different states of matter. The kinetic molecular theory of gases, ideal and real gases. Gas laws: Boyle's law, Charles's law, the ideal gas law. Gas mixtures, partial pressure. General characterization of liquids, surface tension, viscosity. General characterization and classification of solids. Changes of state: melting, freezing, evaporation, condensation, sublimation.

Seminar: Introduction to basic gas laws. Laboratory preparation of gases. Calculation problems connected to evolution of gases based on chemical equations.

9th week:
Lecture:
Classification of multicomponent systems, properties of solutions and mixtures. Solubility and units of concentration. Vapor pressure, freezing and boiling point of solutions. Osmosis pressure. Determination of molecular weight. Phase diagrams, critical temperature and pressure. Thermodynamic temperature.

Seminar: Theory of redox reactions. Balancing of redox reactions. Calculations based on redox reactions. Preparation of salts from its metal.

10th week:
Lecture:

Basics of thermochemistry. Heat of reaction, Hess's law. The importance of heat of formation. Heat of reaction and bond energies. The direction of spontaneous chemical reactions: internal energy, enthalpy, free energy and entropy.

Seminar: Review exercises in balancing of redox and acid-base reactions.

11th week:
Lecture:
Dependence of reaction rates on concentrations and the temperature. Order of reactions. Activation energy. Catalysts, homogeneous and heterogeneous catalytic reactions. Enzymes. Photochemical processes. The equilibrium condition and the equilibrium constant. Possibilities to shift the composition of equilibria. Dependence of the equilibrium constant on temperature and pressure. Le Chatelier's principle.

Seminar: Definition of pH. Theoretical background of pH calculation. Introduction to water ionisation constants. Relationship between the Kw and H+.

12th week:
Lecture: Solubility equilibria, solubility product. Temperature dependence of solubility. Gas-liquid and liquid-liquid equilibria. Extraction. Different theories of acid-base reactions (Arrhenius, Brønsted, Lewis). Characterization of aqueous solutions, electrolytic dissociation. Strength of acids and bases. Super acids. Dissociation constant and degree of dissocation.
Seminar: Calculation of pH of strong acids and strong bases.

13th week:
Lecture: Self-ionization of water. Ionic product of water. The definition and calculation of pH. Amphoteric substances. Buffer solutions and acid-base indicators. Acid-base properties of salts. Complex ion equilibria. Pearson's hard-soft theory.
Seminar: Calculation of pH of weak acids and weak bases. Determination of dissociation rate. Theoretical background of buffer systems, buffer capacity. Calculation problems regarding the pH of buffer systems.

14th week:
Lecture: Basics of electrochemistry. Galvanic cells and the concept of electrode potential. Standard electrode potentials, oxidizing and reducing agents. Water as a redox system. Electrolysis, voltage needed in electrolytic cells, overvoltage. Quantitative laws of electrolysis. Galvanic cells and batteries.
Seminar: Electrochemical exercises. Fundamental of galvanic cells (Daniell cell). The concept of electromotive force, redox potential, standard redox potential. Nernst equation. Review exercises of pH calculations.

Requirements

Minimum requirements of the seminar:
1. The presence of students at seminars is obligatory. If a student misses three seminars even for any medical reasons, the student's lecture book won't be signed.

2. During the semester, the students are required to write two tests. The sum of scores from both tests must be at least 50 % to get the signature and these students are eligible to register for the theoretical exam. The students with low test results (the score of both tests are between 20 and 40 %) can take a comprehensive test (Test III) in the examination period and the passing level is 60 %. Test III will be organized only once in the examination period. If the score of the individual tests is less than 20 %, the student's lecture book won't be signed and the student has to retake the course next year.

Department of Pharmaceutical Technology

Subject: **PHARMACY PROPEDEUTICS**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: The methods of Greek, Roman and Arab treatments.

2nd week:
Lecture: Pharmaceutics in ancient times and in middle ages.

3rd week:
Lecture: The development of anatomical and morphological thinking.

4th week:
Lecture: The development of bacteriological thinking.

5th week:
Lecture: The development of physiological thinking.

6th week:
Lecture: The history of the development of medical departments.

7th week:
Lecture: Factors that helped in the development of theoretical and practical pharmacy in Hungary.

8th week:
Lecture: The development of pharmacies.

9th week:
Lecture: The pharmaceutical career as a profession.

10th week:
Lecture: The structural build-up of the Hungarian public health.

11th week:
Lecture: Drug as remedy.

12th week:
Lecture: Grouping of drugs. (origin, therapeutic effect, the area of utilization, the method of administration)

13th week:
Lecture: Drug supply. The functional conditions of pharmacies (personal, material).

14th week:
Lecture: The professional books, journals in a pharmacy. (Pharmacopoeia, Hungarian/foreign). Formulae Normales (pharmaceutical and medical edition). Prescriptions.

Requirements

Students have to attend 30% of the lectures. All materials covered in lectures is an integral part of the subject and therefore included in the self-control test and the final exam.

Requirements for signing the Lecture book:
The Department may refuse to sign the lecture book if the student didn’t attend 30% of lectures.

Department of Solid State Physics

Subject: **PHYSICS**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **14**
Practical: **28**

1st week:
Lecture: What is physics: the nature of the laws in science and physics.

2nd week:
Lecture: Classical Mechanics. Description of the motion. Kinematics.

3rd week:
Lecture: The mechanics of point masses. Newton's laws. Mass and force laws.

4th week:
Lecture: Conserved quantities. Momentum, angular momentum, work and energy.

5th week:
Lecture: Gravity: Kepler's laws, Force fields, The inverse square law.

6th week:
Lecture: Vibrations: Harmonic vibration, force law and energy conservation.

7th week:
Lecture: Waves in elastic media: Hook's law. Propagation of disturbances. The wave equation, Propagating and standing waves.

8th week:
Lecture: Electrostatics. Charges, Coulomb's law, electrostatic potential.

9th week:
Lecture: Electromagnetism. The Lorentz force, magnetic fields. Induction, electromagnetic waves.

10th week:
Lecture: Geometrical Optics: The laws of reflection and refraction. Fermat's principle. Optical lenses and image formation.

11th week:
Lecture: Physical optics: Wave propagation, and interference, Huygens Fresnel principle, Light waves, colour.

12th week:
Lecture: Introduction to quantum mechanics: Matter waves. The dual nature of light, The Schrodinger equation. Atomic spectra and the structure of atoms.

13th week:
Lecture: Thermal physics. Temperature scales. The ideal gas. The black body radiation.

14th week:
Lecture: Nuclear physics: Radioactivity. Radiations. The mass defect. The structure of the nucleus.

Requirements

Aim of the courses is to introduce the basic concepts and quantities for natural science studies. Aim of the practice is to provide skills to apply physical laws to simple situations to derive quantitative result, and use physical quantities properly.

Course topics
1. Kinemics, description of motion, veloxity, acceleration, path, path length
2. planar motion, projectiles, rotation, vibration.

3. Force and mass. The axioms of the Newtonian mechanics, The equation of motion, Harmonic oscillator.
4. Conserved quantities. Energy, momentum, work and potential energy,
5. Gravitastional force. Planetary motion. Kepler1s laws. Cavendish experiment. The mass of earth.
6. Ideal gas: the concept of temperature. Origin of the ideal gas law. .The law of equipartition.
7. Ellastic media, the hooks law, waves, wave propagation, wave equation, harmonic waves.
8. Wave propagation in three dimensiopns. Wave surface, refraction and interferrence. Transversal and longitudinal waves. Polaeisation.
9. The light. Propagation velocity. geometrical optics of light rays, reflection, refraction. relative and absolute index of refraction the Fermat principle.
10. Electromagnetism. Descriptive properties of the electrostatic and magnetic fields. Coulombs law.
11. Light as an electromagnetic wave, and light as a quanta. Connection between the colour and the wavelength, The photon, Photoelectric effect.
12. Interaction of light and matter. Thermal radiation of the absolute black body. The planc constant. The Broglie relation, The structure of the atom. Description of the spectrum lines.
13. The nucleon. Law of radioactive decay. binding energy and the mass defect. Description of the nuclear forces.
14. Consultation

Requirements for the practice is the completion of two problem solving tests during the semester.
The course is graded based on the written exam results.

Division of Biomathematics

Subject: **MATHEMATICS**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**
Practical: **28**

1st week:
Lecture: Introduction to mathematics: sets and classification of numbers. Order of operations, rounding numbers, scientific notation, direct and inverse proportionality, units and their conversions, prefixes.
Practical: Introduction to mathematics: sets and classification of numbers. Order of operations, rounding numbers, scientific notation, direct and inverse proportionality, units and their conversions, prefixes.

2nd week:
Lecture: Linear and quadratic equations, systems of equations. Logarithms and exponentials.
Practical: Linear and quadratic equations, systems of equations. Logarithms and exponentials.

3rd week:
Lecture:
Vectors, coordinate geometry and functions (basic types, transformations, inverse functions). Slope and equations of a line. Fundamentals of trigonometry. Area and volume of geometrical figures.
The concept of limit, some limit theorems, continuity, some theorems on continuous functions.

Practical:
Vectors, coordinate geometry and functions (basic types, transformations, inverse functions). Slope and equations of a line. Fundamentals of trigonometry. Area and volume of geometrical

figures.
The concept of limit, some limit theorems, continuity, some theorems on continuous functions.

4th week:
Lecture: Infinite series, compound interest, limit of sequences.
Practical: Infinite series, compound interest, limit of sequences.

5th week:
Lecture: Some definitions of derivatives, limit of sequences.
Practical: Some definitions of derivatives, limit of sequences.

6th week:
Lecture: The Chain rule, derivatives of trigonometric functions, Implicit differentiation and higher derivatives.
Practical: The Chain rule, derivatives of trigonometric functions, Implicit differentiation and higher derivatives.

7th week:
Lecture: Differentials and Newton-Raphson approximations, L'Hopital's rule, application of derivatives.
Practical: Differentials and Newton-Raphson approximations, L'Hopital's rule, application of derivatives.

8th week:
Lecture: Integration, an area problem, definition of definite integral, some theorems on integral calculus, fundamental theorem of calculus.
Practical: Integration, an area problem, definition of definite integral, some theorems on integral calculus, fundamental theorem of calculus.

9th week:
Lecture: Area between graphs, more applications of integral calculus.
Practical: Area between graphs, more applications of integral calculus.

10th week:
Lecture: Formal integration, indefinite integrals, integration by parts, trigonometric integrals.
Practical: Formal integration, indefinite integrals, integration by parts, trigonometric integrals.

11th week:
Lecture: Integration by trigonometric substitution, partial fraction.
Practical: Integration by trigonometric substitution, partial fraction.

12th week:
Lecture: Numerical integration, trapezoidal rule, Simpson's rule.
Practical: Numerical integration, trapezoidal rule, Simpson's rule.

13th week:
Lecture: Differential equations.
Practical: Differential equations.

14th week:
Lecture: Application of differential equations in biochemistry, Michaelis-Menten equation of enzyme kinetics.
Practical: Application of differential equations in biochemistry, Michaelis-Menten equation of enzyme kinetics.

Requirements

1. Lectures:
Attendance to lectures is emphatically recommended. All material covered in the lectures is an integral part of the subject and therefore included in the self-control tests and the final exam. Some concepts and ideas are discussed in the lectures only and are not in the textbook.
A student may collect 10 bonus points at the seminars if she/he adequately answers the questions in the 5-minute tests at the beginning of the seminars. These bonus points are added to the result of the final exam and/or the course test according to point 5.

2. Seminars:
Attendance to seminars is compulsory, however a student may miss maximum 4 (four) seminars. The teacher will discuss the material of the lectures in more detail on seminars. In the seminars, students are encouraged to ask questions related to the topic of the lectures discussed.

3. Exemptions:
Applications for exemption from the mathematics course has to be turned in to the Credit Transfer Committee. Such requests are not accepted by the Biomathematics Division or the Department of Biophysics and Cell Biology. The deadline for such applications is Friday on the third week. No application will be considered after this date.

4. Requirements for signing the lecture book:
Maximum 4 absences are allowed from the seminars. If the number of absences from the seminars is more than four, we will not sign the lecture book.

5. Self-control tests (STC) and final exam (FE):
Students will have two STCs during the semester. One on week 7 and the other one on week 13 whose structure will be identical to those of the final exam. None of the SCTs are obligatory. Each SCT will be graded (0-100 %, 0% for absence) and the results of the two SCTs will be averaged (Xave). The missed test will be counted as 0% in the average. Missed SCTs cannot be made up at a later time. Based on the SCTs students may obtain the following grades:

X ave percentage	Mark
0-59.99	FAIL(1)
60-69.99	PASS(2)
70-79.99	SATISFACTORY(3)
80-89.99	GOOD(4)
90-100	EXCELLENT(5)

Students who could not meet the above described conditions for exemption during the two semesters must sit for the FE from the whole material of the semester. Students have three chances (A, B, C) for passing the mathematics FE in the winter exam period after the semester in which the course was taken. On the FE students may obtain the following grades:

Percentage	Mark
0-49.99	FAIL(1)
50-64.99	PASS(2)
65-74.99	SATISFACTORY(3)
75-84.99	GOOD(4)
85-100	EXCELLENT(5)

6. Compulsory reading:
Belágyi, Mátyus, Nyitrai: Mathematics, ISBN: 978-963-343-8
Yuen & Yuan: Calculus, Springer-Verlag Singapore Pte. Ltd. 2000, ISBN: 981-3083-8, 981-3083-2

7. Rules for calculator usage during course tests and the final examination
In order to ensure a fair evaluation, to avoid disturbances in the testing room, and to protect the security of the test material the following types of calculators are NOT permitted:
- Calculators with built-in computer algebra systems (capable of simplifying algebraic expressions)

- Pocket organizers, handheld or laptop computers
- Any device capable of storing text. Calculators with a typewriter keypad (so-called QWERTY devices), electronic writing pads and pen-input devices are not allowed either. Calculators with letters on the keys (e.g. for entering hexadecimal numbers or variable names) are permitted as long as the keys are not arranged in QWERTY format
- Calculators or other devices capable of communicating with other devices
- Calculators built into wireless phones
- Calculators with paper tape or models that make noise

In general, students may use any four-function, scientific or graphing calculator except as specified above. Sharing calculators during tests is not allowed, and the test proctor will not provide a calculator.

Department of Anatomy, Histology and Embryology

Subject: **PHARMACEUTICAL ANATOMY**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **42**
Practical: **28**

1st week:
Lecture: 1. Covering and lining epithelia. 2. Glandular epithelium. 3. Connective tissues.
Practical: -

2nd week:
Lecture: 1. Adipose tissue. Cartilage. 2. Bone. Bone formation. 3. Muscle tissue.
Practical: Histology: Histology of epithelial tissues. 1. Endothel (small intestine, HE) 2. Columnar epithelium (small intestine, brush border, HE), 3. Pseudostratified epithelium with cilia (trachea, HE), 4. Stratified squamos non-keratinizing epithelium (oesophagus, HE), 5. Stratified squamos keratinizing epithelium (fingertip, HE), 6. Sebaceous, sweat and apocrine glands (axillary skin, HE), 7.Mucous and serous glands (submandibular gland, HE)

3rd week:
Lecture: 1. Blood vessels. 2. Blood. 3. Bone marrow and blood formation.
Practical: Histology: Connective tissue. 1. Fibroblasts (healing wound, HE), 2. Mast cell (healing wound, toluidine blue), 3. Macrophages (skin, trypane blue-nuclear fast red), 4. Collagen fiber (colon, HE), 5. Elastic fiber (aorta, orcein), 6. Reticular fiber (liver, AgNO3 impregnation). Demonstration: Mesenchyme (umbilical cord, HE)

4th week:
Lecture: 1. Histology of lymphatic organs I. 2. Histology of lymphatic organs II. 3. Fertilization. Cleavage.
Practical: Histology: Adipose tissue. Cartilage. Bone. 1. Hyaline cartilage (trachea, HE), 2. Elastic cartilage (epiglottis, orcein), 3. Fibrous cartilage and bone (knee joint, HE), 4. Bone, cross-section (Schmorl's stain). Demonstration: Adipocytes (suprarenal gland, HE)

5th week:
Lecture: 1.Gastrulation, formation of the mesoderm. 2. Differentiation of the ectoderm and mesoderm. 3. Differentiation of the entoderm, folding of the embryo.
Practical: Histology: Bone formation. Muscle tissue. 1. Enchondral ossification epiphyseal growth plate (knee joint, HE), 2. Skeletal muscle (HE), 3. Smooth muscle (large intestine, HE), 4. Cardiac muscle (PTAH). Demonstration: Skeletal muscle (iron-hematoxylin)

6th week:
Lecture: 1. Fetal membranes. Placenta. The fetal

period. Twins. 2-3. Osteology and arthrology I-II.
Practical: Histology: Blood vessels. Blood. Bone marrow. Blood formation. 1. Elastic artery (orcein), 2. Muscular artery and vein (HE), 3. Arteriole, venule, capillary (colon, HE), 4. Blood smear (May-Grünwald-Giemsa), 5. Bone marrow (HE).

7th week:
Lecture: 1. The upper limb. 2. The lower limb. 3. Anatomy of the head and neck.
Seminar: Anatomy: Upper and lower limbs. The bones, joints, muscles, blood vessels and nerves of the upper limb. Sites of venous injections and measurement of blood pressure. Bones, joints, ligaments and membranes of the pelvis. The structure and function of the pelvic girdle. The bones, joints, muscles, blood vessels and nerves of the lower limb. Sites of muscular injections. Femoral canal.
Practical: Histology: Histology of lymphatic organs.1. Thymus (HE), 2. Lymph node (HE), 3. Spleen (HE), 4. Palatine tonsil (HE). Demonstration: Lymphatic follicle (colon, HE)

8th week:
Lecture: 1. Nasal and oral cavities. 2. The pharynx and the larynx. 3. The heart I.
Seminar:

Self Control Test (1st written midterm SCT)

9th week:
Lecture: 1. The heart II. 2. The trachea, lungs and pleura. 3. Histology of the lung.
Practical: Anatomy: The anatomy of the head, neck and back. Subdivisions of the skull. Calvaria and base of the skull. Sutures and fontanelles. The bony orbit, nasal cavity and paranasal sinuses. Temporomandibular, atlantooccipital and atlantoaxial joints. Overview of the anatomy of the head and neck. Sensory and motor innervation of the face. Muscles of facial expression. The parotid gland. Common carotid artery and its branches. Internal and external jugular veins. Cervical plexus. Define the location of the hyoid bone, thyroid gland and thyroid cartilage. Site of conicotomy. Surface projection of the apex of the lung. The larynx and the pharynx. The structure of the vertebral column.

10th week:
Lecture: 1. Development of the lung and heart. 2. Circulatory system. The vascular system of the embryo. 3. The oesophagus. The stomach.
Practical: Histology: The histology of the respiratory system. 1. Larynx (HE), 2. Trachea (HE), 3. Lung (HE), Demonstration: Lung injected with indian ink (HE).
11th week:
Lecture: 1. Small and large intestines. 2. The pancreas. The liver I. 3. The liver II. The system of the portal vein.
Practical: Anatomy: The anatomy of the heart and the respiratory system. The structure of the wall of the thorax. Lymphatic drainage of the mammary gland. The lungs, pleura and pleural recesses. The root of the lung. The heart. The pericardium and its sinuses. The mediastinum and its major parts.

12th week:
Lecture: 1. The peritoneum. The retroperitoneum. 2. Neuroendocrine regulation. The hypothalamo-hypophyseal system. 3. The pineal, thyroid, parathyroid and suprarenal glands.
Practical: Histology: Histology of the alimentary system. 1. Stomach (HE), 2. Jejunum (HE), 3. Colon (HE), 4. Liver (pig, HE), 5. Pancreas (HE), Demonstration: Vermiform appendix (HE)

13th week:
Lecture: 1. The kidney. 2. The urinary system. 3. Male genital organs.
Practical: Histology: Histology of the endocrine system. 1. Pituitary gland (HE), 2. Thyroid gland (HE), 3. Parathyroid gland (HE), 4. Suprarenal gland (HE).

14th week:
Lecture: 1. Female genital organs I. 2. Female genital organs II. 3. Development of the urogenital system.
Practical:

Histology: The histology of the kidney and genital organs. 1. Kidney, longitudinal section (HE), 2. Testis and epididymis (HE), 3. Ovary (HE), 4. Uterus, progesteron phase (HE), Demonstration: Corpus luteum (HE)

Anatomy: The anatomy of the alimentary system and the urogenital apparatus. The structure and layers of the abdominal wall. The stomach, the duodenum, the liver, the pancreas and the spleen. Demonstration of some parts of the small and large intestines. The peritoneum. The abdominal aorta and its branches. Lymphatic drainage of the abdominal cavity. The diaphragm. Location and capsules of the kidney. The kidney in a transverse section. Visceral relation of pelvic organs. Demonstration of male and female pelvic organs. Demonstration of external genital organs. Internal iliac artery. Sacral plexus.

Self Control Test (2nd written midterm SCT)

Requirements

The educational activities of 'Pharmaceutical Anatomy' course include lectures, seminars and practices. Attendance of the seminars and practices is compulsory. The presence on seminars and practices will be recorded. If one collects two or more seminar and practice absences (regardless of the reason of the absences) the course organizer may refuse the end-semester signature.
Note, however, that the requirements of the course include material delivered in the lecture hall only, not necessarily available in the recommended textbooks, while in other cases some information in the suggested textbook is not regarded as part of the exam material.
The program of the lectures, seminars/practices are written in the University Calendar and the materials will be uploaded to the eLearning website of the Anatomy Department.

Rules of examinations
Mid-term examinations:
During the term, two self-control tests (SCTs) are organized on the 8th and the 14th week. The written exams cover the topics of lectures, seminars/practices and official textbooks of the second semester. The SCTs are conducted with the help of Moodle system. Attendance of the SCTs is compulsory. If one meets the passing conditions (see below), the end-semester examination may be substituted with the result achieved on the basis of these tests.

Evaluation of the mid-term examinations:
The midterm exams will be evaluated with points and the points of the two examinations will be added. Students with scores higher than 60% earn an exemption from the final examination with a mark that will be calculated on the basis of the overall performance on the two midterm examinations.

End-semester exam:
The end-semester exam (ESE) is a written exam, that is conducted with the help of Moodle system, and covers the topics of lectures, seminars and practices of the semester.
The ESE mark based on the average score of mid-semester tests will be offered if
- one's average score of the mid-semester tests is above 60%; and
- none of the individual tests' results are less than 50%.
- the signature of semester is NOT refused by the course coordinator.

The mark based on the result of ESE or based on the average score of mid-semester tests is calculated according to the following table:

score	mark
0 – 59.9 %	fail
60 – 69.9 %	pass
70 – 79.9 %	satisfactory
80 – 89.9 %	good
90 – 100 %	excellent

- If one is not satisfied with this result, (s)he may participate in ESE during the examination period.

Registration for the exam and postponement:
Through the NEPTUN system.

Reading materials
A. Birinyi: Anatomy, 2nd edition, University of Debrecen, 2008.
M. Petkó: Histology, University of Debrecen
K.L. Moore, and A.M.R. Agur: Essential Clinical Anatomy 2nd Edition, Lippincott Williams an Wilkins, 2002. ISBN: 0-78172830-4.
L.P. Gartner: Concise Histology. Saunders Elsevier, 2011. ISBN: 978-0-7020-3114-4.
T.W.Sadler: Langman's Medical Embryology. 10.th Edition, Lippincott Wiiliams and Wilkin 2006. ISBN: 0-7817-9485-4.
Sobotta: Atlas of Human Anatomy I-II. 14th Edition Urban and Schwanrzenberg, ISBN: 978-0-443-10349-0.

Department of Foreign Languages

Subject: **HUNGARIAN LANGUAGE I/2.**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: 1. Emlékszel?

2nd week:
Practical: 2. Napirend

3rd week:
Practical: 3. Melyik a jobb?

4th week:
Practical: 3. Melyik a jobb?

5th week:
Practical: 4. A testem

6th week:
Practical: 5. Beteg vagyok

7th week:
Practical: 6. Ismétlés a tudás anyja Midterm test

8th week:
Practical: 7. A család

9th week:
Practical: 7. A család

10th week:
Practical: 8. Csak azért is zumbázni akarok

11th week:
Practical: 9. Mit csináltál tegnap?

12th week:
Practical: 9. Mit csináltál tegnap? 10. Hol nyaraltatok?

13th week:
Practical: 10. Vizsga lesz! End term test

14th week:
Practical: Oral exam

Requirements

Requirements of the course:

Attendance
Attending language classes is compulsory. If a student is late it is considered as an absence. Students can miss only 10 percent of the classes that is maximum 2 occasions.
The teacher evaluates active participation in each class. Students are not supposed to share coursebooks in the classes therefore if they fail to bring the coursebook to the class for the second time the attendance is refused.

Testing, evaluation
In each Hungarian language course, students must sit for 2 written language tests and an oral exam. Students must appear at the lecture hall at least 15 minutes before the exam. If students are late, they are not allowed to write the test.
A further minimum requirement is the knowledge of 200 words per semester divided into 10 word quizzes. There are five word quizzes before and another five after the midterm test. If a student fails or misses any word quizzes he / she cannot take the written test. A word quiz can be postponed by a week and students can take it only with their own teacher. Students can get bonus points (5-5%) by taking two extra quizzes containing 20 sentences each, before the midterm and end term tests. The sentences are taken from the units of the coursebook.
The oral exam consists of a role-play from a list of situations covered in the coursebook. If students fail the oral exam, they fail the whole course. The results of the written tests and the oral exam are combined and averaged.
Based on the final score the grades are given as follows.

Final score	**Grade**
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the final score of the written tests is below 60, the student can take a written remedial exam once covering the whole semester’s material.

Coursebook:
See the website of the Department of Foreign Languages: **ilekt.med.unideb.hu.**
Audio files to the course book, oral exam topics and vocabulary minimum lists are also available on the website.

Subject: **LATIN LANGUAGE II.**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Revision

2nd week:
Practical: Anatomy of the GI tract, Gastrointestinal disorders

3rd week:
Practical: Accusative case, Numbers with multiple forms

4th week:
Practical: Routes of administration, Effect-denoting expressions of the GI tract

5th week:
Practical: Latin conjugation system; Imperatives and participles on prescriptions

6th week:
Practical: Prescriptions related to the GI tract

7th week:
Practical: Respiratory system; Prepositions requiring accusative case

8th week:
Practical: Revision for the midterm test

9th week:
Practical: Respiratory conditions and the medications of the respiratory system

10th week:
Practical: Prepositions requiring ablative case

11th week:
Practical: Skin (anatomy, related problems, action and use expression, prescriptions)

12th week:
Practical: Cardiovascular system., Prescribing powders and suppositories in different dose forms

13th week:
Practical: Revision for the End term test

14th week:
Practical: Evaluation and closing of the semester

Requirements

Requirements of the course:

Attendance
Attending language classes is compulsory. If a student is late it is considered as an absence. Students can miss only 10 percent of the classes that is maximum 2 occasions.
The teacher evaluates active participation in each class. Students are not supposed to share coursebooks in the classes therefore if they fail to bring the coursebook to the class for the second time attendance is refused.

Testing, evaluation
In each Latin language course, students must sit for 2 written language tests. Students must appear at the lecture hall at least 15 minutes before the exam. If students are late, they are not allowed to write the test.
A further minimum requirement is the knowledge of 300 words per semester. There is a written word quiz in the first 5-10 minutes of the class, every week. If a student fails 4-4 successful word

quizzes till the mid-term and the end-term tests they are not allowed to sit in for the test. If a student does not have at least 8 successful word quizzes he / she has to take a vocabulary exam that includes all 300 words. A word quiz can be postponed by a week and students can take it only with their own teacher. Students can obtain bonus points (5-5%) by taking all the word quizzes successfully.
Based on the final score the grades are given as follows.

Final score	Grade
0 – 59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the final score is below 60, the student can take a remedial exam once covering the whole semester's material.

Coursebook:
See the website of the Department of Foreign Languages: **ilekt.med.unideb.hu.**
Minimum vocabulary lists and further details are also available on the website.

Department of Human Genetics

Subject: **PHARMACEUTICAL BIOLOGY II.**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **35**
Practical: **28**

1st week:
Lecture: (1) Prokaryotic and eukaryotic cell cycle and cell division. (2) Mitosis and meiosis. (3) Cytogenetics I. Karyogram, ideogram, banding techniques. Human autosomal trisomies.
Practical: Seminar: Introduction to genetics. Cell division.

2nd week:
Lecture: (4) Cytogenetics II. Abnormalities of the X and Y chromosomes. Structural aberrations of human chromosomes. (5) Genes and alleles. Mendelian laws.(6) Transmission genetics. Dominant, recessive and sex-linked inheritance.
Practical: Seminar: Cytogenetics.

3rd week:
Lecture: (7) Recombination of non-allelic genes. (8) Gene interactions. Mitochondrial inheritance. (9) Human mendelian traits and diseases. Inborn errors of metabolism I.
Practical: Seminar: Transmission genetics.

4th week:
Lecture: (9) Human mendelian traits and diseases. Inborn errors of metabolism II. (10) Genetics of blood groups and HLA system. (11) DNA polymorphisms.
Practical: Seminar: Pedigree analysis. Problem solving and seminar on mendelian genetics.

5th week:
Lecture: (13) Polygenic inheritance and multifactorial traits. (14) Gene regulation in prokaryotes. Operons. (15) Mutations, mutagenic effects and agents. Ames test. Dynamic mutations. DNA repair.
Practical: Study of sex chromatin.

Demonstration of mammalian chromosomes. Preparation of metaphase spreads. (Laboratory practical.)
Self Control Test (1st self-control test in extra time.)

6th week:
Lecture: (16) Transformation, transduction. (17) Conjugation in bacteria, plasmids. (18) Gene regulation in eukaryotes I.
Practical: Complementation test. The gene concept. (Laboratory practical.)

7th week:
Lecture: (19) Gene regulation in eukaryotes II. (20) Homologous and specific recombination. IS elements, transposons. (21) Gene engineering (Recombinant DNA) I.
Practical: Induction of beta-galactosidase in E. coli cells. (Laboratory practical.)

8th week:
Lecture: (22) Gene engineering (Recombinant DNA) II. (23) Application of recombinant DNA in biotechnology and biomedical sciences I. (24) Application of recombinant DNA in biotechnology and biomedical sciences II.
Practical: Seminar: Gene regulation, operons. Bacterial genetics. Mutation and polymorphisms.

9th week:
Lecture: (25) Modern genetic engineering methods and their application. (26) Developmental genetics. (27) Molecular genetics of the cell cycle.
Practical: Seminar: Eukaryotic gene regulation.

10th week:
Lecture: (28) Cancer genetics. (29) Population genetics.
Practical: Seminar: Recombinant DNA.
Self Control Test (2nd self-control test in extra time.)

11th week:
Lecture: (30) Evolutionary genetics. (31) Pharmacogenetics, pharmacogenomics.
Practical: Detection of human polymorphism by polymerase chain reaction. (Laboratory practical.)

12th week:
Lecture: (32) Ecogenetics and ecogenomics. Genetic polymorphism of human populations. (33) Genomics, proteomics, the human genome project.
Practical: Transformation of Escherichia coli. PCR evaluation of the human polymorphism experiment. (Laboratory practical.)

13th week:
Lecture: (34) System biological approach to disease. (35) Network analysis.
Practical: Seminar: Cell cycle regulation and cancer.

14th week:
Practical: Seminar: Genomics.
Self Control Test (3rd self-control test in extra time.)

Requirements

The prerequisite of Pharmaceutical Biology II. (second semester subject) is Pharmaceutical Biology I. (first semester subject). Students are not allowed to register until they have a successful ESE in Pharmaceutical Biology I.

Conditions of signing the lecture book:

1, Attendance
Concerning attendance, the rules laid out in the EER of the University are clear.
The presence of students at laboratory practices and seminars is obligatory and will be recorded. The professor refuses his/her signature in the student's Lecture Book for the semester's course-work in the case of over four weeks of absence, even if the student has an acceptable excuse.

If the student is absent from more than two practices or seminars (taken together), the semester will be accepted only if they pass an examination based on the material covered by the laboratory classes and seminars of the semester (lab test).
Successful accomplishment of the laboratory practices will be controlled by signing the laboratory notes. If 3 or more practices will not be accepted, the lecture book will not be signed. These students must sit for a written exam from the laboratory material.
The presence of students on at least 30% of lectures is obligatory and will be recorded. The professor refuses his/her signature in the student's Lecture Book for the semester's course-work if the student was absent from more than 24 lectures, even if the student has an acceptable excuse.

2, Self-control tests
During the semesters there will be 3 self control tests offered. Participation in at least two of them is required for the signature.

Exemption requests:
Applications for exemption (based on previous studies in other universities) should be submitted during the first two weeks of the semester. Requests are not accepted after that deadline! Exemption is granted only, if the student can pass an "Assessment of knowledge" test. The passing limit is 50%.

Rules concerning repeaters:
Attendance of labs and seminars for those repeaters who have a signed lecture book from the previous year (i.e. they failed, or they are repeaters because they have never taken Pharmaceutical Biology II. exam) is dispensable. Students should register for the subject electronically during the first weeks of the semester. They can take the three midterm tests in order to qualify for test bonuses and they take the regular exam at the end of the semester. They cannot have home-work bonuses. Students, who did not earn a signature in the previous year, have to register and attend the labs and seminars and they are considered as the other students registering the course at the first time.

Final Examination (FE):
There will be a written examination at the end of the semester which covers all the material of the two semesters taken in the lectures, seminars, and laboratory practices (for a detailed list see the University Bulletin). The examination questions include multiple choice, and short essay questions, figures, definitions, etc. The marks are based on the student's performance, expressed in percentage (%) as shown in the table below:

Percentage (%)	Grade
0 - 49.99	fail (1)
50.00 - 61.99	pass (2)
62.00 - 69.99	satisfactory (3)
70.00 - 79.99	good (4)
80.00 - 100	excellent (5)

The percentage values include the student's performance at the FE as well as the bonus percentage they have obtained by taking the three mid-semester tests.
The following table shows the bonus percentage based on the average result of the semester tests. Absence counts as 0%.

Average of the 3 tests (%)	Bonus (%)
40.00 - 43.99	1
44.00 - 47.99	2
48.00 - 51.99	3
52.00 - 55.99	4
56.00 - 59.99	5
60.00 - 63.99	6
64.00 - 67.99	7
68.00 - 71.99	8
72.00 - 75.99	9
76.00 - 79.99	10
80.00 - 83.99	11
84.00 - 100	12

Further bonuses can be given for the correct solution of one extra question in each midterm test.
Maximum number of the bonuses in the second semester is 15. Bonuses are calculated only in the year of acquisition.
FE includes cell biology (Pharmaceutical Biology I.) and genetics & molecular biology (Pharmaceutical Biology II). Those students, who ask in advance to have their ESE mark in Pharmaceutical Biology I. to be considered as a part of their grade on the FE will be exempted from cell biology. They have to take examination only in genetics & molecular biology. However, this examination includes the following topics from the first semester: DNA, chromatin, chromosomes, nucleus, cell cycle and cell division of eukaryotes and prokaryotes, since these are topics covered by genetics, as well. In this case the final grade of the FE is calculated as the average of the results of the ESE and the genetics exam taken at the end of the second semester. None of the grades can be fail (1) and in dubious cases the result of the genetics exam is accounted more.
The slides of the lectures and up-to-date information can be found at https://elearning.med.unideb.hu, username and password is your network-id (same as Neptun-id) and password. You will be able to check the content after the Neptun has registered you to the subject.
Departmental homepage: https://humangenetics.unideb.hu

Department of Inorganic and Analytical Chemistry

Subject: **INORGANIC AND QUALITATIVE ANALYTICAL CHEMISTRY PRACTICE**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Seminar: **14**
Practical: **70**

1st week:
Seminar:
1. Reaction of potassium chlorate with sulphur and red phosphorus **(demonstration) (S.I. Practice 1).**
2. Reaction of hydrogen sulfide with sulfur

dioxide **(demonstration) (S.I. Practice 1).**
3. Preparation of solutions of ammonium sulfide and polysulfide, the decomposition of polysulfide **(demonstration) (S.I. Practice 1).**
4. Laboratory preparation of hydrogen with the use of Kipp-apparatus and combustion of hydrogen **(demonstration) (S.I. Practice 1).**
Demonstrations taken from the lectures
5. Reaction of melted potassium chlorate with gummy bear.
6. Detection and confirmation of SO and HS gases (SO + KIO, HS + Pb(NO) and PbS + HO)).

Practical: 1. Inorganic and analytical laboratory rules**(exposition).**
2. Laboratory safety **(exposition).**
3. Distribution of laboratory equipment.
4. Reaction of potassium chlorate with sulphur and red phosphorus **(demonstration) (S.I. Practice 1).**
5. Reaction of hydrogen sulfide with sulfur dioxide **(demonstration) (S.I. Practice 1).**
6. Preparation of solutions of ammonium sulfide and polysulfide, the decomposition of polysulfide **(demonstration) (S.I. Practice 1).**
7. Laboratory preparation of hydrogen with the use of Kipp-apparatus and combustion of hydrogen **(demonstration) (S.I. Practice 1).**
Demonstrations taken from the lectures
8. Reaction of melted potassium chlorate with gummy bear.
9. Detection and confirmation of SO and HS gases (SO + KIO, HS + Pb(NO) and PbS + HO)).

2nd week:
Seminar:
1. Laboratory preparation of chlorine and its reaction with metals **(team study, the chlorine gas is taken form cylinder) (S.I. Practice 2).**
2. Preparation of chlorine by reacting NaClO (hypo) with HCl **(reading) (S.I. Practice 2).**
3. Reaction of alkali-chroides, -bromides and ioidides with concentrated (cc) H2SO4 **(S.I. Practice 2).**
4. Reactions of hypochlorite ion **(S.I. Practice 2).**
5. Laboratory preparation of oxygen gas **(team study) (S.I. Practice 2).**
6 Combustion of elements in oxygen **(team study) (S.I. Practice 2).**
7. Reactions of hydrogen peroxide **(S.I. Practice 2).**
8. Chemical properties of sulfurous and sulfuric acid **(S.I. Practice 2).**
Demonstrations taken from the lectures
9. Preparation of peroxymonosulfuric (Caro's) acid and its strong oxidizing properties
Practical: 1. Laboratory preparation of chlorine and its reaction with metals **(team study, the chlorine gas is taken form cylinder) (S.I. Practice 2).**
2. Preparation of chlorine by reacting NaClO (hypo) with HCl **(reading) (S.I. Practice 2).**
3. Reaction of alkali-chroides, -bromides and ioidides with concentrated (cc) H2SO4 **(S.I. Practice 2).**
4. Reactions of hypochlorite ion **(S.I. Practice 2).**
5. Laboratory preparation of oxygen gas **(team study) (S.I. Practice 2).**
6 Combustion of elements in oxygen **(team study) (S.I. Practice 2).**
7. Reactions of hydrogen peroxide **(S.I. Practice 2).**
8. Chemical properties of sulfurous and sulfuric acid **(S.I. Practice 2).**
Demonstrations taken from the lectures
9. Preparation of peroxymonosulfuric (Caro's) acid and its strong oxidizing properties

3rd week:
Seminar:
1. Laboratory preparation of nitrogen **(S.I. Practice 3).**
2. Chemical properties of ammonia, oxidation of NH3 by halogens.**(team study) (S.I. Practice 3).**
3. Preparation and study of nitrogen monoxide **(team study) (S.I. Practice 3).**
4. Preparation and chemical properties of nitric acid and nitrates **(S.I. Practice 3).**
5. Experiments with phosphorus and with phosphorus pentoxide **(S.I. Practice 3).**
Demonstrations taken from the lectures
6. Preparation and properties of O (LB 16.6).
7. Ammonia fountain (LP).

Practical: 1. Laboratory preparation of nitrogen **(S.I. Practice 3).**
2. Chemical properties of ammonia, oxidation of NH3 by halogens.**(team study) (S.I. Practice 3).**
3. Preparation and study of nitrogen monoxide **(team study) (S.I. Practice 3).**
4. Preparation and chemical properties of nitric acid and nitrates **(S.I. Practice 3).**
5. Experiments with phosphorus and with phosphorus pentoxide **(S.I. Practice 3).**
Demonstrations taken from the lectures
6. Preparation and properties of O (LB 16.6).
7. Ammonia fountain (LP).

4th week:
Seminar:
1. Properties of carbon dioxide **(team study) (S.I. Practice 4).**
2. Preparation and properties of carbon monoxide **(reading) (S.I. Practice 4).**
3. Experiments with boric acid and reactions of borate ion **(S.I. Practice 4).**
4. Reactions of alkali and alkaline earth metals with water **(team study) (S.I. Practice 4).**
5. Solution of alkali and alkaline earth metals in liquid ammonia **(demonstration) (S.I. Practice 4).**
6. Interaction of aluminium, lead and tin with acids and alkalies **(S.I. Practice 4).**
7. Interaction of iron, copper and zinc with acids and alkalies **(S.I. Practice 4).**
Demonstrations taken from the lectures
8. Cooling in the laboratory, cooling mixtures (solid CO – acetone cooling mixture).

Practical: 1. Properties of carbon dioxide **(team study) (S.I. Practice 4).**
2. Preparation and properties of carbon monoxide **(reading) (S.I. Practice 4).**
3. Experiments with boric acid and reactions of borate ion **(S.I. Practice 4).**
4. Reactions of alkali and alkaline earth metals with water **(team study) (S.I. Practice 4).**
5. Solution of alkali and alkaline earth metals in liquid ammonia **(demonstration) (S.I. Practice 4).**
6. Interaction of aluminium, lead and tin with acids and alkalies **(S.I. Practice 4).**
7. Interaction of iron, copper and zinc with acids and alkalies **(S.I. Practice 4).**
Demonstrations taken from the lectures
8. Cooling in the laboratory, cooling mixtures (solid CO – acetone cooling mixture).

5th week:
Seminar:
1. Practical classification of reactions and ions.
2. The reactions of anions.
3. The analysis of anion group I (carbonate, hydrogen carbonate, silicate, sulfide,polysulfide and sulfite ions).
4. Identification of halogenate ions.
5. Purity tests: Investigation of bromate impurity in potassium bromide.

Purity tests
6. Investigation of bromate impurity in potassium bromide.

Practical: 1. Practical classification of reactions and ions.
2. The reactions of anions.
3. The analysis of anion group I (carbonate, hydrogen carbonate, silicate, sulfide,polysulfide and sulfite ions).
4. Identification of halogenate ions.
5. Purity tests: Investigation of bromate impurity in potassium bromide.
Purity tests
6. Investigation of bromate impurity in potassium bromide.

6th week:
Seminar:
1. The analysis of anion group II (phosphate, sulfate, fluoride, bromate and iodate ions).
2. The analysis of anion group III (chloride, bromide and iodide ions).
3. Removal of orthophosphate ions from aqueous solutions**(team study).**
4. „Etching test"**(demonstration).**
5.Reactions of the members of IInd anion group with [Fe(SCN)4]- **(demonstration).**
Unknown sample
6. Detection of an anion of group I-II in a solid salt of an alkali metal (CO32– ; HCO3– ; S2– ; SO32– ; SO42– ; PO43– (HPO42– ; H2PO4–); F– ; BrO3– ; IO3–).

Voluntary test
-The same as unknown sample, but solution is given.
Demonstrations taken from the lectures
7. Color of halogens and their aqueous solutions.
8. Color of the-starch-iodine complex (the iodine test for starch).

Practical: 1. The analysis of anion group II (phosphate, sulfate, fluoride, bromate and iodate ions).
2. The analysis of anion group III (chloride, bromide and iodide ions).
3. Removal of orthophosphate ions from aqueous solutions**(team study).**
4. „Etching tes***t*****(demonstration).**
5**.**Reactions of the members of IInd anion group with [Fe(SCN)4]- **(demonstration).**
Unknown sample
6. Detection of an anion of group I-II in a solid salt of an alkali metal (CO32– ; HCO3– ; S2– ; SO32– ; SO42– ; PO43– (HPO42– ; H2PO4–); F– ; BrO3– ; IO3–).
Voluntary test
-The same as unknown sample, but solution is given.
Demonstrations taken from the lectures
7. Color of halogens and their aqueous solutions.
8. Color of the-starch-iodine complex (the iodine test for starch).

7th week:
Seminar:
1. Identification of bromide and iodide ions coexisting in solution with the use of chlorine water.
2. Identification of chloride ion in the presence of bromide or/and iodide (Berg's reaction).
Unknown sample
3. Detection of two anions of group I-III in a solution of two alkali metal salts (CO32– S2– ; SO32– ; SO42– ; PO43– (HPO42– ; H2PO4–); F– ; BrO3– ; IO3– ; Cl– ; Br– ; I– ; SO32– and SO42– ions do not coexist).
Voluntary test
- Detection of one or two anions of group I-III in solution of two alkali metal salts (CO32– S2– ; SO32– ; SO42– ; PO43– (HPO42– ; H2PO4–); F– ; BrO3– ; IO3– ; Cl– ; Br– ; I– ; SO32– and SO42– ions do not coexist).

Practical: 1. Identification of bromide and iodide ions coexisting in solution with the use of chlorine water.
2. Identification of chloride ion in the presence of bromide or/and iodide (Berg's reaction).
Unknown sample
3. Detection of two anions of group I-III in a solution of two alkali metal salts (CO32– S2– ; SO32– ; SO42– ; PO43– (HPO42– ; H2PO4–); F– ; BrO3– ; IO3– ; Cl– ; Br– ; I– ; SO32– and SO42– ions do not coexist).
Voluntary test
- Detection of one or two anions of group I-III in solution of two alkali metal salts (CO32– S2– ; SO32– ; SO42– ; PO43– (HPO42– ; H2PO4–); F– ; BrO3– ; IO3– ; Cl– ; Br– ; I– ; SO32– and SO42– ions do not coexist).

8th week:
Seminar:
1. The analysis of anion group IV (nitrite, nitrate and chlorate ions).
2. Detection of nitrite and nitrate ions with Griess-Ilosvay reagent.
Unknown sample
3. Detection of two anions of group I–IV in a mixture of two alkali metal salts (CO32– S2– ; SO32– ; SO42– ; PO43– (HPO42– ; H2PO4–); F– ; BrO3– ; IO3– ; Cl– ; Br– ; I– ; NO2– and NO3–). The pairs of : SO32– – SO42– ; Br– – NO3– and I– – NO3– are not given).
Voluntary test
4. The same as unknown sample, but solution is given.
Demonstrations taken from the lectures
5. Preparation of nitrous acid (cc. NOsolution + ice + HCl)
6. The brown ring test for nitrite ions
7. The
8. Reaction of chlorate ions with cc. HSO

Practical: 1. The analysis of anion group IV (nitrite, nitrate and chlorate ions).
2. Detection of nitrite and nitrate ions with Griess-Ilosvay reagent.

Unknown sample
3. Detection of two anions of group I–IV in a mixture of two alkali metal salts (CO_3^{2-} S^{2-} ; SO_3^{2-} ; SO_4^{2-} ; PO_4^{3-} (HPO_4^{2-} ; $H_2PO_4^-$); F^- ; BrO_3^- ; IO_3^- ; Cl^- ; Br^- ; I^- ; NO_2^- and NO_3^-). The pairs of : SO_3^{2-} – SO_4^{2-} ; Br^- – NO_3^- and I^- – NO_3^- are not given).
Voluntary test
4. The same as unknown sample, but solution is given.
Demonstrations taken from the lectures
5. Preparation of nitrous acid (cc. NOsolution + ice + HCl)
6. The brown ring test for nitrite ions
7. The
8. Reaction of chlorate ions with cc. HSO

9th week:
Seminar:
1. The reactions of cations
2. The analysis of cation group I and group IIA (Copper(II), silver(I), cadmium(II), mercury(I), mercury(II), lead(II) and bismuth(III) ions).
Purity test
3. Investigation of lead impurity in boric acid.
4. Investigation of silver impurity in “bismuth subnitrate, heavy”.

Practical: 1. The reactions of cations
2. The analysis of cation group I and group IIA (Copper(II), silver(I), cadmium(II), mercury(I), mercury(II), lead(II) and bismuth(III) ions).
Purity test
3. Investigation of lead impurity in boric acid.
4. Investigation of silver impurity in “bismuth subnitrate, heavy”.

10th week:
Seminar:
1. Sanger – Black’s test for trace analysis of arsenic impurity in solution **(demonstration).**
Purity test
2. Investigation of iron impurity in citric acid.
Unknown sample
3. Detection of two cations of group I or IIA in a solution (Ag^+, Cd^{2+}, Cu^{2+}, Hg_2^{2+}, Hg^{2+}, Pb^{2+}, Bi(III) (Hg_2^{2+} – Hg^{2+} and Cu^{2+} – Hg_2^{2+} ions are not given together).
Voluntary test
- Detection of one or two cations of group I and IIA in solution (Hg_2^{2+} – Hg^{2+} and Cu^{2+} – Hg_2^{2+} ions are not given together).
Demonstrations taken from the lectures
4. The reactions of cations of cation group I and group IIA (Copper(II), silver(I), cadmium(II), mercury(I), mercury(II), lead(II) and bismuth(III) ions) with KI and KCrO.

Practical: 1. Sanger – Black’s test for trace analysis of arsenic impurity in solution **(demonstration).**
Purity test
2. Investigation of iron impurity in citric acid.
Unknown sample
3. Detection of two cations of group I or IIA in a solution (Ag^+, Cd^{2+}, Cu^{2+}, Hg_2^{2+}, Hg^{2+}, Pb^{2+}, Bi(III) (Hg_2^{2+} – Hg^{2+} and Cu^{2+} – Hg_2^{2+} ions are not given together).
Voluntary test
- Detection of one or two cations of group I and IIA in solution (Hg_2^{2+} – Hg^{2+} and Cu^{2+} – Hg_2^{2+} ions are not given together).
Demonstrations taken from the lectures
4. The reactions of cations of cation group I and group IIA (Copper(II), silver(I), cadmium(II), mercury(I), mercury(II), lead(II) and bismuth(III) ions) with KI and KCrO.

11th week:
Seminar:
1. The analysis of cation group III (nickel(II), cobalt(II), iron(II), iron(III), manganese(II), chromium(III), zinc(II) and aluminium(III) ions).
2. “Fluoride test” for aluminium **(demonstration).**
3. Detection of traces of nickel in cobalt salts.
4. Preparation and properties of cyanide complexes of some transition metal ions **(S.I. Practice 11).**
5. Use of organic reactions in analysis: determination of Fe^{2+} and Fe^{3+}ions with 2,2’-dipyridyl reagent, determination of Ni^{2+} ions with dimethylglyoxime reagent and determination of Zn^{2+} ions with dithizone.**(S.I. Practice 11).**
Unknown sample
4. Detection of two cations of group III in solution (the oxidation state of Fe and Cr can be

+3, and the oxidation state of Mn can be +2 only).

Voluntary test

-Detection of one or two cations of group III in solution (the oxidation state of Fe and Cr can be +3, and the oxidation state of Mn can be +2 only).

Practical: 1. The analysis of cation group III (nickel(II), cobalt(II), iron(II), iron(III), manganese(II), chromium(III), zinc(II) and aluminium(III) ions).

2. “Fluoride test” for aluminium **(demonstration).**

3. Detection of traces of nickel in cobalt salts.

4. Preparation and properties of cyanide complexes of some transition metal ions **(S.I. Practice 11).**

5. Use of organic reactions in analysis: determination of Fe^{2+} and Fe^{3+}ions with 2,2’-dipyridyl reagent, determination of Ni^{2+} ions with dimethylglyoxime reagent and determination of Zn^{2+} ions with dithizone.**(S.I. Practice 11).**

Unknown sample

4. Detection of two cations of group III in solution (the oxidation state of Fe and Cr can be +3, and the oxidation state of Mn can be +2 only).

Voluntary test

-Detection of one or two cations of group III in solution (the oxidation state of Fe and Cr can be +3, and the oxidation state of Mn can be +2 only).

12th week:

Seminar:

1. The analysis of cation group IV (calcium(II), strontium(II) and barium(II) ions).

2. The analysis of cation group V (magnesium(II), lithium(I), sodium(I), potassium(I) and ammonium ions).

3. Reaction of $Sr^{2+}$and Ba^{2+} ions with sodium rhodizonate **(S.I. Practice 12).**

4. Salts of alkali metal ions with poor solubility in water **(S.I. Practice 12).**

5. Detection of traces of ammonia **(demonstration).**

Unknown sample

6. Detection of two cations of group I, IIA, III, IV or V in solution (**One** component is a cation of group I, IIA or III (Cu^{2+}; Ag^{+} ; Cd^{2+}; Hg_2^{2+}; Hg^{2+}; Pb^{2+} ; Bi(III) ; Ni^{2+} ; Co^{2+} ; Fe^{2+} ; Fe^{3+} ; Mn^{2+}; Cr^{3+} ; Zn^{2+} ; Al^{3+}) and the**other one** is a cation of group IV or V (Ca^{2+} ; Sr^{2+} ; Ba^{2+} ; Li^{+} ; Na^{+} ; K^{+} ; NH_4^{+}). The oxidation state of Cr is +3, and the oxidation state of Mn is +2. Fe can be in oxidation state +2 or +3).

Voluntary test

-The same as the unknown sample (solution is given).

Demonstrations taken from the lectures

Practical: 1. The analysis of cation group IV (calcium(II), strontium(II) and barium(II) ions).

2. The analysis of cation group V (magnesium(II), lithium(I), sodium(I), potassium(I) and ammonium ions).

3. Reaction of $Sr^{2+}$and Ba^{2+} ions with sodium rhodizonate **(S.I. Practice 12).**

4. Salts of alkali metal ions with poor solubility in water **(S.I. Practice 12).**

5. Detection of traces of ammonia **(demonstration).**

Unknown sample

6. Detection of two cations of group I, IIA, III, IV or V in solution (**One** component is a cation of group I, IIA or III (Cu^{2+}; Ag^{+} ; Cd^{2+}; Hg_2^{2+}; Hg^{2+}; Pb^{2+} ; Bi(III) ; Ni^{2+} ; Co^{2+} ; Fe^{2+} ; Fe^{3+} ; Mn^{2+}; Cr^{3+} ; Zn^{2+} ; Al^{3+}) and the **other one** is a cation of group IV or V (Ca^{2+} ; Sr^{2+} ; Ba^{2+} ; Li^{+} ; Na^{+} ; K^{+} ; NH_4^{+}). The oxidation state of Cr is +3, and the oxidation state of Mn is +2. Fe can be in oxidation state +2 or +3).

Voluntary test

-The same as the unknown sample (solution is given).

Demonstrations taken from the lectures

13th week:

Seminar:

1. Summary on group reactions.

2. Complete qualitative analysis of a solid sample.

Unknown sample

3. Complete qualitative analysis (cations, anions) of a solid mixture of two components. The

cations or the anions in the two components are the same. This way **the number of the detectable ions is 3.**
The same **cations** can be in the sample which were investigated formerly (Cu2+; Ag+ ; Cd2+; Hg2+; Pb2+ ; Bi(III) ; Ni2+ ; Co2+ ; Fe3+ ; Mn2+; Cr3+ ; Zn2+ ; Al3+ ; Ca2+ ; Sr2+ ; Ba2+ ; Li+ ; Na+ ; K+ ; NH4+), but Mg2+ is not given, and also two cations of group IV and of group V can not be together. The oxidation state of Hg, and Mn can be +2 only, oxidation state of Fe and Cr can be +3.
The possible **anions** are as follows: CO32– (HCO3–) ; SO42– ; PO43– (HPO42– , H2PO4–); F–; Cl– ; Br– ; I– ; NO3– The various protonated forms of the anions cannot be identified.
4. Inventory and return of laboratory equipments.

Practical: 1. Summary on group reactions.
2. Complete qualitative analysis of a solid sample.
Unknown sample

3. Complete qualitative analysis (cations, anions) of a solid mixture of two components. The
cations or the anions in the two components are the same. This way **the number of the detectable ions is 3.**
The same **cations** can be in the sample which were investigated formerly (Cu2+; Ag+ ; Cd2+; Hg2+; Pb2+ ; Bi(III) ; Ni2+ ; Co2+ ; Fe3+ ; Mn2+; Cr3+ ; Zn2+ ; Al3+ ; Ca2+ ; Sr2+ ; Ba2+ ; Li+ ; Na+ ; K+ ; NH4+), but Mg2+ is not given, and also two cations of group IV and of group V can not be together. The oxidation state of Hg, and Mn can be +2 only, oxidation state of Fe and Cr can be +3.
The possible **anions** are as follows: CO32– (HCO3–) ; SO42– ; PO43– (HPO42– , H2PO4–); F–; Cl– ; Br– ; I– ; NO3– The various protonated forms of the anions cannot be identified.
4. Inventory and return of laboratory equipments.

Requirements

The laboratory course of 78 hours consists of seminars (1 class hours per week) and laboratory practices (5 hours per week). The course is given during 13 weeks. In the seminars the theoretical background of the laboratory investigations and some special or particular problems of analytical operations of the current experiments are discussed. The practices help students to get knowledge of material and to have training in the qualitative analytical laboratory operations and in compilation of laboratory reports.

Subject: **INORGANIC AND QUALITATIVE ANALYTICAL CHEMISTRY THEORY**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **42**

1st week:
Lecture: Elements in the periodic table. Classification of the elements. Production of the elements by separation and by chemical (metallurgical) methods. Preparation of the non-metallic elements by oxidation. Reduction of metal oxides by carbon, hydrogen or metals. Thermal decomposition of metal-halides and carbonyls. Preparation and purification of metals by electrolysis. Hydrogen. Atomic and physical properties, abundance, chemical properties. Deuterium and tritium. Production and uses. The Noble gases. (Group 18). Atomic and physical properties, distribution, chemical properties. Clatrates, ionic and covalent compounds. Production and uses.
2nd week:
Lecture: The halogens. (Group 17) Atomic and physical properties, distribution, chemical properties of the halogens. Interhalogens. Hydrogen halides, oxides and oxoacids. Structure and acidity of the oxoacids. Preparation and uses. The chalcogens. (Group 16). Atomic and physical properties, distribution, chemical

properties of the chalcogens. Compounds with hydrogen and halogens. Water and softening of water. Oxides and oxoacids of chalcophylic elements. Sulphur-nitrogen compounds. Production and uses of the elements.

3rd week:
Lecture: Nitrogen, phosphorus, arsenic, antimony and bismuth (Group 15). Atomic and physical properties, distribution, chemical properties of the elements. Typical compounds, comparison of the stereochemistry of nitrogen and phosphorus. Hydrides, preparation and uses of ammonia. Structure, chemical properties of the oxides and oxoacids. Production and uses of the elements.

4th week:
Lecture: Carbon, silicon, germanium, tin and lead (Group 14). Atomic and physical properties, distribution, chemical properties of the elements. Chemistry of carbon and silicon. Typical compounds, the stereochemistry of carbon. Important compound of silicon. Oxides, oxoacids and related compounds. Carbon-nitrogen compounds, carbides. Production and uses of the elements.

5th week:
Lecture: Boron, aluminium, gallium, indium and thallium (Group 13). Atomic and physical properties, distribution, chemical properties of the elements. Structure and chemical properties of EX3 compounds. 3-centre bonding. Boron hydrides, binary and ternary hydrides of Al. Oxides and related compounds. Production and uses of the elements.

6th week:
Lecture: Introduction to qualitative analysis (This topic is partially worked up during the seminars). Short history of the analytical chemistry. Basic experimental methods in analytical chemistry. Classification of chemical reactions in analytical chemistry: acid-base, redox and complexation reactions, reactions with colour changes and precipitation. Specific, and selective reactions. Sensitivity. Preparation and homogeneity of the samples. Dissolution of solid samples. Classifications of the cations and anions based on inorganic chemical considerations. Types of sulphides. Tioacids, tiobasics and tiosalts. Introduction to coordination chemistry. Equilibria, stability correlations. Classifications of the complexes and ligands. Hard-soft theory and its application in analytical chemistry. Anions. Group 1. and 2: carbonate, bicarbonate, silicate, sulphide, poly-sulphide, sulphite, tiosulphate, hypoclorite; and borate, phosphate, sulphate, fluoride, bromate, iodate. Groups 3 and 4: chloride, bromide, iodide, cyanide, tiocyanide; and nitrite, nitrate, acetate, chlorate, perchlorate, peroxide.

7th week:
Lecture: Systematic analysis of cations. The Fresenius system. Reactions and separation of Group 1A and 1B cations: Ag(I), Pb(II), Hg(I), Cu(II), Hg(II), Bi(III), Cd(II). Reactions and separation of Group 2 cations (anions of semimetals): As(III), As(V), Sb(III) and Sb(V), Sn(II) and Sn(IV). Reactions and separation of Group 3 cations: Ni(II), Co(II), Fe(II), Fe(III), Mn(II), Cr(III), Al(III) and Zn(II). Reactions and separation of Group 4 cations: Ca(II), Sr(II) and Ba(II). Reactions of Group 5 cations: sodium -, potassium -, and lithium ions, Mg(II) and ammonium ions. Complete analysis of cations. Separation methods in the qualitative analysis.

8th week:
Lecture: S-block elements (Group 1 and 2): Atomic and physical properties, distribution, chemical properties and uses of the alkali and alkaline earth metals. Dissolution of Na in liquid ammonia. Covalent and coordination compound of the alkali metal elements. Crown ethers and cryptands. Compounds of alkaline earth metals: hydrides, halogenides, oxides, hydroxides, salts with strong acids, complexes. The Grignard reagent.

9th week:
Lecture: Transition metals (d-block elements, Group 3 -12): General trend in the d-block. Electronic structure, oxidation state, atomic and ionic size. Horizontal and vertical similarities in the d-block. Atomic and physical properties,

distribution, chemical properties and uses of the transition metals. Compounds: hydrides, halogenides, oxides, hydroxides, salts with strong acids, complexes. Acid-base properties and redoxy reactions. Transition metal ions in aqueous solutions: hydrated cations, oxocations and oxoanions. Iso- and heteropolyacids. Organometallic compounds. Carbonyls.

10th week:
Lecture: Titanium, Zirconium and Hafnium. Atomic and physical properties, distribution, chemical properties and uses of the elements. Halogenids and oxides. TlCl4, TiO2, ZrO2. Vanadium, Niobium and Tantalum. Atomic and physical properties, distribution, chemical properties and uses of the elements. Halogenides as cluster compounds. Oxides and related compounds. Chromium, Molybdenum and Tungsten. Atomic and physical properties, distribution, chemical properties and uses of the elements. Halogenides and oxides. Iso and heteropolyacids. Some Cr(III) compounds. Manganese, Technetium and Rhenium. Atomic and physical properties, distribution, chemical properties and uses of the elements. Important compounds of manganese.

11th week:
Lecture: Iron, Cobalt and Nickel. Atomic and physical properties, distribution, chemical properties and uses of the elements. Production of iron and steel. Important inorganic and coordination compounds of the elements. Platinum metals (Ru, Rh, Pd, Os, Ir, Pt). Atomic and physical properties, distribution, chemical properties, production and uses of the elements. Important inorganic and coordination compounds of the elements. Copper, Silver and Gold. Atomic and physical properties, distribution, chemical properties and uses of the elements. Chemistry of photography. Zinc, Cadmium and Mercury. Atomic and physical properties, distribution, chemical properties, production and uses of the elements. Halogenides, oxides, sulphides and coordination compounds.

12th week:
Lecture: f-block elements. Electronic structure, the lanthanide contraction. Some important complexes of Gd. Important uranium compound related to the atomic energy industry.

13th week:
Lecture: Introduction to the bioinorganic chemistry. Essential and toxic elements in biologic systems. Classification of the biological functions of the essential elements. Complex forming properties of the biologically important ligands. Biological functions of the essential elements. Transport and activation of the small biomolecules. Metalloenzymes, metalloproteins. Important examples, enzyme models.

14th week:
Lecture: Biological functions of alkali and alkaline earth metal ions. Transition metals and other elements. Transport, storage and activation of oxygen. Role and metabolism of iron. Copper containing proteins and metabolism of copper. Biological role of zinc in activation of enzymes. Importance of Mo, Se and silicon. Medical applications: diagnosis and therapy. Toxicity of metal ions.

Department of Organic Chemistry

Subject: **ORGANIC CHEMISTRY PRACTICE I.**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Seminar: **14**
Practical: **42**

1st week:
Seminar: Receiving of laboratory equipments, safety education. Crystallization from water and organic solvent. Controlling of purity by thin-layer chromatography (TLC), and determination of melting point. Filling in of laboratory notes.
Practical: Receiving of laboratory equipments, safety education. • Crystallization. • Crystallization of acetanilide from water. (p. 62.) • Crystallization of benzanilide from methanol. (p. 62.) • Controlling of the purity by thin-layer chromatography (TLC), and determination of melting point. (p. 64.) • Filling of laboratory notes

2nd week:
Seminar: Vacuum, simple and steam distillation. Isolation of nicotine from tobacco leaves.
Practical: • Distillation. • Vacuum and simple distillation of water. (p. 63.) • Steam distillation. • Isolation of nicotine from tobacco leaves. (p. 64.) • Filling of laboratory notes.
Self Control Test

3rd week:
Seminar: Isolation of caffeine from tea leaves. Separation of organic compounds with liquid-liquid extraction.
Practical: • Liquid-liquid extraction. • Isolation of caffeine from tea leaves. (p. 65.) • Separation of 1,3-dinitrobenze and 3-nitroaniline with liquidliquid extraction. (p. 67.) • Filling of laboratory notes.
Self Control Test

4th week:
Seminar: Column chromatography. Identification of hydrocarbons with test tube reactions.
Practical: • Separation of acetanilide and m-dinitrobenzene by column chromatography. (p. 73.) • Identification of hydrocarbons (test tube reactions). (p. 68.) Determination of unknown compound.

Self Control Test

5th week:
Seminar: Identification of organic halides with test tube reactions.
Practical: • Identification of organic halides (test tube reactions). (p. 72.) Filling in of laboratory notes. Cleaning of the laboratory glasswares. Deposite the laboratory equipments.

Self Control Test (Comprehensive written test)

Requirements

Conditions on signing the lecture book: The laboratory work is evaluated by a five-level practical grade.
Prerequisite: General Chemistry Theory and Practice.
The Organic Chemistry Seminar and Laboratory Practice will be kept in three groups. Each group will exercise for 5 weeks.

Subject: **ORGANIC CHEMISTRY THEORY I.**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **56**

1st week:
Lecture: The definition and brief history of organic chemistry. Overview of the basic general chemical concepts needed for this subject. The basic nomenclatutre systems in organic chemistry: common or trivial names and systematic nomenculture. Basic rules to generate systematic names of organic compounds; substitutive and functional class nomenclature. The rules to generate the names the groups derived from hydrocarbons. The rules to generate the names of unbranched and branched (saturated

and unsaturated) hydrocarbons. Description of functional groups in organic compounds. An overview of the most important organic compound groups based on their functional groups. The effect of functional groups on the electron structure of compounds.

2nd week:
Lecture: Classification and chemical bond of hydrocarbons. A brief summary of the theories ofthe chemical bond: the shared electron pair model, the valence bond model. Covalent and ionic bonds. The basics of LCAO-MO theories, types of atomic and molecular orbitals. Bi- and polycentric molecular orbitals, delocalization. VB theory, resonance structures and rules of their writing. Hybridization.

3rd week:
Lecture: Electron shift phenomena, inductive and mesomeric effects, conjugation and hyperconjugation. Secondary bonds, intermolecular interactions, hydrogen bond, dipole-dipole, dipole-induced dipole interactions.

4th week:
Lecture: Characterization of the structures of alkanes and cycloalkanes. Review their conformational and physical properties. Basics of stereochemistry: characterization of constitutional, conformational and configurational isomers. Chirality, types of chiral molecules. The concept of enantiomers and diastereomers, general comparison of their chemical and physical properties. Absolute and relative configuration. Optical activity. The representation of organic molecules. The absolute configuration of chiral compounds, Fischer and Cahn-Ingold-Prelog convention. The role of chirality in drug chemistry.

5th week:
Lecture: Basics of the structure elucidation of organic compounds.

6th week:
Lecture: Elemental reactions. Definitions of transition state, intermediates, Gibbs energy, kinetical and thermodinamical parameters of chemical reactions. Multi-step reactions (consecutive reactions), intermediates. Hammond postulate. Parallel (competitive) reactions. Thermodynamic and kinetic control. Reactivity and selectivity. Reagents and reactive intermediates. Classification of organic chemical reactions based on attack agent and type of the reaction. Brönsted and Lewis acid-base theory, "hard" and "soft" acids and bases.

7th week:
Lecture: Chemical properties of alkanes, radical substitution, chain reaction. Statistical and regioselective halogenation and interpretation based on radical stability in alkane halogenation. Sulphonation, sulphochlorination, nitration and oxidation of alkanes. The basic petrochemical processes (pyrolysis, cracking, isomerization) and their industrial significance. The most important natural sources and the synthetic methods of alkanes. Steroids

8th week:
Lecture: The characterization of the structure of alkenes, cycloalkenes, di- and polyenes. The hindered rotation: characterization of E / Z isomers. Synthesis of alkenes, cycloalkenes. Physical and chemical properties of alkenes and cycloalkenes. Electrophilic and radical addition reactions and practical significance. Interpretation of the regioselectivity of the addition reactions; the Markovnikov's rule.

9th week:
Lecture: Types of polymerization. Substitution in allylic position, interpretation of the stability of allylic intermediates. Oxidation of alkenes. Addition of conjugated dienes, partial and complete addition. 1,2 and 1,4 addition and its interpretation based on kinetic and thermodynamic control. Diels-Alder cycloaddition.

10th week:
Lecture: Characterization of the structure of alkynes and their physical properties. The stability and synthesis of alkynes. Chemical transformations of alkynes: C-H acidity, addition reactions and their significance. The role of

acetylene in the chemical industry, coal-based chemical industry

11th week:
Lecture: The concept and the interpretation of aromaticity. Neutral and charged homo and heteroaromatic systems. The type and mechanism of the most important aromatic electrophilic substitution reactions (halogenation, nitration, sulphonation, Friedel-Crafts acylation and alkylation). The SEAr reactions of substituted benzene derivatives – the reactivity and regioselectivity. Classification of substituents and interpretation of their effect on reactivity and regioselectivity.

12th week:
Lecture: Electrophilic substitution reactions of five- and six-membered heteroaromatic base compounds. Addition reactions of monocyclic aromatic hydrocarbons. Reactions of aromatic hydrocarbons containing alkyl substituents, the stability of benzyl-type reactive intermediates. Most important representatives of polycyclic aromatic hydrocarbons.

13th week:
Lecture: Classification of halogenated hydrocarbons, characterization of their structure and physical properties. The effect of the structure of the hydrocarbon skeleton, and the quality of the halogen on the strength of the C-Hlg bond and reactivity. Synthesis of halogenated hydrocarbons. Reactions of halogenated hydrocarbons. Interpretation of decreased, normal and high reactivity of halogenated hydrocarbons. Nucleophilic substitution and elimination of halogenated hydrocarbons. Interpretation of the mechanism of these reaction (SN1, SN2; α- and β-elimination; E1, E2 and E1cB).

14th week:
Lecture: Reaction of halogenated compounds with metals. The basics of chemistry of organometallic compounds. Their bonding system, the term "umpolung". Synthesis and reactivity of organometallic compounds. Organimetallic compounds as nucleophiles and carbanion equivalents. C-C bond formation with organometallic reagentsGrignard compounds and their application. Synthesis and interconversion of organometallic compounds, transmetallation.

Requirements

Lecture: terminal examination.

Requirement level:
Sufficient level of acquisition of the knowledge given in the lecture.

Prerequisite for applying for the exam: Obtaining a signature, for which the lectures are min. 30% must attend. This is checked electronically via the eLearning system.

Department of Physical Chemistry

Subject: **PHYSICAL CHEMISTRY I.**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **28**
Seminar: **28**

1st week:
Lecture: General information.

Seminar: General information.

2nd week:
Lecture: Basic notions of thermodynamics.
Seminar: Basic notions of thermodynamics.

3rd week:
Lecture: First law of thermodynamics.
Seminar: First law of thermodynamics.

4th week:
Lecture: Second and third laws of thermodynamics.
Seminar: Second and third laws of thermodynamics.

5th week:
Lecture: Phase transitions.
Seminar: Phase transitions.

6th week:
Lecture: Mixtures.
Seminar: Mixtures.

7th week:
Lecture: Chemical equilibrium.
Seminar: Chemical equilibrium.

8th week:
Lecture: Transport processes.
Seminar: Transport processes.

9th week:
Lecture: Electrical conductance.
Seminar: Electrical conductance.

10th week:
Lecture: Galvanic cells.
Seminar: Galvanic cells.

11th week:
Lecture: Reaction kinetics - 1
Seminar: Reaction kinetics - 1

12th week:
Lecture: Reaction kinetics - 2
Seminar: Reaction kinetics - 2

13th week:
Lecture: Interfacial phenomena
Seminar: Interfacial phenomena

14th week:
Lecture: Colloids.
Seminar: Colloids.

Requirements

The semester is closed with written examination. The examination contains theoretical material as well as problems from those solved in the seminars.
The prerequisite of the examination is the successful completion of the seminars.

Seminar requirements:
- Attendance at seminars is mandatory.
(Properly justified absence is possible up to 3 times - the seminar leader must be notified in advance of the planned absence or a medical certificate is required. In case of a larger number of absences, we cannot accept the semester.)
- Successful writing of tests.
(It is obligatory to write 2 tests during the semester. Successful writing of these and the achievement of at least 50% on the basis of the average of the two ZHs is a necessary condition for admission to the exam.)

Division of Biophysics

Subject: **BIOPHYSICS**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **14**
Seminar: **13**
Practical: **15**

1st week:
Lecture: Introduction to the course. Generation and absorption of X-rays. X-ray contrast materials.

2nd week:
Lecture: Fluorescence spectroscopy, flurescence techniques.

3rd week:
Lecture: Lasers and their biomedical applications. Photodynamic therapy.
Practical: Introduction.

4th week:
Lecture: Optical and electron microscopy.
Seminar: S1: Biostatistics. Set theory. Random events. Conditional probability, marginalization. Independent events. Descriptive statistics. The measure of center and spread.

Practical: Practices are performed in subgroups of 4-5 students in a rotary system For subgroup assignment, please see your lab teacher. P1: Measurement of nuclear radiation P2: Spetrofluorimetry P3: Determination of diffusion constant P4: Refractrometry P5: Light microcopy Optical measurements

5th week:
Lecture: Ionizing radiations and their interaction with materials. Dosimetry, tissue effects, detection of radiation.
Seminar: S2: Biostatistics. Random variables. Distribution function and cumulative distribution function of the random variable. Discrete probability distributions: binomial and Poisson-distribution.

6th week:
Lecture: Research, diagnostic and therapeutic application of stable and radioactive isotopes. Contrast materials, radiopharmaceutical.
Seminar: S3: Biostatistics. Continuous random variables; probability density function. Normal and standard normal distribution. Statistical design and analysis; sampling, estimation. Central limit theorem.
Practical: Practices are performed in subgroups of 4-5 students in a rotary system.

7th week:
Lecture: Medical imaging (CT, PET, SPECT, MRI)
Seminar: S4: Biostatistics. Hypothesis testing. Null hypothesis. Statistical significance. One- and two tailed tests. The z-test. One sample t-test.

Practical: Practices are performed in subgroups of 4-5 students in a rotary system.

8th week:
Lecture: Diffusion at the molecular level, statistical interpretation. Fick's 1st law. Thermodiffusion. Osmosis
Seminar: S5: Biostatistics. Paired t-test. F-test. Unpaired t-test.

Practical: Practices are performed in subgroups of 4-5 students in a rotary system.

9th week:
Lecture: Structure of biological membranes. Membrane transport.
Seminar: S6: Biostatistics. Conditional probability in medicine, screening tests. ROC curve. Epidemiologic investigations: odds ratio and relative risk. The Kaplan-Meier curve.

Practical: Practices are performed in subgroups of 4-5 students in a rotary system.

10th week:
Lecture: Pharmacology of ion channels (gating, selectivity). Patch clamp technique.

11th week:
Lecture: Origin of membrane potential Resting potential, action potential, electric excitability.

Practical: Practical exam

12th week:
Lecture: Fluid mechanics, blood circulation. Newtonian fluids, viscosity, creams and emulsions.

13th week:
Lecture: Methods of pharmacological research. Gelelectrophoresis, isoelectric focussing, blotting. Detecting molecular interactions (SPR, FCS, FRET)

14th week:
Lecture: Biophysics of drug delivery. Nanotechnology approaches.

Requirements

Compulsory reading:
Lecture materials and description of lab practical (published on the web page of the Department).
Medical Biophysics (Editors.: S. Damjanovich, J. Fidy, J. Szöllősi, Medicina, Budapest, 2009, ISBN: 978-963-226-127-0)

Condition for signing the lecture book:
- All labs have done (if one missed, only one repetition option is available)
- Lab exam attended (no make-up is available)
- Minimally 5 out of 6 biostatistics seminars attended (no make-up is available)
- Signing up for the electronic course PHARM-Biophysics at the exam.unideb.hu website by the end of week 3 (the site can only be reached from inside the University network)
- Lecture attendance is strongly recommended

Practical requirements
Students write a short quiz (may contain test questions and short calculation problem(s)) before each lab topic. At least 50% must be earned in this test to be eligible for doing the lab. Students failing the quiz need to repeat it then do the practicals within the frame of spare practicals.
In the laboratory practical, a laboratory logbook (into a booklet with stable pages) should be written to make the conditions of the measurements accomplished repeatable according to the notes. Students must be prepared for the lab. One part of this preparation is a summary of the theoretical part of the lab exercises to be performed. Each lab is graded from 1 to 5. The average score of 4 or 5 of all labs is rewarded with a +1 exam point. That is added to the laboratory practical exam result. In case of unpreparedness, the lab exercise should be repeated, where a maximum of 2 points can be obtained for the make-up lab. An immediate organization of the make-up lab is the student's responsibility by obtaining written permission from the tutor at the end of the logbook.
Exams and grading:
- Lab exam (see the actual timetable) – 10+1 points max
- Final exam in biostatistics (see the actual timetable) – 20 points max
- Exemption test (electronic) in biophysics, or written exam (electronic) in the final exam - 70 points max

Total: 100 points.

Grades:

- 50< pass (2)
- 60< satisfactory (3)
- 70< good (4)
- 80< excellent (5)

Please note that lab and biostatistics work during the semester constitutes a compulsory part of the final score, which cannot be changed during the exam period, so take your studies seriously throughout the semester.

Repeaters

The signature obtained for the subject earlier is making students exempted from attending labs and biostatistics seminars.

Exempted students can choose to keep their scores from last year or to take the exams together with the rest of the class during the semester. Exemption-related decisions must be made before the end of the 3rd week of education, and the study advisor at biophysedu@med.unideb.hu notified about it. In the absence of written notification, we automatically assume that the last year’s score is kept, and no further changes will be possible later. Biostatistics and Lab exemptions, scores, exams are independent of each other.

CHAPTER 17
ACADEMIC PROGRAM FOR THE 2ND YEAR

Department of Foreign Languages

Subject: **HUNGARIAN LANGUAGE II/1.**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: 1. fejezet: Emlékszik?

2nd week:
Practical: 1. fejezet: Emlékszik? / Tegezés - Önözés

3rd week:
Practical: 2. fejezet: Tegezés - Önözés

4th week:
Practical: 3. fejezet: Élelmiszerek 1.

5th week:
Practical: 4. fejezet: Élelmiszerek 2.

6th week:
Practical: 5. fejezet: Étkezések, étteremben 1.

7th week:
Practical: 6. fejezet: Étkezések, étteremben 2.

8th week:
Practical: 7. fejezet: Összefoglalás, midterm test

9th week:
Practical: 8. fejezet: A városban 1.

10th week:
Practical: 9. fejezet: A városban 2.

11th week:
Practical: 10. fejezet: Édes otthon 1.

12th week:
Practical: 11. fejezet: Édes otthon 2.

13th week:
Practical: 12. fejezet: Összefoglalás End term test

14th week:
Practical: Oral exam

Requirements

Requirements of the course:

Attendance
Attending language classes is compulsory. If a student is late it is considered as an absence. Students can miss only 10 percent of the classes that is maximum 2 occasions.
The teacher evaluates active participation in each class. Students are not supposed to share coursebooks in the classes therefore if they fail to bring the coursebook to the class for the second time the attendance is refused.

Testing, evaluation
In each Hungarian language course, students must sit for 2 written language tests and an oral exam. Students must appear at the lecture hall at least 15 minutes before the exam. If students are late, they are not allowed to write the test.

A further minimum requirement is the knowledge of 200 words per semester divided into 10 word quizzes. There are five word quizzes before and another five after the midterm test. If a student fails or misses any word quizzes he / she cannot take the written test. A word quiz can be postponed by a week and students can take it only with their own teacher. Students can get bonus points (5-5%) by taking two extra quizzes containing 20 sentences each, before the midterm and end term tests. The sentences are taken from the units of the coursebook.
The oral exam consists of a role-play from a list of situations covered in the coursebook. If students fail the oral exam, they fail the whole course. The results of the written tests and the oral exam are combined and averaged
Based on the final score the grades are given as follows.

Final score	**Grade**
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the final score of the written tests is below 60, the student can take a written remedial exam once covering the whole semester's material.

Coursebook:
See the website of the Department of Foreign Languages: **ilekt.med.unideb.hu.**
Audio files to the course book, oral exam topics and vocabulary minimum lists are also available on the website.

Department of Inorganic and Analytical Chemistry

Subject: **PHARMACEUTICAL BIOCHEMISTRY I.**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **36**
Practical: **4**

1st week:
Lecture: Introduction to Biochemistry. Molecular design of life. Amino acids. Peptides. Primary, secondary, tertiary, quaternary structures.

2nd week:
Lecture: Determination of peptide structures. Peptide synthesis. Denaturation. Methods for separation and structural determination. Protein structure and function. Oxigen transporting proteins: Myoglobin and Hemoglobin.

3rd week:
Lecture: Carbohydrates. Biological role of carbohydrates. Monosaccharides, disaccharides, polysaccharides. Glycoconjugates. Glycobiology.

4th week:
Lecture: Introduction to biological membranes. Lipids. Classification and functions of lipids. Neutral fats, oils and waxes. The major classes of membrane lipids. Membrane models.

5th week:
Lecture: Enzymes. Classification. Coenzymes. Mechanism of enzyme action. Control of enzyme

activity. The kinetic properties of enzymes. The Michaelis-Menten model. Graphic evaluation of the kinetic parameters. Inhibition of enzyme activity. Diagnostic importance of enzymes.

6th week:
Lecture: Metabolism: basic concepts and design. Metabolism of carbohydrates. Glycolysis. The fate of pyruvate. Entry of fructose and galactose into glycolysis. Gluconeogenesis. Cori cycle.

7th week:
Lecture: The pentose phosphate pathway. Glycogen metabolism. Glycogen degradation and synthesis. The coordinated control of synthesis and breakdown. Disease of glycogen storage.

8th week:
Lecture: Citric acid cycle. Pyruvatedehydrogenase complex. The citric acid cycle is a source of biosynthetic precursors. Control of the citric acid cycle. The glyoxylate cycle.

9th week:
Lecture: Oxidative phosphorylation. The three enzyme complexes of the respiratory chain. Synthesis of ATP. The ATP yield of the complete oxidation of glucose.

10th week:
Lecture: Fatty acid metabolism. Oxidation of fatty acids and unsaturated fatty acids. Energetics of fatty acid oxidation. Synthesis of ketone bodies.

11th week:
Lecture: Biosynthesis of fatty acids. The elongation cycle. Biosynthesis of cholesterol. Clinical aspects. Obesity.

12th week:
Lecture: Digestion of proteins. Amino acid degradation. Transamination and oxidative deamination. The urea cycle. The link between the urea and the citric acid cycle. The fates of the carbon skeletons of amino acids. Disorders of amino acid metabolism.

13th week:
Lecture: DNA and RNA: Molecules of heredity. Purine and pyrimidine bases, nucleosides and nucleotides. cAMP, ATP. Nucleotid coenzymes.

14th week:
Lecture: Digestion of nucleicacids Catabolism of purines and pirimidines. Disorders in the metabolism. One-carbon groups carried by tetrahydrofolate. Biological methylations.
Practical: Kinetic studies on beta-glucosidase from sweet almond.

Requirements

Detailed instructions will be given on the first lecture.

Subject: **QUANTITATIVE ANALYTICAL CHEMISTRY I.**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **28**
Seminar: **28**

1st week:
Lecture: Introduction: Analytical chemistry and its objectives. The analytical process. Measurements. Equilibria in solution and their quantitative analytical applications.
Seminar: Calculations in acid-base systems: Simple problems about pH calculations (revision). Quantitative description of solutions containing monobasic acids and bases. Buffers in acid-base chemistry.

2nd week:
Lecture: Acid-base equilibria (based on Brönsted-Lowry theory). Basic concepts: bases, acids, ampholytes, self-dissociation, base strength, acid strength, dissociation constant, association constant, pH calculations: pH of strong acids and strong bases, weak acids, weak bases and buffers, pH of polyprotic acids and bases, overlapping parallel acid-base equilibria: macro- and micro constants.
Seminar: Calculations in acid-base systems: Simple problems about pH calculations (revision). Quantitative description of solutions containing monobasic acids and bases. Buffers in acid-base chemistry.

3rd week:
Lecture: Acidimetric and alkalimetric titrations: titration curves and their calculations, factors influencing the shape of the titration curves, end-point, equivalence point, methods of endpoint indication (Gran function and its applications). Applications of acid-base titrations.
Seminar: Di- and polybasic acids and bases, ampholytes (illustration with evaluating the titration curve of a sample of phosphoric acid). Problems based on acid-base titrations. Calculation of equivalence points, indicator selection. Calculations for planning titration-based methods, calculation of final results from experimental data.

4th week:
Lecture: Complex formation equilibria. Basic concepts: stepwise equilibrium, equilibrium constants, concentration distribution curves, simultaneous equilibria influencing complexometric reactions, conditional stability constant, chelate effect.
Seminar: Di- and polybasic acids and bases, ampholytes (illustration with evaluating the titration curve of a sample of phosphoric acid). Problems based on acid-base titrations. Calculation of equivalence points, indicator selection. Calculations for planning titration-based methods, calculation of final results from experimental data.

5th week:
Lecture: Complexometric titrations: titration curves and their calculations, factors influencing the shape of the titration curves, indication in complexometry, selective complex formation reactions. Applications of complexometric titrations.
Seminar: Di- and polybasic acids and bases, ampholytes (illustration with evaluating the titration curve of a sample of phosphoric acid). Problems based on acid-base titrations. Calculation of equivalence points, indicator selection. Calculations for planning titration-based methods, calculation of final results from experimental data.

6th week:
Lecture: Precipitation equilibria: Basic concepts: solubility, solubility product, factors influencing the solubility (the common ion effect, temperature effect, solvent effect, effects of simultaneous solution equilibria: protonation/hydrolysis or complex formation). Titration based on precipitate formation: titration curves and their calculations, shape of titration curves, endpoint indication. Practical applications (argentometry).
Seminar: Practice, consultation.

7th week:
Lecture: Equilibria of redox systems: Basic concepts: redox potential, Nernst equation, equilibrium redox potential, equilibrium constant and redox potential, factors influencing the redox potential. Redox titrations (oxidimetry, reductometry): titration curves and their calculations, shape of titration curves, practical applications (permanganometry, chromatometry, bromatometry, iodometry).
Seminar: Test I.

8th week:
Lecture: Methods of analytical separation. Basic concepts: distribution constant, distribution coefficient, separation factor. Separation methods with phase transition. Theory and practice of gravimetry. Extraction methods: liquid-liquid, solid-liquid extraction, distillation. pH dependence of solute partitioning processes.

Determination of metal ions by extraction.
Seminar: Complex formation equilibria. The concept and calculation of conditional stability constants. Calculations connected to complexometric titration methods.

9th week:
Lecture: Chromatographic methods: Basic concepts: classification, separation techniques, chromatographic process (HETP, number of theoretical plates, basic equation of chromatography, peak broadening, van Deemter equation, resolution and its optimization), characteristic values of a chromatogram (retention parameters, quantitative evaluation methods).
Seminar: Complex formation equilibria. The concept and calculation of conditional stability constants. Calculations connected to complexometric titration methods.

10th week:
Lecture: Gas chromatography: components of a gas chromatograph, detectors, role of temperature in gas chromatography, practical applications. Liquid chromatography: modules of a liquid chromatograph, detectors. Electrophoresis: slab gel electrophoresis and capillary electrophoresis.
Seminar: Quantitative description of redox equilibria. Calculations based on redox titration methods.

11th week:
Lecture: Basic concepts: signal, noise, sensitivity, limit of detection, reproducibility, accuracy, precision, calibration, signal to noise ratio, basics of error calculation. Discarding questionable data points. Q-test, t-test. GLP, GMP.
Seminar: Quantitative description of redox equilibria. Calculations based on redox titration methods.

12th week:
Lecture: Spectroscopic methods: Origin of spectrum. Classification of spectroscopic methods. Molecular spectroscopy, UV-VIS. Analytical applications of fluorescence and phosphorescence. Lambert-Beer law. Construction of spectrometers, detectors, monochromators. Applications of spectrophotometry.
Seminar: Quantitative description of precipitation equilibria. Solubility product and solubility. Effects of pH and the excess of precipitating ion on solubility. Problems based on precipitation reactions and precipitation-based titrimetric methods.

13th week:
Lecture: Atomic spectroscopic methods. Atomic spectrum, spectral lines. Atomization, ionization. Construction of the atomic spectrometers. Sample introduction. Flame atomic absorption spectrometry (FAAS), graphite furnace AAS. ICP, ICP-MS Interferences in atomic spectrometry. Speciation analysis.
Seminar: Quantitative description of precipitation equilibria. Solubility product and solubility. Effects of pH and the excess of precipitating ion on solubility. Problems based on precipitation reactions and precipitation-based titrimetric methods.

14th week:
Lecture: Fundamentals of electrochemistry. Analytical applications of the interaction between electric current and matter. Potentiometry, Electrodes. Direct and indirect potentiometry and conductometry.
Seminar: Test II.

Requirements

Minimum requirements of the seminar:
1. The presence of students at seminars is obligatory.
2. During the semester, the students are required to write two tests. The score of both tests must be at least 40 % to get the signature and these students are eligible to register for the theoretical exam. The students with low test results (the score of both tests are between 20 and 40 %) can take a

comprehensive test (Test III) in the examination period and the passing level is 60 %. Test III will be organized only once in the examination period. If the score of the individual tests is less than 20 %, the student's lecture book won't be signed and the student has to retake the course next year.

Department of Organic Chemistry

Subject: **ORGANIC CHEMISTRY PRACTICE II.**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Practical: **56**

1st week:
Practical: Receiving of laboratory equipments. Safety educations. **Repetition:** crystallization from water, filtration, TLC, determination of melting point.

2nd week:
Practical: Repetition**:** distillation of acetone from KMnO4 and vacuum distillation of water. Separation of benzoic acid and benzanilide by liquid-liquid extraction.

Self Control Test (Short written test from the safety rules and laboratory equipments.)

3rd week:
Practical: Identification of hydroxyl derivatives of hydrocarbons. Test tubes reaction. Identification of unknown compounds.
Self Control Test (Short written test: purification and identification of solid compounds and distillation methods.)

4th week:
Practical: Preparation of benztriazole and 3-nitroaniline.
Self Control Test (Short written test test: chemistry of hydroxy derivatives of hydrocarbons: alcohols; phenols.)

5th week:
Practical: Identification of amino derivatives of hydrocarbons. Identification of unknown compounds

Self Control Test (Short written test: preparation and chemistry of diazonium salts.)

6th week:
Practical: Identification of oxo derivatives of hydrocarbons. Identification of unknown compounds. Preparation of cyclohexanone-2,4-dinitrophenylhydrazone.
Self Control Test (Short written test: Preparation and chemistry of amines.)

7th week:
Practical: Preparation of benzamide and benzoic acid.
Self Control Test (Short written test: Preparation and chemistry of aldehydes and ketones.)

8th week:
Practical: Synthesis and separation of 4-chlorobenzoic acid and 4-chlorobenzyl alcohol. TLC, determination of melting point.
Self Control Test (Short written test: Synthesis and chemistry of carboxylic acid derivatives.)

9th week:
Practical: Preparation of 2,3-diphenyl-quinoxaline and 2,6-dibenzylidene-cyklohexanone. TLC, determination of melting point.

10th week:
Practical: Isolation and saponification of the glyceride of nutmeg. TLC, determination of melting point.

11th week:
Practical: Complex practical test: Identification

of unknown compounds with test tube reactions.

12th week:
Practical: Preparation of O-Acetyl-salicylic acid
Self Control Test (Final written test.)

13th week:
Practical: Isolation of anethole from anise with steam distillation. Synthesis of p-anisic acid.

14th week:
Practical: Filling of laboratory notes. Cleaning of the laboratory glasswares. Deposit of the laboratory equipments. Assessment of laboratory practice.

Requirements

Compulsory literature: The hand-out provided by the leader of the laboratory practice.

Suggested Reading: The hand-out of the lecture of organic chemistry II as well as its compulsory and suggested literature.

Conditions on signing the lecture book: The laboratory work is evaluated by a five-level practical grade.

Subject: **ORGANIC CHEMISTRY THEORY II.**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **56**

1st week:
Lecture: Classification and characterization of hydroxyl derivatives of hydrocarbons (alcohols, phenols) and their thio analogues. Interpretation of their physical properties derived from their bonding system. The acid-base properties of alcohols, phenols and thio analogues. Preparation of alcohols, ethers, phenols and thio analogues.

2nd week:
Lecture: Alcohols and phenols as nucleophiles: alkylation, acylation, formation of sulphonate and inorganic esters; acid catalyzed transformations of alcohols (conversion of alcohols to halogenated derivatives, elimination reactions). Oxidation of alcohols and phenols. The characterization of ethers; synthesis and cleavage of ethers. Characterization of the special ether derivatives: epoxides, semi-acetals, acetals and enoleters. Cumene-based phenol synthesis.

3rd week:
Lecture: Overview of the organic compounds possessing C-N single bond. Classification of amines and characterization of their bonding systems. Interpretation of their physical derived from their bonding system. Synthesis of aliphatic and aromatic amines; industrial methods. Review and interpretation of basicity of amines. Chemical transformation of amines: alkylation, acylation of amino group. Synthesis of sulfonamide and reaction with nitric acid. Oxidation of the amines. SEAr reactions of anilines.

4th week:
Lecture: Characterization of nitro compounds: the bonding system, interpretation of electron-withdrawing effect and C-H acidity. Synthesis of nitro compounds. Preparation of diazonium salts, reactions of diazonium salts and their practical significance. Azo compounds and their industrial significance.

5th week:
Lecture: Classification and characterization of oxo compounds: the bonding system and stability

of carbonyl group. Physical properties of oxo compounds. Acid-base properties of aldehydes and ketones: acidity of thea-hydrogen, keto-enol tautomerism. Synthesis of aldehydes and ketones.

6th week:
Lecture: Reactions of aldehydes and ketones. Nucleophilic addition with O-, S-, N- and C-nucleophiles, the reversibility of the additions. Condensation reactions. Oxidation and reduction. Reactions ona-carbon; aldol dimerization,a-halogenation. Nucleophilic addition reactions ofa, b-unsaturated oxo compounds.

7th week:
Lecture: Classification of carboxylic acids and their derivatives, description and comparison of their bonding systems. Stability and reactivity of the carboxylic acid derivatives. Physical properties and synthesis of carboxylic acids.

8th week:
Lecture: Review and interpretation of the acid-base properties of carboxylic acids and their derivatives (O-H, N-H and C-H acidity). Interconversion of the carboxylic acid derivatives, acyl nucleophilic substitution. Reductive transformations of carboxylic acid derivatives, transformation of their carbon skeleton.

9th week:
Lecture: b-Dicarbonyl andb-oxo-carboxylic acid derivatives, C-H acidity and basic of enolate chemistry: formation of carbon-carbon bond, malonic ester, acetoacetic ester and cyanoacetic ester syntheses. Substituted (halogenated, hydroxy and oxo) carboxylic acid derivatives and their interconversion. Synthesis and interconversion of carbonic acid derivatives and their major representatives. Practical significance of carbonic acid derivatives.

10th week:
Lecture: Structure, synthesis and chemical properties of amino acids. Characterization ofa-amino acids which are forming protein/peptides. Structure and determinations of peptides. Determination of amino acid sequence by chemical and enzymatic methods, possibility of automation. Synthesis of peptides. The basic protecting groups and activation methods for peptide synthesis. Solid phase synthesis, automation. The occurrence, classification and functions of proteins. Levels of protein structure: primary, secondary, tertiary and quaternary structures, structure formation. Structure and function relationship.

11th week:
Lecture: Classification, structure and nomenclature of carbohydrates. Basic configuration and conformational conditions of monosaccharides. Most important chemical properties of monosaccharides: mutarotation, transformation of oxo group and hydroxyl groups, synthesis of glycosides.Most important representatives of di- and oligosaccharides (sucrose, maltose, cellobiose, lactose, cyclodextrins), factors determining their structure. Synthesis of di- and oligosaccharides, basic protecting groups and activation methods.

12th week:
Lecture: Structure of heterocyclic compounds. Three-, four-, and five-membered heterocycles containing one heteroatom. β-lactam antibiotics. Porphyrins. Five-membered ring systems with two or more heteroatoms. Six-membered ring systems containing one heteroatom.

13th week:
Lecture: Characterization and significance of six-membered heterocycles with multiple heteroatoms. The significance and types of alkaloids, flavonoids and vitamins.

14th week:
Lecture: Classification and characterization of nucleic acids, their building blocks. Synthesis of nucleosides and nucleotides. Primary, secondary and tertiary structure and biological function of DNA and RNA. The genetic code. Information content of the nucleotide, amino acid and carbohydrate code and their correlation. Nucleotide coenzymes.

Requirements

Terminal examination, comprehensive examination.

Requirement level:
Sufficient level of acquisition of the knowledge given in the lecture.

Prerequisite for applying for the exam:
Obtaining a signature, for which the lectures are min. 30% must attend. This is checked electronically via the eLearning system.

Department of Physical Chemistry

Subject: **COLLOID AND SURFACE CHEMISTRY PRACTICE**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Practical: **28**

8th week:
Practical: 1. Rheological characterization of concentrated emulsions (creams).

9th week:
Practical: 2. Measurement of surface tension of solutions by Du Nouy tensiometer.

10th week:
Practical: 3. Polymer's relative molecular masses from viscosity measurements.

11th week:
Practical: 4. Adsorption from solution.

12th week:
Practical: 5. Solubilization.

13th week:
Practical: 6. Determination of size distribution of a sedimenting suspension.

14th week:
Practical: 7. Experiments on thixotropic or other anomalous fluids with a rotation viscometer

Requirements

Attendance on all practice is compulsory. Preparation of lab notebooks is necessary to get the signature. More detailed instructions will be given on the first lab course.

Subject: **COLLOID AND SURFACE CHEMISTRY THEORY**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: "A": A subject of colloid and surface chemistry. Classification of the dispersed systems. Type of colloids. Typical everyday colloids. Preparation of colloids. The basic characteristics of colloid systems: dispersity, morphology, spatial distribution, interparticle interactions, normal distribution.

Thermodynamic and kinetic stability.
"B": Molecular interactions. Attraction forces: ion-ion, ion-dipole, dipole-dipole, dispersion interactions. Hydrogen bonds, hydrophobic interactions.

2nd week:
Lecture: "A": Definition of energy of activation. Basic transport properties. Description of Brownian motion, random walk. Diffusion coefficient, average distance. Einstein-Stokes equation. Sedimentation equation. Diffusion flux and diffusion equation. Measuring of size distribution with different techniques (osmosis, diffusion, light scattering, Donnan potential).
"B": Interfacial chemistry. Definition of interfacial region, types of interfaces. Surface tension. Surface tension depends on the intermolecular interactions. Determination of surface tension. Temperature dependence of surface tension. Spreading. Monomolecular films.

3rd week:
Lecture: "A": Curved interfaces. The effect of surface curvature on the vapor pressure of a liquid. Kelvin equation. Meniscus, contact angle, wetting, spreading. Hydrophilic, hydrophobic surfaces.
"B": Adsorption. Hardy-Harkins best continuity rule. Surface activity and inactivity. Gibbs isotherm equation. Monolayer and multilayers (Langmuir-Blodgett). Physical state of the monolayers. Application of monolayers. Film formation. Analysis, membrane modeling, water conservations, sensors. Vesicles, liposomes.

4th week:
Lecture: "A": Solid surfaces. Molecular structure and characterization. Adsorption at the gas-solid interface, adsorption isotherms. Type of isotherms. Langmuir, BET. Freundlich. Capillary condensation. Adsorption from solutions. Applications. Theory and types of chromatographies. Retention time.
"B": Association colloids. Amphipathic molecules. Surfactants, physical properties of solutions of surfactants. Micelles. CMC, dependence on chain length and salt concentration. The Krafft point. Detergency, chemistry of washing. Solubilization. Applications in medicine. Lung surfactants.

5th week:
Lecture: "A": Charged surfaces. Origin of surface charge, electrodes. Mulliken experiment, elementary charge. Electrical double layer models. Hemholtz, Gouy Chapman and Stern models.
"B": Electrical double layer. Zeta-potential. Electrophoresis. Reversal of sign of the Zeta-potential. Overcharge. Electrophoresis.

6th week:
Lecture: "A": Stability of dispersion colloids. Electrostatic theory: DLVO. Inter-particle forces. Hamaker-equation. Hardy-Schulze rule. Stability ratio. Critical coagulation concentration. Applications of the DLVO theory. Steric and electrostatic stabilization.
"B": Macromolecules. Definitions and types. Structure and size of polymers. Determination of size. Sorption of polymers. Bridging flocculation. Depletion flocculation lyophilic colloids as sensitizers. Targeted medicine.

7th week:
Lecture: "A": Emulsion. Emulsion types. Identification of emulsion type. Emulsion stability. Emulsifiers HLB (hydrophilic -lipophilic balance) values. Physical properties of emulsions. Breaking emulsions. Foam. Foam Stability. Inhibition and breaking of foam. Examples.
"B": Rheology. Theory and definition of viscosity. Rheological types of matter. Shear rate, basic equations. Viscosity- and rheometers. Viscosity of solutions of colloids. Response of matter to shear: typical cases. Structure of coherent systems. Gels, creams: thixotropy.

Requirements

Attendance on the lectures is highly recommended. The evaluation is based on the total score of a written test, 50% is necessary to pass. More detailed information will be presented on the first lecture.

Subject: **PHYSICAL CHEMISTRY II.**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: One of the following topics: Measuring the concentration of a coloured solute by spectrophotometry or determination of thermodynamic quantities by calorimetry or electrochemistry.

2nd week:
Practical: One of the following topics: Measuring densities by pycnometer, composition of a binary mixture or determination of partial molar volumes. Measuring electrical conductivity of solutions or dissociation constant of weak acids measured by conductometry.

3rd week:
Practical: One of the following topics: Determination of NaHCa3content of a solid sample by gas volumetry or distillation.

4th week:
Practical: One of the following topics: pH-metric titration curves of hydrochloric and acetic acids. Dissociation equilibria of ampholites, determination of isoelectric pH or study of electrolysis.

5th week:
Practical: One of the following topics: Kinetic measurements, mutarotation of glucose measured by polarimetry or kinetics of a second order reaction: hydrolysis of esters or initial rates and activation energy of the iodine clock.

6th week:
Practical: One of the following topics: Reaction rate of decomposition of H2O2 measured by gas volumetry. Investigation of buffers. Study of the iodine-iodide-triiodide equilibrium.

7th week:
Practical: One of the following topics: Redox potentials from potentiometric titrations. Determination of activity coefficient for concentration galvanic cell.

Requirements

The measurements and knowledge of the associated theory are graded and an overall mark will be given.
Safety training is mandatory before the first lab practice.
Everybody should work and do the measurement individually according to the pre-set schedule (it will be provided prior to the first lab). The laboratory practices are 4-hours long. In accordance with the regulations of University of Debrecen, attendance is compulsory with the exception of health or family problems. In this case, the students should agree with the teacher on replacement dates for the missed experiments.

Department of Physiology

Subject: **HUMAN PHYSIOLOGY I.**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **28**
Seminar: **14**

1st week:
Lecture: Introduction
Basic receptor function
Passive and active transport

2nd week:
Lecture: Ion channels
Resting membrane potential
The mechanism of action potential

3rd week:
Lecture: Cardiac action potential
ECG
Excitation-contraction coupling in cardiac muscle

4th week:
Lecture: Contractile properties of the heart
The cardiac output and the cardiac cycle
Effects of humoral agents and the autonomic nervous system
on the heart

Self Control Test

5th week:
Lecture:
Physiology of synapse and neuromuscular junction
Skeletal muscle
Smooth muscle

6th week:
Lecture:
Physiology of the body fluids. Plasma.
Red blood cells. Blood types.
Jaundice. Hemostasis.

7th week:
Lecture:
Mechanics of respiration, Compliance, work of breathing
Gas transport in the blood
Central control of breathing

Self Control Test

8th week:
Lecture:
General properties of circulation, Arterial circulation
Microcirculation, venous circulation
Cardiovascular reflexes

9th week:
Lecture:
Humoral control of cardiovascular function
Nervous control of cardiovascular function
Circulation of special areas: Brain, Heart, Splanchnic area, skin and skeletal muscle

10th week:
Lecture: Cardiovascular Shock

13th week:
Self Control Test

Requirements

1. Signature of the Semester
Attendance of the lectures and seminars are compulsory. The signature of the semester may be refused if one has more than four absences from the seminars. Every student must attend seminars with the group appointed by the Educational Office. The program of the Human Physiology I lectures is listed a the e-learning web site of the Department of Physiology. For continuous updates

on all education-related matters, please check the elearning.med.unideb.hu website (Department of Physiology menu item).

2. Evaluation during the semester (mid-semester tests)
The progress of students will be tested three times during the semester in the form of a written test (multiple choice questions). Participation on mid-semester written tests is compulsory.
3. Examination
The first semester is closed by an oral end-semester exam (ESE) covering the topics of all lectures and seminars. The list of oral exam questions is available on the elearning.med.unideb.hu website (Department of Physiology menu item). Students may be exempted for ESE if the average score of the three mid-semester tests is higher than 60%, and (s)he has fewer than 4 - 4 lecture and seminar absences. If all these conditions are met, the offered mark will be calculated according to the following table:

score	mark
60 – 69.9 %	pass (2)
70 – 79.9 %	satisfactory (3)
80 – 89.9 %	good (4)
90 – 100 %	excellent (5)

The student can refuse to accept the offered mark based on the results of mid-semester tests and choose to take ESE.

Division of Pharmacognosy

Subject: **BOTANY PRACTICE**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Structure of plant cells, Diagnostic plant cell constituents, Inclusions, Vacuoles, Staining plant cells (Neutral Red, Lugol Solution etc.), Plasmolysis of plant cells, Preparation of your own microscopic samples.

2nd week:
Practical: Epidermis studies, Stomata, Primary and secondary epidermis, Digitalis purpureae folium, Salviae folium, Absinthi folium, Altheae folium, Thymi folium, Types of ti-chomes in Lamiaceae. Frangulae cortex, Analysis of Periderms and lenticels. Studying of Parenchymas and Collenchymas, Salep tuber, Calami Rhysoma, Marrubi herba, Capsici fructus, Cydonae fructus, Foeniculi fructus, Auranti pericarpium.

3rd week:
Practical: Studies on vascular tissues, Xylem - Tracheas, Tracheides, Xylemparenchymas, Fiber cells, Types of thickening, Phloem - Sieve cells, Sieve tubes, Sieve plates, Companion cells, Albuminous cells, Types of Vascular Bundles, Veratri radix, Agrimo-niae herba, Calami rhizoma, Belladonae folium, Filicis maris rhyzoma.

4th week:
Practical: Tissues of Primary and Secondary Roots, Veratri radix, Valerianae radix, Primulae radix, Liquiritiae radix, Saponariae albae readix, Belladonae radix, Gentianae radix, Altheae radix.
5th week:
Practical: Tissues of Secondary roots,

Ipecacuanhae radix, Ononidis radix, Ratanhiae radix, Tissues of rhizomes, Graminis rhizoma,Veratri rhizoma, Rhei rhizoma.

6th week:
Practical: Tissues of Stems (Monocotyledonopsida, Dicotyledonopsida), Characterization of Cortex, Agrimoniae herba, Stem of Equisetum arvense, Chinae cortex, Frangula cortex, Cinnamoni cassiae Cinnamon ceylonici cortex, Quercus cortex.

7th week:
Practical: Tissues of leaves, Sennae folium, Absinthi folium, Uvae ursi folium, Belladonae folium, Stramonii folium, Hyoscyami folium, Calciumoxalate inclusions.

8th week:
Practical: Fruit studies, Foeniculi fructus, Carvi fructus, Anisi vulgaris fryctus, ConiAuranti pericarpium,i fructus, Coriandri fructus, Juniperus galbulus, Fruits of Apiaceae.

9th week:
Practical: Seed studies, Tisseus of seeds, Lini semen, Strophanti semen, Sinapis nigrae semen, Strychni semen, Myrysticae semen, Stereomicroscopic studies on seeds, Identifying characters of drugs.

10th week:
Practical: Characterization of Pharmaceutically important Families and Species of plants, Plant Identification, Dicotyledonopsida, Ranunculaceae, Helleboraceae, Papaveraceae, Fumariaceae.

11th week:
Practical: Characterization of Pharmaceutically important Families and Species of plants, Plant Identification, Rosaceae, Fabaceae, Apiaceae, Brassicaceae.

12th week:
Practical: Characterization of Pharmaceutically important Families and Species of plants, Plant Identification, Apocyneceae, Rubiaceae, Boraginaceae,

13th week:
Practical: Characterization of Pharmaceutically important Families and Species of plants, Plant Identification, Lamiaceae, Solanaceae, Scrophulariaceae, Asteraceae.

14th week:
Practical: Characterization of Pharmaceutically important Families and Species of plants, Plant Identification, Monocotyledonopsida, Liliaceae, Poaceae.

Requirements

Detailed information is given in the first practical course and via the e-learning system.

Completion of the practice requires:
- completion of the practical tests (in person, or on e-learning platform, depending on the situation)

Subject: **BOTANY THEORY**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: History of pharmaceutical botany and pharmaceutical plant science. Anatomy, structure, function and metabolism of plant cells. Basic plant cell types, function of plant organelles.

2nd week:
Lecture: Anatomy of plant tissues, Meristems, Parenchymas, Collenchymas, Sclerenchymas, Epidermis (types of stomata), Vascular tissues, Ground tissues, Secretory tissues.

3rd week:
Lecture: Primary and Secondary plant body, Tissues of the Root and Stem, Xylem and Phloem, Function of Vascular Cambium. Organs Organizations of Root and Stem systems.

4th week:
Lecture: Primary and Secondary plant body, Tissues of Leaves and Reproductive Organs (anatomy of flowers), Organization of Leaves and Reproductive Organs, Plant Life Cycle, Gametophyte and Sporophyte, Sexual Reproduction of Plants, Double Fertilization and Pollination of Plants.

5th week:
Lecture: Inflorescens. Fruit Types (true and accessory fruits) and Seed Dispersal. Plant Embryo and Seed Anatomy, Development of Seeds, Types of Seedlings.

6th week:
Lecture: Classification and Systematic of Plants, Historical Aspects of Plant Classification, Artificial- versus Natural System of Classification, Levels of Taxonomic Categories, Phenetic, Numeric- and Applied Taxonomy.

7th week:
Lecture: Kingdoms of Living Creatures, Cyanobacteria, Algae and Origin of Eukaryotes, Endosymbiont Theory, Embryophyta, Cormophyta and Spermatophyta Plants, (Mosses, Liverworts and Hornworts, Lychenophyta, Pteridophyta, Gymnospermatophyta, Angiospermatophyta).

8th week:
Lecture: Characterization of spermatophytes. Orders, families and important taxa of gymnosperms.

9th week:
Lecture: Taxonomy of Angiosperms. Orders, families and important taxa of Magnoliidae.

10th week:
Lecture: Dicotyledonopsida: Orders, families and important taxa of Hamamelididae and Dilleniidae.

11th week:
Lecture: Dicotyledonopsida: Orders, families and important taxa of Rosidae.

12th week:
Lecture: Dicotyledonopsida, Orders, families and important taxa of Asteridae.

13th week:
Lecture: Monocotyledonopsida: Orders, families and important taxa of Liliidae.

14th week:
Lecture: Monocotyledonopsida: Orders, families and important taxa of Commelinidae and Arecidae.

Requirements

Detailed information is given in the first lecture and via the e-learning system.

Completion of the lecture requires:
- examination during the exam period based on the uploaded lectures (in person, or, on video platform face-to-face, depending on the situation).

Department of Biochemistry and Molecular Biology

Subject: **PHARMACEUTICAL BIOCHEMISTRY II.**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **44**
Practical: **5**

1st week:
Lecture: Biochemistry of nutrition. Energy requirement. Basic metabolic rate. Energy content of the food. Energy storage and thermogenesis. Biochemical mechanism of obesity. Protein as N and energy source. N balance. Essential amino acids. Protein malnutrition. Vegetarianism. Clinical aspects of protein nutrition. Carbohydrates and lipids. Vitamins. Structure, biochemical functions. Relationship between the biochemical functions and the symptoms of deficiency. Essential inorganic elements of the food (metabolism, function, deficiency). Steroid hormones. Vitamin D.

2nd week:
Lecture: Medical importance of the lipid metabolism. Organization of lipid structures. Mixed micelles in the digestive tract. Lipoproteins in blood plasma. Synthesis of cholesterol Cholesterol transport in the body. The LDL receptor and its gene. Excretion of cholesterol. Biochemical explanation of elevated blood cholesterol levels. Biochemical explanation of obesity.
Signal transduction I. Term and levels of regulation. Term and levels of regulation. Significance and interrelationship between metabolic, cytokine, hormonal and neuronal regulation. Forms of external signals. Receptors and transducers. Systems increasing the sensitivity of regulation: allosteria, substrate cycle, interconversion cycle, cascades.

3rd week:
Lecture: Signal transduction II. Signalling pathways of nonpenetrating signals. Ionchannel receptors. Seven transmembrane domain receptors G proteins and GTP-ases. The adenylate cyclase and the phospholipase C signalling pathway.G proteins and GTP-ases. The adenylate cyclase and the phospholipase C signalling pathway. Control of enzyme activity.

4th week:
Lecture: Signal transduction III: The NO system. Nuclear receptors.
Genomics. Levels of eucariotic gene expression. The active chromatin. Regulation of transcription. Regulation at the mRNA level. Translational regulation. Posttransational events. Gene therapy.

5th week:
Lecture: Biochemistry of cell proliferation: Mitotic cascade. M-phase kinase. Products and biochemical function of protooncogenes. Mechanism of oncogene formation. Tumor suppressor genes and their biochemical function. Biochemical features of terminal differentiation. Biochemistry of programmed cell death.
Neurobiochemistry I: Blood-brain barrier and the transport processes in the CNS

6th week:
Lecture: Neurobiochemistry II: Metabolical processes in the CNS, synthesis of neurotransmitters. Enzymathic processes in the production and degradation of neurotransmitters. Metabolism of the central nervous system, energy producing pathways of neurons.

7th week:
Lecture: Neurobiochemistry III: Biochemical background of Alzheimer disease and biochemical bases of its therapy.
Biochemistry of stress: Stress proteins and enzymes in eukariotic cells. Heat shock proteins and their functions under normal circumstances. Hsp 70 and hsp 60 protein families. Role of chaperones and chaperonins. Thermotolerance of

the cell. Hsp 90 protein family and their role in the cells. Transcriptional regulation of heat shock genes. Stress signals.
Iron and hem metabolism I: Iron transport, storage and distribution in the human body. Molecular regulation of the iron level in cells: stability of transferring receptor and ferritin mRNA, IRE binding protein.
Self Control Test

8th week:
Lecture: Iron and hem metabolism II: Risk of the free iron and intracellular hemolysis. Hem. Uroporphynoids, hem-proteins. Synthesis of hem, regulation of the synthesis in eukariotic cells. Degradation of hem: formation, conjugation and excretion of bile pigments. Hem oxygenase. Disorders in hem metabolism. Hemoglobin. Biochemistry of the liver I. Hemoglobin; structure, function and regulation. Pathological forms of hemoglobin. Comparison of hemoglobin and mioglobin, regulation of oxygen binding.

9th week:
Lecture: Biochemistry of blood clotting: Contact phase of blood coagulation. Blood clotting in the test tube and in the body. Classification of blood coagulation. Role of thrombocytes and the vascular endothel. Limiting factors, inhibitors and activators of blood coagulation. Fibrinolysis.

10th week:
Lecture: Biochemistry of the liver: Biotransformation. Biochemical consequences of ethanol consumption.

11th week:
Lecture: Spring break

12th week:
Lecture: Biochemistry of the extracellular matrix: function and components. Glucosaminoglycans and proteoglycans. Collagens: structure, function and genetic origin. Biochemistry of the sport. Biochemistry of the cytoskeleton. Proteins of myofibrils. Molecular mechanism for the generation of force. Metabolic fuel of muscle. Metabolism of muscle in various work load.

13th week:
Self Control Test

14th week:
Practical: Enzymes of biotransformation.

Requirements

Requirements for signing the semester:
Students have to carry out the practice and participate on the obligatory lectures. (Please check the dates of the obligatory lectures in the schedule. You have to bring your student card for the obligatory lectures.)

Lecture slides will be uploaded to the elearning site of the Department (https://elearning.med.unideb.hu). Students can't miss any obligatory lecture. In case of any absence from the obligatory lectures, the subject won't be signed and the student can't take the final exam. Note, that taking a successful exam is very difficult without the proper understanding of the lecture material, for which attendance on all lectures is essential.
There will be two written **control tests** during the semester, by which 2x25 points (max. 50 points) can be collected. According to the result of the control tests, students can collect bonus points: those students who reach at least 25 points will get 2,5 bonus points; those who reach 35 points will get 5 bonus points. Bonus points will be added to the result of the final written exam. Control tests are not obligatory.
There is one **practice** in this semester on the 14th week, it is obligatory for every student. Those students, who don’t attend the practice, can’t get signature for the semester and can’t take the exam. Practices are not obligatory for repeaters (if they have got signature previously).

The **final**„A”, „B” and „C” **exams** are written exams. On the exam 50 points can be collected by the exam test from the material of the “Pharmaceutical Biochemistry” lectures. Bonus points collected by the control tests during the semester will be added to this result. 60% (30 points) is needed to get a passing mark, and the grade increases with every 5 points: 30-34,5 pass; 35-39,5 satisfactory; 40-44,5 good; 45-55 excellent). If a student fails the written „C” exam, department provides him/her a chance to prove his/her knowledge in an oral exam, in front of an examination committee. There is no topic list for the oral questions, student can be asked from any part of the material of the lectures and of the lecture slides (lecture slides can be downloaded from the https://elearning.med.unideb.hu website of the department). If the student passes this oral exam, he/she will be given a grade 2 (pass). The department will provide one examination date per week during the exam period.

Improvement exam: Those students, who want to improve their exam grade, can take one improvement exam during the exam period. In case of the improvement exam we will count the better grade. The improvement exam dates and exam tests are the same as the regular exam.

Please follow the announcements of the department on the announcement table (LSB downstairs, 1st corridor), and on the elearning site of the Department (https://elearning.med.unideb.hu).

Department of Foreign Languages

Subject: **HUNGARIAN LANGUAGE II/2.**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Emlékszel?

2nd week:
Practical: Testrészek

3rd week:
Practical: Tünetek

4th week:
Practical: Gyógyszerek

5th week:
Practical: Klinikák és szakorvosok

6th week:
Practical: Lassítsunk egy kicsit!

7th week:
Practical: Összefoglalás, Midterm test

8th week:
Practical: Szoktál kanapészörfölni?

9th week:
Practical: Jó és rossz szokások

10th week:
Practical: Instrukció

11th week:
Practical: Tessék mondani!

12th week:
Practical: Anamnézis

13th week:
Practical: Összefoglalás End term test

14th week:
Practical: Oral exam

Requirements

Requirements of the course:

Attendance
Attending language classes is compulsory. If a student is late it is considered as an absence. Students can miss only 10 percent of the classes that is maximum 2 occasions.
The teacher evaluates active participation in each class. Students are not supposed to share coursebooks in the classes therefore if they fail to bring the coursebook to the class for the second time the attendance is refused.

Testing, evaluation
In each Hungarian language course, students must sit for 2 written language tests and an oral test. Students must appear at the lecture hall at least 15 minutes before the exam. If students are late, they are not allowed to write the test.

A further minimum requirement is the knowledge of 200 words per semester divided into 10 word quizzes. There are five word quizzes before and another five after the midterm test. If a student fails or misses any word quizzes he / she cannot take the written test. A word quiz can be postponed by a week and students can take it only with their own teacher. Students can get bonus points (5-5%) by taking two extra quizzes containing 20 sentences each, before the midterm and end term tests. The sentences are taken from the units of the coursebook.
The oral exam consists of a role-play from a list of situations covered in the coursebook. If students fail the oral exam, they fail the whole course. The results of the written tests and the oral exam are combined and averaged.
Based on the final score the grades are given as follows.

Final score	**Grade**
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the final score of the written tests is below 60, the student can take a written remedial exam once covering the whole semester's material.

Coursebook:
See the website of the Department of Foreign Languages: **ilekt.med.unideb.hu.**
Audio files to the course book, oral exam topics and vocabulary minimum lists are also available on the website.

Department of Inorganic and Analytical Chemistry

Subject: **QUANTITATIVE ANALYTICAL CHEMISTRY PRACTICE II.**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Practical: **70**

1st week:
Practical: Introduction to the Quantitative Analytical Chemistry Laboratory.
Laboratory Safety Information.
Review of lab equipment.

2nd week:
Practical: Preparation of~0.1 M HCl titrant (250 ml).
Determination of the exact concentration of the HCl titrant solution using potassium hydrogen carbonate stock solution.
Determination of HgO in a HgO-KCl mixture (unknown sample).

3rd week:
Practical: Preparation of~0.1 M NaOH titrant by the Sörensen (500 ml) and determination of its exact concentration.
Determination of oxalic acid (unknown sample).
Simultaneous determination of sulfuric acid and boric acid in a mixture (unknown sample).
Preparation of 0.02 M potassium permanganate titrant (250 ml).

4th week:
Practical: Preparation of 0.05 M sodium oxalate stock solution (100.00 ml).
Determination of the exact concentration of the potassium permanganate titrant solution using sodium oxalate stock solution.
Determination of ferrous oxalate by permanganometric titration (unknown sample).
Determination of hydrogen peroxide (unknown sample).

5th week:
Practical: Preparation of 0.02 M sodium thiosulfate titrant (250 ml) and determination of its exact concentration using 0.003 M potassium iodate stock solution.
Determination of copper(II) (unknown sample).Determination of iodide ion (unknown sample).

6th week:
Practical: Preparation of 0.02 M potassium bromate titrant (250.00 ml).
Determination of ascorbic acid active ingredient content of vitamin C tablet (unknown sample).
Determination of the composition of KCl-KBr mixture using 0.05 M silver nitrate stock solution (unknown sample).

7th week:
Practical: Preparation of 0.01 M Na2EDTA titrant solution (250.00 ml). Simultaneous determination of calcium(II) and magnesium(II)ions (unknown sample).
Determination of Al(III) (unknown sample).
Lab equipment return.

8th week:
Practical: Thin layer chromatography

9th week:
Practical:
Conductometry

10th week:
Practical: Atomic spectroscopy

11th week:
Practical:
pH-metry

12th week:
Practical:
Gelelectrophoresis

13th week: **Practical:** Size exlusion chromatography **14th week:** **Practical:**	UV-VIS spectrophotometry

Requirements

The course is scheduled for semester 4. The laboratory practice consists of two separate parts: classical quantitative analysis and instrumental analysis. The classical quantitative analysis part involved acid-base, redox, argentometric and complexometric titrations as well as two gravimetric procedures. The instrumental analysis part will introduce the student to the practice of atomic and molecular spectroscopy, and different electrochemical methods.
Attendance is compulsory at all of the sessions of the laboratory practice. All practice sessions involved short oral or written tests in order to make sure that student come to the lab fully prepared.
Grading is based on three separate factors:
- the average grade of short test written at the beginning of the classical quantitative analysis lab sessions (an average grade of them at least 2.0 is necessary to avoid a "fail" grade),
- the average grade of unknown samples at the classical quantitative analysis lab sessions (an average of them at least 2.0 is necessary to avoid a "fail" final grade),
- the average grade of instrumental analysis lab sessions (an average of them at least 2.0 is necessary to avoid a "fail" final grade).

Subject: **QUANTITATIVE ANALYTICAL CHEMISTRY THEORY II.**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **14**

Requirements

Exam: oral
In the oral exam two topics are randomly selected, one from the first () and the other from the second () part of the list. During preparation one topic (of your choice) needs to be written in detail while the other will be the subject of an oral exam. The final mark will be determined by the results of the two topics.

Subject closing topic list for pharmacy students
1. Inorganic chemical considerations for the classification of Group I cations.
Separation scheme for Group IA and B cations, chemical equations of reactions for the separation and identification of individual cations in this group.
2. Inorganic chemical considerations for the classification of Group II cations.
Separation scheme for Group II cations, chemical equations of reactions for the separation and identification of individual cations in this group.
3. Inorganic chemical considerations for the classification of Group III cations.
Separation scheme for Group III cations, chemical equations of reactions for the separation and identification of individual cations in this group.
4. Inorganic chemical considerations for the classification of Group IV cations.
Separation scheme for Group IV cations, chemical equations of reactions for the separation and

identification of individual cations in this group. Chemical equations of reactions for the identification of individual cations in Group V.
5. Classification of anions. Characterization of anions by their reactivity in acid-base, precipitation, complex formation and redox reactions. Chemical equations of anion identification reactions.
6. Chemical reactions in qualitative analysis. Selective, specific and group reactions. Identification tests, purity tests, content analysis. Ways of reporting the sensitivity of test reactions. Masking.
7. Rules of sampling for general and pharmaceutical analysis. Sample preparation for inorganic and organic analysis.
8. Statistical evaluation of the experimental data. Experimental errors. S/N. Statistical tests. Evaluation of the experimental results (types and possible errors of the calibration). Analytical performance parameters.
9. Quantitative description of acid-base equilibria. The Brönsted equation and its use.
10. Complex formation equilibria, apparent stability constants.
11. Precipitation equilibria. Factors influencing the solubility of precipitates.
12. Redox equilibria and redox titration curves.
13. Titration curves and their significant points: equivalent volume, end point, titration errors.
Chemical end point detection in titrimetric analysis. Chemical requirements for reagents and standard solutions in titrimetric analysis.
14. Practice of acid-base titrations, possibilities of application.
15. Theoretical background and practice of complexometric titrations. The chelate effect.
16. Permanganometry.
17. Bromatometry and iodometry.
18. Analytical applications of precipitation reactions. Argentometric titration curves.
Practice of argentometry.
19. Gravimetry (theoretical background, practical steps, examples).
20. Background of separation methods based on extraction. pH dependence of solute partitioning processes.
Determination of metal ions by extraction. Distillation.
21. Theoretical basis of the formation of molecular and atomic spectra. Main application fields of the spectroscopic methods.
22. Construction of the UV-Vis spectrometers (constructions, main parts, principles).
23. The practice of UV-Vis spectroscopy (analytical procedures, application areas, basic law).
24. Theoretical basis of atomic spectroscopy. Main methods and applications of atomic spectroscopy.
25. Potentiometry and its application in analytical chemistry.
26. Conductometry and its application in analytical chemistry.
27. Theoretical basis of chromatography (types, principles, instrumentation (injection, separation, detection), band spreading, separation efficiency, evaluation of chromatograms).
28. Gelelectrophoresis and capillary electrophoresis.

Department of Pharmaceutical Technology

Subject: **PHARMACEUTICAL TECHNOLOGY THEORY I.**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture:
Pharmaceutical Technology and the task of Pharmaceutical technology.
Definition of drug and dosing. Prescription. The connection between biopharmacy and pharmaceutical technology. Basic principles of pharmacokinetics. The connection between pharmaceutical preparation and drug effect.

2nd week:
Lecture: Pharmaceutical Pharmacopoeas. Formulae Normales. Rules and regulations in pharmacy.

3rd week:
Lecture:
Technological processes: Heating. Distillation. Other methods for separation (sedimentation, centrifugation, expression, drying, filtration.)

4th week:
Lecture: Filtration. Theoretical bases of filtration. Types of instruments for filtration.

5th week:
Lecture: Solutions. Thermodynamic terms of solution, dissolution, diffusion, time of dissolution. Possibilities of increasing dissolution. Colligative properties.

6th week:
Lecture: Pharmaceutical dosage forms: liquid pharmaceutical forms, solutions, stock solutions, aqueous solutions, oily solutions, syrups, aromatic waters, gargles, alcoholic solutions.

7th week:
Lecture: Emulsions. Macro and microemulsions.

8th week:
Lecture: Emulsifying agent. Stability of emulsions. Stabilization of emulsions. Formulation of emulsions, investigations.

9th week:
Lecture: Suspensions. Definitions, types of suspensions, physical and chemical basics of suspensions. Stability of suspensions. Formulation of suspensions, investigations.

10th week:
Lecture: Mixing. Quality of mixing. Duration of mixing. Instruments for mixing. Homogenity

11th week:
Lecture: Physical and chemical theoretical bases of drug formulation. Monophasic-systems. Mechanical properties of liquids, viscosity, bases of reology. Determination of viscosity.

12th week:
Lecture: Di-and polyphasic systems. Interfacial occurrence: interface, interfacial tension. Wetting angle. Dispers polyphasic systems, viscosity of dispers polyphasic systems, sedimentation and flocculation, electrostatic occurrence, coagulation.

13th week:
Lecture: Colloid systems. Molecular colloids, association colloids (termotrop and liotrop association colloids)., Mucilages, enemas.

14th week:
Lecture: Consultation.

Requirements

Students have to attend 30% of the lectures.

Requirements for signing the Lecture book:
The Department may refuse to sign the subject if the student didn't attend 30% of lectures according to attendance list.
At the end of semester students have oral exam. The prerequisite of oral exam is a written test before exam. If student doesn't write more then 60% and fail the written test, it is prohibited to take an oral exam and get a fail (1) mark.

Subject: **PHARMACEUTICAL TECHNOLOGY PRACTICE I.(PRESCRIPTION WRITING I.)**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Practical: **56**

1st week:
Practical:
Introduction, general information. Lab safety, laboratory regulations. Requirements. Weighing.
Weighing of chamomile, and talcum.
Weighing of Paraffinum liquidum, and distilled water.
To learn: Latin declension, numbers.

2nd week:
Practical:
Technical books of pharmacy (European Pharmacopoiea, Formulae Normales, Hungarian Pharmacopoeia)
The prescription, nomenclature.
Simple calculations (w/w %).
Solutions, auxiliary materials.
Weighing of Paraffinum liquidum, and distilled water.

3rd week:
Practical:
The Latin form of prescriptions.
Simple and composite solutions for internal and external use.
Solutio contra rhagades mamillae FoNo VII. 34,0g

4th week:
Practical:
Enemas and solutions for internal use.
Dose calculation.
Solutio papaverini 50,0g (magistral prescription)
Klysma chlorali pro infante FoNo VII 80,0g

5th week:
Practical:
Nasal and ear drops. Mixture.
Mixtura pectoralis FoNo VII. 100,0g
Nasogutta zinci c. ephedrino FoNo VI. 10,0g

6th week:
Practical: Test I.

7th week:
Practical: Gargle and suspensions.
Gargarisma antiseptica FoNo VII.
Solutio Castellani sine fuchsino FoNo VII.

8th week:
Practical: Suspensions.
Suspensio terpini FoNo VII. 100,0g
Solutio theophyllini FoNo VII. 100,0g

9th week:
Practical: Peroral drops and their dose calculation.

Gutta aethylmorphini FoNo VII 10,0g
Suspensio anaesthetica FoNo VI 100,0g

10th week:
Practical: Decoctions and infusions.

Gutta expectorans composita FoNo VII.
Infusum ipecacuanhae pro parvulo FoNo VI 100,0g

11th week:
Practical: Test 2.

12th week:
Practical: Emulsions.
Emulsio olei ricini FoNo VII. 100,0 g
Glycerinum boraxatum FoNo VII. 20,0g

13th week:
Practical:
Preparations of special emulsions (liniment).
Solutio noraminophenazoni pro parvulo FoNo VII. 100,0g
Linimentum scabicidum FoNo VI 100,0g

14th week:
Practical: Supplemental practice. Consultation. Correction.

Requirements

You have to attend every practical in Pharmaceutical Technology. If you are not able to go to practice, you have to bring us certification by a doctor. However, 1-2 occasions if you have very important activity, please foretell it us, and we will let you know the makeup of practice. These occasions will be valid exception the tests.
You have to get ready for practical. We will give you guidelines of practical and we will discuss them. You have to study them at home. You have to write protocol about the practical according to our discussion and practical notes, so you have to bring with you a note book and you have to write the medicines in prescription form.
We will measure back your preparations after the practice. At least 5 preparations will be measured back. If the grade of the measuring is failed, you must prepare it once more, but the average of the marks has to be at least satisfactory (3).
You will write short tests in most practices and 2 summery tests. This short test will contain measurement conversions, Latin words and phrases, definitions etc. The summery tests will contain the knowledge of Pharmaceutical Technology practice. If you fail your summery test, you have got only one more chance to improve your test. In case of improvement the summery test mark will be the average of the first and the improved test. The mark of each summery test has to be a pass (2) or more then more pass (2) mark. If one or two summary test mark is a fail (1) mark at the end of semester, the practical grade will be a fail (1) mark as well.

During the semester the students will have one or more individual drug preparation as well. The average mark shouldn't be fail (1) mark for individual drug preparation, or the teacher my refuse the signing of practice.
During the practice if the teacher recognizes any mistake that occurs because the student is not well prepared, the student may get a fail (1) mark for that practice. Besides, the teacher may give mark form 1-5 after every practice according to the student's individual practice work, expenditure of preparation, clean and order of workplace, proper use of equipment, and proper behaviour.
This final grade will be the average of 2 summery tests, grade of short tests from prescription pharmacy lab, the grade of measuring back, grade of individual drug preparation and all other marks.
At the end of the semester you will get 5-stage practical grade.

Subject: **PUBLIC PHARMACY PRACTICE AFTER 2ND YEAR (PERSONNEL AND OBJECTIVE REQUIREMENTS OF PHARMACY AND PREPARATION OF PHARMACEUTICAL DOSAGE FORMS)**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Practical: **120**

Requirements

Syllabus of summer practice for second year pharmacy students Duration of practice:

4 weeks, 8 hours per day, from which 2 hours may be spent preparing. Second year students are required to gain proficiency in the following areas during their practice at a public pharmacy, and subsequently acquire knowledge about the conditions pertaining to personnel, equipment, supplies, operation, and workflow of a public pharmacy.

Requirements for the student:
Accept and sign the non-disclosure agreement. Any absence from practice must be authentically justified based on the rules of the place of training. All absences must be made up. He/she is expected to follow the directions of the pharmacist in charge of the training.

Skills expected from the student after the completion of practice:
• practical application of theoretical knowledge obtained during his / her studies
• he / she is expected to know the premises and the assets of the public pharmacy and be able to obtain information from manuals and scientific journals used during his / her work
• he / she is expected to learn about the working activities of a public pharmacy
• he / she is required to have an appropriate work relationship with the co-workers in the pharmacy

Student tasks during the practice:
Under the supervision of the pharmacist in charge of the training he / she will participate in the following activities:

1. Conditions pertaining to the personnel, equipment and supplies of the pharmacy:
• he / she is required to know the activities expected form the co-workers and the rules and regulations pertaining to them
• he / she is expected to know the rules of procedures
• he / she is expected to know the work protocol of the pharmacy
• he / she is required to be aware of rules and regulations pertaining to premises, equipment, supplies and assets
• he / she is expected to read pharmaceutical manuals and journals
• he / she is required to handle computer programs used in the pharmacy
• he / she is expected to become acquainted with authorities supervising work in pharmacies and representative bodies

2. Preparing medicine:
Acquiring knowledge about simple pharmaceutical technologies (measurement, mixing powders, dilution, calculating solution concentration and doses, and other simple calculations performed in pharmaceutical practice) Learning magistral medicine preparation and its tools Preparation of liquid medication under supervision, appropriate packaging, knowledge of the usage

Evaluation:
Keeping an electronic notebook: description of 1 syllabus-related practical issue in half / one page every two weeks The pharmacist in charge of the training checks the work and description every second week and evaluates it using a five-point system. He /She sends the electronic notebook to the Dean's Office according to the rules of the place of training. At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in a written form and grades the student based on a three-point system. He / she will send it to the Dean's Office in a printed and signed form according to the rules of the training place.

Student evaluation:
After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training place.

Department of Physiology

Subject: **HUMAN PHYSIOLOGY II.**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **28**
Seminar: **9**

1st week:
Lecture:
Introduction, preparation for laboratory practice
General principles of endocrinology
Hypophysis, growth hormone
Calcium balance, physiology of bone
The hormones of adrenal medulla, catecholamines

2nd week:
Lecture:
The thyroid gland I.
Male, Female gonadal functions
Pregnancy, lactation

3rd week:
Lecture:
The hormones of adrenal cortex I.
The hormones of adrenal cortex II.
The hormones of pancreatic islets

4th week:
Lecture:
Endocrine regulation of intermediary metabolism

Self Control Test

5th week:
Lecture:
Introduction, quantitative description of renal function
Mechanism and regulation of glomerular filtration
Tubular transport processes

6th week:
Lecture:
Urinary concentration and dilution, clinical correlates
Osmoregulation, water balance, diuretics
Defence of body fluid volume, sodium balance

7th week:
Lecture:
Acid-base balance and acid-base disturbances
Potassium balance, micturition

Self Control Test

8th week:
Lecture:
Neural and hormonal control of the GI tract
Motor functions of the gastrointestinal tract

9th week:
Lecture:
Secretion of saliva and gastric juice
Exocrine functions of the pancreas and liver
Absorption of nutrients

10th week:
Lecture:
Nutrients and vitamins
Regulation of food intake and energy balance
Regulation of body temperature

Self Control Test

Requirements

1. Signature of the semester
Attendance of lectures and seminars is compulsory. The signature of the semester may be refused in case of more than four absences from the seminars. The completion of a missed seminar with a different group is not possible. Student must attend seminars with the group appointed by the Educational Office. For continuous updates on all education-related matters, please check the elearning.med.unideb.hu website (Department of Physiology menu item).

2. Evaluation during the semester (mid-semester tests)
The progress of students will be tested 3 times during the semester in the form of a written test (multiple choice questions). Students may earn bonus points that can be used to improve the score of the written part on the closing exam. Bonus point calculation is based on the actual semester's scores.

The average score of the three mid-term tests is calculated and
a). If the average score is 80% or higher, the student is exempted from written part of the final exam, and only the oral part will be performed.
b). If the average score is between 70% and 80%, 10 bonus points will be added to the result of the written part of the final examination.
c). If the average score is between 60% and 70%, 5 bonus points will be awarded.
If the number of absences of either the seminars or lectures exceeds four, the bonus points are lost.

3. Examination
The second semester is closed by the final exam, which is composed of a written test and an oral section, covering the topics of all lectures, seminars and laboratory practices of the full academic year. The passing limit for the written test is 60%. The result of the exam is failed if the student fails either on the written part or on the oral part.
The list of oral exam questions is available on the elearning.med.unideb.hu website (Department of Physiology menu item).

Subject: **HUMAN PHYSIOLOGY II. PRACTICAL**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Practical: **22**

1st week:
Practical: Orientation lecture

2nd week:
Practical: Investigation of the cardiovascular functions

3rd week:
Practical: Determination of parameters characterising the respiratory functions

4th week:
Practical: Examination of the blood

5th week:
Practical: Computer aided acquisition and processing of biological signals

6th week:
Practical: Effects of electrolytes on the uterinal smooth muscle function

7th week:
Practical: Effects of neurotransmitters and hormones on the uterinal smooth muscle function

8th week:
Practical: Computer simulation of the Frank-Straling-mechanism

9th week:
Practical: Simulation of the renal transport mechanisms

10th week:
Practical: Remedial lab

11th week:
Practical: Exam

Requirements

1. Signature of the semester
Attendance of laboratory practices is compulsory. The signature of the semester may be refused in case of more than two absences from the practices. All missed practices must be made up. Completion of all topic sheets in the Exercise Book, each verified by the signature of the teacher, is also a precondition of the signature. Student must attend on Labs with the group appointed by the Educational Office.
For continuous updates on all education-related matters, please check the elearning.med.unideb.hu web site (Department of Physiology menu item).

2. Evaluation during the semester (mid-semester tests)
None

3. Examination
Laboratory practical knowledge of the students will be tested at the end of the second semester as part of the of the Lab Exam evaluation with five level grades.
As a precondition of attending the Lab Exam, the fully completed Exercise Book (with all the verified topics) must be presented. Students are expected to perform the given experiment on their own and must be familiar with the theoretical background also.
If the evaluation of the Lab Exam is `fail` (1) then the Lab Exam can be repeated once during the exam period. There will be only one date for the improvement of the Lab Exam during the exam period.

Improvement of the successful Lab Exam grade is NOT possible during the regular examination period.

Division of Pharmacognosy

Subject: **PHARMACOGNOSY PRACTICE I.**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Practical: **56**

1st week:
Practical: Introduction. General discussion.

2nd week:
Practical: Carbohydrate-containing plant drugs I.

3rd week:
Practical: Carbohydrate-containing plant drugs II.

4th week:
Practical: Fixed oils. Plant drugs containing organic acids and derivates.

5th week:
Practical: Essential oils I.: Plants containing monoterpene-based essential oils.

6th week:
Practical: Essential oils II.: Plants containing monoterpene-based essential oils II..

7th week:
Practical: Essential oils III.: Sesquiterpene and phenylpropanoid-based essential oils.

8th week:
Practical: Drugs containing secoiridoids and sesquiterpene lactones. Bitterness value determination.

9th week:
Practical: Iridoid containing plant drugs.

10th week:
Practical: Triterpenes, triterpene saponins.

11th week:
Practical: Cardenolid glycosides.

12th week:
Practical: Basic techniques in medicinal plant biotechnology, in vitro cultures producing secondary metabolites.

13th week:
Practical: Practical exam: Recognition of plant drugs.

14th week:
Practical: Practical exam: Recognition of plant drugs.

Requirements

Detailed information is given in the first practical course and via the e-learning system.

Completion of the practice requires:
- plant drug and herbal tea recognition test (in person, or, on a video platform, face-to-face, depending on the situation)
- completion of the three practical tests (in person, or on e-learning platform, depending on the situation)

Subject: **PHARMACOGNOSY THEORY I.**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: The origins of pharmacognosy. The nomenclature of plant drugs; Sources of drugs, Production of drugs; Basic metabolic pathways, Origin of primary and secondary metabolites. The biosynthetic pathways.

2nd week:
Lecture: Basic principles in phytochemistry, plant biochemical pathways, primary and secondary metabolism, classification of secondary metabolites. Chemistry of secondary metabolties.

3rd week:
Lecture: Nature as a source of medicine, sources of bioactive natural products. Natural products as lead compounds. Plant tissue cultures, biotechnology, bioprospecting, search for new bioactive natural products. Gathering and cultivation of herbal material. Industrial crops as medicinal plants. Possible roles of phytotherapy in evidence-based medicine.

4th week:
Lecture: Quality assurance of medicinal plants nad products. Identification by macro-, and micromorphology. Detection of adulterants and contaminants in medicinal plant products. Pharmaceutical quality: impurities, pesticide residuals, heavy metals, microbiological contamination. Phytochemistry in quality assurance: methods of analysis, treshold values.

5th week:
Lecture: Carbohydrate containing drugs. Amylums, gums.

6th week:
Lecture: Organic acids: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy. Fixed oils, waxes, fats: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

7th week:
Lecture: Amino acids, proteins, peptides and enzymes: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy. Isoprenoids in general. Essential oils: production, biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

8th week:
Lecture: Monoterpenes and derivates: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

9th week:
Lecture: Oxydized monoterpenes: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

10th week:
Lecture: Sesquiterpenes and derivates: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

11th week:
Lecture: Diterpenes (resins and balsams), triterpene derivates: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy. Saponins.

12th week:
Lecture: Steroids and steroid saponins, furostanol and spirostanol derivates: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

13th week:
Lecture: Cardenolid glycosides and miscellaneous terpenoids: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

14th week:
Lecture: Consultation.

Requirements

Detailed information is given in the first lecture and via the e-learning system.

Completion of the lecture requires:
- examination during the exam period based on the uploaded lectures (in person, or, on video platform face-to-face, depending on the situation).
- we offer an optional pre-examination test for offered grade, before the exam period (in person or, on e-learning platform, depending on the situation).

CHAPTER 18
ACADEMIC PROGRAM FOR THE 3RD YEAR

Department of Anatomy, Histology and Embryology

Subject: **PHARMACEUTICAL NEUROBIOLOGY**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Lecture: **38**
Seminar: **14**
Practical: **14**

1st week:
Lecture: 1. Introduction. Development of the nervous system. Parts of the nervous system. 2. The histology of the nervous system. 3. Dura mater, pia mater. Circulation in the brain. Blood-brain barrier.
Practical: Histology: The neural tissue. Histology of the spinal cord. 1. Peripheral nerve (HE), 2. Spinal ganglion (HE), 3. Spinal cord (HE), 4. Spinal cord (Bielschowsky impregnation).

2nd week:
Lecture: 1. The structure of the spinal cord. 2. The structure of the brainstem and cerebellum. 3. The structure of the diencephalon and telencephalon
Practical: Histology: Histology of the cerebral and cerebellar cortex. 1. Cerebellum (HE), 2. Cerebellum (Golgi impregnation), 3. Cerebrum (Golgi impregnation)

3rd week:
Lecture: 1. Morphological basis of the neurotransmission. The chemical synapses. 2. Axonal transport. Degeneration and regeneration in the nervous system. 3. Membrane properties of the neurons and glial cells.
Practical: Practice in Dissecting room: Gross anatomy of the spinal cord and the brain

4th week:
Lecture: 1. Neurotransmitters, receptors. Pre- and postsynaptic mechanisms of neurotransmission. 2. Features and significance of the central excitatory and inhibitory synapses. 3. Somatomotor function of the spinal cord.
Seminar: Seminar

5th week:
Lecture: 1. The somatomotor system. 2. Vestibular apparatus. 3. Roles of the spinal cord in the coordination of movements.
Seminar: Seminar

6th week:
Lecture: 1. Roles of brainstem and cerebellum in the coordination of movements. 2. Discussion. 3. General principles of the somatosensory system. The skin.
Seminar: Seminar

7th week:
Lecture: SELF CONTROL
Seminar: -
Self Control Test (SELF CONTROL - THE DATE DEFINED LATER)

8th week:
Lecture: 1. Somatosensory system. 2. Somatovisceral sensory functions. 3. Neural mechanisms of the pain sensation.
Seminar: Seminar

9th week:
Lecture: 1. Theoretical background of the pain therapy. 2. Anatomy of the eye. 3. Physiology of vision.
Practical: Histology: Functional microscopic anatomy of the skin. 1. Fingertip skin (HE), 2. Scalp (HE).

10th week:
Lecture: 1. Physiology of taste and smell sensation. 2. Anatomy of auditory and vestibular system. 3. Physiology of hearing.
Seminar: Seminar

11th week:
Lecture: 1. The structure of the autonomic nervous system. 2. Functional properties of the autonomic nervous system. 3. Central vegetative regulation (hypothalamus).
Practical: Histology: Microscopic anatomy of the eyeball and internal ear. 1. Eye (HE), 2. Inner ear (HE).

12th week:
Lecture: 1. Cerebral cortex, EEG. 2. Sleep, wakefulness. 3. Learning, memory.
Seminar: Seminar
Practical: Lab

13th week:
Lecture: 1. The monoaminergic and limbic system. 2. Motivation, behaviour, emotions. 3. Discussion.
Seminar: Seminar
Practical: Lab

14th week:
Lecture: SELF CONTROL
Self Control Test (SELF CONTROL - THE DATE DEFINED LATER)

Requirements

Signature of the semester

The neurobiology course is an integrated one, delivered as a joint effort of three departments (Departments of Anatomy, Histology and Embryology and Physiology). In this academic year the Anatomy, Histology and Embryology Department is the course organizer.

The educational activities of the Neurobiology course include lectures, seminars and practices. Note, however, that the requirements of the course include material delivered in the lecture hall only, not necessarily available in the recommended textbooks, while in other cases some information in the suggested textbook is not regarded as part of the exam material.

Attendance of the seminars and practices is compulsory. If one collects two or more seminar and practice absences (regardless of the reason of the absences) the course organizer may refuse the end-semester signature.

Evaluation during the semester

During the term two self-control tests (SCTs) are organized. The SCTs are conducted with the help of Moodle system. Attendance of the SCTs is compulsory. If one meets the passing conditions (see below), the end-semester examination may be substituted with the result achieved on the basis of these tests.

Examination

The semester is closed by a written end-semester exam (ESE) covering the topics of all lectures, seminars and laboratory practices of the semester. The ESE is a written test that is conducted with the help of Moodle system.

The ESEmark based on the average score of mid-semester tests will be offered if
- one’s average score of the three mid-semester tests is above 60%; and
- none of the individual tests' results are less than 50%.
- the signature of semester is NOT refused by the course coordinator.

The mark based on the result of ESE or based on the average score of mid-semester tests is calculated according to the following table:

score	mark
0 – 59.9 %	fail
60 – 69.9 %	pass
70 – 79.9 %	satisfactory
80 – 89.9 %	good
90 – 100 %	excellent

If one is not satisfied with this result, (s)he may participate in ESE during the examination period.

Department of Behavioural Sciences

Subject: **PHARMACEUTICAL PSYCHOLOGY**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Nature of psychology: main fields, theories and methods. Biopsychosocial model

2nd week:
Lecture: Somatic symptom and related disorders

3rd week:
Lecture: The placebo effect

4th week:
Lecture: The psychology of pain

5th week:
Lecture: Stress, coping, psychological immune system

6th week:
Lecture: Health behaviours: definition, demographic determinants. Variables influencing health attitudes

7th week:
Lecture: Illness as crisis. Chronic illness, hospitalisation

8th week:
Lecture: Communication with people with special needs and handicap

9th week:
Lecture: Addictions: definition, classification, prescription drug abuse, alcohol and drug dependence, smoking, behavioural addictions

10th week:
Lecture: Illness behaviours: definition, the experience of illness, patient role. Representations and benefits of illness. Illness cognitions

11th week:
Lecture: Mood disorders and psychotic disorders. Symptoms, prevalence, relevance and compliance

12th week:
Lecture: Change in health behaviour. Stages of change, the Prochaska-DiClemente model.

13th week:
Lecture: Psychosomatics

14th week:
Lecture: Pre-exam

Requirements

Written pre-exam at the last week of the semester (offered grade). If the student accepts the offered grade, it will be the exam grade. If the student does not accept the offered grade, (s)he can take the exam during the exam period, starting with an „A” exam (written).

Department of Foreign Languages

Subject: **MEDICAL HUNGARIAN I.**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Introduction; Revision

2nd week:
Practical: Body parts and internal organs

3rd week:
Practical: Most common diseases

4th week:
Practical: Types of medicine

5th week:
Practical: Forms of medicine; Containers

6th week:
Practical: How to take medicine?; Frequent side effects

7th week:
Practical: Midterm test

8th week:
Practical: Questioning the patient

9th week:
Practical: Dialogues in the pharmacy 1.

10th week:
Practical: Dialogues in the pharmacy 2.

11th week:
Practical: Equipment in the pharmacy

12th week:
Practical: Medicine kit

13th week:
Practical: Revision

14th week:
Practical: End term test; Oral exam

Requirements

Requirements of the course:
Attendance
Attending language classes is compulsory. If a student is late it is considered as an absence. Students can miss only 10 percent of the classes that is maximum 2 occasions.
The teacher evaluates active participation in each class. Students are not supposed to share coursebooks in the classes therefore if they fail to bring the coursebook to the class for the second time the attendance is refused.

Testing, evaluation
In Medical Hungarian courses, students have to sit for two oral language exams.

A further minimum requirement is the knowledge of 200 words per semester divided into 10 word quizzes. There are five word quizzes before and another five after the midterm test. If a student fails or misses any word quizzes he / she cannot take the written test. A word quiz can be postponed by a week.
The oral exam consists of a role-play from a list of situations covered in the coursebook. If students fail the oral exam, they fail the whole course. The results of the written tests and the oral exam are combined and averaged.

Based on the final score the grades are given as follows.

Final score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the final score of the written tests is below 60, the student can take a written remedial exam once covering the whole semester's material.

Coursebook:
See the website of the Department of Foreign Languages: **ilekt.med.unideb.hu.**
Audio files to the course book, oral exam topics and vocabulary minimum lists are also available on the website.

Department of Laboratory Medicine

Subject: **CLINICAL BIOCHEMISTRY I.**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Lecture: **28**
Practical: **14**

1st week:
Lecture: 1. Introduction: pathobiochemistry, clinical chemistry, laboratory diagnostics
2. Different levels of laboratory diagnostics (reference values, requesting test, interpretation of results)

2nd week:
Lecture:
3. Laboratory aspects of investigating human disorders
4. Pathochemistry and laboratory signs of cell damage

3rd week:
Lecture:
5. Pathobiochemistry of inflammation
6. Pathobiochemistry of plasma proteins

4th week:
Lecture: 7. Clinical biochemistry of tumor metastasis
8. Pathobiochemical alterations in association with tumor growth and metastasis formation and their laboratory detection I.

5th week:
Lecture: 9. Tumormarkers in the diagnosis of malignant diseases

10. Inherited metabolic diseases and their laboratory diagnostics I.

6th week:
Lecture: 11.Inherited metabolic diseases and their laboratory diagnostics II.
12. Inherited metabolic diseases and their laboratory diagnostics III.

7th week:
Lecture: 13. Disorders of iron metabolism. Laboratory diagnostics of microcytic anemias.
14. Laboratory diagnostics of hemoglobinopathies.
Practical: Molecular genetic methods in clinical biochemistry. Laboratory safety.

8th week:
Lecture:
15. Laboratory diagnostics of macrocytic and hemolytic anemias

Practical: Hematology I. Blood collection, anticoagulants. Preparation of a blood smear, staining.

9th week:
Lecture:
16. Laboratory diagnostics of quantitative platelet disorders.
17. Laboratory diagnostics of acute and chronic leukemias and lymphomas I.

Practical: Hematology II. Evaluation of a normal smear. Red blood cell morphology. Determination of reticulocyte count.
Self Control Test

10th week:
Lecture:
18. Laboratory diagnostics of acute and chronic leukemias and lymphomas II.
19. Laboratory diagnostics of acute and chronic leukemias and lymphomas III.

Practical: Hematology III. Determination of hemoglobin and hematocrit. Hematology analyzers.

11th week:
Lecture:
20. Blood group serology, biochemistry, inheritance, antigens and antibodies of ABO blood group system
21. Biochemistry, inheritance, antigens and antibodies of Rh blood group

Practical: Hematology IV. Evaluation of peripheral smears in malignant hematological diseases. Protein electrophoresis, myeloma multiplex.

12th week:
Lecture:
22. Other blood group system (Kell, Kidd, Duffy, MN, Ss, Ii). Regulation of transfusion
23. Blood products.

Practical: Determination of AB0 and Rh blood groups.

13th week:
Lecture: 24. Laboratory diagnostics of central nervous system diseases. Laboratory investigation of the cerebrospinal fluid.
25. Clinical biochemistry at the extremes of ages.

Practical: Detection of irregular antibodies, antibody screening, compatibility testing.

14th week:
Lecture:
26. Clinical biochemistry at the extremes of ages
27. Therapeutic drug monitoring I.-II.

Practical: Immunoassay.
Self Control Test

Requirements

Participation on practicals: Attendance of practicals is obligatory. Altogether one absence in the first semester and two absences in the second semester are permitted. In case of further absences, the practicals should be made up for by attending the practicals with another group in the same week, or a medical certificate needs to be presented. Please note that strictly only a maximum of 3 students are allowed to join another group to make up for an absence. Requirements for signing the Lecture book: The Department may refuse to sign the Lecture book if the student is absent from practicals more than allowed in a semester. Assessment: At the end of the first and second semester there is a written examination assessed by the five-grade evaluation. There will be 2 written exams (SCTs) during the first semester. The students can get an offered grade at the end of the first semester based on the results of the SCTs. During the second semester there will be 3 SCTs. Bonus percentage will be given on the basis of the results of the SCTs, which will be added to the result of the final exam. The Clinical Biochemistry II. final exam will be a written test from the material of the I. and II. semester and clinical physiology. The materials of Clinical Biochemistry subject are uploaded on the e-learning website. (www.elearning.med.unideb.hu)

Requirements for examinations:
The examination is based on the lecture and practical material (Practicals in Laboratory Medicine, eds.: János Kappelmayer and László Muszbek, 2016) as well as the relevant chapters from the textbook of William J. Marshall: Clinical Chemistry (8th edition, 2017).

Department of Pharmaceutical Chemistry

Subject: **PHARMACEUTICAL CHEMISTRY PRACTICE I.**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Lab safety instructions, requirements.

2nd week:
Practical: Analytical exercises of selected inorganic compounds according to the Pharmacopeia.

3rd week:
Practical: Analytical exercises of selected inorganic compounds according to the Pharmacopeia.

4th week:
Practical: Analysis of alcohols, citric acid, urea.

5th week:
Practical: Benzoic acid, resorcinol, thymol, methenamine.

6th week:
Practical: Vitamines.

7th week:
Practical: Pain killers

Requirements

The laboratory practice is organized in groups, 7x4 hours. The presence of students at the practices is obligatory. If the student is absent from more than one practices, the semester will not be accepted (there is no possibility to arrange additional extra lab practices).

The semester of the student's lab practice will not be accepted in either of the following cases:
1. three unacceptable written tests/demos with the evaluation "Failed" (Mark "1"),
2. the student was not permitted to start the Lab Practice in two occasions*,

3. the student presented two unacceptable Lab Practice written tests/demos with the evaluation "Failed" (Mark "1"), and was not permitted to start the Lab Practice in one occasion*.
4. five demos or notebooks with the evaluation "Failed" (Marks "1" or "0") altogether in any combination.
5. the average of the marks is below 2.0
6. When the student can not present 4 successful Lab Practices in the semester.

*The student will not be permitted to start a Lab Practice in either of the following cases:
1. the student does not show up in the laboratory in 20 minutes from the scheduled starting date of the Practice,
2. the student can not present her/his lab practice notebook prepared according to the said requirements,
3. the student is unable to reach at least 5.0 points (55.5%) of the maximum score (9.0 points) related to the questions asked in connection with the topics of the Laboratory Practice!
4. When writing the test, cabs and other illegal sources are not allowed to use. If the student is found out in a cheating, the student must leave the Lab, and the Practice will be considered unsuccessful (Mark "0").

Subject: **PHARMACEUTICAL CHEMISTRY THEORY I.**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Lecture: **42**

1st week:
Lecture: Topics and history of pharmaceutical chemistry. Pharmacopeia, as the standard of quality control. Physical and chemical investigations. Methods for the identification and control of medicinal substances. Nomenclature of the medicinal substances.
Practical: Short introductory practice.

2nd week:
Lecture: Pharmacologically important inorganic compounds.
Practical: Analytical exercises of selected inorganic compounds according to Pharmacopeia.

3rd week:
Lecture: General anesthetics: inhalation anesthetics, barbital and non-barbital-type narcotics. Anesthetics with pregnane skeletone. Sedatives and hypnotics: alcohols, aldehydes, urethanes, barbiturates and with 4-quinazolone, bezodiazepine and piperidine skeletone.
Practical: Alcohols, solvents. Barbituric acid derivatives.

4th week:
Lecture: Antiepileptic agents (anticonvulsants): compounds with barbiturate, hydantoin, oxazolidin-dione, succinimide and acylurea structure.
Practical: Aminophenazon derivatives, urethan, phenytoin.

5th week:
Lecture: Narcotic Analgetics: codeine, morphine, thebaine derivatives Morphinane, bezomorphane, phenylpiperidine and metadone derivatives. Non-diphenylmethane -type amines. Another major analgetics. Competitive antagonists of morphine and morphine derivatives.
Practical: Selected aromatic compounds: resorcinol, thymol, acetylsalicylic acid etc.

6th week:
Lecture: Analgetic antipyretics: derivatives of salicylic acid, aniline, and anthranylic acid.

Pyrazolone- and arylacetic acid-type analgetics.
Practical: Phenothiazin derivatives; methenamine.

7th week:
Lecture: Analgetic antipyretics: steroid anti-inflammatory agents. Antihistamines.
Practical: Carbohydrates, ascorbic acid, citric acid.

8th week:
Lecture: Psychopharmacones: anxiolytics (minor tranquilizers): carbamates, benzodiazepines, and diphenylmethane-type compounds. Another anxiolytics.

9th week:
Lecture: Antipsychotics, neuroleptics (major tranquilizers): Reserpine. Derivatives of phenothiazine and butyrophenone. Diphenylbutyl piperidines.

10th week:
Lecture: Antiparkinson agents: piperidylphenyl propanols, diphenyl-methanes, phenothiazines, thioxanthenes.

11th week:
Lecture: Psychostimulants: Analeptics. Phenylethyl amine, piperidine, morpholine and oxazoline derivatives. Anorectic agents. Psychoenergetic agents: monoamin-oxidase (MAO) inhibitory compounds, tricyclic antidepressants. Psychomimetics: LSD, psylocibine, mescaline, tetrahydrocannabiol.

12th week:
Lecture: Central and peripheral antitussive agents. Expectorants. Bronchodilators. Medicines effective on the nasal and other mucosa, and on the respiratory system.

13th week:
Lecture: Central Muscle relaxants: ethers of glycerol and derivatives of 1,3-propanediol. Peripheral muscle relaxants: substances with membrane-stabilizing and depolarizing effects.

14th week:
Lecture: Parasymphatomimetics: acetylcholin and the direct parasymphatomimetics. Nitrogen-containing, and organophosphoric ester-type cholinesterase inhibitors (paralysers). Insecticids. Cholinesterase-reactivating antidote. Parasymphatolytics; alkaloids with tropane skeleton. Synthetic tropane derivatives. Another parasympatolytics without tropane skeletone.

Requirements

Lectures: Attendance to lectures is emphatically recommended. All material covered in lectures is an integral part of the subject and therefore included in the self-control tests and the final exam. Several new concepts and ideas are discussed in the lectures only and are not present in the textbook. Examination is possible only after a successfully finished laboratory practice.

Department of Pharmaceutical Technology

Subject: **PHARMACEUTICAL TECHNOLOGY PRACTICE II. (INDUSTRIAL PRACTICE I.)**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Practical: **56**

1st week:
Practical: Aseptic requirements. Preparation of infusions. Tests.

2nd week:
Practical: Infusio natrii chlorati Ph.Hg.VII., Infusio salina Ph.Hg.VII.

3rd week:
Practical: Infusio glucosi Ph.Hg. VII.,Infusio manniti 100mg/m Ph.Hg.VII.

4th week:
Practical: Infusio natrii lactici Ph.Hg. VII., Infusio gastrica

5th week:
Practical: Test from infusions.

6th week:
Practical: General principles and technologies of granulation, excipients of granules.

7th week:
Practical: Wet granulation by kneading.

8th week:
Practical: Pharmacopoeial tests and test devices of granules.

9th week:
Practical: General principles and technologies of tablet compression, tablet presses.

10th week:
Practical: Test from tableting

11th week:
Practical: Galenic drug preparation, aims and methods. Pharmaceutical standard procedures. Liquid dosage forms ‘1. Galenic solutions, suspensions.

12th week:
Practical: Liquid dosage forms ‘2. Syrups and Colloidal solutions. Formulation techniques, equipment.

13th week:
Practical: Semisolid dosage forms ‘1. Hydrophilic ointments. Formulation techniques, equipment.
Semisolid dosage forms 2. Hydrophobic ointments.

14th week:
Practical: Test 3.

Requirements

You have to attend every practical in Industrial Practice during the 14 weeks. If you are not able to go to practice, you have to bring us certification by a doctor. But on 1-2 occasions if you have very important activity, please foretell it us, and we will discuss when we have any possibility to replace you them. These occasions will be valid exception the tests.
You have 5 weeks tableting, galenic and aseptic lab as well. At the 13th week, you write a big test from both parts (tableting, galenic, aseptic) and get individual mark for every part. The average of these tree marks will be your practical mark. None of them can be a fail (1) mark. If you fail your test, you have got only one more chance to improve your test. If you get a fail mark for the improvement test, you have to write a test from both parts again and the mark of this test will be the final practical mark. In case you do not pass this test, you are not able to get the final signature from Industrial practice.
The final practical grade will be the average of tableting lab, galenic lab and aseptic lab marks but none of the marks can be fail (1).
If you want to improve your practical mark, you have to write an improvement test from both parts.

Subject: **PHARMACEUTICAL TECHNOLOGY PRACTICE II. (PRESCRIPTION WRITING II.)**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Practical: **56**

1st week:
Practical: Introduction, general information. Labour safety, laboratory regulation. Requirements.

2nd week:
Practical:
Suppositories. Calibration of suppository moulds individually (1,2,3 g)
Determination of the calibration value:
1. Adeps solidus
2. Adeps solidus compositus
3. Massa macrogoli

3rd week:
Practical:
Determination of displacement factors.
Calculation of tota massa.
Suppositorium noraminophenazoni 100 mg FoNo VII.

4th week:
Practical:
Preparation of suppositories and suspension type ointments
1.Suppositorium theophyllini 250 mg FoNo VII.
2.Unguentum antisepticum FoNo VII. (suspension ointment)

5th week:
Practical:
Preparation of ointments.
1.Unguentum carbamidi FoNo VII. (dissolved ointment)
2.Suppositorium antispastica pro parvulo FoNo VI.

6th week:
Practical:
Creams.
1.Unguentum boraxatum FoNo VII.(w/o ointment)
2.Cremor aquosus FoNo VII. (o/w ointment)
Consultation

7th week:
Practical: Test 1.

8th week:
Practical:
Gels.
1.Unguentum salicylatum FoNo VII.
2.Anaesthetic gel (individ. comp.)
3.Suppositorium analgeticum forte FoNo VII.

9th week:
Practical:
Pastes. Individual drug preparation 1st group
1.Pasta contra solarem FoNo VII.
2.Pasta zinci oxydati Ph.Hg.VII.
3.Suppositorium spasmolyticum FoNo VII.

10th week:
Practical:
Undivided powders. Individual drug preparation 2nd group
1.Pulvis antacidus FoNo VII.
2.Sal ad rehidrationem FoNo VII.
3.Unguentum neonatorum FoNo VII.

11th week:
Practical:
Individual drug preparation 3rd group
1.Unguentum haemorrhoidale FoNo VII.
2.Suppositorium ad nodum FoNo VII.
3.Unguentum nutritivum FoNo VII.

12th week:
Practical:
Individual drug preparation 4th group
Supplemental practice.

13th week:
Practical: Test 2.

14th week:
Practical: Consultation. Correction.

Requirements

You have to attend every practical in Pharmaceutical Technology. If you are not able to go to practice, you have to bring us certification by a doctor. However, 1-2 occasions if you have very important activity, please foretell it us, and we will let you know the makeup of practice. These occasions will be valid exception the tests.
You have to get ready for practical. We will give you guidelines of practical and we will discuss them. You have to study them at home. You have to write protocol about the practical according to our discussion and practical notes, so you have to bring with you a note book and you have to write the medicines in prescription form.
We will measure back your preparations after the practice. At least 5 preparations will be measured back. If the grade of the measuring is failed, you must prepare it once more, but the average of the marks has to be at least satisfactory (3).
You will write short tests in most practices and 2 summery tests. This short test will contain measurement conversions, latin words and phrases, definitions etc. The summery tests will contain the knowledge of Pharmaceutical Technology practice. If you fail your summery test, you have got only one more chance to improve your test. In case of improvement the summery test mark will be the average of the first and the improved test. The mark of each summery test has to be a pass (2) or more then more pass (2) mark. If one or two summary test mark is a fail (1) mark at the end of semester, the practical grade will be a fail (1) mark as well.
During the semester the students will have one or more individual drug preparation as well. The average mark shouldn't be fail (1) mark for individual drug preparation, or the teacher my refuse the signing of practice.
During the practice if the teacher recognizes any mistake that occurs because the student is not well prepared, the student may get a fail (1) mark for that practice. Besides, the teacher may give mark form 1-5 after every practice according to the student's individual practice work, expenditure of preparation, clean and order of workplace, proper use of equipment, and proper behaviour.
This final grade will be the average of 2 summery tests, grade of short tests from prescription pharmacy lab, the grade of measuring back, grade of individual drug preparation and all other marks.
At the end of the semester you will get 5-stage practical grade.

Subject: **PHARMACEUTICAL TECHNOLOGY THEORY II.**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture:
Sterilization. Theoretical bases of sterilization. Methods of sterilization. Methods of physical sterilization. (heat sterilization, sterilization with radiation, sterilization with ultrasound.)

2nd week:
Lecture: Aseptic formulation of drug. "Clear surface". Microbiological purity of dosage forms. Principles for aseptic formulation. Disinfections. Preservation.

3rd week:
Lecture: Infusion systems. Basic principles. Formulation of infusions.

4th week:

Lecture: Investigation of infusions. Special infusion systems. Tanks (use of plastic tanks.).

5th week:
Lecture: Injections. Basic principles. Definitions. Methods of administration. Biopharmaceutical problems. Basic requirements for the formulation of injections. Active agents and ingredients of injectable systems. Solvents. Formulation of injections.

6th week:
Lecture: Tanks for injections, filling and closing. Sterilization. Examination of injections and quality assurance. Stabilization of injections. Special injectable solutions. (injectable suspensions, dry powder, tablets)

7th week:
Lecture: Drying. Theoretical bases of drying. Methods of drying. Heating transfer at room temperature. Fluidization. Lyophilization.

8th week:
Lecture: Granules. Theoretical bases of the formulation of granules. Types of bandage. Modes for the formulation of granules. Dry and wet granulation. Structure granulation. Granulation with fluidization.

9th week:
Lecture:
Ingredients of tableting and granulation. (Diluents, desintegration agents, binders, adsorption agents, moisture maintain agents, hydriphylizating agents, glidant, lubricant, antiadhesion agents, antistatic agents, dyes, colouring agents.). Investigation of tablets and granules.

10th week:
Lecture: Pharmaceutical dosage forms for rectal use. Definitions. Suppository bases and suppository ingredients. Formulation of suppository by cold compression and moulding.

11th week:
Lecture:
Formulation of suppository by cold compression and moulding.
Special formulations for suppositories, investigation of suppositories. Suppository mold.

12th week:
Lecture: Ointments. Definitions, nomenclature. Colloidal theory of ointment bases. Classification of ointment bases.

13th week:
Lecture: Formulation of ointment, cream, paste and hydrogel. Requirements for choosing the suitable ointment base. Biopharmacy of ointments. Quality assurance of ointments. Ophthalmic ointments, paste. Investigations.

14th week:
Lecture: Consultation

Requirements

Students have to attend 30% of the lectures.

Requirements for signing the Lecture book:
The Department may refuse to sign the subject if the student didn’t attend 30% of lectures according to attendance list.
At the end of semester students have oral exam. The prerequisite of oral exam is a written test before exam. If student doesn’t write more then 60% and fail the written test, it is prohibited to take an oral exam and get a fail (1) mark.

Division of Pharmacognosy

Subject: **PHARMACOGNOSY PRACTICE II.**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Practical: **56**

1st week:
Practical: Introduction. General discussion.

2nd week:
Practical: Alkaloids I.

3rd week:
Practical: Alkaloids II.

4th week:
Practical: Alkaloids III.

5th week:
Practical: Anthraquinone containing plant drugs.

6th week:
Practical: Flavonolignane and dianthrone containing plant drugs.

7th week:
Practical: Flavonoid containing plant drugs I.

8th week:
Practical: Flavonoid containing plant drugs II.

9th week:
Practical: Tannin containing plant drugs.

10th week:
Practical: Coumarin containing plant drugs.

11th week:
Practical: Plant drugs containing miscellaneous phenolic compounds.

12th week:
Practical: Examination of herbal tea mixtures.

13th week:
Practical: Practical exam: Recognition of plant drugs, identification and characterization of herbal tea mixtures.

14th week:
Practical: Practical exam: Recognition of plant drugs, identification and characterization of herbal tea mixtures.

Requirements

Detailed information is given in the first practical course and via the e-learning system.

Completion of the practice requires:
- plant drug and herbal tea recognition test (in person, or, on a video platform, face-to-face, depending on the situation)
- completion of the three practical tests (in person, or on e-learning platform, depending on the situation)

Subject: **PHARMACOGNOSY THEORY II.**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Alkaloids: history, distribution, properties. Lysine and ornithine derived alkaloids: biosynthetic origin, classification,

chemistry, therapeutic applications in phytotherapy.

2nd week:
Lecture: Phenylalanine and tryptophane-derived alkaloids: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

3rd week:
Lecture: Glycine and histidine derived alkaloids; other, special amino acid derivates, glucosinolates, isothiocyanates: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

4th week:
Lecture: Phloroglucin-derivates, anthraquinone derivates: Biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

5th week:
Lecture: Flavonoids: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

6th week:
Lecture: Flavonolignanes, lignanes: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

7th week:
Lecture: Coumarines, furano and pyranocoumarines: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

8th week:
Lecture: Tannins: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

9th week:
Lecture: Naphtoquinones, phenolic compounds, phenolic glycosides, phenypropanoids: biosynthetic origin, classification, chemistry, therapeutic applications in phytotherapy.

10th week:
Lecture: Phytotherapy in general. Evidence-based phytomedicine. Phytotherapeutic products. Side-effects, contraindications and interactions of herbal medicine.

11th week:
Lecture: Antioxidants, plant anti-inflammatory agents. Phytotherapy of the cardiovascular and the central nervous system.

12th week:
Lecture: Phytotherapy of the gastrointestinal and the urogenital tracts.

13th week:
Lecture: Phytotherapy of the respiratory system. External applications. Chemoprevention.

14th week:
Lecture: Consultation.

Requirements

Detailed information is given in the first lecture and via the e-learning system.

Completion of the subject requires:
- examination during the exam period based on the uploaded lectures (in person, or, on video platform face-to-face, depending on the situation)
- we offer an optional pre-examination test for offered grade, before the exam period (in person or, on e-learning platform, depending on the situation).

Department of Foreign Languages

Subject: **MEDICAL HUNGARIAN II.**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Introduction; Revision

2nd week:
Practical: Grouping of medicine; Administration of medicine

3rd week:
Practical: Medical aids; Medical kit

4th week:
Practical: First aid kit

5th week:
Practical: Travel kit

6th week:
Practical: Important verbs

7th week:
Practical: Midterm test

8th week:
Practical: The digestive system and related medications

9th week:
Practical: The ideal laxative

10th week:
Practical: The respiratory system and related medications

11th week:
Practical: The skin and skin preparations

12th week:
Practical: The eye and eye preparations

13th week:
Practical: Mini presentations

14th week:
Practical: End term test; Oral exam

Requirements

Requirements of the course:

Attendance
Attending language classes is compulsory. If a student is late it is considered as an absence. Students can miss only 10 percent of the classes that is maximum 2 occasions.
The teacher evaluates active participation in each class. Students are not supposed to share coursebooks in the classes therefore if they fail to bring the coursebook to the class for the second time the attendance is refused.

Testing, evaluation
In Medical Hungarian courses, students have to sit for an oral mid-term and an oral final exam. Students must appear at the lecture hall at least 15 minutes before the exam. If students are late, they are not allowed to take the test.
A further minimum requirement is the knowledge of 200 words per semester divided into 10 word quizzes. There are five word quizzes before and another five after the midterm test. If a student fails or misses any word quizzes he / she cannot take the written test.

The oral exam consists of a role-play from a list of situations covered in the coursebook. If students fail the oral exam, they fail the whole course.
Based on the final score the grades are given as follows.

Final score	**Grade**
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the final score of the written tests is below 60, the student can take a written remedial exam once covering the whole semester's material.

Coursebook:
See the website of the Department of Foreign Languages: **ilekt.med.unideb.hu.**
Audio files to the course book, oral exam topics and vocabulary minimum lists are also available on the website.

Department of Immunology

Subject: **IMMUNOLOGY**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Lecture: **28**
Seminar: **6**
Practical: **14**

1st week:
Lecture: Elements of the immune system. The structure of lymphoid tissues, primary and secondary lymphoid organs.

2nd week:
Lecture: Component and cells of the innate response. Characteristics and function of the innate immune response.
Seminar: Components and cells of the innate response. Characteristics and function of the innate immune response.

3rd week:
Lecture: Antigen presentation. Structure of MHC, MHC polymorphism. Antigen presentation.
Seminar: Antigen presentation. Structure of MHC, MHC polymorphism. Antigen presentation.

4th week:
Lecture: Antigen recognition by T-lymphocytes. The T-cell response. Activation, differentiation, effector functions. T-cell subsets.
Seminar: Antigen recognition by T-lymphocytes. The T-cell response. Activation, differentiation, effector functions. T-cell subsets.

5th week:
Lecture: B-lymphocytes. An introduction to antibody structure and function.
Practical: B-lymphocytes. An introduction to antibody structure and function.

6th week:
Lecture: Inflammation. Effector function of helper T-cell. Activation and function of cytotoxic T-lymphocytes.
Practical: Inflammation. Effector function of helper T-cell. Activation and function of

cytotoxic T-lymphocytes.

7th week:
Lecture: Activation and antigen-dependent differentiation of B-lymphocytes. The development of immunological memory.
Practical: Activation and antigen-dependent differentiation of B-lymphocytes. The development of immunological memory.

8th week:
Lecture: Monoclonal antibodies. Vaccination.
Practical: Monoclonal antibodies. Vaccination.
Self Control Test

9th week:
Lecture: Central tolerance. Peripherial mechanisms of immune tolerance.
Practical: Central tolerance. Peripherial mechanisms of immune tolerance.

10th week:
Lecture: Tumor immunology, monoclonal antibodies in tumor therapy.
Practical: Tumor immunology, monoclonal antibodies in tumor therapy.

11th week:
Lecture: Anti-viral response Hypersensitivity reactions.
Practical: Anti-viral response Hypersensitivity reactions.

12th week:
Lecture: Mechanisms of the development of autoimmune diseases.
Practical: Mechanisms of the development of autoimmune diseases.

13th week:
Lecture: Transplantation. Immunodeficiences.
Practical: Transplantation. Immunodeficiences.

14th week:
Lecture: Generation of B- and T-cell diversity, development of B and T lymphocytes.
Practical: Generation of B- and T-cell diversity, development of B and T lymphocytes.
Self Control Test

Requirements

Signing of the Lecture Book:
Participation in the Seminars and the Practical Courses is compulsory. The Department shall refuse to sign the students' Lecture book if he/she is absent from more than two seminars during semester.

Self control tests (SCTs), offered grades, end-term exam:
During the semester two self control tests (SCT) will be organised (weeks 8 and 14).
The first SCT contains the material of the lectures of weeks 1-7 as well as the material of seminars on weeks 1-7. To ensure a solid basic knowledge of immunology, students must score higher than 60% to qualify for the 2nd SCT, hence for an offered grade.
The 2nd SCT contains the material of lectures 8-13 and seminars 8-13
If a student's score for the first SCT is higher than 60% and the score of the second SCT is higher than 50%, she/he will be offered a grade. Should student accept this offered grade, she/he will be exempted from the end-term exam.
The offered grades are calculated by the following algorithm, based on the cumulative percentage points of the two SCTs (i.e. 200 points maximum).

110 - 139: pass (2)
140 - 149: satisfactory (3)
150 - 169: good (4)
170 - 200: excellent (5)

Those students who have not qualified for an offered grade must take the end-term exam during the

exam period. The end-term exam consists of a written and an oral part.
"A" exam: To qualify for the oral part of an "A" exam, students must score higher than 70% on the written (entry) exam. Students who score less than 70% on the written part will fail (thus, the oral exam will not take place).
"B" exam: "B" exams are identical to "A" exams except when the student failed the oral, but not the written, part of the "A" exam. With a score of higher than 70% on the written part of the "A" exam, the student is exempt from the written exam on the "B" exam.
"C" exam: "C" exams are oral exams only, without a written entry test.
Those students who would like to improve the grade of a successful ("A" or "B" exam) or do not accept the offered grade, are also exempted from the entry test.
The list of exam topics is available on the departmental website (www.elearning.med.unideb.hu).
Lecture materials and other information concerning education can be found on our website at www.elearning.med.unideb.hu.

Department of Laboratory Medicine

Subject: **CLINICAL BIOCHEMISTRY II.**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Lecture: **56**
Seminar: **8**
Practical: **28**

1st week:
Lecture: Clinical Biochemistry II. 1. Coagulopathies, (general introduction), haemophilias, other coagulopathies
2. von Willebrand disease
3. Platelet function disorders
Clinical physiology:
Introduction, cellular and molecular factors of pathologic cardiac excitability.
Practical: Laboratory informatics

2nd week:
Lecture: Clinical Biochemisrty II. 4. Inherited thrombophilias
5. Acquired thrombophilias
6. Prethrombotic state, thromboembolias, consumption coagulopathies
Clinical Physiology:
Pathologic contractile function of the heart (contractile proteins, intracellular Ca2+-homeostasis and cardiac pumping)
Practical: Laboratory diagnostics of coagulopathias

3rd week:
Lecture:
Clinical Biochemistry II. 7.Laboratory diagnosis of autoimmune diseases.
8. Disorders of sodium and water metabolism I.
9. Disorders of sodium and water metabolism II.
Clinical Physiology:
Myocardial ischemia, myocardial infarction and new ischemic sydromes (hibernation, preconditioning, stunning)
Practical: Laboratory diagnostics of platelet functions disorders. Laboratory monitoring of antiplatelet therapy.

4th week:
Lecture:
Clinical Biochemistry II. 10. Disorders of potassium metabolism.
11. Disturbances of the acid-base balance
12. Laboratory diagnostics of renal disorders
Clinical Physiology: Cardiac hypertropy and failure.
Practical: Laboratory diagnostics of Thrombophilia. Laboratory monitoring of

anticoagulant therapy.

5th week:
Lecture:
Clinical Biochemistry II. 13. Patobiochemistry of the renal function I.
14. Patobiochemistry of the renal function II.
15. Hypoglycaemias
Clinical Physiology:
Heart failure (molecular pathophysiology)
Practical: Laboratory diagnostics of renal disorders

6th week:
Lecture:
Clinical Biochemistry II. 16. Pathogenesis and pathomechanism of diabetes mellitus
17. Pathobiochemistry and clinical biochemistry of the acute complications of diabetes mellitus
18. Laboratory diagnostics of diabetes mellitus
Clinical physiology: Endothelium, smooth muscle, vessels.
Practical: Examination of urine sediment
Self Control Test

7th week:
Lecture:
Clinical Biochemistry II. 19. Disorders of lipid metabolism.
20. Laboratory diagnostics of hyperlipidemia
21. Risk factors of atherosclerosis
Clinical physiology: Hypertension
Practical: Basic laboratory methods in metabolic diseases

8th week:
Lecture:
Clinical Biochemistry II. 22. Laboratory diagnostics of acute coronary syndrome I.
23.Laboratory diagnostics of acute coronary syndrome II.
24. Laboratory diagnostics of hyperuricaemia and gout.
Clinical Physiology: New translational perspectives in cardiovascular medicine.
Practical: Case presentation

9th week:
Lecture:
Clinical Biochemistry II. 25. Pathobiochemistry of liver disorders
26. Laboratory diagnostics of liver disorders. Patobiochemistry of acute hepatic disorders.
27. Pathobiochemistry and laboratory diagnostics of cholestasis and cirrhosis.
Clinical Physiology: Stem cells in cardiovascular medicine
Practical: Laboratory investigation of cerebrospinal fluid and other body fluids.

10th week:
Lecture:
Clinical Biochemistry II. 28. Laboratory diagnostics of liver disorders. Patobiochemistry of acute hepatic disorders.
29. Pathobiochemistry and laboratory diagnostics of cholestasis and cirrhosis
30. Pathobiochemistry and laboratory diagnosis of autoimmune liver diseases.
Clinical Physiology: Cellular and molecular elements of the respiratory system with clinical significance.
Seminar: Clinical Physiology: The basics of EKG.
Practical: Separation techniques.
Self Control Test

11th week:
Lecture:
31. Pathobiochemistry and laboratory diagnostics of the gastrointestinal tract I.
32.Pathobiochemistry and laboratory diagnostics of the gastrointestinal tract II.
33. Laboratory diagnostic of acute pancreatitis
Seminar: Clinical Physiology: ECG diagnosis of arrhytmias I.
Practical: Laboratory diagnostics of myocardial infarction, POCT.

12th week:
Lecture:
34. Clinical biochemistry of hypothalamus and hypophysis
35. Pathobiochemistry of thyroid disorders.
36.Laboratory diagnostics of thyroid functions.
Clinical Physiology: Clinical physiology of nutrition and metabolism.

Seminar: Clinical physiology: ECG diagnosis of arrhytmias II.
Practical: Laboratory evaluation of autoimmune diseases.

13th week:
Lecture:
37. Clinical chemistry of parathyroid disorders. Disorders of calcium, phosphate and magnesium metabolism.
38. Patobiochemistry and laboratory diagnostics of adrenal cortex disorders.
39. Pathobiochemistry and laboratory diagnostics of adrenal medulla disorders.
Clinical Physiology: Clinical physiology of the nervous system I.

Seminar: Clinical Physiology: Angina pectoris, myocardial
Practical: Laboratory evaluation of liver and pancreas function.
Self Control Test

14th week:
Lecture: 40.Clinical biochemistry of gonadal functions.
41. Laboratory diagnostics of bone disorders.
42. Laboratory diagnostics of muscle disorders.
Clinical Physiology: Clinical physiology of the nervous system II.
Practical: Laboratory evaluation of liver and pancreas function-case presentation.

Requirements

Clinical Biochemistry - Participation on practicals:
Attendance of practicals is obligatory. Altogether one absence in the first semester and two absences in the second semester are permitted. In case of further absences, the practicals should be made up for by attending the practicals with another group in the same week, or a medical certificate needs to be presented. Please note that strictly only a maximum of 2 students are allowed to join another group to make up for an absence.

Requirements for signing the Lecture book:
The Department may refuse to sign the Lecture book if the student is absent from practicals more than allowed in a semester.

Assessment:
At the end of the second semester there is a written examination assessed by the five-grade evaluation. During the second semester there will be 3 SCTs. Bonus percentage will be given on the basis of the results of the SCTs, which will be added to the result of the final exam. The Clinical Biochemistry II. final exam will be a written test from the material of the I. and II. semester and clinical physiology. The materials of Clinical Biochemistry subject are uploaded on the e-learning website.(www.elearning.med.unideb.hu)

Requirements for examinations:
The examination is based on the lecture and practical material (Practicals in Laboratory Medicine, eds.: János Kappelmayer and László Muszbek, 2016) as well as the relevant chapters from the textbook of Marshall: Clinical Chemistry (8th edition, 2017).

Department of Pharmaceutical Chemistry

Subject: **PHARMACEUTICAL CHEMISTRY PRACTICE II.**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Safety instructions, requirements.

2nd week:
Practical: Carbohydrates.

3rd week:
Practical: Imipramine, promethazine, trimethoprim, quinine.

4th week:
Practical: Coffein, theobromine, theophylline, allopurinol.

5th week:
Practical: Analysis of china alkaloids, drotaverin, papaverin. Quareline tablet.

6th week:
Practical: Investigation of the Boron-Zinc ointment; investigation of Pulvis Chinacisalis

7th week:
Practical: Analysis of Suppositorium analgeticum and Rutascorbin tablet.

Requirements

Requirement: Pharmaceutical Chemistry Theory I.
The laboratory practice is organized in groups, 7x4 hours. The presence of students at the practices is obligatory. If the student is absent from more than one practices, the semester will not be accepted (there is no possibility to arrange additional extra lab practices).

The semester of the student's lab practice will not be accepted in either of the following cases:
1. three unacceptable written tests/demos with the evaluation "Failed" (Mark "1"),
2. the student was not permitted to start the Lab Practice in two occasions*,
3. the student presented two unacceptable Lab Practice written tests/demos with the evaluation "Failed" (Mark "1"), and was not permitted to start the Lab Practice in one occasion*.
4. five demos or notebooks with the evaluation "Failed" (Marks "1" or "0") altogether in any combination.
5. the average of the marks is below 2.0
6. When the student can not present 4 successful Lab Practices in the semester.

*The student will not be permitted to start a Lab Practice in either of the following cases:
1. the student does not show up in the laboratory in 20 minutes from the scheduled starting date of the Practice,
2. the student can not present her/his lab practice notebook prepared according to the said requirements,
3. the student is unable to reach at least 50 % of the maximum score related to the questions asked in connection with the topics of the Laboratory Practice!
4. When writing the test, cabs and other illegal sources are not allowed to use. If the student is found out in a cheating, the student must leave the Lab, and the Practice will be considered unsuccessful (Mark "0").

Subject: **PHARMACEUTICAL CHEMISTRY THEORY II.**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Lecture: **56**

1st week:
Lecture: Local anesthetics: natural compounds. Synthetic substances: esters, amides, ketones, ethers, urethanes and amidines. Spasmolytics: papaverin and its analogues. Bencyclan.

2nd week:
Lecture: Cardiovascular drugs. Antianginal compounds: nitrit- and nitrate esters. B-Adrenergic receptor-blocking agents. Inhibitors of the calcium channel, calcium antagonists. Another coronary dilators. Cardiotonics: cardial glycosides. Another types of cardiotonics. Antiarrythmic agents.

3rd week:
Lecture: Compounds controlling the blood pressure. Antihypertensives, hypotensives. Agents with central attack. Beta-receptor blockers, beta-adreno-receptor antagonists, adrenergic neuron-blockers. Vasodilators. Ganglionic blocking agents. Inhibitors of the angiotensin-converting enzyme. Peripheral dopamine-receptor agonists. Selective dilators of the cerebral blood-vessels. Anticoagulants.

4th week:
Lecture: Medicines of the hyperlipoidemia: clofibrate, nicotinic acid, lovastatin. Compounds effective on the hematopoiesis. Plasma substitutes. Substances effective on the hemostasis: anticoagulants, antithrombotics, inhibitors of platelet aggregation. Coagulants, derivatives of vitamin K. Fibrinolysis inhibitors.

5th week:
Lecture: Diuretics: xanthin and uracyl derivatives. Inorganic mercury salts. Sulfonamides, amino acids, cyclic amidines, aldosteron antagonists. Osmotic diuretics. Laxatives, choleretics. Antacid agents and obstipants.

6th week:
Lecture: Non-steroid anti-inflammatory agents: salicylates, arylalkanoic acids, N-arylanthranylic acids, 5-pyrazolone-derivatives. Antirheumatic agents: compounds of gold. 4-Amino-quinolines, thiols. Anti-gouty agents. Medicines of the immune system: immunostimulants. Immunosupressive agents. Vitamins.

7th week:
Lecture: Steroid hormones. Androgenes, anabolics, anti-androgenes. Oestrogenes, gestogenes, anticonceptives. Corticosteroids: mineralo- and glucocorticoids. Agents effective on the thyroid dysfunction. Antidiabetics. Prostaglandins.

8th week:
Lecture: Inorganiv and organic antiseptic agents, disinfectants. Alcohols, phenols, N-chloro compounds, surface active agents, dyes. Synthetic antibacterial agents. Sulfonamides, nitrofuran derivatives.

9th week:
Lecture: Fluoroquinolones. Antifungal compounds: imidazoles, triazoles, Antifungal antibiotics: polyenes, griseofulvin.

10th week:
Lecture: Antibacterial antibiotics. Cyclopeptides, lipo- glyco- and depsipeptides. Beta-lactam antibioics. Penicillins: natural and semi-synthetic penicillins. Beta-lactamase inhibitors.

11th week:
Lecture: Natural and semi-synthetic cephalosporins. Carbacephems. Monocyclic B-lactams.

12th week:
Lecture: Aminocyclitol (aminoglycoside) antibiotics. Macrolide antibiotics, erythromycin

and semisynthetic derivatives. Ansa-macrolides. Natural and semi-synthetic tetracyclins.

13th week:
Lecture: Medicines of the parasitic diseases. Antimalarial agents: quinine and other derivatives. Antiprotozoal agents. Medicines of toxoplasmosis and amoebiasis. Trichomonacide and trypanocidal substances. Anthelminics.

14th week:
Lecture: Antiviral compounds: Acyclovir, Ribavirin, Zidovudin. Neuraminidase inhibitors Antineoplastic agents: cytostatic compounds. Folic acid-, purin-, and pyrimidin-antagonists. Nucleoside antagonists. Biological alkylating compounds. Platinum derivatives. Anthracyclineglycosides. Taxol. Targeted chemotherapy.

Requirements

Requirement: Pharmaceutical Chemistry Theory I.

Lectures:
Attendance to lectures is recommended. All material covered in lectures is an integral part of the subject and therefore included in the self-control tests and the final exam.
Condition to final exam is to fulfill the Pharmaceutical Chemistry Practice II. and the self-control test (at least 85% rate of success).
The final exam is oral (covering Pharmaceutical Chemistry I. and II.).

Department of Pharmaceutical Technology

Subject: **PHARMACEUTICAL TECHNOLOGY PRACTICE III. (INDUSTRIAL PRACTICE II.)**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Practical: **56**

1st week:
Practical: Dialysis. Solutions for dialysis. perfusion solutions. Eye drops. Eye creams.

2nd week:
Practical: Soutio pro dialysi peritoneale I. (Ph.Hg.VII.)
Solutio anticoagulans “ACD” (Ph.Hg.VII.)

3rd week:
Practical: Collins “C” solution
Kardiostop I. solution

4th week:
Practical: Oculogutta neomycini (FoNo.VII.).
Oculentum simplex (Ph.Hg.VII.).
Oculentum hydrosum (Ph.Hg.VII.)
Oculentum neomycini FoNo VII.

5th week:
Practical: Test from infusions and eye preparations.

6th week:
Practical: High-shear granulation.

7th week:
Practical: Fluid bed granulation.

8th week:
Practical: Hard gelatin capsules, capsule filling and pharmacopoeial tests.

9th week:
Practical: Tablet compression, process parameters and tablet qualification.

10th week:
Practical: Test from tableting.

11th week:
Practical: Semisolid dosage forms '3. Suspension type ointments Pastes. Formulation techniques, equipment.

12th week:
Practical: Solid dosage forms '1. Combined suppository bases. Aims and formulation techniques, equipment.

13th week:
Practical: Solid dosage forms '2. Suppository formulation in industrial scale. Aims and formulation techniques, equipment.

14th week:
Practical: Cosmetics. Aim, possibilities and formulation techniques, equipment.
Test.

Requirements

You have to attend every practical in Industrial Practice during the 14 weeks. If you are not able to go to practice, you have to bring us certification by a doctor. But on 1-2 occasions if you have very important activity, please foretell it us, and we will discuss when we have any possibility to replace you them. These occasions will be valid exception the tests.
You have 5 weeks tableting, galenic and aseptic lab as well. At the 13th week, you write a big test from both parts (tableting, galenic, aseptic) and get individual mark for every part. The average of these tree marks will be your practical mark. None of them can be a fail (1) mark. If you fail your test, you have got only one more chance to improve your test. If you get a fail mark for the improvement test, you have to write a test from both parts again and the mark of this test will be the final practical mark. In case you do not pass this test, you are not able to get the final signature from Industrial practice.
The final practical grade will be the average of tableting lab, galenic lab and aseptic lab marks but none of the marks can be fail (1).
If you want to improve your practical mark, you have to write an improvement test from both parts.

Subject: **PHARMACEUTICAL TECHNOLOGY PRACTICE III. (PRESCRIPTION WRITING III.)**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Practical: **56**

1st week:
Practical: Course: Prescription Pharmacy Introduction, general information. Labour safety, laboratory regulations. Requirements. Preparations of pastes. 1. Pasta boraxata FoNo VII. 2. Pasta Burowi FoNo VII. 3. Sirupus kalii chlorati FoNo VII. Course: Sterile and aseptic formulations Parenteral nutrition. Dialyzing. Peritoneal dialysis. Solutio pro dialysi peritoneale I. (Ph.Hg VII.) Solutio pro dialysi peritoneale II. (Ph.Hg VII.)

2nd week:
Practical: Course: Prescription Pharmacy Vaginal dosage forms (ovulum, globulus, globulus vaginalis longiformis), Preparation of suppositories by the help of cold compression with Theobroma oil. 1. Ovulum nystatini FoNo VII. 2. Globulus glycerini boraxati FoNo VII. 3. Globulus zinci sulfurici (individual composition) ($ZnSO_4$ 1,60g; Butyrum cacao 10,0g; for 4 globuli). Course: Sterile and aseptic formulations Cytostatic infusion solutions. Perfusion solutions. Collins solution. Kalium

dihydrogenphosphoricum 2,05g. Glucosum anhydricum 25,0g. Magnesium sulfuricum 7,4g. Procainium chloratum 0,1g. Aqua dest. pro inj. ad 500ml. Collins I.solution (SZOTE). Kalium dihydrogenphosphoricum 2,05g. Kalium hydrophosphoricum 9,70g. Kalium chloratum 1,12g. Natrium hydrogencarbonicum 0,84g. Aqua dest. pro inj. ad 1000ml.

3rd week:
Practical: Course: Prescription Pharmacy Divided powders. 1. Pulvis antidoloricus FoNo VII. 2. Pulvis asthmalyticus fortis FoNo VII. 3. Pasta contra solarem FoNo VII. 4. Cremor aquosus FoNo VII. Course: Sterile and aseptic formulations Plasma substitute infusion solutions. Cardiostop solutions. Cardiostop I. solution. Natrium chloratum 0,4g. Kalium chloratum 0,3g. Magnesium chloratum sol. 50% 0,3g. Glucosum anhydricum 1,5g. Mannitum 20,6g. Aqua dest. pro inj. ad 500,0ml. Solutio anticoagulans ACD(Ph.Hg.VII.).

4th week:
Practical: Course: Prescription Pharmacy Incompatibilities. 1. Incompatibility 1. 20,0g 2. Incompatibility 2. 150,0g 3. Incompatibility 3. 100,0g 4. Incompatibility in suppository. (Codein. 0,24g; Aspirin 3,00g, Phenacetin 3,00g, Adeps solidus 3 instead of Adeps solidus 50) Course: Sterile and aseptic formulations, Ophthalmic ointments, Oculentum simplex Ph.Hg.VII. 50,0g, Oculentum hydrosum Ph.Hg.VII 20,0g, Oculentum neomycini FoNoVII 10,0g

5th week:
Practical: Course: Prescription Pharmacy Sparsorium. 1. Sparsorium antisudoricum FoNo VII. 2. Sparsorium contra pruritum FoNo VII. 3. Incompatibility 4. 30,0g (ointment) 4. Incompatibility 5. 10p.(powder) Course: Sterile and aseptic formulations. Test.

6th week:
Practical: Course: Prescription Pharmacy Test 1. Course: Formulation of tablets and granules. Repetition: Tablets and granules. Preparation: Tabletta aminophenazoni.

7th week:
Practical: Course: Prescription Pharmacy 19. Incompatibility 6. (talc) 20. Sparsorium infantum FoNo VII. 21. Pasta antirheumatica FoNo VII. 22. Pulvis combinatus FoNo VII. Course: Formulation of tablets and granules. Tableting. Quality control of tablets. Preparation: Tabletta coffeini.

8th week:
Practical: Course: Prescription Pharmacy 23. Suppositorium algopyrini FoNo VII. 24. Unguentum infantum FoNo VII. 25. Pulvis chinacisalis cum vitamino C FoNo VII. 26. Suspensio bismogeli FoNo VII. Course: Formulation of tablets and granules. Quality control of tablets and granules.

9th week:
Practical: Course: Prescription Pharmacy 27. Suppositorium ad nodum FoNo VII. 28. Unguentum anaestheticum FoNo VII. 29. Cremor erythromycini FoNo VII. 30. Pulvis spasmalgeticus FoNo VII. Course: Formulation of tablets and granules. Quality control of tablets. Individual and average weight. Test of disintegration. Test of mechanical hardness.

10th week:
Practical: Course: Pharmacy Prescriptions in clinical practice 31. Solutio cacisali 32. Globulus with chamomillae 33. Ointment for hands 34. Mucilage for urine tract. Course: Formulation of tablets and granules. Test.

11th week:
Practical: Course: Prescription, Pharmacy Individual drug preparation practice. Course: Galenic preparations and their manufacture. Preparation and investigation of ointments and creams.

12th week:
Practical: Course: Prescription Pharmacy 35. Mixtura pectoralis adde Dionin FoNo VII. 36. Suppositorium antipyreticum pro parvulo FoNo VI. 37. Pulvis paracetamoli cum codeino FoNo VII. 38. Unguentum antirheumaticum FoNo VII.

Course: Galenic preparations and their manufacture. Preparation and investigation of suspension ointments and pastes.

13th week:
Practical: Course: Prescription, Pharmacy Test 2. Course: Galenic preparations and their manufacture. Preparation and investigation of suppositories.

14th week:
Practical: Course: Prescription, Pharmacy 39. Unguentum antiphlogisticum pro infante FoNo VII. 40. Unguentum ichthyolsalicylatum FoNo VII. 41. Pulvis cholagogus FoNo VII. 42. Unguentum dermophylicum FoNo VII. Course: Galenic preparations and their manufacture. Preparation and investigation of powders.

Requirements

You have to attend every practical in Pharmaceutical Technology. If you are not able to go to practice, you have to bring us certification by a doctor. However, 1-2 occasions if you have very important activity, please foretell it us, and we will let you know the makeup of practice. These occasions will be valid exception the tests.

You have to get ready for practical. We will give you guidelines of practical and we will discuss them. You have to study them at home. You have to write protocol about the practical according to our discussion and practical notes, so you have to bring with you a note book and you have to write the medicines in prescription form.

We will measure back your preparations after the practice. At least 5 preparations will be measured back. If the grade of the measuring is failed, you must prepare it once more, but the average of the marks has to be at least satisfactory (3).

You will write short tests in most practices and 2 summery tests. This short test will contain measurement conversions, Latin words and phrases, definitions etc. The summery tests will contain the knowledge of Pharmaceutical Technology practice. If you fail your summery test, you have got only one more chance to improve your test. In case of improvement the summery test mark will be the average of the first and the improved test. The mark of each summery test has to be a pass (2) or more then more pass (2) mark. If one or two summary test mark is a fail (1) mark at the end of semester, the practical grade will be a fail (1) mark as well.

During the semester the students will have one or more individual drug preparation as well. The average mark shouldn’t be fail (1) mark for individual drug preparation, or the teacher my refuse the signing of practice.

During the practice if the teacher recognizes any mistake that occurs because the student is not well prepared, the student may get a fail (1) mark for that practice. Besides, the teacher may give mark form 1-5 after every practice according to the student’s individual practice work, expenditure of preparation, clean and order of workplace, proper use of equipment, and proper behaviour.

This final grade will be the average of 2 summery tests, grade of short tests from prescription pharmacy lab, the grade of measuring back, grade of individual drug preparation and all other marks.

At the end of the semester you will get 5-stage practical grade.

Subject: **PHARMACEUTICAL TECHNOLOGY THEORY III.**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Vaginal pharmaceutical forms (vaginal suppositories, vaginal balls,-cylinders,-tablets).Other vaginal pharmaceutical forms. Biopharmaceutical problems. Pills. Formulation of pills. Control of pills. Bolus.

2nd week:
Lecture: Dragée. The process of coating. The methods of coating (sugar coating, film coating, gastric coating, enteric coating.). Dry coating.

3rd week:
Lecture: Formulation of dragée by fluidization. Equipment for coating. Dragée core and the temperature of drying. Investigations of dragée.

4th week:
Lecture: Capsules. Hard gelatine capsules. Soft gelatine capsules, formulation, filling. Intestinosolvent capsules. Wafer-capsules. Investigation of capsules.

5th week:
Lecture: Blood and blood preparations. Blood preservative solutions. Solutions for volume substitution.

6th week:
Lecture: Parenteral nutritive infusions, fat emulsions. “ All in one “ mixtures.

7th week:
Lecture: Ophthalmic pharmaceutical forms, definitions. Anatomy of the eye, biopharmacy problems. Requirements for ophthalmic pharmaceutical forms. (compatibility, without irritation, free from bacteria, stability). Basic principles for pharmaceutical formulation

8th week:
Lecture:
Special ophthalmic pharmaceutical forms, contact lamella, contact lens. Tanks., ear drops, nasal drops

9th week:
Lecture: Pharmaceutical dosage forms formulated by extraction. Basic requirements of extraction. Factors influenced by extraction. Methods of extraction. (Maceration, turbo-extraction, hydro-extraction, perfusion extraction, extraction with reverse flow.) Extracts, tinctures. Decoctions, Infusions.

10th week:
Lecture: Inhalations and aerosols. Definitions.. Biopharmaceutical problems. Formulation of inhalations and aerosols in theory and also in practice. Propellants. Dosage forms that protect environment. Containers for aerosols. Filling of aerosols. Investigation of aerosols.

11th week:
Lecture: Primer packing materials. Describing primer packing materials and containers: glass, plastic. Investigations. Special packing materials.

12th week:
Lecture: Stability of drugs. Principles of reaction kinetics and the use of reaction kinetics in pharmaceutical technology. Rapid stability investigations.

13th week:
Lecture: Directions for Good Manufacturing Practice (GMP)

14th week:
Lecture: Consultation.

Requirements

Students have to attend 30% of the lectures.

Requirements for signing the Lecture book:
The Department may refuse to sign the subject if the student didn't attend 30% of lectures according to attendance list.
At the end of semester students have oral exam. The prerequisite of oral exam is a written test before exam. If student doesn't write more then 60% and fail the written test, it is prohibited to take an oral exam and get a fail (1) mark.

Subject: **PUBLIC PHARMACY PRACTICE AFTER 3RD YEAR (PREPARATION OF PHARMACEUTICAL DOSAGE FORMS, MANAGEMENT-QUALITY ASSURANCE, DISPENSING, PHARMACEUTICAL BUSINESS ADMINIST)**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Practical: **120**

Requirements

Syllabus for the practice in a public pharmacy after third year Duration of practice:

4 weeks, 8 hours daily, from which 2 hours may be spent preparing individually The student is required to gain proficiency in the following areas during his /her practice at a public pharmacy, and subsequently acquire knowledge about pharmacy operation including dispensing medication, preparing medication, validation and quality assurance, and the overall operation of the pharmacy.

Requirements for the student:
Accept and sign the non-disclosure document. Absence from practice must be authentically justified based on the rules of the place of training. Absences must be made up. He/she is expected to follow the guidance of the pharmacist in charge of the training.

Skills expected from the student after the completion of practice:
• practical application of the theoretical knowledge obtained during his / her studies
• he / she is expected to know the premises and the assets of the public pharmacy and be able to get information from manuals and scientific journals used during his / her work
• he / she is expected to learn about the work activities of a public pharmacy
• he / she is required to have an appropriate working relationship with the co-workers at the pharmacy
• he / she is expected to know the rules and regulations pertaining to the operation of pharmacies
• he/ she is required to explore the possibilities of communicating with patients

The student's tasks during the practice:

Under the supervision of the pharmacist in charge of the training he / she participates in the following activities:

1. Preparation of medicine. In the process he / she is required to learn:
How to prepare magistral / individual formulations according to the rules and to recognize

incompatibilities The legal possibilities of changing the original prescription The rules of labelling and their application (identifiability of manufacturer and patient, application, administration, shelf-life) Documentation of preparation, and administrative obligations
Storage of materials, processing of basic formulations and subsequent administrative obligations Formulations of the compendium and FoNo

2. Operation and quality assurance.
In the process he / she is required to learn
• administrative work in the pharmacy
• standard procedures for workflow
• how to check and document workflow
• the rules pertaining to the examining and sampling incoming medications, documentation of examinations

3. Drug dispense. In the process he / she is required to learn
• how to check the content and layout of the prescription
• the database of nutrition complements and medicinal formulae
• adequate application of the computer program.

He / she is expected to get acquainted with the process and documentation of drug dispensing, and communication with patients
• the notion of pharmacy care and its practical ramifications

4. Medicine ordering. In the process he / she is required to learn:
• how to order medicine
• about narcotics and activities involving their handling
• the rules pertaining to hazardous waste

Evaluation:
Keeping an electronic notebook: description of 1 syllabus-related practical problem in half / one page. The pharmacist in charge of the training checks the work and description every second week and evaluates it using a five-grade system. He /She sends the electronic notebook to the Dean's Office according to the rules of the place of training. At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in written form and evaluates the student based on a three-grade system. He / she sends it to the Dean's Office in a printed and signed form according to the rules of the training place. Student evaluation: After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training facility.

CHAPTER 19
ACADEMIC PROGRAM FOR THE 4TH YEAR

Department of Biopharmacy

Subject: **PHARMACEUTICAL BIOANALYTICS AND BIOTECHNOLOGY I.**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Modern biotechnology (history, basic concept)

2nd week:
Lecture: Biotechnology methods and biotechnology products in therapy

3rd week:
Lecture: Production of biotechnological drugs I.: fermantation

4th week:
Lecture: Production of biotechnological drugs II..: recombinant technology, GMO

5th week:
Lecture: Gene technology I.: GH, insulin, enzymes, mABs, cytokines

6th week:
Lecture: Gene technology II.: vaccines, antibiotics

7th week:
Lecture: Gene technology III.: gene therapy, personalized medication
Self Control Test

8th week:
Lecture: Gene technology IV.: stem cells, stem cells in therapy, cell banks.

9th week:
Lecture: Gene technology V.: pharmaco genetics, pharmaco genomics, HGP, ENCODE project

10th week:
Lecture: Modern drug delivery systems, nano and biotechnology based therapies.

11th week:
Lecture: Biotechnology based targeted (cancer) therapies

12th week:
Lecture: Industrial production: documentation, QA, QC, validity

13th week:
Lecture: Regulation, biosimilar products, FDA/EMA regulation,
Ethics of biotechnology, future directions

14th week:
Lecture: Self Control Test

Requirements

At least 30% of the lectures must be visited. Students have to write two self control tests, in the middle of the semester and at the and of the semester.
Only students having adequately fulfilled the requirements are allowed to get the signature and take the final oral exam.

Department of Medical Microbiology

Subject: **MEDICAL MICROBIOLOGY I.**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Lecture: **28**
Seminar: **10**
Practical: **10**

1st week:
Lecture: The microbial word. Pharmaceutical importance of microbes. Prokaryotic cell structure.
Practical: Laboratory safety instructions. Bacterial normal flora. Collection of clinical samples, sample processing.

2nd week:
Lecture: Morphology and physiology of bacteria. Pathogenesis and infection. Bacterial genetics.
Practical: Examination of microscopic morphology of bacteria. Microscopic techniques (dark field and phase contrast microscope, electron microscopy). Unstained specimens. Staining methods (Gram-, Ziehl-Nielssen-and Neisser- staining).

3rd week:
Lecture: Host defences against bacterial infections. Immunological basis of vaccination.
Practical: Culture techniques (culture conditions, media, colony morphology). Identification of bacteria (examination of biochemical activity). Diagnosis of anaerobic infections.

4th week:
Lecture: Passive and active immunization. Immunoglobulins. Vaccines.
Practical: Immunoserological methods in microbiological diagnosis (precipitation, agglutination, complement fixation, ELISA and western-blot).. Molecular diagnostic methods.

5th week:
Lecture: Principles of antibacterial chemotherapy, major groups of antibiotics and their mechanism of action. Mathematical description of the antibiotic effect. Antibiotic policy.
Practical: Methods for testing antibiotic susceptibility. Examination of antibiotic interactions.

6th week:
Lecture: Gram-positive cocci and rods. Gram-negative cocci. Acid-fast bacteria
Practical: Development and clinical trial of antibiotics.

7th week:
Lecture: Gram-negative coccobacilli. Gram-negative rods. Curved rods.
Seminar: Diagnosis of enteric bacterial infections.

8th week:
Lecture: Mycoplasms and obligatory intracellular bacteria. Spirochaetes.
Seminar: Bacterial respiratory infections. Antituberculotic agents.

9th week:
Lecture: Cell wall synthesis inhibitors.
Seminar: Bloodstream infections. Bacterial meningitis.

10th week:
Lecture: Protein synthesis inhibitors.
Seminar: Urinary tract infections. Bacterial sexually transmitted diseases (STD)

11th week:
Lecture: Antibiotics interfering with nucleic acid metabolism and antimetabolite antibiotics.
Seminar: Antibacterial agents for the treatment of meningitis and urinary tract infections. Antibiotics against anaerobic bacteria.

12th week:
Lecture: Fungal cell structure, physiology, virulence.
Seminar: Types and mechanisms of clinically relevant antibiotic resistance.

13th week:
Lecture: Antifungal agents. Medically important fungal pathogens.
Seminar: Diagnosis of fungal infections.

14th week:
Lecture: Normal flora. Pre-, pro- and synbiotics.
Seminar: Antimicrobial agents in clinical practice.

Requirements

Participation in the practical courses and seminars is obligatory. The Department may refuse to sign the students' Lecture book if they are absent from more than two practices or seminars in a semester.
At the end of 1st semester the student is required to take an end-semester examination based on the whole material of the lectures, practices and seminars of the semester. The examination consists of a written test and an oral examination.

Department of Pharmaceutical Technology

Subject: **PHARMACEUTICAL TECHNOLOGY THEORY IV.**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Stability. Determination of expiry date. In vitro-in vivo correlation. Absolute and relative bioavailability.

2nd week:
Lecture: Microcapsules. Microemulsions. Liposomes.

3rd week:
Lecture: Drug delivery in plastics ages.

4th week:
Lecture: Drug delivery in modern health I.

5th week:
Lecture: Drug delivery in modern health II.

6th week:
Lecture: Transdermal therapeutic system.

7th week:
Lecture: Nasal and inhalation therapeutic systems.

8th week:
Lecture:
Pharmaceutical and formulation consideration in medicine design.

9th week:
Lecture: Special aspects in the field of pediatrics and geriatrics.

10th week:
Lecture: Parenteral therapeutic system. Ocular therapeutic system.

11th week:
Lecture: Magic bullets, drug targeting. pharmaceutical biotechnology. Passive, active targeting.

12th week:
Lecture: Dragée. Coating. Types of coating.

13th week:
Lecture: Bioequivalent and biosimilar drugs.

14th week:
Lecture: Discussion for final exam.

Requirements

Students have to attend 30% of the lectures.

Requirements for signing the Lecture book:
The Department may refuse to sign the subject if the student didn't attend 30% of lectures according to attendance list.
At the end of semester students have oral exam. The prerequisite of oral exam is a written test before exam. If student doesn't write more then 60% and fail the written test, it is prohibited to take an oral exam and get a fail (1) mark.

Subject: **PHARMACEUTICAL TECHNOLOGY PRACTICE IV. (INDUSTRIAL PRACTICE III.)**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Practical: **42**

1st week:
Practical: Injections

2nd week:
Practical: Injectio natrii chlorati 100 mg/ml (Ph.Hg.VII.).
Injectio kalii chlorati 100 mg/ml (Ph.Hg.VII.)

3rd week:
Practical: Sterilization method in Autoclave.

4th week:
Practical: Injectio aethylmorphinii chlorati 20 mg/ml.
Injectio acidi ascorbici 10%.
Injectio procainii chlorati 20 mg/ml (Ph.Hg.VII.).
Injectio atropinii sulfurici 1 mg/ml (Ph.Hg.VII.)

5th week:
Practical: Injection Test.

6th week:
Practical: Industrial production of granules and tablets, Pharmacopoeial tests, dissolution tests

7th week:
Practical: Oral modified and controlled release tablets, theory and production.

8th week:
Practical: Pan coating, theory and practice, excipients and steps of sugar coating.

9th week:
Practical: Fluid bed coating.

10th week:
Practical: Test from tableting.

12th week:
Practical: Galenic preparation 1

13th week:
Practical: Galenic preparation 2

14th week:
Practical: Galenic preparation 3; Test from galenic preparation

Requirements

You have to attend every practical in Industrial Practice during the 14 weeks. If you are not able to go to practice, you have to bring us certification by a doctor. But on 1-2 occasions if you have very important activity, please foretell it us, and we will discuss when we have any possibility to replace you them. These occasions will be valid exception the tests.
You have 5 weeks tableting, galenic and aseptic lab as well. At the 13th week, you write a big test from both parts (tableting, galenic, aseptic) and get individual mark for every part. The average of these tree marks will be your practical mark. None of them can be a fail (1) mark. If you fail your test, you have got only one more chance to improve your test. If you get a fail mark for the improvement test, you have to write a test from both parts again and the mark of this test will be the final practical mark. In case you do not pass this test, you are not able to get the final signature from Industrial practice.
The final practical grade will be the average of tableting lab, galenic lab and aseptic lab marks but none of the marks can be fail (1).
If you want to improve your practical mark, you have to write an improvement test from both parts.

Department of Pharmacology

Subject: **PHARMACEUTICAL AND BIOANALYTICAL CHEMISTRY I.**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Lecture: **28**
Seminar: **14**

1st week:
Lecture: Introduction, the role of analytical and bioanalytical chemistry in pharmaceutical and medical sciences.
Seminar: Introduction, announcement of requirements.

2nd week:
Lecture: Sampling and sample preparation, preparation of applied materials and labor-wares.
Seminar: Functional groups.

3rd week:
Lecture: Sample preparation II.: LLE, CLLE, SPE, MEPS, SPME, LPME, ASE, MAE, SFE.
Seminar: Samples in the pharmaceutical industry.

4th week:
Lecture: Molecular spectroscopy I.: Base principles and application of IR spectroscopy in pharmaceutical sciences.
Seminar: System suitability, LOD, LOQ..

5th week:
Lecture: Structural identification of small organic compounds by mass spectrometry (EI-MS). Basics, construction of MS equipments (EI-CI-FAB-FIB-MALDI ion sources).
Seminar: Structure identification (IR, UV-VIS, EI-MS).

6th week:
Lecture: Molecular spectroscopy II.: Basics and application of UV-VIS spectrophotometry in drug metabolism and bioanalytics.
Seminar: Consultation from the lecture materials.

7th week:
Lecture: 1st Self-control test
Seminar: Demonstration of instruments and equipments (IR, UV-VIS, DI-MS, SPE, SPME, MEPS, etc.).
Self Control Test

8th week:
Lecture: Chromatographic separation I.: basic principles of chromatography, chromatographic techniques TLC, 2D TLC, affinity chromatography, column chromatography, SEC.
Seminar: Consultation of the 1st SCT.

9th week:
Lecture: Chromatographic separation II.: Basic principles and application of GC, HPLC and SFC in drug development and pharmaceutical industry.
Seminar: Calibration, chromatographic parameters.

10th week:
Lecture: Drugs, drug related substances, metabolites, degradation products in the environment (sources, effects, measurement possibilities, prevention).
Seminar: Units, unit conversion, dilution, concentration, calculation of concentration.

11th week:
Lecture: Classification of drug impurities.
Seminar: Instrumental demonstration (GC, HPLC).

12th week:
Lecture: Identification and measurement of drug impurities.
Seminar: Consultation from the lecture and seminar materials.

13th week:
Lecture: 2nd Self-control test
Seminar: Self-Control test
Self Control Test

14th week:
Lecture: Consultation
Seminar: Consultation

Requirements

At least 30 % of the lectures must be visited. Students have to write each of the two control tests and one from the seminar.

The requirements for the signature: I. the average of the self control tests from the theory must be minimum 40%. II. The result of the seminar test must be minimum 75%!

Subject: **PHARMACOLOGY PRACTICE I.**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Practical: **56**

1st week:
Practical: Introduction to pharmacology.

2nd week:
Practical: Receptors and signaltransduction.

3rd week:
Practical: Neurotransmission and neurotransmitters in the CNS.

4th week:
Practical: General anesthetics.

5th week:
Practical: Sedatohypnotics. Antidepressants and lithium. Antipsychotics.

6th week:
Practical: Antiepileptics.

7th week:
Practical: Pharmacologic management of Parkinsonism.

8th week:
Practical: Drugs used in Alzheimer’s Disease.

9th week:
Practical: Migraine.

10th week:
Practical: Central and peripheral skeletal muscle relaxants.

11th week:
Practical: Drugs with important actions on smooth muscle. Local anesthetics.

12th week:
Practical: Basic pharmacology.

13th week:
Practical: Cholinerg-activating and cholinoceptor-blocking drugs.

14th week:
Practical: Adrenoceptor-activating and blocking drugs. General consultation on the curriculum of the first semester.

Requirements

During the semester students have to take two exams. Requirements for the signature of the Lecture Book for the semester are at least a pass (2) on both exams. Attendance at seminars is compulsory: the signature may be refused in the case of absences from more than four seminars. Signature is compulsory for the student to be allowed to take the End of Semester Exam (ESE).
The average of the two mid-semester exams provides the grade of the Assessment of Workmanship (AW5) for the Pharmacology I. practice. In case the student does not reach a pass (2) on both mid-semester exams, the signature of the lecture book is refused, and the student fails the semester. In case the student does not reach a pass (2) on one of the mid-semester exams, the student must take a correction exam from all the topics of the semester on the last week of the semester. The grade of the correction exam will be averaged with the two mid-semester exams and this average will give the grade of the AW5 for the Pharmacology I. Practice. Further correction of this AW5 grade is not an option.

Subject: **PHARMACOLOGY THEORY I.**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Lecture: **56**

1st week:
Lecture: Introduction to pharmacology of CNS drugs. Neurotransmission and the CNS. General anesthetics.

2nd week:
Lecture: Opioid analgesics and antagonists.

3rd week:
Lecture: Drugs of abuse.

4th week:
Lecture: Sedatohypnotics.

5th week:
Lecture: Antidepressants II and lithium. Antipsychotics.

6th week:
Lecture: Antiepileptics.

7th week:
Lecture: Pharmacologic management of Parkinsonism

8th week:
Lecture: Drugs used in Alzheimer’s Disease

9th week:
Lecture: Pharmacology of ANS drugs

10th week:
Lecture: Migraine. Skeletal Muscle Relaxants.

11th week:
Lecture: Drugs with important actions on smooth muscle. Local anesthetics.

12th week:
Lecture: Basic pharmacology

13th week:
Lecture: Cholinerg-activating drugs.Cholinoceptor-blocking drugs.

14th week:
Lecture: Adrenoceptor-activating drugs. Adrenoceptor-blocking drugs. Pharmacology of eye.

Requirements

During the semester students have to take two exams. Requirements for the signature of the Lecture Book for the semester are at least a pass (2) on both exams.

Attendance at seminars is compulsory: the signature may be refused in the case of absences from more than four seminars. Signature is compulsory for the student to be allowed to take the End of Semester Exam (ESE).
At the end of the semester from Pharmacology I. theory students take End of Semester Exam (ESE) which is oral. Students draw 3 exam titles from the topics of the first semester.
During the semester there is an opportunity to be freed from the constraint of the End of Semester Exam. Without taking the exam, students are offered the grade calculated from the two exams passed during the semester if it is at least good (4) or excellent (5). Correction of the offered grade is in the form of taking the oral End of Semester Exam instead. The result of the exam can be better or even worse than the offered grade.

Department of Public Health and Epidemiology

Subject: **PREVENTIVE MEDICINE AND PUBLIC HEALTH**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Lecture: **28**
Seminar: **22**
Practical: **8**

1st week:
Lecture: 1. The history, scope and methods of public health and preventive medicine, major public health issues in developing and developed countries
2. Introduction to human ecology
Seminar: 1-2. Demographical methods to study the health status of the population

2nd week:
Lecture: 3. Air pollution and health
4. Water pollution and health
Seminar: 3-4. Principles of prevention

3rd week:
Lecture: 5.Health hazards of ionising radiation and radioactive substances
6. Toxicology of organic solvents and pesticides
Seminar: 5-6. Occupational health and safety in pharmacist practice.

4th week:
Lecture: 7. Malnutrition, Nutritional deficiency diseases
8. Foodborne diseases, Diet related chronic diseases, Obesity
Seminar: 7-8. Financing the supply of medicines I.

5th week:
Lecture: 9.Health effect of noise and vibration
10. Heavy metals in the human environment
Seminar: 9-10. Financing the supply of medicines II.

6th week:
Lecture: 11.Global environmental changes and human health
12. Public health consequences of substance abuse
Seminar: 11-12. Cadmium toxicity, case study

7th week:
Lecture: 13.Socioeconomic determinants of health, inequality and health
14. Lifestyle and health
Seminar: 13-14. Health promotion, Health education

8th week:
Lecture: 15. Introduction into the general epidemiology of non-communicable diseases
16. Epidemiology of mental diseases
Seminar: 15-16. Midterm test

9th week:
Lecture: 17.Epidemiology of neoplastic diseases
18. Epidemiology of cardiovascular diseases
Seminar: 17-18. Epidemiological measures and studies

10th week:
Lecture: 19.Epidemiology of skeletal and dental diseases
20. Epidemiology of chronic respiratory diseases
Seminar: 19-20. Preventive strategies

11th week:
Lecture: 21.Introduction into the general epidemiology of communicable diseases
22.Epidemiology of communicable diseases transmitted through the skin and sexually transmitted diseases
Seminar: 21-22. Reporting and control of communicable diseases, vaccination

12th week:
Lecture: 23.Epidemiology of nosocomial infections
24.Epidemiology of respiratory infectious diseases
Seminar: 23-24. Global Burden of Disease database

13th week:
Lecture: 25. Epidemiology of viral hepatitis
26. Health policy principles
Seminar: 25-26. Sterilization and disinfection

14th week:
Lecture: 27. Health care systems of developed countries
28. Needs, demands and use of health services
Seminar: 27-28. Hospital infection control

Requirements

Requirements for signing the lecture book:
Attendance of lectures is highly recommended. Attendance of the seminars is obligatory. The academic adviser refuse to sign the lecture book if a student is absent more than two times from the seminars even if he/she has an acceptable excuse. Students should also perform a midterm test on the 8th week of the semester. The midterm test covers the topics of all lectures and seminars held in the first 7 weeks of the semester. There is no possibility to repeat this test during the semester and examination period. The mark of the midterm test will be included in the calculation of the final average mark of the subject.

Requirements for the final exam:
The final exam involves written and oral sections covering the topics of all lectures and seminars of the subject. The oral exam covers the topics of all seminars of the semester. The written exam consists of multiple choice test questions related to Environmental Health, Epidemiology and Health Policy. Each section is evaluated separately. The final exam is assessed on the basis of the average of five marks including the result of midterm test, and the results of Environmental Health, Epidemiology, Health Policy tests, and mark of the oral exam. It is failed if either the oral or any part (Environmental Health, Epidemiology, Health Policy) of the written exam is graded unsatisfactory. Students should repeat only that/those section/sections of the final exam that has/have been previously unsuccessful. In this case the final exam is graded according to the average of the passing marks obtained on the first and repeated exams.

Type of exam:
final exam after one semester (ESE)
Prerequisites: completion of immunology and clinical biochemistry II. subjects

Course description
The course covers the main areas of public health: environmental health including the health consequences of air and water pollution, occupational and nutritional health; the principles of epidemiology, the epidemiology and control of communicable and non-communicable diseases. Special attention is given on the main topics underlying nutritional disorders and deficiencies, health hazards of pharmacist' practice and preventive strategies.

Requirements
To acquire knowledge about the principles and the most important issues of environmental health, communicable and non-communicable diseases and health policy.

Methods of education
The education of the subject is based on lectures and seminars. The practical adaptation of the topics of lectures are highly promoted by seminars. Students will learn about the major public health issues in developing and developed countries and organisation of public health services. During the epidemiology seminars students will learn how to calculate the most important indicators for the measurement of morbidity and mortality. In addition, the epidemiology of communicable and non-communicable diseases will be discussed in detail.

Department of Behavioural Sciences

Subject: **BIOETHICS**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Introduction

2nd week:
Lecture: General Ethics Introduction – philosophical and conceptual overview

3rd week:
Lecture: Modern Medical Ethics – its evolution, character-traits and relation to its predecessors.

4th week:
Lecture: Patient Rights – their history,

importance and challenges in the modern healthcare systems

5th week:
Lecture: End of Life Decisions – withholding and –drawing treatments, futility, triage

6th week:
Lecture: Fundamental Ethical Questions of Human Trials and Research Integrity

7th week:
Lecture: Casuistry as a Means of Analysis – 1st case analysis

8th week:
Lecture: Questions of Patient Rights and Justice – 2nd case analysis

9th week:
Lecture: End of Life Decision, Questions re. Comatose and Vegetative patients – 3rd case analysis

10th week:
Lecture: Challenges of Research Ethics – 4th case analysis

11th week:
Lecture: Ethical Questions of Reproduction – abortion, eugenics, and the sociopolitical aspects of bioethics

12th week:
Lecture: Ethical Questions of Pharmacy – Marketing, COI

13th week:
Lecture: Ethical Questions of Pharmacy – RCT-s, research integrity

14th week:
Lecture: Wrap-up

Requirements

Requirements:
Grade: Colloquium, offered grade can be given based on activity and presentation

Requirement of the signature: making a presentation

Compulsory readings:
Gregory E. Pence - Medical Ethics -Accounts of Ground-Breaking Cases McGraw-Hill Education, 2016
Guidry-Grimes, Laura, Veatch, Robert - The Basics of Bioethics – Routledge, 2019

About the course:
The course outlines and explores the basics of modern bioethics. It helps students orienting in the diverse questions of contemporary bioethics – ranging from its ethical foundations, theories and argumentation, through patient rights and the questions of autonomy, to the end of life decisions and research ethics issues.
On top of laying down the theoretical and conceptual grounds of the subject matter, the course aims to map the national and international legal frameworks and policy environment. Besides, the course's purpose is to train those competences which enables the students to interpret and critically reflect upon the actual laws through general and professional ethical norms, by means of developing their rhetorical, logical and philosophical skills.

Department of Biopharmacy

Subject: **PHARMACEUTICAL BIOANALYTICS AND BIOTECHNOLOGY II.**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **28**
Practical: **56**

1st week:
Lecture: Immunoanalytical methods I.: Southern-blotting, Northern-blotting, Western-blotting, dot-blot
Practical: Introduction, laboratory safety instructions.

2nd week:
Lecture: Immunoanalitycal methods II.: RIA, ELISA, IHC.
Practical: Protein isolation

3rd week:
Lecture: Isolation of nucleic acids, types of gel electrophoresis, SCG, DNS-chip, Comet assay.
Practical: Protein isolation

4th week:
Lecture: PCR, RT-PCR: basic principles and practical applications.
Practical: Western-blot

5th week:
Lecture: Synthesis of oligonucleotides and peptides. Sequencing of nucleic acids and proteins.
Practical: Western-blot

6th week:
Lecture: Basic principles of proteomics, applications in medical and pharmaceutical research.
Practical: Isolation of nucleic acids, agarose gel electrophoresis.

7th week:
Lecture: Basics and application in the pharmaceutical research and clinical diagnosis.
Practical: Isolation of nucleic acids, agarose gel electrophoresis.
Self Control Test

8th week:
Lecture: Analytical techniques in clinical diagnosis of selected diseases, laboratory tests.
Practical: Immunohistochemistry.

9th week:
Lecture: Therapeutic Drug Monitoring.
Practical: TLC

10th week:
Lecture: Toxicology. Instrumental analysis of some selected drugs.
Practical: RIA.

11th week:
Lecture: Bioanalysis: the role and importance of bioanalytical experiments in drug research and drug development.
Practical: PCR, RT-PCR.

12th week:
Lecture: Analytical aspects of quality insurance in the pharmaceutical industry.
Practical: ELISA

13th week:
Lecture: Environmental rules, prescriptions and applied analytical methods and techniques in the pharmaceutical industry.
Practical: Microarray

14th week:
Lecture: Self Control Test

Requirements

At least 30% of the lectures must be visited. Absence of more than one practice is not allowed during the semester. Students have to write two self control tests, in the middle of the semester and at the end of the semester.
Only students having adequately fulfilled the requirements of practice are allowed to get the signature and take final comprehensive oral exam covering the two semesters.

Department of Clinical Pharmacology

Subject: **CLINICAL BASICS**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **56**
Seminar: **28**

1st week:
Lecture: Angina pectoris, myocardial infarction. Cardiac arrhytmias.
Seminar: Introduction.

2nd week:
Lecture: Hypertension. Hyperlipidemias.
Seminar: Heart failure.

3rd week:
Lecture: Diabetes mellitus.

4th week:
Lecture: Diseases of the upper respiratory tract. Bronchial asthma. Allergy.
Seminar: Urological and kidney diseases.

5th week:
Lecture: Hematology.
Seminar: Anticoagulant therapy.

6th week:
Lecture: Adrenal diseases, Ca-metabolism. Ostoeoporosis.
Seminar: Diseases of the thyroid gland and hypophysis.

7th week:
Lecture: Neurological symptoms and diseases.

8th week:
Lecture: Obstetrics and gynecology.
Seminar: Endocrinology, case report.

9th week:
Lecture: Inflammatory bowel diseases. Tumors of the GI tract. Hepatitis, liver failure. Gastroesophageal reflux disease, gastritis. GI ulcers.

10th week:
Lecture: Alcohol and drug dependencies. Psychiatric drug therapy. Dementia. Depression, mood disorders.

11th week:
Lecture: Autoimmune diseases.

12th week:
Lecture: Pediatric diseases.
Seminar: Pediatric emergency.

13th week:
Lecture: Rheumatic diseases, Degenerative joint diseases, gout.

14th week:
Lecture: Oncology, biological therapy.
Seminar: Consultation.

Department of Medical Microbiology

Subject: **MEDICAL MICROBIOLOGY II.**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **14**
Seminar: **14**

1st week:
Lecture: Human pathogenic protozoa I.
Seminar: Antimalarial drugs. Development of malaria vaccine.

2nd week:
Lecture: Human pathogenic protozoa II.
Seminar: Antiprotozoal drugs.

3rd week:
Lecture: Medically important cestodes and trematodes.
Seminar: Antihelminthic drugs I.

4th week:
Lecture: Medically important nematodes.
Seminar: Antihelmintic drugs II. Drugs against ectoparasites.

5th week:
Lecture: General properties of viruses, pathogenesis, replication strategies.
Seminar: Diagnosis of viral infections, culturing, serology.

6th week:
Lecture: Antiviral agents.
Seminar: Determination of susceptibility to antiviral agents.

7th week:
Lecture: Herpesviruses.
Seminar: Treatment and vaccination of herpes infections.

8th week:
Lecture: Hepatitis viruses.
Seminar: Treatment, vaccination and diagnosis of viral hepatitis.

9th week:
Lecture: DNA viruses: Adeno, Parvo, Papilloma, Pox
Seminar: Congenital and neonatal virus infection.

10th week:
Lecture: Medically important RNA viruses.
Seminar: Treatment and vaccination of respiratory viruses.

11th week:
Lecture: Medically important arbo and robo viruses.
Seminar: Diagnosis of enteric viral infections.

12th week:
Lecture: HIV virus
Seminar: Opportunistic infections.

13th week:
Lecture: Prions
Seminar: Microbial control of pharmaceutical products.

14th week:
Lecture: Sterilization and disinfections.
Seminar: Standards of microbial purity of pharmaceutical products.

Requirements

Participation in the practical courses and seminars is obligatory. The Department may refuse to sign the students' Lecture book if they are absent from more than two practices or seminars in a semester. At the end of the 2nd semester the student is required to take a final examination based on the whole material taught in the Medical Microbiology course. The final examination consists of a written test and oral examination.

Department of Pharmaceutical Surveillance and Economics

Subject: **PHARMACEUTICAL MANAGEMENT AND ORGANISATION**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Scope, goals and tools of Pharmaceutical Management: definition of the main tasks of management, specific aspects of a medicinal product, characteristics of the national and international drug market, international trends in marketing and health care. The trends on pharmaceutical business Statistical and scientific approaches evaluating the health parameters of the country: epidemiology and demographics of the country, (population, life span, death rate, median age. life expectancy, incidence rates).

2nd week:
Lecture: Health care and financing in a macro level, Involvements of the government in health care: principles of central solidarity, benefits for public Health care systems and funds: (funds and costs of national health care system, the drug reimbursement system. social network, centralized vs private hospitals, impacts of economy on the health care funds and relation to macroeconomic indicators GDP, GNP, GVA, GDP, unemployment rate, etc).

3rd week:
Lecture: Specific goals and approach of Health Technology Assessment (HTA). Scientific approach evaluating the health status of individuals: Quality of Life assessments. Impact of Evidence Based Medicine and trials in relation to the processes of national and international drug development and marketing authorization (registration).

4th week:
Lecture: Retail Pharmacy – types of business, function, startup requirements, settlement of daily work. Regulations, laws, guidelines, directives. The legal base of Pharmacy operation and registration of a pharmacy unit. Technical requirements of pharmacy.

5th week:
Lecture: Pharmaceutical product supply. The organization of the drug supply in selected countries.. Drug manufacturing and distribution process from manufacturers to patients. Pricing aspects: manufacturing costs, wholesale margin, marketing costs and, „retail price" of the medicinal product.

6th week:
Lecture: Pharmacy – as an Operation of a business unit: Costs, revenue, stocks, costs of staff and liquidity rules. Taxation, social contributions. Human resources management and employment

7th week:
Lecture: Managing the sales and the product portfolio. The importance of the OTC versus prescriptional (Rx) products. (main characteristics of product lines, consideration of safety and economics, generic versus an innovative product).

8th week:
Lecture: The roles of the Health Authorities and the National Pharmacy Officer. Quality Assurance, GMP, GLP, GCP, GPP. The concepts and the most important categories of quality

definitions. International organizations for pharmacists.

9th week:
Lecture: Drug marketing: drug information, advertisement, medical and pharmacy representatives. Life cycle of the drugs. Concept of marketing in a generics and OTC drugs. Marketing goals during the drug distribution process by contributors, wholesalers and distributors.

10th week:
Lecture: Marketing and advertising rules, Ethical issues in the pharmaceutical distribution and care . Ethical Codex for sales. Concept of Evidence Based Medicine.

11th week:
Lecture: The preclinical and clinical phases of the research and development. Specific goals of a clinical trial: proof of concept, safety, efficacy. Drug development: The aspects of human rights and ethics in clinical trials: ICH-GCP guidelines, concerns about the use of placebo, healthy volunteers and patients- Vulnerable patients groups (children, pregnant, elderly).

12th week:
Lecture: Critical steps of the innovative drug research – drug development process and the final characteristics of medicinal products. The legal base of pharmaceutical product registration, Innovative versus generic development. Drug development: the specific aims of the preclinical and clinical phases. Laboratory and animal models, human Phase I. – Phase IV. Impact of a “Go/ No go” decision during drug development.

13th week:
Lecture: Drug Utilisation studies, medicinal product consumption and the use of big-data. Prevention, public healthcare and pharmaco-epidemiology. Scientific approach and statistical parameters evaluating the health status of population.

14th week:
Lecture: Consultation on selected topics of pharm management.

Requirements

Concerning attendance of classes, the rules in the Regulations Governing Admission, Education and Examinations of the University of Debrecen are valid.

Conditions of signing the lecture book (by the end of semester):
Participation in at least three (3) of 6 interim tests are required for the signature. Those ones who failed will be required to pass the "end of semester test" in order to obtain signatures.

Exam (semifinal, colloquium)
The exam will be written and oral exam at the end of the semester which covers all the topics of the semester taken in the lectures or seminars. Written part includes a TEST (single choice, multiple choice, short description or definitions, etc.) and an Oral part (Two topics from selected list of questions provided.)
Grade (semifinal mark)
The average of the three scores (Test, Topic-1 Topic-2) compose the final mark (1-5 grades). Exemption (full or partial) may be earned - only for those student who had at least 5 tests taken successfully during the semester and reached at least 70%.

Changes for emergency phase:
Classes are held in the form of distance learning, following to the original schedule in a form of webinar/eLearning platform. Attendance on the on-line lectures or electronic attendance register is not obligatory for the students.

The lecture materials are uploaded to eLearning system, this is the official material of exam.

Registered students regularly receive lecture-specific questions by each week that will need to be answered and worked out individually; alternatively a short test will be opened that should be filled-out related to the topics of the given lecture. Once ready with the answers, it should be uploaded/ or sent back – that will "validate" the attendance of the student and facilitate the understanding the topics of lecture for the week.
Students will have to participate on two obligatory interim tests during elearning period of the semester. There will be one occasion announced for retake-test for all students concerned both tests in order to complete the missed tests or to to gain improvement..

The Dean of the Faculty could permit electronic exams.
Students should write a summary –type of assay on topics related to materials covered and then present in form of an oral presentation (on-line).
Based on the above mentioned criteria, students will be graded with a proposed mark.

Department of Pharmaceutical Technology

Subject: **INDUSTRIAL PHARMACEUTICAL TECHNOLOGY**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **28**
Practical: **14**

1st week:
Lecture: Treatment of working atmospheres Filtration of working atmospheres

2nd week:
Lecture: Iso-technology

3rd week:
Lecture: Dissolution Lyophilization

4th week:
Lecture: Filtration of liquids Sterilization

5th week:
Lecture: Solid Forms I. Mixing process

6th week:
Lecture: Solid Forms II: Conversion into dosage form.

7th week:
Lecture: Semi-Solid Forms I. Soft gelatin capsules

8th week:
Lecture: Packaging

9th week:
Lecture: Liquid Forms I. Content of liquid forms

10th week:
Lecture: Materials of containers for liquid forms

11th week:
Lecture: Liquid Forms II. Preparation of liquid forms

12th week:
Lecture: Filling of liquid forms Design of production plants

13th week:
Lecture: Semi-Solid Forms II. Transdermal systems

14th week:
Lecture: Consultation

Requirements

Students have to attend 30% of the lectures. All materials covered in lectures is an integral part of the subject and therefore included in the self-control test and the final exam.

Requirements for signing the Lecture book:
The Department may refuse to sign the lecture book if the student didn't attend 30% of lectures.

Department of Pharmacology

Subject: **PHARMACEUTICAL AND BIOANALYTICAL CHEMISTRY II.**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **28**
Practical: **56**

1st week:
Lecture: The fate of the drugs in the body (ADMER).
Practical: Introduction, laboratory safety instructions.

2nd week:
Lecture: Bioanalysis in the pharmaceutical industry.
Practical: Gas chromatography (GC): analysis of alcohols.

3rd week:
Lecture: Techniques used for modeling oxidative and non-oxidative drug metabolism.
Practical: Infrared spectroscopy (IR)

4th week:
Lecture: In vitro and ex vivo techniques in the drug metabolism studies.
Practical: High Performance Liquid Chromatography (HPLC).

5th week:
Lecture: Antioxidants
Practical: Mass spectrometry (DI-EI-MS): structural analysis of small organic compounds.

6th week:
Lecture: Antioxidant assays.
Practical:
Ultraviolet-Visible (UV-VIS) spectrophotometry.

7th week:
Lecture: 1st self-control.
Practical: Sample preparation (LLE, CLLE, SPE, SPME, MEPS).
Self Control Test

8th week:
Lecture: MS in bioanalysis. Basic principles, APIs, analysers, detectors, vacuum system.
Practical: SPME.

9th week:
Lecture: Hyphenated techniques (GC-MS, LC-MS, SFC-MS, MS-MS).
Practical: UV-VIS-II.: Galvinoxyl assay

10th week:
Lecture: Biosensors.
Practical: GC-MS: qualitative analysis of an unknown powder mixture.

11th week:
Lecture: Validation.
Practical: Modeling drug metabolism: EC-MS, Fenton-reaction.

12th week:
Lecture: Analytical aspects of human drug development.
Practical: LC-MS/MS

13th week:
Lecture: 2nd Self-control test
Practical: Self-control test

Self Control Test

14th week:
Lecture: Consultation
Practical: Consultation

Requirements

At least 30 % of the lectures must be visited. Students have to write each of the two control tests and one from the practice. The requirements for the signature: I. the average of the self control tests from the theory must be minimum 40%. II. The result of the practice test must be minimum 60%!
According to the emergency situation in this semester (2020-2nd semester) the tests will be carried out via the e-learning system.
The Final exam will be carried out according to the instructions of the Faculty management (Dean and vice-Dean).

Subject: **PHARMACOLOGY PRACTICE II.**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Practical: **56**

1st week:
Practical: Introduction to Pharmacology II.

2nd week:
Practical: Experimental demonstration I.

3rd week:
Practical: Experimental demonstration II.

4th week:
Practical: Experimental demonstration III.

5th week:
Practical: Experimental demonstration IV.

6th week:
Practical: Antihypertensive agents

7th week:
Practical: Hypothalamic and pituitary hormones. Diabetes mellitus and antidiabetic drugs. General characteristics of steroid hormones. Adrenocorticosteroids and adrenocortical antagonists.

8th week:
Practical: The gonadal hormones and inhibitors. Uterotonics, tocolytics. Agents that affect bone mineral homeostasis. Thyroid and antithyroid drugs.

9th week:
Practical: Drugs used in acid-peptic disease. Gastro-oesophagal reflux disease (GERD). Drugs promoting gastrointestinal motility. Antiemetic drugs. Laxatives. Antidiarrheal drugs.

10th week:
Practical: Drugs used in the treatment of chronic inflammatory bowel disease. Pancreatic enzyme replacement products. Pharmacology of the liver. Regulation of the appetite. Pharmacotherapy of obesity. Gerontopharmacology.

11th week:
Practical: Histamine and antihistaminic drugs. Serotonin, agonists and antagonists.

12th week:
Practical: Antifungal agents. Antiparasitic chemotherapy: basic principles. Antiprotozoal drugs. Anthelmintic drugs.

13th week:
Practical: Immunpharmacology

14th week:
Practical: Cancer chemotherap. General consultation on the curriculum of the second semester.

Requirements

During the semester students have to take two exams. Requirements for the signature of the Lecture Book for the semester are at least a pass (2) on both exams.

Attendance at seminars is compulsory: the signature may be refused in the case of absences from more than four seminars. Signature is compulsory for the student to be allowed to take the Final Exam (FE).
The average of the two mid-semester exams provides the grade of the Assessment of Workmanship (AW5) for the Pharmacology II. practice. In case the student does not reach a pass (2) on both mid-semester exams, the signature of the lecture book is refused, and the student fails the semester. In case the student does not reach a pass (2) on one of the mid-semester exams, the student must take a correction exam from all the topics of the semester on the last week of the semester. The grade of the correction exam will be averaged with the two mid-semester exams and this average will give the grade of the Assessment of Workmanship (AW5) for the Pharmacology II. practice. Further correction of this AW5 grade is not an option.

Subject: **PHARMACOLOGY THEORY II.**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **56**

1st week:
Lecture: Myocardial ischemia, antianginal drugs. Drugs used in heart failure.

2nd week:
Lecture: Agents used in cardiac arrhythmias

3rd week:
Lecture: Antihypertensive agents Agents used in hyperlipidemia

4th week:
Lecture: Bronchodilators and other agents used in asthma.

5th week:
Lecture: Diuretics and antidiuretics Drugs used in disorders of coagulation.

6th week:
Lecture: Introduction to the pharmacology of the endocrinology. Hypothalamic and pituitary hormones.

7th week:
Lecture: Diabetes mellitus and antidiabetic drugs. General characteristics of steroid hormones. Adrenocorticosteroids and adrenocortical antagonists.

8th week:
Lecture: The gonadal hormones and inhibitors. Uterotonics, tocolytics. Agents that affect bone mineral homeostasis. Thyroid and antithyroid drugs.

9th week:
Lecture: Introduction to the pharmacology of gastroenterology. Drugs used in acid-peptic disease. Gastro-oesophagal reflux disease (GERD). Drugs promoting gastrointestinal motility. Antiemetic drugs. Laxatives. Antidiarrheal drugs.

10th week:
Lecture: Drugs used in the treatment of chronic

inflammatory bowel disease. Pancreatic enzyme replacement products. Pharmacology of the liver.Regulation of the appetite. Pharmacotherapy of obesity. Gerontopharmacology.

11th week:
Lecture: Pharmacology of the inflammation, steroid and non-steroid anti-inflammatory drugs, the ergot alkaloids. Pharmacotherapy of rheumatoid arthritis.

12th week:
Lecture: Beta-lactam antibiotics. Chloramphenicol, tetracyclines, aminoglycosides. Macrolides. Quinolones. Antiviral chemotherapy and prophylaxis.

13th week:
Lecture: Immunpharmacology

14th week:
Lecture: Cancer chemotherap. Toxicology

Requirements

During the semester students have to take two exams. Requirements for the signature of the Lecture Book for the semester are at least a pass (2) on both exams. Attendance at seminars is compulsory: the signature may be refused in the case of absences from more than four seminars. Signature is compulsory for the student to be allowed to take the Final Exam (FE).
At the end of the semester from Pharmacology II. theory students take Final Exam (FE) which is oral. Students draw 2 exam titles from the topics of the second semester and 1 exam title from the topics of the first semester.

CHAPTER 20
ACADEMIC PROGRAM FOR THE 5TH YEAR

Department of Biopharmacy

Subject: **BIOPHARMACY**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **28**
Practical: **28**

1st week:
Lecture: Fundamentals to biopharmacy.
Practical: Basic pharmacokinetic parameters.

2nd week:
Lecture: The LADMER system and its components.
Practical: Volume of Distribution, Clearance, Half-life.

3rd week:
Lecture: Liberation, absorption, distribution, metabolism, elimination, response.
Practical: One-compartment open model.

4th week:
Lecture: Drug release from the delivery system, bioavailability of the drug at the absorption site.
Practical: Continuous and intermittent drug delivery.

5th week:
Lecture: Drug clearance, hepatic drug elimination, renal drug elimination.
Practical: Equations, pharmacokinetic calculations.

6th week:
Lecture: Drug transport. Active and passive transport.
Practical: Equations, pharmacokinetic calculations II.

7th week:
Lecture: Type of drug delivery systems.
Practical: Equations, pharmacokinetic calculations III.

8th week:
Lecture: Biopharmacy of tables and capsules.
Practical: Equations, pharmacokinetic calculations IV.

9th week:
Lecture: Oral controlled release.
Practical: Equations, pharmacokinetic calculations V.

10th week:
Lecture: Delivering drugs by inhalation.
Practical: Equations, pharmacokinetic calculations VI.

11th week:
Lecture: Transdermal system.
Practical: Equations, pharmacokinetic calculations VII.

12th week:
Lecture: Time-programmed and patient-controlled drug delivery.
Practical: Equations, pharmacokinetic calculations VIII.

13th week:
Lecture: Smart drug delivery system and targeted therapy.
Practical: Equations, pharmacokinetic calculations IX.

14th week:
Lecture: Pharmaceutical biotechnology.
Practical: End of semester control test

Requirements

At least 30% of the lectures must be visited. Absence of more than one practice is not allowed during the semester. Students have to write end of semester control test. Only students having adequately fulfilled the requirements of practice are allowed to get the signature and take the final oral exam.

Subject: **PHARMACEUTICAL CARE**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Pharmaceutical care (history, subject, theory, basic)

2nd week:
Lecture: Medication therapy management (subject, concept, theory)

3rd week:
Lecture: International pharmaceutical care protocols

4th week:
Lecture: Pharmaceutical care in Metabolic Syndrome

5th week:
Lecture: Diabetes prevention and pharm. care

6th week:
Lecture: Dyslipidemia and hypertension

7th week:
Lecture: Practice and theory of cholesterol, glucose, INR, and blood pressure measurement I.

8th week:
Lecture: Practice and theory of cholesterol, glucose, INR, and blood pressure measurement II.

9th week:
Lecture: Nutrition, diet and pharm. care I (theory, BMI, calculations, prevention, nutrition piramid)

10th week:
Lecture: Nutrition, diet and pharm. care II (special diet and nutrition, special diet in metabolic syndrome and in oncology patients)

11th week:
Lecture: Pharmaceutical care and it's limitation (in cold, cough, flu, upper respiratory problems, fever, sunburn etc.)

12th week:
Lecture: Asthma, COPD and special inhalation medication.

13th week:
Lecture: Pharmaceutical care in reflux problems, heart burn, etc.

14th week:
Lecture: Pharm. care in hemostasis (coagulation, measurement etc.)

Requirements

At least 30% of the lectures must be visited. There is no self control test during the semester. Only students having adequately fulfilled the requirements are allowed to get the signature and take the final exam.

Department of Clinical Pharmacology

Subject: **CLINICAL PHARMACOLOGY**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Basic principles of Clinical Pharmacology.

2nd week:
Lecture: Ethical and legal aspects.

3rd week:
Lecture: The study phases (I-II).

4th week:
Lecture: The study phases (III-IV).

5th week:
Lecture: The clinical trial protocol.

6th week:
Lecture: The GCP requirements in Clinical Pharmacology.

7th week:
Lecture: Study Report (Clinical, Final).

8th week:
Lecture: Statistical methods in Clinical Pharmacology.

9th week:
Lecture: Quality Assurance in Clinical Pharmacology.

10th week:
Lecture: Adverse events, serious adverse events, side effect.

11th week:
Lecture: Patient Information and Informed Consent.

12th week:
Lecture: Practical experience in an ongoing study.

13th week:
Lecture: Visit of a pharmaceutical company.

Requirements

The aim of this course is to introduce the students into a rapidly developing and evolving subject. Clinical Pharmacology is not merely a link between Pharmacology and Clinical Medicine. The objective is to enhance the understanding of how drugs act and may be best used in the clinic, how compounds are transformed into drugs, how clinical trials are conducted.

Requirements of admission: after 4 years of pharmaceutical or medical studies

Speakers:
Miklós Bodor, M.D., Ph.D., Associate Professor, Head of the Division of Clinical Pharmacology
Péter Kovács, M.D., Ph.D., D.Sc, Professor in Pharmacology
Sándor Somodi, M.D., Ph.D., Assistant Professor

Required infrastructure: lecture hall, library
Examination: oral and written
Literature: special papers and handbooks will be provided

Department of Pharmaceutical Chemistry

Subject: **QUALITY CONTROL**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Definition and history of quality management. Basics of quality policy. Definitions of Quality Assurance (QA) and Quality Control (QC).

2nd week:
Lecture: Elements of Total Quality Management (TQM). Key issues of establishing TQM. The Six Sigma concept. Construction of a Project Quality Plan.

3rd week:
Lecture: Quality in the manufacturing and marketing activity. The quality circle. Quality improvement tools and techniques. Quality systems: the history of development and basics of the ISO system of standards.

4th week:
Lecture: Relationship between the elements of quality management, QA, GMP and QC. The GXP system for drug production and distribution. Good Pharmacy Practice (GPP). Philosophy, elements and directives of GPP. Guidelines for GPP requirements in practice.

5th week:
Lecture: The role of the GXP system during the life cycle of medicines and drug-can-didates. The concept of Good Manufacturing Practice (GMP) requirements. Application of GMP: quality management.

6th week:
Lecture: Application of GMP: personnel aspects; premises and equipment.

7th week:
Lecture: Application of GMP: documentation.

8th week:
Lecture: Application of GMP: production, manufacturing.

9th week:
Lecture: Application of GMP: contract manufacture and analysis; complaints and recalls; self-inspection. Validation: basic concepts of Good Validation Practice (GVP).

10th week:
Lecture: Basics of Good Distribution Practice (GDP). Personnel aspects of quality management infrastructure: responsibilities of the key personnel (production leaders and quality managers). The phenomenon of Qualified Person (QP).

11th week:
Lecture: The cost of quality: failure costs, prevention costs, appraisal costs. Sterile drug production: GMP requirements, methods of sterilization.

12th week:
Lecture: Definition and elements of Good Laboratory Practice (GLP). Documentation of the laboratory examinations and experiences. Good Control Laboratory Practice (GCLP). Essentials of Good Clinical Practice (GCP). Quality assurance of GCP. ICH GCP guidelines.

13th week:
Lecture: Inspections and auditing. International harmonization of inspections (PIC/S; ICH). WHO Guidelines for inspections.

14th week:
Lecture: The Drug Registration procedure. Approval by the EU Member State authorities (EMEA). The US Federal Food and Drug Administration (FDA): Office of Regulatory

Affairs (ORA). FDA Center for Drug Evaluation and Research (CDER). FDA quality system regulations for drug approval. Counterfeit medicines.

Requirements

Within the pharmaceutical industry, quality is the key issue that has to be addressed above all others. It is the reason that so many regulations, guidelines and controls are important and applied. The course "Quality assurance" deals with quality in its widest sense, reviewing the International Standards Organization (ISO) series of standards, generic instruments such as Total Quality Management (TQM) and industry-specific topics like Good Manufacturing Practice (GMP). The conduct of pre-clinical and clinical studies of drug-candidates is controlled by a variety of regulations and guidelines known collectively as Good Laboratory Practice (GLP) and Good Clinical Practice (GCP), respectively. The assurance of safety and efficacy of pharmaceuticals from the time they leave the factory to the point at which they are used by the patient is the concept of Good Distribution Practice (GDP) and Good Pharmacy Practice (GPP), which latter is also essentially obliged to take care of patients under physician-controlled- and self-medication.

Examination: written.

Department of Pharmaceutical Surveillance and Economics

Subject: **CLINICAL PHARMACY**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **28**
Seminar: **42**

1st week:
Lecture: Introduction. The place of hospital and clinical pharmacy in the science. The hospital and clinical pharmacist's place, role, task and relations within healthcare system. The place, task and role of hospital pharmacy in the medicine supply at a hospital. Regulations. Research and education in the field of hospital and clinical pharmacy.

Seminar: Documents on ward (patient's record, file, charts, medication records, controlled drug records). Records in the hospital pharmacy.

2nd week:
Lecture: Order, storage, dispensing and control of medicines. Procurement, public procurement. '9R's. Financing. Formularies. Medication errors. Medicine distribution systems (stock system, traditional, unit dose, daily dose). Medicine information. Clinical pharmacy services.
Seminar: Medication therapy management. MedRec. Pharmaceutical calculations. MAI, STOPP/START, PIM, Naranjo-scale.

3rd week:
Lecture: Therapeutic drug monitoring. The effects of medicines on the lab test findings. Changes of the lab findings due to medicine as an adverse drug reaction.
Seminar: Medical devices on ward.

4th week:
Lecture: Compliance – non-compliance, adherence, persistence. Their causes, aetiology and methods of their measurement. Strategies for improving compliance. Adherence in the main medicine groups. Communication and motivational interview. Quality assurance in the hospitals.
Seminar: Paediatric pharmacy.
5th week:
Lecture: Basics of oncology. Oncology

pharmacy.
Seminar: Oncology pharmacy 1: solid tumour and haematological malignancies.

6th week:
Lecture: Centralized aseptic services. IV admixtures. Incompatibility of IV admixtures. Plasma expanders, ion supplementation. Blood and blood derivate.
Seminar: Oncology pharmacy 2: adverse drug reaction management.

7th week:
Lecture: Nosocomial infections. Infection control, prevention and surveillance. Antimicrobial therapy. Antibiotic resistance. Antibiotic stewardship. OPAT.
Seminar: Dermatology in the clinical pharmacy practice. Bandages and dressings.

8th week:
Lecture: Clinical nutrition.
Seminar: Clinical toxicology.

9th week:
Lecture: Gerontopharmacology. Beers criteria.
Seminar: Impaired organ functions and medicine use.

10th week:
Lecture: Clinical pharmacy aspects of clinical trials, pharmacovigilance and phamacoeconomics. Drug utilization studies. Compounding in a hospital.
Seminar: Adverse drug reactions, clinically relevant interactions, pharmacogenetics.

Requirements

Students have to attend 30% of the lectures. All materials covered in lectures is an integral part of the subject and therefore included in the self-control test and the final exam.

Requirements for signing the Lecture book:
The Department may refuse to sign the lecture book if the student didn't attend 30% of lectures.

Subject: **PHARMACOVIGILANCE**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **19**
Seminar: **9**

1st week:
Lecture: The new concept and definitions in Pharmacovigilance. Scientific, regulatory and medical considerations. National and international PhV guidelines for health care professionals.
Seminar: Roles and responsibilities: drug agencies, manufacturers and HCP.

2nd week:
Lecture: Definitions of medical and drug safety terminology. MEDRA coding, adverse drug reaction, ADR, AE, SAE, CIOMS. Discussion of selected examples.
Seminar: Reporting in practice: characterization of events.

3rd week:
Lecture: The clinical part: Classification of side effects, adverse drug reactions. Drug and food interactions. Reporting guidelines and practice.
Seminar: Examples of herbal- and food-drug interactions.

4th week:
Lecture: The clinical part II. Population based, genetic, gender, and age factors in drug safety, vulnerable populations.
Seminar: Decision making tools and examples.

5th week:
Lecture: The EUDRA-Vigilance system for drug safety reporting. National and European guidelines.
Seminar: Risk management practice: risk factors, age, specific population, and other exogenous risk factors.

6th week:
Lecture: The process: safety reporting and process of Signal detection.
Seminar: The implications on public health and economy.

7th week:
Lecture: The theory: basics of Drug safety and Benefits/risk evaluation. Risk management and signal detection, statistical aspects. Discussion of selected examples.
Seminar: Safety reporting in clinical practice Reports and results.

8th week:
Lecture: Drug safety in practice. Pharmacovigilance in practice: tools for pharmacists, physicians and for the patients. Consultation on selected topics.
Seminar: Routine and additional risk minimization practices.

9th week:
Lecture: Roles, responsibilities and participants of the national and EU pharmacovigilance systems. The implications on public health and economy.
Seminar: Patient education: options and results. The role of pharmacists and the medical team in pharmacovigilance practice. Alerts and attention for specific data to collection.

10th week:
Lecture: Consultation on selected topics in PhVPreparation for the drug safety presentation.

Requirements

Concerning attendance of classes, the rules in the Regulations Governing Admission, Education and Examinations of the University of Debrecen are valid.

Conditions of signing the lecture book (by the end of semester):
Participation in at least three (3) of the interim tests are required for the signature. The ones who failed will be required to pass the "end of semester test" in order to obtain signatures.

Exam (semifinal)
The exam will be written and oral exam at the end of the semester which covers all the topics of the semester taken in the lectures or seminars. Written part (TEST (single choice, multiple choice, short description or definitions, etc.) and an Oral part (Two topics from selected list of questions provided.)

Grade (semifinal mark)
The average of the three scores (Test, Topic-1 Topic-2) compose the final mark (1-5 grades).
Exemption (full or partial) may be earned - only for those student who had at least 70%, can be eligible to submit an: I.) Oral presentation or a II.) Written assay of selected topics.

Department of Pharmaceutical Technology

Subject: **DRUG INTERACTIONS THEORY**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Introduction, definitions. Basic principles. Pharmacokinetic and pharmacodynamic interactions.

2nd week:
Lecture: Biotransformation, pharmacogenetics. Vaccination related interactions.

3rd week:
Lecture: Antithrombotic therapy and its interactions.

4th week:
Lecture: Cancer management and drug interactions.

5th week:
Lecture: Diabetes treatment and it's drug interactions. Contraceptives' interactions.

6th week:
Lecture: Possible interactions during antibiotic therapy.

7th week:
Lecture: The role of alcohol in interactions. CNS drugs and interactions 1.

8th week:
Lecture: CNS drugs and interactions II.

9th week:
Lecture: NSAIDs- drug interactions.

10th week:
Lecture: Interactions with sympathomimetics and antiasthmatics.

11th week:
Lecture: Cardiovascular drug interactions I.

12th week:
Lecture: Cardiovascular drug interactions II.

13th week:
Lecture: Consultation.

14th week:
Lecture: Consultation.

Requirements

Students have to attend 30% of the lectures. All materials covered in lectures is an integral part of the subject and therefore included in the self-control test and the final exam. Requirements for signing the Lecture book: The Department may refuse to sign the lecture book if the student didn’t attend 30% of lectures.

Subject: **PHARMACEUTICAL COMMUNICATION SKILLS**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **14**
Seminar: **4**

1st week:
Lecture: Verbal communication
Seminar: Verbap communication

2nd week:
Lecture: Verbal communication
Seminar: Verbal communication

3rd week:
Lecture: Non-verbal communication
Seminar: Non-verbal communication

4th week:
Lecture: Non-verbal communication
Seminar: Non-verbal communication

5th week:
Lecture: Metacommunication

6th week:
Lecture: Metacommunication

7th week:
Lecture: Problem solving lectures based on different special situations.

8th week:
Lecture: Problem solving lectures based on different special situations

9th week:
Lecture: Problem solving lectures based on different special situations.

10th week:
Lecture: Problem solving lectures based on different special situations.

11th week:
Lecture: Problem solving lectures based on different special situations.

12th week:
Lecture: Problem solving lectures based on different special situations.

13th week:
Lecture: Problem solving lectures based on different special situations.

14th week:
Lecture: Test
Self Control Test

Requirements

Attendance in the lectures is required.

Division of Nuclear Medicine and Translational Imaging

Subject: **RADIOPHARMACY PRACTICE**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Practical: **14**

Requirements

Practice: (i) main rules of radiation protection, (ii) activity calculation, (iii) gamma-spectrometry, (iv) iodine capsules and technetium generators, (v) visit in the PET centres, (vi) radio-HPLC methods.

Subject: **RADIOPHARMACY THEORY**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **14**

1st week:
Lecture: Radionuclides and radioactive tracking in the living organs - nuclear medicine.

2nd week:
Lecture: Radiation properties of radionuclides for diagnosis and therapy. Dosimetry.

3rd week:
Lecture: In vivo radioisotope diagnostics in humans.

4th week:
Lecture: Radionuclide therapy as human treatment.

5th week:
Lecture: General methods of radioisotope manufacturing.

6th week:
Lecture: Radionuclide genarators and applications.

7th week:
Lecture: Preparation of radiopharmaceuticals used in nuclear medicine, quality assurence, GMP

8th week:
Lecture: Advantage and disadvantages of radiopharmaceutical kit formulation. The Nuclear Pharmacy concept.

9th week:
Lecture: Preparation and use of radiopharmaceuticals with positron emitters (F-18, C-11, N-13, O-15).

10th week:
Lecture: Radioactive noble gases (Kr-81m, Xe-133) and I-123 as well as I-131 labelled radiopharmaceuticals.

11th week:
Lecture: Anionic Tc-99m complexes for renal, bone and hepatobiliar investigations.

12th week:
Lecture: Neutral and cationic Tc-99m complexes; brain and heart imaging. Preparation and use of Tc-99m labelled macromolecules and radio-colloids; blood cell labelling.

13th week:
Lecture: Other radioactive metals in diagnostic radiopharmaceuticals (Cr-51, Ga-67, In-111, T1-201).

14th week:
Lecture: Therapeutic radiopharmaceuticals containing P-32, Y-90, I-131, Sm-153, Re-186 and Re-188 radionuclides.

Requirements

Radioactive tracing under in vivo conditions. Principles of diagnostic imaging and radionuclide therapy. Types of physiological and biochemical processes to be traced with radioactive methods: macroscopic flow systems (blood, liquor and lymphatic circulation), selective localization (absorption), metabolism and excretion.

Radioactive tracers: types of radiations, radioisotope preparations, decay rows, generator systems, GMP productions. The Mo-99/Tc-99m generator and other generators.

Tc-99m radiopharmaceuticals: cationic, neutral and anionic complexes as well as colloids. Technetium labelling techniques. Ga-67/68, In-111 and Tl-201 radiopharamceuticals. PET radiopharmaceuticals: C-11, N-13, O-15, F-18 compounds. Radiopharmaceuticals containing radioiodine (I-123, I-131). Therapeutic radiopharmaceuticals.
(See also reading material, Gopal B. Saha: Fundamentals of Nuclear Pharmacy, Springer 2010, sixth edition)

CHAPTER 21
REQUIRED ELECTIVE COURSES

DEENK Life Sciences Library

Subject: **LIBRARY SYSTEM**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Practical: **10**

1st week:
Practical: Introduction to the Library and library use:
- Traditional services (registration, rules of library usage, loans, reading room, computer lab).
- Electronic services (the Library's home page, online catalogues).

2nd week:
Practical: Electronic Information Resources:
- Electronic journals.
- Link collections.

3rd week:
Practical: Databases:
- Medline.
- Impact Factors.

4th week:
Practical: Databases

5th week:
Practical: Test

Requirements

The aim of the course:
The aim of this course is to acquire a basic theoretical and practical knowledge on library search systems and databases for an effective learning-research activity.

Course description:
The purpose of this course is to introduce students to the short history of the DEENK, its structure and regulations, and to present its services via the library’s own website.
Students will learn about the structure of the website, and get an overview of the most important menu items. Students will also become familiar with the use of traditional and electronic library systems and services, databases, and the online catalogue.

PubMed:
Students will learn about its structure, its role in scientific research activities, and the most important search methods and possibilities in online resources, health websites, and online journals.

Department of Applied Chemistry

Subject: **PHARMACEUTICAL EXCIPIENTS**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Lecture: **14**

1st week:
Seminar: Basic standards of SI. Prefixes. Measurements in pharmacy.

2nd week:
Seminar: Basic chemical calculations.

3rd week:
Seminar: Introduction to Polymer Chemistry.

4th week:
Seminar: Polymeric excipients, general characterization..

5th week:
Seminar: General view of a medicine. Active ingredients, excipients, contaminants.

6th week:
Seminar: Consultation, problem solving

7th week:
Seminar: Mid-term test

8th week:
Seminar: Controlled drug release.

9th week:
Seminar: Fillers, solvents, emulsifiers.

10th week:
Seminar: Antioxidants, preservatives.

11th week:
Seminar: Aerosol propellants, colorants.

12th week:
Seminar: Materials for packaging.

13th week:
Seminar: Incompatibility. Consultation, problem solving.

14th week:
Seminar: End-term test.

Requirements

The presence of students at the seminar is obligatory and will be recorded. If the student is absent from more than 4 seminars, the semester will not be accepted Evaluation is based on exam performance: mid-course and end-course written exams (50-50 %). Detailed information will be given in the first lecture.

Department of Biochemistry and Molecular Biology

Subject: **MOLECULAR MECHANISM OF DISEASES OF GREAT POPULATIONS**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Lecture: **25**

1st week:
Lecture: Introduction to molecular medicine

2nd week:
Lecture: Genomic medicine

3rd week:
Lecture: Diabetes

4th week:
Lecture: Obesity

5th week:
Lecture: Vitamin D and immune defects

6th week:
Lecture: Cancer I.

7th week:
Lecture: Cancer II.

8th week:
Lecture: Cancer II.

9th week:
Lecture: Osteoporosis

10th week:
Lecture: Immune deficiencies

Requirements

Course content: topics presented at the lectures (available at the elearning site of the Department of Biochemistry and Molecular Biology)

Follow the link:
Educational materials- Elective courses

Attendance:
Students are expected and required to attend all lectures of this course. No more than one unexcused absence is permitted. Students will fail the course on their second unexcused absence. Legitimate excuses should be presented in writing to the course administrator by the specified date.

Grading policy:
The final grade will be based on the final oral exam at the end of the semester. Students have to select one topic from the full list of course topics for their oral exam, and can sign up for the topic at the link below. The final sign-up sheet will be posted on the department web-site at the beginning of the exam period. **It will be your responsibility to contact the lecturer for the assignment and for the date of the oral examination.** The course lecturers will assign scientific publications to the students based on the sign-up sheet. For the oral exam students are expected to prepare a short Powerpoint presentation (4-5 slides) based on the publication, and discuss the publication with the lecturer.
Please follow the **announcements** of the course administrator about exam dates or changes in the schedule on the bulletin board (LSB downstairs, 1corridor), and on the department

Department of Emergency Medicine

Subject: **FIRST AID AND REANIMATION**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **7**
Practical: **7**

1st week:
Lecture: The concept of first aid, first aid levels. Time Factor. The role of the scene. The usage of paramedics, rules of calling ambulance. ABCDE approach.

2nd week:
Lecture: Concept and recognition of unconsciousness. Symptoms of airway obstruction. Airway management. Recovery position.

3rd week:
Lecture: Organizational tasks at the site of the resuscitation. Prevention and solution of the complications of resuscitation. BLS. Effect, result, success in CPR. AED.

4th week:
Lecture: Death as a process. Reversibility. Assessment of vital signs. First aid for burns. Shock.

5th week:
Lecture: Burning; first aid in burning diseases; shock.
Intoxications. Ways of poison can enter the body. First
aid of poisoning with corrosive and non-corrosive
substances. Typical symptoms and recognition of common poisons.

6th week:
Seminar: Checking breathing and circulation. Ventilation without equipment. ABCDE approach.

7th week:
Practical: Practising ventilation without equipment.

8th week:
Practical: Practising chest compression.

9th week:
Practical: Cardiac arrest care simulation (BLS+AED)

Self Control Test

10th week:
Practical: General rules of wound care. Presenting wound dressing and immobilization devices. Sterility. Bleeding control. Arterial pressure points. Arterial and venous pressure bandage.
First aid for soft tissue contusion, distortion, dislocation and bone fracture.
Immobilization devices: Schanz cervical collar, Desault's bandage, hand and finger fracture fixation. Triangular bandage.
Kramer-, pneumatic air splint device.
Bone fracture care by body regions.
Complex trauma care.

Requirements

Condition of signing the Lecture book:
Attendance at practices is compulsory. The tutor may refuse to sign the Lecture book if the student is absent from the practicals more than twice in a semester. Missed practicals should be made up after consultation with the tutor. Facilities for a maximum of 2 make-up practicals are available at the Simulation Center in Debrecen. The current knowledge of students will be tested twice in each semester driving a written test.

Department of Operative Techniques and Surgical Research

Subject: **BASIC KNOWLEDGE OF SURGICAL BIOMATERIALS FOR STUDENTS OF PHARMACY**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **8**
Seminar: **16**
Practical: **8**

1st week:
Lecture: General and surgical deontology. Surgical armamentarium
Seminar: Cutting, hemostatic, grasping-retracting, special and suturing instruments. Order of the instrumental trays and tables. Handling and sterilization of the instruments.

2nd week:
Lecture: Wound closure and the required surgical biomaterials.
Practical: Surgical needles, suture materials, knotting and suturing techniques.

3rd week:
Lecture: Operating room environment, order of the operating work. Scrubbing and the required materials. Preparations for the operation, isolation of the operative field.
Practical: Scrubbing. Wound closure with different suturing techniques on biopreparate models.

4th week:
Lecture: Hemostasis. Methods and the required materials. Injection techniques and blood sampling. Punction, preparation and cannulation of vessels.
Seminar: Different types of infusion accessories. Demonstration of the infusion pump.
Practical: Ligation of vessels on gauze models. Vein preparation/cannulation, injection techniques (i.m., i.v.) and taking blood samples on phantom models. Preparing the infusion set and connecting it to the venous catheter. Different types and use of blood pressure manometers.

5th week:
Lecture: Surgical incisions and laparotomies. Basic principals of intestinal surgery. Endoscopic techniques.
Seminar: Wound types. Principles of wound care. Wound dressings. Definition, types and application of catheters and drains. Video-demonstration of laparotomies. Catheterization of the urinary bladder (video-demonstration). Incontinence and its treatment. Urine condoms. Types and handling of stoma bags.

6th week:
Lecture: Insight into the surgery of the parenchymal organs. Bioplasts and tissue adhesives and their application field. Conicotomy, tracheostomy. Basic principles of vascular surgery.
Seminar: Treatment of splenic injuries. Application of bioplasts and tissue adhesives. Conicotomy and tracheostomy. Reconstruction of blood vessels and the required biomaterials. (video demonstrations)

7th week:
Lecture: Ethical issues for animal research. Animal care, ethical problems, permissions. Keeping and treatment of experimental and laboratory small animals (mouse, rat).
Seminar: Treatment of laboratory animals. Drug delivery and administration. Requirements of ISO, GLP.

8th week:
Lecture: Narcosis and anesthesia of experimental animals. Intraoperative monitoring, registration of various parameters.
Seminar: In vivo, ex vivo, in vitro techniques and models. Extermination, autopsy and taking samples of experimental animals.
Self Control Test

Requirements

Prerequisite:
Pharmaceutical technology theory I, Human physiology II

Aim of the subject:
The main aim is to acquire up-to-date theoretical and practical knowledge that is appropriate to the

modern age and the students can get acquainted with the basic methods, that can help the pharmacy students to be familiar with the basic surgical interventions and the required materials during their future work. The students have to learn the characteristics and the means of application of the biomaterials (suturing materials, bioplasts, tissue adhesives, catheters, drains, stoma bags, urine condoms, incontinence pads) that can be used during the surgical practice. They should have the knowledge of the manual interventions that they may need during pharmacological experimental work. A further aim is to improve manual skills. They have to possess the basic knowledge and skills for catastrophe, in order to be capable to help in manual (operative) - often life-saving - activity. They should have the basic knowledge to be able to inform patients, which is part of the work done by the dynamic team of a doctor and pharmacist.

Requirements:
If the student is absent from more than 20% of all teaching hours (6 out of 32) without any acceptable reason, the Department may refuse to sign the Lecture Book. Besides the suggested reading materials the hand-outs are also part of the curriculum. Performance is assessed on the five-grade scale (AW5) and it is based on the work through the semester and completion of the final written test at the end of the course.

Department of Pharmaceutical Chemistry

Subject: **CHEMICAL BIOLOGY**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Lecture: **14**

1st week:
Lecture: Structure of proteins and polysaccharides.

2nd week:
Lecture: Structure of nucleic acids

3rd week:
Lecture: Structure of macromolecular lipides. Interactions determinating the structure of macrolecules.

4th week:
Lecture: Chemical synthesis of peptides and proteines.

5th week:
Lecture: Chemical synthesis of polysaccharides.

6th week:
Lecture: Chemical synthesis of nucleic acids

7th week:
Lecture: Molecular biology as a tool of chemical biology.

8th week:
Lecture: Methodologies of molecular biology

9th week:
Lecture: Electron spectroscopy and vibrational spectroscopy in chemical biology

10th week:
Lecture: Basics of NMR spectroscopy

11th week:
Lecture: X-ray diffraction. Theoretical calculations in chemical biology.

12th week:
Lecture: The molecular recognition.

13th week:
Lecture: Mass spectrometry in chemical biology.

14th week:
Lecture: Case studies of chemical biology.

Requirements

The aim of the course: to treat the fundamentals of modern analytical and synthetic methodologies that can be applied in biological research.

Requirements:
Good knowledge of basic organic chemistry.
Teaching material will be provided at the beginning of the course.

Subject: **ILLICIT DRUGS**
Year, Semester: 3rd year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Groups of drugs

2nd week:
Lecture: Designer drugs

3rd week:
Lecture: Synthetic drugs

4th week:
Lecture: Cannabis

5th week:
Lecture: THC

6th week:
Lecture: Opium

7th week:
Lecture: Morphine

8th week:
Lecture: Heroine

9th week:
Lecture: Therapy of opioid dependence

10th week:
Lecture: Coca plant

11th week:
Lecture: Cocaine

12th week:
Lecture: Psychedelic drugs

13th week:
Lecture: LSD

14th week:
Lecture: Other drugs

Department of Pharmaceutical Surveillance and Economics

Subject: **INTRODUCTION TO FINANCIAL MANAGEMENT FOR PHARMACISTS**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Lecture: **12**
Seminar: **5**

1st week:
Lecture: Models and the key elements of micro-economy, specific aspects of a market on price related to product characteristics and demand.

2nd week:
Lecture: Consumer decisions. Management of an investment: costs and margins. Calculations of ROI and IRR.

3rd week:
Lecture: Model for macroeconomy. National and international relations of goods, price and investments.

4th week:
Lecture: The trends on inflation and unemployment rate. Decisions of fiscal and monetary politics.

5th week:
Lecture: Business aspects of a Pharmacy operation. Management in a pharmacy. The concepts and the most important cost categories and definitions, P/L and the balance sheet.

6th week:
Lecture: The operation, financial aspects of a pharmacy as a business unit. Revenue, costs and cash/ flow.

7th week:
Seminar: Elements of a Business plan and C/F plans.

8th week:
Seminar: Calculations of an investment, plan for business development, expected revenue and return of investment in a Business plan and C/F in practice.

Requirements

Concerning attendance of classes, the rules in the Regulations Governing Admission, Education and Examinations of the University of Debrecen are valid.
Participation in at least three (3) of 6 interim tests are required for the signature. Those ones who failed will be required to pass the "semifinal test" in order to obtain signatures.

Exam (semifinal, colloquium)
The exam will be written and oral exam at the end of the semester which covers all the topics of the semester.

Written part:
Test and three topics from selected list of questions provided.

Grade (semifinal mark)
The average of the three scores (Test, Topics) compose the final mark (1-5 grades).

Subject: **INTRODUCTION TO PHARMACOECONOMY AND - EPIDEMIOLOGY**
Year, Semester: 3rd year/2nd semester
Number of teaching hours:
Lecture: **10**
Seminar: **2**

1st week:
Lecture: Introduction to Pharmacoepidemiology: The new concept and definitions, Study design, methodology, KAy parameters in epidemiology, Sample size, bias, confounding analysis.

2nd week:
Lecture: Drug utilization studies. Classification of outcome and exposure, Database and Data mining in practice.

3rd week:
Lecture: Measures of association, Population Attributable Risk

4th week:
Lecture: The analysis of "real life" data, assessments and trends based on big-datasets, by population

5th week:
Lecture: Systematic literature review, methodology of a metaanalysis

6th week:
Seminar: Practice of selected methodology

7th week:
Lecture: Quality of Life, questionnaires, VAS tests, validation

8th week:
Lecture: Cost of medicine, treatment, burden of diseases. Result, Efficacy and Efficiency

9th week:
Lecture: Cost of prevention in medicine, the results of changes in life-style

10th week:
Lecture: Health Technology Assessment: rationale and theory

11th week:
Lecture: The practice of Cost -benefits (CBA) and Cost-utility (CUA) analysis, ICER

12th week:
Seminar: Calculations in practice: investments and cost of drug development

Requirements

Concerning attendance of classes, the rules in the Regulations Governing Admission, Education and Examinations of the University of Debrecen are valid.
Participation in at least three (3) out of the 2 tests and two (2) practices are required for the signature. Those ones who failed will be required to pass the "semifinal test" in order to obtain signatures.
The exam will be written and oral exam at the end of the semester which covers all the topics of the semester.

Written part:
Test and two topics from selected list of questions.

Grade (semifinal mark)
The average of the three scores (1x Test, 2x Topics) compose the final mark (1-5 final grade).

Changes for emergency phase:
Lectures and seminars are held in the form of distance learning, according to the original timetable in the form of webinar at the platform of eLearning system. Attending on-line lectures and electronic attendance register is not obligatory for students.
Attending on-line seminars and the electronic attendance register is obligatory for students.
The lecture materials are uploaded to eLearning system, this is the base of exam.

Minimum Requirements for Semester:
Uploading and writing on-line exercises, small tests (altogether syllabus) that are given by the teacher at the platform of eLearning are obligatory and the completed syllabus should be uploaded.

Exam:
The Dean of the Faculty could permit electronic exams.
The final exam test and calculations will be provided via eLearning system.
Based on the above mentioned criteria, students will be graded with a proposed mark.

Department of Pharmaceutical Technology

Subject: **BIOCOSMETICS**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **14**

1st week:
Lecture: History of cosmetics I.

2nd week:
Lecture: History of cosmetics II.

3rd week:
Lecture: History of cosmetics III.

4th week:
Lecture: Biocosmetics, theory

5th week:
Lecture: Basic skin types.

6th week:
Lecture: Cosmetic changes on skin I.

7th week:
Lecture: Cosmetic changes on skin II.

8th week:
Lecture: Therapy of seborrhoea.

9th week:
Lecture: Decor cosmetics I.

10th week:
Lecture: Decor cosmetics II.

11th week:
Lecture: Tooth and mouth care.

12th week:
Lecture: Cosmetics preparations I.

13th week:
Lecture: Cosmetics preparations II.

14th week:
Lecture: Consultation

Requirements

Students have to attend 30% of the lectures. All materials covered in lectures is an integral part of the subject and therefore included in the self-control test and the final exam.

Requirements for signing the Lecture book:
The Department may refuse to sign the lecture book if the student didn't attend 30% of lectures.

Subject: **DIETARY SUPPLEMENTS AND GENERAL NUTRIENTS**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **28**

Requirements

Students have to attend 30 % of the lectures.

Subject: **GALENIC PREPARATIONS**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Ointments

2nd week:
Lecture: Suppositories

3rd week:
Lecture: Solutions

4th week:
Lecture: Suspensions

5th week:
Lecture: Emulsions

6th week:
Lecture: Official prescriptions 1-5

7th week:
Lecture: Official prescriptions 5-10

8th week:
Lecture: Official prescriptions 10-15

9th week:
Lecture: Official prescriptions 10-15

10th week:
Lecture: Official prescriptions 15-20

11th week:
Lecture: Official prescriptions 20-25

12th week:
Lecture: Official prescriptions 25-30

13th week:
Lecture: Official prescriptions 30-35

14th week:
Lecture: Official prescriptions 35-40, Consultation

Requirements

Students have to attend 30% of the lectures. All materials covered in lectures is an integral part of the subject and therefore included in the self-control test and the final exam.

Requirements for signing the Lecture book:
The Department may refuse to sign the lecture book if the student didn't attend 30% of lectures.

Subject: **INDUSTRIAL PHARMACEUTICAL PRACTICE**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Objectives of industrial drug formulation. Regulatory and quality assurance.

2nd week:
Practical: GMP. Industrial scaleup.

3rd week:
Practical: Solid Forms I. Mixing process.

4th week:
Practical: Solid Forms II. Conversion into dosage form.

5th week:
Practical: Semi-Solid Forms I. Soft gelatin capsules.

6th week:
Practical: Dissolution. Lyophilization.

7th week:
Practical: Liquid Forms I. Content of liquid forms. Materials of containers for liquid forms.

8th week:
Practical: Semi-Solid Forms II. Transdermal systems.

9th week:
Practical: Suppositories. Design of production plants.

10th week:
Practical: Treatment of working atmospheres. Filtration of working atmospheres.

11th week:
Practical: Iso-technology. Packaging.

12th week:
Practical: Filtration of liquids. Sterilization.

13th week:
Practical: Liquid Forms II. Preparation of liquid forms. Filling of liquid form.

14th week:
Practical: Consultation. Test.

Requirements

Attendance at practice is obligatory. At the end of semester students get a 5 stage grade.

Subject: **INTRODUCTION TO SCIENTIFIC RESEARCH**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **14**

1st week:
Lecture: In vitro cell culture models.

2nd week:
Lecture: Topical drug formulation.

3rd week:
Lecture: Formulation of nanobeads.

4th week:
Lecture: Per os drug formulation.

5th week:
Lecture: Formulation of S(M/N)EDDS (self -micro/nano emulsifying drug delivery system).

Requirements

The subject will be kept in blocks.
Requirements: 30% of lectures are obligatory.

Subject: **JURISTIC KNOWLEDGE FOR PHARMACISTS**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **14**

1st week:
Lecture: Introduction to Law – Norms, Mores and Folkways, Defining Law

2nd week:
Lecture: Families of Law, Functions of Law, Classification of Law

3rd week:
Lecture: Sources of Law, Principles for resolve conflicts of Law

4th week:
Lecture: Interpretation of Law, Dispute resolution

5th week:
Lecture: Law and Ethics in Pharmacy I. – The rights of the patient

6th week:
Lecture: Law and Ethics in Pharmacy II. – Moral principles in medical practice, Ethical Codes for Pharmacists

7th week:
Lecture: Health and Pharmaceutical Care, The 7 Star Pharmacist

8th week:
Lecture: The Good Pharmacy Practice

9th week:
Lecture: Pharmaceutical Legislation

10th week:
Lecture: International Health Organisations

11th week:
Lecture: Global Health Law I.

12th week:
Lecture: Global Health Law II.

13th week:
Lecture: Case Studies (Patient Rights, Ethics)

14th week:
Lecture: consultation

Requirements

Students have to attend 30% of the lectures. All materials covered in lectures is an integral part of the subject and therefore included in the self-control test and the final exam.

Requirements for signing the Lecture book:

The Department may refuse to sign the lecture book if the student didn't attend 30% of lectures.

Subject: **NANOPHARMACEUTICS**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Lecture: **14**

1st week:
Lecture: Introduction. Nanotechnology and Nanomedicine

2nd week:
Lecture: Investigation methods of nanotechnology and nanopharmaceutics.

3rd week:
Lecture: Nano-sized drug delivery systems 1. Liposomes.

4th week:
Lecture: Nano-sized drug delivery systems 2. Nanoparticles and nanotubes.

5th week:
Lecture: Nano-sized drug delivery systems 3. Unimolecular polymer and dendrimer conjugates.

6th week:
Lecture: Nano-sized drug delivery systems 4. Micellar systems, polymer micelles.

7th week:
Lecture: Nano-sized drug delivery systems 5. Antibodies and their conjugates.

8th week:
Lecture: Nano-sized drug delivery systems 6. Cyclodextrins.

9th week:
Lecture: Nano-sized drug delivery systems 7. Vectors for nucleic acid drug delivery.

10th week:
Lecture: Theranostics.

11th week:
Lecture: Pharmacokinetics and toxicology of nanopharmaceutics.

12th week:
Lecture: Interaction of nanopharmaceutics and biological barriers. Cellular internalization and intracellular behaviour of nanopharmaceutics.

13th week:
Lecture: Nanopharmaceutics: drugs in the therapy.

14th week:
Lecture: Consultation.

Requirements

Students have to attend 30 % of the lectures. Written test at the end of semester.

Subject: **NUTRITIONAL THERAPY**
Year, Semester: 4th year/1st semester
Number of teaching hours:
Lecture: **14**

1st week:
Lecture: Introduction. Digestive and absorption problem of nutrients. Pathological definitions.

2nd week:
Lecture: Nutrition of newborns and infants. Metabolism and absorption disturbances.

3rd week:
Lecture: Type and composition of infant nutrition.

4th week:
Lecture: Classification of artificial nutrition. Percutan Endoscopic Gastrostomy.

5th week:
Lecture: Classification and composition of enteral nutrition products. Manufacturing requirements and release.

6th week:
Lecture: Determination of energy demand and nutrient requirement. Practice of Glicemic Index.

7th week:
Lecture: Fluid and electrolyte therapy. Rehydration in hospital and home.

8th week:
Lecture: Accessories and type of parenteral nutrition therapy.

9th week:
Lecture: Preparation of parenteral nutrition therapy.

10th week:
Lecture: Carbohydrate intake aspects. Ketogenic diet.

11th week:
Lecture: Lipid intake aspects.

12th week:
Lecture: Protein intake aspects. Food allergy and food intolerance.

13th week:
Lecture: Vitamins and trace elements intake aspects.

14th week:
Lecture: Practice of enteral nutrition by other way. Cooking in the kitchen of Dietetic Service at Clinical Center.

Requirements

Students have to attend 50 % of the lectures. Written test at the end of semester.

Subject: **OPERATING SYSTEM OF THE PHARMACEUTICAL INDUSTRY**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **14**

1st week:
Lecture: Pharmaceutical quality system I.

2nd week:
Lecture: Pharmaceutical quality system II.

3rd week:
Lecture: Pharmaceutical industry and patent systems I.

4th week:
Lecture: Pharmaceutical industry and patent systems II.

5th week:
Lecture: CGMPS and the concepts of modern quality systems I.

6th week:
Lecture: CGMPS and the concepts of modern quality systems II.

7th week:
Lecture: Pharmaceutical computer systems I.

8th week:
Lecture: Pharmaceutical computer systems II.

9th week:
Lecture: Pharmaceutical GMP regulations I.

10th week:
Lecture: Pharmaceutical GMP regulations II.

11th week:
Lecture: Generics I.

12th week:
Lecture: Generics II.

13th week:
Lecture: Marketing

14th week:
Lecture: Consultation

Requirements

Students have to attend 30 % of the lectures. All materials covered in lectures is an integral part of the subject and therefore included in the self-control test and the final exam.

Requirements for signing the Lecture book:
The Department may refuse to sign the lecture book if the student didn't attend 30 % of the lectures.

Subject: **PHARMACEUTICAL COMPUTER ADMINISTRATION**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Computer knowledge.

2nd week:
Lecture: Computer programs I.

3rd week:
Lecture: Computer programs II.

4th week:
Lecture: Computer programs in pharmacy I.

5th week:
Lecture: Computer programs in pharmacy II.

6th week:
Lecture: Computer programs in pharmacy III.

7th week:
Lecture: Computer programs in pharmacy IV.

8th week:
Lecture: Exam

9th week:
Lecture: Ordering program on computer (in pharmacy) I.

10th week:
Lecture: Ordering program on computer (in pharmacy) II.

11th week:
Lecture: Ordering program on computer (in pharmacy) III.

12th week:
Lecture: Administration on computer I.

13th week:
Lecture: Administration on computer II.

14th week:
Lecture: Consultation.

Requirements

Attendance of practicals is obligatory. Altogether two absences in the semester is permitted. After absence the practical should be made up. At the end of the semester students get 5-stage practical grade.
Requirements for signing the Lecture book:
The Department may refuse to sign the lecture book if the student is absent from the practicals more than allowed in a semester

Subject: **STATE EXAM PRACTICE I. PHARMACY DISPENSING**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Practical: **120**

1st week:
Lecture: Theoretical and practical knowledge of registered drug preparations, galenicals, magistral preparations,

2nd week:
Lecture: individual prescriptions

3rd week:
Lecture: dosage forms.

4th week:
Lecture: the theoretical and practical knowledge of vaccines, immunosera, and sutures for human and veterinary use

5th week:
Lecture: The basic knowledge of medical aid products, equipments and machines for pharmaceutical preparations.

6th week:
Lecture: Basic knowledge of pharmacy management,

7th week:
Lecture: pharmaceutical affairs organizations and juristic knowledge for pharmacists. Pharmacy organizations.

8th week:
Lecture: Knowledge of measurement conversion and the International System of Units (SI). Basic knowledge of biopharmacy, pharmacology and pharmacognosy. Control of pharmaceutical preparations.

Requirements

Syllabus for the practice in a public pharmacy before final examination

Duration of the practice is 2+4 months, 8 hours daily, from which two hours may be spent on preparing individually. Pharmacy students should gain experience on the following areas in a general pharmacy during their practice and subsequently acquire knowledge about pharmacy operation including: dispensing medication, preparing medication, validation and quality assurance, and the overall operation of the pharmacy.

Requirements for the student:
Accept and sign the non-disclosure document. Absence from practice must be authentically justified based on the rules of the place of training. Absences must be made up. He/she is expected to follow the guidance of the pharmacist in charge of the training.

The expected skills made on the student after completion of the practice:
• practical application of the theoretical knowledge obtained during his / her studies,
• the knowledge of the practical application of the rules and regulations concerning the operation of pharmacies,
• he / she is required to have an appropriate working relationship with the co-workers at the pharmacy
• he/ she is expected to communicate with the patients in an appropriate way,
• he / she is required to appropriately inform and give advice in connection with the patients' questions regarding self-healing and preparations without prescription (drugs and other products),
• he / she is required to identify „problematic patients" from the point of view of communication and to handle situations properly with help.

The student's tasks during the practice:

Under the supervision and instructions of the pharmacist in charge of the training he / she participates in the following activities:
1. Drug Dispense. In the process he / she is required to learn:
• how to check the content and layout of the prescription
• the application of the rules regarding the replacement of drugs, ordering of drugs on the basis of international non-proprietary name,
• appropriate patient information knowing the effects and adverse effects of drugs,
• recognition and evaluation of the characteristic interactions based on database (drug-drug, drug-food, drug-food supplement),
• characteristic/obligatory cases and methods of medical information and consultation,
• duties in connection with the known/identified adverse effects of drugs,
• adherence control and means of correction, common uses,
• the typical cases of self-healing, the dispensing of the preparations without prescription that can be applied for this purpose,
• the possibilities and rules of access to data regarding the patients' previous medication (OEP database),
• the database of nutrition complements and medicinal formulae
• proper application of the labelling and dispensing computer program.

2. Preparation of medicine. In the process he / she is required to learn:
• How to prepare magistral / individual formulations according to the rules and to recognize incompatibilities
• The legal possibilities of changing the original prescription
• The rules of labelling and their application (identifiability of manufacturer and patient, application, administration, shelf-life)
• Documentation of preparation, and administrative obligations
• Storage of materials, processing of basic formulations and subsequent administrative obligations
• Formulations of the compendium and FoNo

3. Operation, quality assurance.
In the process he / she is required to learn:
• administrative work in the pharmacy
• the rules concerning the staff of the pharmacy; qualification, labor law requirements,
• standard procedures for workflow
• how to check and document workflow

• the rules pertaining to the examining and sampling incoming medications,
• documentation of examinations

4. Medication management.
In the process he / she is required to learn:
• aspects of inventory management,
• how to order medicine
• duties in case of waste products, returned items, damage,
• withdrawal of products from circulation,
• duties regarding shift of prices,
• closings: daily, weekly, periodic as well as schedule of OEP reports,
• importance and practice of supervision of prescriptions,
• about narcotics and activities involving their handling,
• the rules pertaining to hazardous waste.

Evaluation:

Keeping an electronic workbook: the description of two practical problems in half/one page weekly. One of them should describe a question related to the patient (dispensing drugs), the other topic can be chosen from the three other areas (preparation of medicine, operation, medication management). The descriptions made during the practice should be concerned with all the areas of the activities at a pharmacy. The pharmacist in charge of the training checks the work and description every week and evaluates it using a five-grade system. He / She sends the electronic notebook to the Dean's Office according to the rules of the place of training. The student is required to make a 10-15-minute-long presentation for the co-workers of the pharmacy from a professional scientific journal recommended by the pharmacist in charge of the training (the documentation of which will be kept in the workbook) on one occasion. The presentation will take place on a date agreed on by the training location and the student. At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in written form and evaluates the student based on a three-grade system. He / she sends it to the Dean's Office in a printed and signed form according to the rules of the training place. Student evaluation: After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training facility.

Subject: **STATE EXAM PRACTICE I. PRESCRIPTION PHARMACY**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Practical: **120**

Requirements

Duration of the practice is 2+4 months, 8 hours daily, from which two hours may be spent on preparing individually.

Pharmacy students should gain experience on the following areas in a general pharmacy during their practice and subsequently acquire knowledge about pharmacy operation including: dispensing medication, preparing medication, validation and quality assurance, and the overall operation of the pharmacy.

Accept and sign the non-disclosure document.
Absence from practice must be authentically justified based on the rules of the place of training. Absences must be made up.
He/she is expected to follow the guidance of the pharmacist in charge of the training.

- practical application of the theoretical knowledge obtained during his / her studies,
- the knowledge of the practical application of the rules and regulations concerning the operation of pharmacies,
- he / she is required to have an appropriate working relationship with the co-workers at the pharmacy
- he/ she is expected to communicate with the patients in an appropriate way,
- he / she is required to appropriately inform and give advice in connection with the patients' questions regarding self-healing and preparations without prescription (drugs and other products),
- he / she is required to identify „problematic patients" from the point of view of communication and to handle situations properly with help.

Under the supervision and instructions of the pharmacist in charge of the training he / she the following activities:

1. Drug Dispense. In the process he / she is required to learn:
   - how to check the content and layout of the prescription
   - the application of the rules regarding the replacement of drugs, ordering of drugs on the basis of international non-proprietary name,
   - appropriate patient information knowing the effects and adverse effects of drugs,
   - recognition and evaluation of the characteristic interactions based on database (drug-drug, drug-food, drug-food supplement),
   - characteristic/obligatory cases and methods of medical information and consultation,
   - duties in connection with the known/identified adverse effects of drugs,
   - adherence control and means of correction, common uses,
   - the typical cases of self-healing, the dispensing of the preparations without prescription that can be applied for this purpose,
   - the possibilities and rules of access to data regarding the patients' previous medication (OEP database),
   - the database of nutrition complements and medicinal formulae
   - proper application of the labelling and dispensing computer program.

2. Preparation of medicine. In the process he / she is required to learn:
   - How to prepare magistral / individual formulations according to the rules and to recognize incompatibilities
   - The legal possibilities of changing the original prescription
   - The rules of labelling and their application (identifiability of manufacturer and patient, application, administration, shelf-life)
   - Documentation of preparation, and administrative obligations
   - Storage of materials, processing of basic formulations and subsequent administrative obligations
   - Formulations of the compendium and FoNo

3. Operation, quality assurance. In the process he / she is required to learn:

- administrative work in the pharmacy
- the rules concerning the staff of the pharmacy; qualification, labor law requirements,
- standard procedures for workflow
- how to check and document workflow
- the rules pertaining to the examining and sampling incoming medications,
- documentation of examinations

4. Medication management. In the process he / she is required to learn:
- aspects of inventory management,
- how to order medicine
- duties in case of waste products, returned items, damage,
- withdrawal of products from circulation,
- duties regarding shift of prices,
- closings: daily, weekly, periodic as well as schedule of OEP reports,
- importance and practice of supervision of prescriptions,
- about narcotics and activities involving their handling,
- the rules pertaining to hazardous waste.

Keeping an electronic workbook: **the description of two practical problems in half/one page weekly**. One of them should describe a question related to the patient (dispensing drugs), the other topic can be chosen from the three other areas (preparation of medicine, operation, medication management). The descriptions made during the practice should be concerned with all the areas of the activities at a pharmacy. The pharmacist in charge of the training checks the work and description every week and evaluates it using a five-grade system. He / She sends the electronic notebook to the Dean's Office according to the rules of the place of training.
The student is required to make a 10-15-minute-long presentation for the co-workers of the pharmacy from a professional scientific journal recommended by the pharmacist in charge of the training (the documentation of which will be kept in the workbook) on one occasion. The presentation will take place on a date agreed on by the training location and the student.
At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in written form and evaluates the student based on a three-grade system. He / she sends it to the Dean's Office in a printed and signed form according to the rules of the training place.

After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training facility.

Subject: **STATE EXAM PRACTICE II. INSTITUTIONAL PHARMACY OR GALENIC LABORATORY**
Year, Semester: 5th year/2nd semester
Number of teaching hours:
Practical: **120**

Requirements

Duration of the practice is 2+4 months, 8 hours daily, from which two hours may be spent on preparing individually.
Pharmacy students should gain experience on the following areas in a general pharmacy during

their practice and subsequently acquire knowledge about pharmacy operation including: dispensing medication, preparing medication, validation and quality assurance, and the overall operation of the pharmacy.

Accept and sign the non-disclosure document.
Absence from practice must be authentically justified based on the rules of the place of training.
Absences must be made up.

He/she is expected to follow the guidance of the pharmacist in charge of the training.

- practical application of the theoretical knowledge obtained during his / her studies,
- the knowledge of the practical application of the rules and regulations concerning the operation of pharmacies,
- he / she is required to have an appropriate working relationship with the co-workers at the pharmacy
- he/ she is expected to communicate with the patients in an appropriate way,
- he / she is required to appropriately inform and give advice in connection with the patients' questions regarding self-healing and preparations without prescription (drugs and other products),
- he / she is required to identify „problematic patients" from the point of view of communication and to handle situations properly with help.

Under the supervision and instructions of the pharmacist in charge of the training he / she the following activities:

1. Drug Dispense. In the process he / she is required to learn:
    - how to check the content and layout of the prescription
    - the application of the rules regarding the replacement of drugs, ordering of drugs on the basis of international non-proprietary name,
    - appropriate patient information knowing the effects and adverse effects of drugs,
    - recognition and evaluation of the characteristic interactions based on database (drug-drug, drug-food, drug-food supplement),
    - characteristic/obligatory cases and methods of medical information and consultation,
    - duties in connection with the known/identified adverse effects of drugs,
    - adherence control and means of correction, common uses,
    - the typical cases of self-healing, the dispensing of the preparations without prescription that can be applied for this purpose,
    - the possibilities and rules of access to data regarding the patients' previous medication (OEP database),
    - the database of nutrition complements and medicinal formulae
    - proper application of the labelling and dispensing computer program.

2. Preparation of medicine. In the process he / she is required to learn:
    - How to prepare magistral / individual formulations according to the rules and to recognize incompatibilities
    - The legal possibilities of changing the original prescription
    - The rules of labelling and their application (identifiability of manufacturer and patient, application, administration, shelf-life)
    - Documentation of preparation, and administrative obligations
    - Storage of materials, processing of basic formulations and subsequent administrative

obligations
- Formulations of the compendium and FoNo

3. Operation, quality assurance. In the process he / she is required to learn:
- administrative work in the pharmacy
- the rules concerning the staff of the pharmacy; qualification, labor law requirements,
- standard procedures for workflow
- how to check and document workflow
- the rules pertaining to the examining and sampling incoming medications,
- documentation of examinations

4. Medication management. In the process he / she is required to learn:
- aspects of inventory management,
- how to order medicine
- duties in case of waste products, returned items, damage,
- withdrawal of products from circulation,
- duties regarding shift of prices,
- closings: daily, weekly, periodic as well as schedule of OEP reports,
- importance and practice of supervision of prescriptions,
- about narcotics and activities involving their handling,
- the rules pertaining to hazardous waste.

Keeping an electronic workbook: **the description of two practical problems in half/one page weekly**. One of them should describe a question related to the patient (dispensing drugs), the other topic can be chosen from the three other areas (preparation of medicine, operation, medication management). The descriptions made during the practice should be concerned with all the areas of the activities at a pharmacy. The pharmacist in charge of the training checks the work and description every week and evaluates it using a five-grade system. He / She sends the electronic notebook to the Dean's Office according to the rules of the place of training.
The student is required to make a 10-15-minute-long presentation for the co-workers of the pharmacy from a professional scientific journal recommended by the pharmacist in charge of the training (the documentation of which will be kept in the workbook) on one occasion. The presentation will take place on a date agreed on by the training location and the student.
At the end of the practice the pharmacist in charge of the training evaluates the student's overall practical work on an assessment sheet in written form and evaluates the student based on a three-grade system. He / she sends it to the Dean's Office in a printed and signed form according to the rules of the training place.

After the practice the student fills in a questionnaire pertaining to the training place and the pharmacist in charge of the training according to the rules of the training facility.

Subject: **STATE EXAM PRACTICE II. PRESCRIPTION PHARMACY**
Year, Semester: 5th year/2nd semester
Number of teaching hours:
Practical: **120**

1st week:
Lecture: Technical books of pharmacy. (H.Ph. VII., H.Ph.VIII., Eur. Ph. 7., FoNoVII.)

2nd week:
Lecture: Nomenclature,

3rd week:
Lecture: reading of prescriptions

4th week:
Lecture: materials knowledge

5th week:
Lecture: calculations

6th week:
Lecture: computer program.

7th week:
Lecture: Theoretical and practical knowledge of registered drug preparations

8th week:
Lecture: Basic knowledge of pharmacy management, pharmaceutical affairs organizations and juristic knowledge for pharmacists.

9th week:
Lecture: Pharmacy organizations.

10th week:
Lecture: The basic knowledge of medical aid products, equipments and machines for pharmaceutical preparations.

11th week:
Lecture: the theoretical and practical knowledge of vaccines, immunosera, and sutures for human and veterinary use.

12th week:
Lecture: Consultation

13th week:
Lecture: The students need to practice the medium scale pharmaceutical technology operations.

14th week:
Lecture: Equipments and machines for medium scale pharmaceutical technology operations.

Subject: **VETERINARY HYGIENE**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Basics of veterinary hygiene I.

2nd week:
Lecture: Basics of veterinary hygiene II.

3rd week:
Lecture: Basics of veterinary hygiene III.

4th week:
Lecture: Basics of veterinary hygiene IV.

5th week:
Lecture: Formule Normales Veterinariae IV. Preparations from Formule Normales Veterinariae IV.

6th week:
Lecture: Special pharmaceutical forms and their application in veterinary medicine. Classification of drugs, prescription requirements.

7th week:
Lecture: Veterinary illness and therapy I.

8th week:
Lecture: Veterinary illness and therapy II.

9th week:
Lecture: Veterinary illness and therapy III.

10th week:
Lecture: Veterinary illness and therapy IV.

11th week:
Lecture: Veterinary illness and therapy V.

12th week:
Lecture: Zoonosis-animal diseases transmissible to humans I.

13th week:
Lecture: Zoonosis-animal diseases transmissible to humans II.

14th week:
Lecture: Test

Requirements

Students have to attend 30% of the lectures. All materials covered in lectures is an integral part of the subject and therefore included in the self-control test and the final exam.

Requirements for signing the lecture book: The Department may refuse to sign the lecture book if the student didn't attend 30% of lectures.

Department of Pharmacology

Subject: **PHYTOPHARMACOLOGY**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Lecture: **24**

Requirements

Attendance at 50% of lectures is a requirement for acceptance of the semester. Before the end of the semester students have to take a written exam. Requirement on this written exam is at least 60% for the signature of the Lecture Book for the semester and for the student to be allowed to take the End of Semester Exam (ESE). At the end of the semester students take End of Semester Exam (ESE) which is oral. During the semester there is an opportunity to be freed from the constraint of the End of Semester Exam. Students are offered the grade of the written exam passed during the semester if it is at least good (80%) or excellent (90%). Correction of the offered grade is in the form of taking the oral End of Semester Exam instead. The result of the exam can be better or even worse than the offered grade.

Subject: **TOXICOLOGY**
Year, Semester: 5th year/1st semester
Number of teaching hours:
Practical: **28**

1st week:
Lecture: 1. Introduce pharmacy rooms. Division of pharmacy, instruments, equipments. 2. Storage of drug preparations, requirements. chemical substances, drugs, galenicals, registered preparations, drugs with strong effect, Study those chemicals studied at the University, materials knowledge, nomenclature 3. Reading

of Prescriptions, pharmaceutical Latin.

2nd week:
Lecture: 4. Instruments used in Pharmacy, pharmacy balances, small equipments etc. description, cleaning, maintenance. 5. Requirements for packaging of pharmaceutical preparations. Choosing the suitable containers. Packaging materials. Glass, plastic containers, closures. Signatures.

3rd week:
Lecture: 6. Simple processes of pharmaceutical technology (measuring, sieving, mixing of powders, dilution, concentration calculation of solutions, other simple calculations needed for pharmaceutical work.7. Technical books of pharmacy. (H.Ph. VII., H.Ph.VIII., Eur. Ph. 7., FoNoVII.)

4th week:
Lecture: 8. Tests, investigations according to the Eur. Ph. 7.9. Connection with patients. Take part in pharmacy dispensing.

Department of Physical Chemistry

Subject: **POLYMORPHISM OF PHARMACEUTICALS**
Year, Semester: 4th year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Introduction. Polymorphism, definition. Polymorphism in everyday life and pharmaceutical industry. Analytical methods. Ritonavir and cefuroxime.

2nd week:
Lecture: Thermodynamics. Basics of thermoanalytical methods and their application in polymorph research. Monotrope and enantiotrope systems.

3rd week:
Lecture: Patent literature basics. Claims. Polymorphs in the patents. Ranitidine hydrochloride and paroxetine hydrochloride.

4th week:
Lecture: Thermodynamics and kinetics of crystallization. Controlling polymorph composition. The Aspartame case.

5th week:
Lecture: Computational chemistry. Polymorph prediction.

6th week:
Lecture: Basics of X-ray diffraction. Powder diffraction methods. Quantitative XRPD.

7th week:
Lecture: Single crystal X-ray diffraction. Structure of polymorphs. The hydrogen bond.

8th week:
Lecture: Ab initio structure determination from powder diffraction data. Indexing, Rietveld refinement.

9th week:
Lecture: Solid state NMR basics. ssNMR in polymorph research.

10th week:
Lecture: FT-IR and Raman spectroscopy and microscopy. ATR techniques.

11th week:
Lecture: Polymorphism - quality control issues

12th week:
Lecture: Polymorphism of dyes and explosives.

13th week:
Lecture: Crystallographic databases. CSD, polymorph structures in the Database.

14th week:
Lecture: Regulatory questions of polymorphism. FDA, ICH, EMEA rules, Q6A.Case studies. Polymorphism of chocolate

Requirements

Entrance conditions: successful final exam on Pharmaceutical technology II., at least 5 students.

Department of Physiology

Subject: **MODERN TECHNIQUES ALLOWING THE INVESTIGATION OF PHYSIOLOGICAL PHENOMENA**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **20**

1st week:
Lecture: Application of electrophysiological techniques in the investigation of the electric activities of living cells.

2nd week:
Lecture: Methods allowing the monitoring of the intracellular Ca2+ concentration in living cells.

3rd week:
Lecture: Analysis, evaluation and interpretation of current recordings. Biostatistics.

4th week:
Lecture: Preparation of neurones for functional investigation. Possible advantages and disadvantages of the applicable methods.

5th week:
Lecture: Investigation of the signal transducing proteins at the levels of proteins, RNA or DNA (immunocytochemistry, immunohistochemistry, confocal microscopy, Western blot, quantitative [real-time] PCR).

6th week:
Lecture: Cell and tissue culture (primary cultures, cell lines, organ cultures).

7th week:
Lecture: Isolation and identification of contractile proteins by biochemical methods.

8th week:
Lecture: Measurements conducted on isolated ion channels: the bilayer technique.

9th week:
Lecture: tutorial

10th week:
Lecture: Final Assessment.

Requirements

1. Signature of the semester
Lecture attendance may be followed up by the Department. The lecture will not be delivered if 5 or fewer students show up. Nevertheless, the lecture material is going to be asked in the final assessment.

For continuous updates on all education-related matters, please check the elearning.med.unideb.hu web site (Department of Physiology menu item).

2. Evaluation during the semester
None.

3. Examination
At the end of the course a written final assessment will be organized in the form of multiple choice questions.

The result of this assessment will determine the verification mark of the credit course using the following conversion table:
0-39.9% - Failed
40-54.9 - Pass
55-69.9% - Satisfactory
70-84.9% - Good
85-100% - Excellent

Subject: **PROBLEM BASED LEARNING IN PHYSIOLOGY**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: The practices are listed at the web site of the elearning.med.unideb.hu web site (Department of Physiology menu item).

Requirements

1.Signature of the semester
This is an individual project oriented program. The signature of the semester may be refused if the project report is not submitted before to the deadline.

2.Evaluation during the semester
No mid-semester evaluation.

3.Examination
The evaluation is based on the project report submitted before the deadline. For specifics, see the rules below and consult with the elearning.med.unideb.hu website (Department of Physiology menu item).

Aims of the course: The program offers carefully selected and designed problems from the field of Physiology. Students can learn how to apply problem solving approach, self-conducted strategy and analytic thinking in resolving selected problems. Skill in team-work is helpful in the program.

RULES FOR THE PROBLEM BASED LEARNING (PBL) CREDIT COURSE
1. The program is conducted between 3rd and 11th academic weeks of the second semester.
2. Students must have a tutor, this is the prerequisite for the program. Tutor can be any professor of the Department, not only the student's seminar/practical instructor. The applicant should contact the

chosen professor and request him/her to undertake the tutorship. Professors of the Department maintain the right to accept or refuse to be the tutor of an applicant.
3. Special Rule: the applicant has to organize the chosen project and register at the tutor (NOT via NEPTUN) until the end of first academic week. Applications after the first week are not accepted.
4. Preconditions for the program: mark three (3) or better in Physiology I and permission of the Department (arranged by the tutor).
5. The maximum number of participants in the program cannot exceed 100 students. In case, the number of applicants is higher than 100, the seminar/practical instructor or the course coordinator can refuse applicants with mark three or better.
6. Two students works in team on one project, and prepare one mutual report, thus they get the same score at the end of the program regardless their contribution. The Journal Club and Lab Visit programs are carried out individually.
7. Evaluation of the students is based on the written report or the oral presentation using five grade score system (1-5). Grades are final, no make-up is allowed.
8. The list of offered programs is available at the practical lab of the elearning.med.unideb.hu website (Department of Physiology menu item).
9. The deadline for the program is the end of the 11th academic week. Reports should be submitted to the tutor. Missing the deadline automatically results grade 1 (fail).
10. Detailed information for the program can be accessed on the elearning.med.unideb.hu web site (Department of Physiology menu item).

Subject: **THE REGULATORY ROLE OF THE CELL MEMBRANE IN PHYSIOLOGICAL AND PATHOLOGICAL CONDITIONS**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **20**

1st week:
Lecture: Introduction, a general characterisation of the cell membrane. The electrical and biochemical characteristics of the surface membrane.

2nd week:
Lecture: General description of cardiac ionic currents. The connection between excitatory processes and the regulation of [Ca2+]i

3rd week:
Lecture: [Ca2+]i dependent excitatory processes in the surface membrane of cardiac cells.

4th week:
Lecture: The structure of the skeletal muscle. Ionic channels underlying the excitability of the skeletal muscle. Molecular structure of ionic channels.

5th week:
Lecture: Changes in surface membrane function in inherited skeletal muscle disorders: degenerative forms (muscle dystrophies). Changes in surface membrane function in inherited skeletal muscle disorders: alterations in the muscle tone (myotonies).

6th week:
Lecture: The role of the surface membrane in the regulation of calcium homeostasis in neurons. Pathological conditions arising from abnormal calcium handling in neurons.

7th week:
Lecture: Changes in the membrane properties of the neurons under pathological conditions. Pathological conditions arising from the hyperexcitability of neurons.

8th week:
Lecture: The role of TRP channels in the regulation of biological processes of human skin cells. TRP-pathies.

9th week:
Lecture: The role of the endocannabinoid system in the transmembrane signaling of skin-derived cells. Is the human skin always "high"?

Requirements

1. Signature of the semester
Lecture attendance may be followed up by the Department. The lecture will not be delivered if 5 or fewer students show up. Nevertheless, the lecture material is going to be asked in the final assessment.
For continuous updates on all education-related matters, please check the elearning.med.unideb.hu web site (Department of Physiology menu item).

2. Evaluation during the semester
None.

3. Examination
At the end of the course a written final assessment will be organized in the form of multiple choice questions.
The result of this assessment will determine the verification mark of the credit course using the following conversion table:

0-39.9% - Failed
40-54.9 - Pass
55-69.9% - Satisfactory
70-84.9% - Good
85-100% - Excellent

Division of Biomathematics

Subject: **COMPUTER SCIENCE**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Exemption Tests.

2nd week:
Practical: Word processor programs, MS Word I.

3rd week:
Practical: Word processor programs, MS Word II.

4th week:
Practical: Word processor programs, MS Word III.

5th week:
Practical: Fundamentals and basic concepts informatics.

6th week:
Practical: Logical and physical realization of networks.

7th week:
Practical: Internet.

8th week:
Practical: Spreadsheets programs, MS Excel I.

9th week:
Practical: Spreadsheets programs, MS Excel II.

10th week:
Practical: Spreadsheets programs, MS Excel III.

11th week:
Practical: Spreadsheets programs, MS Excel IV.

12th week:
Practical: Computerised presentation, MS PowerPoint.

13th week:
Practical: Summary.

14th week:
Practical: Test.

Requirements

The acquisition of fundamental theoretical and practical knowledge from the function of the modern personal computers.

Course description:
PC architecture, operating systems, file management, network knowledge, internet and its opportunities of application, word processor, spreadsheet, the usage of presentational programs, the achievement of scientific databases and its use.
Without registration, there is no way to do the course! First year students who missed/skipped the exemption test, but signed up for the course in the Neptun must attend the course and do the final test at the end. For students attending the informatics course a maximum of 4 absences are allowed during the semester to receive a signature (we recommend to use as few as possible, in case an emergency comes up). This is taken very seriously! Missing more than 4 classes automatically means losing the chance to pass the course. There will be a final test at the end of the semester. Students are allowed to make up the missed practices with another group but only on the given week, if there are enough free seats in the room.
The course start with an exemption test. Only first year students are allowed to write the exemption test at the first week of the given semester with their group (appointment should be checked in the given timetable). In any other cases (students older than first year/repeaters/students who are not exempted) students have a final test at week 14 of the given semester. There is no other self control test during the semester. At the end of the course students will write a final test. The exemption and the final tests covers topics and skills in connection with Microsoft office Word, Excel, and PowerPoint (versions: 2016) programs, as written in the curriculum. Both of the tests (exemption and the final test) are written tests. The tests are practical tests, conducted in the computer room. Students passing the exemption test will automatically receive 5 (excellent) grade at the end of the semester.

Final grades based on the final test score will be given according to the followings:
0-60% = grade 1 (fail);
61%-70% = grade 2 (pass);
71% - 80% = grade 3 (satisfactory);
81% - 90% = grade 4; (good)
91% = grade 5 (excellent).

Students should download free Office guide books from the internet offered at the webpage of the course (Email registration is required for downloading files). Students who did not get exemption/did not show up at the exemption test/repeaters/students older than first year MUST ATTEND on the course. They should join to one of the groups mentioned in the timetable. The number of the seats is limited in the classroom. Students who has informatics course in the given appointment (according to the timetable) have priority to attend the lesson. Others are allowed to join to the given group if there are free seats. Older students have to do the whole course as well. Students passing the exemption test will automatically receive 5 (excellent) grade at the end of the semester. Students who failed the exemption test must attend the course and do the final test at the end. Students having ECDL (European Computer Driving Licence) or are not required to write the exemption test, they should show their ECDL certificate to the educational manager of the department and they will be exempted automatically.

Division of Biophysics

Subject: **MODERN BIOPHYSICAL METHODS IN BIOLOGY AND MEDICINE**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **24**

3rd week:
Lecture: Luminescence spectroscopy. Theoretical and technical background and principles of application of fluorescence spectroscopy. Fluorescence conjugation of biomolecules, techniques based on fluorescence resonance energy transfer.

4th week:
Lecture: Selected applications of Magnetic Resonance Imaging: exploitation of molecular motions.

5th week:
Lecture: Modern microscopy methods for structural and functional characterization of cells. Theoretical background of fluorescence microscopy and image processing. Generation of scanning and wide-field images. Detectors, analog/digital conversion and digital storage of images. Digital image analysis: principles and biological applications. Principles of confocal microscopy. High resolution non-linear optical microscopy.

6th week:
Lecture: Principles and applications of flow cytometry. Structure of a flow cytometer and its application fields: immunogenetics, receptor and antigen research and diagnostics, DNA and cell cycle analysis, measurement of membrane potential, membrane permeability and determination of cytosolic pH and ion concentrations, application of fluorescence resonance energy transfer to determine protein associations. (FCET).

7th week:
Lecture: Structure of the cell membrane, functional consequences of the mobility (lateral and rotational movement) of proteins in the membrane. Novel models for the structure of the cell membrane, lipid domains. Time-dependent fluorescence and phosphorescence spectroscopy, fluorescence recovery after photobleaching (FRAP), fluorescence correlation spectroscopy.

8th week:
Lecture: Modern electrophysiological techniques. Passive and active electrical properties of the cell membrane, structure and

function of ion channels. Principles and application of the patch clamp technique: recording ionic currents and membrane potential.

9th week:
Lecture: LSC - Laser-Scanning Cytometry (imaging cytometry, slide-based imaging cytometry). Limitations of flow cytometry and microscopy. Comparing flow cytometry, confocal microscopy and laser-scanning cytometry. How does laser-scanning cytometry work? Strength and limitations of the laser-scanning cytometry. Laser scanning-cytometry in cell biology and clinical research.

10th week:
Lecture: Closing test

Requirements

Aim of the course:
Based on the principles covered in biophysics and cell biology discussion of problems with special relevance to medical biology from a modern molecular biophysical and quantitative biological aspect.

Short description of the course topics:
1. Application of nuclear magnetic resonance spectroscopy (NMR) and imaging (MRI) in biology and medicine
2. Luminescence spectroscopy.
3. Flow cytometry and its applications.
4. Structure of the cell membrane, mobility of lipids and proteins in the plasma membrane.
5. Advanced microscopy.
6. Modern electrophysiological techniques
7. Slide-based cytometry.

Compulsory literature: course material and lecture slides published on the website of the Department

Recommended reading: Medical biophysics (Damjanovich, Fidy, Szöllősi Eds.), Medicina, 2009;
Web address for the course material:
http://biophys.med.unideb.hu/en/elect_bpmethods_lecture.htm

Type of examination: practical grade, 5 levels

Requirements:
Conditions for signing the lecture book: attending 5 lectures out of 7. Attention! Lecture books are handled exclusively by the study advisor during the dedicated office hours!
Type of examination: practical grade, 5 levels
*Examination: w*ritten test. The exam date is shown in the curriculum

below 50%: fail
50%-59%: pass
60-69 % : satisfactory
70-79 %: good
>= 80% excellent

Repeated/improved exam: during the examination period, one occasion, written test.

CHAPTER 22
TITLES OF THESES

Department of Anatomy, Histology and Embryology

1. Title: Possible applications of morphofunctional matrices for classification of neurons (computer modelling)
Tutor: Ervin Wolf M.Sc., Ph.D.

2. Title: Correlation analysis of functional brain maps
3. Title: Investigation of contour integration processing in the primary visual cortex using voltage sensitive dye imaging
Tutor: Zoltán Kisvárday M.Sc., Ph.D., D.Sc.

4. Title: Investigation of signalling mechanisms that regulate cartilage development and maturation
Tutor: Róza Zákány M.D., Ph.D.

5. Title: Interrogation of spinal dorsal horn circuits with electrophysiological and optogenetic tools
6. Title: Light- and electron microscopy level analysis of the axons and axon collaterals of spinal lamina I projection neurons
7. Title: Local synaptic connections of projection neurons in spinal lamina I
8. Title: Morphometric analysis of excitatory and inhibitory interneurons in the spinal dorsal horn
Tutor: Péter Szücs M.D., Ph.D.

9. Title: Extracellular matrix in the developing brainstem
Tutor: Ildikó Wéber M.Sc., Ph.D.

10. Title: Matrix metalloproteases in vestibular lesion
Tutor: Botond Gaál M.Sc., Ph.D.

11. Title: Investigation of neuronal network development in the spinal cord
Tutor: Zoltán Mészár M.Sc., Ph.D.

12. Title: The role of the molecular clock in healthy and osteoarthritic chondrocytes
Tutor: Csaba Matta M.Sc., Ph.D.

13. Title: Role of PACAP signalling in cartilage differentiation and regeneration
Tutor: Tamás Juhász M.Sc., Ph.D.

14. Title: Distribution of the extracellular matrix in the red nucleus and pararubral area
Tutor: Éva Rácz M.Sc., Ph.D.

15. Title: The endocannabinoid-mediated modulation of spinal nociception
16. Title: The role of astrocytes in spinal pain processing
Tutor: Zoltán Hegyi M.Sc., Ph.D.

17. Title: Quantitative morphological studies of primary afferent-motoneuron connections in the frog's brainstem
Tutor: András Birinyi M.Sc., Ph.D.

18. Title: Role of pro-inflammatory cytokines in neuron-glia interaction during inflammatory pain states
Tutor: Krisztina Holló M.Sc., Ph.D.

19. Title: Mapping of synapses on dendrites of GABAergic neuron subtypes in the cerebral cortex
Tutor: Petra Talapka Ph.D.

Department of Biochemistry and Molecular Biology

1. Title: The role of the transcription factor BACH1 in macrophage function and tissue homeostasis
2. Title: Transcriptional analysis of the angiogenic effect of macrophages
Tutor: László Nagy M.D., Ph.D., M.H.A.Sc.

3. Title: Characterization of the nuclear tissue transglutaminase
4. Title: The effect of tissue transglutaminase-deficient states on the metabolism of differentiating and terminally differentiated NB4 neutrophil granulocytes

5. Title: The role of tissue transglutaminase in the differentiation of neutrophil granulocytes
Tutor: Zoltán Balajthy M.Sc., Ph.D.

6. Title: Production of dendritic cells and macrophages from embryonic stem cells.
7. Title: Transcriptional programming of dendritic cells
8. Title: Transcriptional programming of embryonic stem cell-derived myeloid cells
Tutor: István Szatmári M.Sc., Ph.D.

9. Title: Bioinformatic analysis of tissue-specific and tumor-specific gene expression regulation
Tutor: László Bálint Bálint M.D., Ph.D.

10. Title: Effects of various coeliac autoantibodies on transglutaminase 2 activities and interactome.
11. Title: Studying structure and function relationship of transglutaminases and its application in translational medicine
Tutor: Róbert Király M.Sc., Ph.D.

12. Title: Epigenetic regulation of homologous recombination
13. Title: Genomic analysis of chromosomal R-loops
Tutor: Lóránt Székvölgyi M.Sc., Ph.D.

14. Title: Analysis of the regulatory elements of the macrophage genome using next generation sequencing data
Tutor: Gergely Nagy M.Sc., Ph.D.

15. Title: Biochemical characterization of retroviral and retroviral-like proteases
Tutor: János Mótyán M.Sc., Ph.D.

16. Title: Analysis of protein interaction networks
17. Title: Metabolomic analysis of saliva
18. Title: Proteomic analyses in diabetes
19. Title: System biology approaches to diabetes
Tutor: Éva Csősz M.Sc., Ph.D.

20. Title: Evaluation of the browning potential and inducibility from human fat tissue biopsies
Tutor: Mária Szatmári-Tóth M.Sc., Ph.D.

21. Title: Regulation and effector functions of alternatively activated macrophages
Tutor: Zsolt Czimmerer M.Sc., Ph.D.

22. Title: Assembly and analysis of the reference genome for the diploid domestic rabbit using PacBio and 10X Chromium sequencing data
23. Title: Bioinformatic meta-analysis of ChIP-seq and ChIA-PET datasets to understand the regulation of transcriptional units
Tutor: Endre Barta M.Sc., Ph.D.

24. Title: Characterization of adipocytes with thermogenic potential
25. Title: Plasticity of the thermogenic potential of adipocytes, identification of key extrinsic and intrinsic factors
26. Title: The effect of environmental factors on the in vitro differentiation and beigeing potential of primary adipocytes
Tutor: Beáta Bartáné Tóth M.Sc., Ph.D.

27. Title: Investigation of novel molecular elements of the browning machinery in different human adipose tissues
28. Title: Investigation of the biological significance of "batokine" secretion in human cell models
Tutor: Endre Károly Kristóf M.D., Ph.D.

29. Title: Analysis of hemoglobin forms in pathologic states
30. Title: Metabolomic analyses in diabetes
Tutor: Gergő Kalló M.Sc., Ph.D.

31. Title: Characterization of genetic risk factors of chronic pancreatitis
Tutor: András Szabó M.Sc., Ph.D.

Department of Biophysics and Cell Biology

1. Title: Investigation of cell surface distribution of erbB-2 oncoprotein in breast tumor cell lines
2. Title: Role of tumor stem cells in trastazumab resistant breast tumors
Tutor: János Szöllősi M.Sc., Ph.D., D.Sc., M.H.A.Sc.

3. Title: Studying the inactivation of voltage gated potassium ion channels in heterologous expression systems
Tutor: György Panyi M.D., Ph.D., D.Sc.

4. Title: Epigenetic regulation of nucleosome-DNA cohesion
Tutor: Gábor Szabó M.D., Ph.D., D.Sc.

5. Title: Mathematical analysis and computer modelling of the topology of cell surface proteins
6. Title: Role of MHC in the organization of cell surface proteins
Tutor: László Mátyus M.D., Ph.D., D.Sc.

7. Title: Cytometry of cytotoxic lymphocytes
8. Title: Physiological roles of the multidrug resistance transporter P-glycoprotein
Tutor: Zsolt Bacsó M.D., Ph.D.

9. Title: Elucidation of the catalytic mechanism of ABC transporters
Tutor: Katalin Goda M.Sc., Ph.D.

10. Title: Development of machine learning-based methods for identification of cellular components
11. Title: Effect of the lipid composition of the cell membrane on membrane protein clustering and on cell biological processes related to the cell membrane
12. Title: Role of changes in the dynamic properties of the cell membrane in the protective role of methane against hypoxia-reperfusion injury
Tutor: Péter Nagy M.D., Ph.D., D.Sc.

13. Title: Membrane biophysical and cell biological effects of cyclodextrins
14. Title: The role of the Hv1 proton channel in vascular smooth muscle cells
Tutor: Zoltán Varga M.Sc., Ph.D., D.Sc.

15. Title: Biophysical analysis and functional significance of cell surface protein patterns in T cell-mediated immune responses
Tutor: Andrea Dóczy-Bodnár M.Sc., Ph.D.

16. Title: Ligand depedence of nuclear receptor function studied by single molecule microsocpy
17. Title: Studying the function and interactions of interleukin-2 and -15 receptors by advanced microscopy
Tutor: György Vámosi M.Sc., Ph.D.

18. Title: Generating and characterizing multicomponent primary human cell cultures for transplantation therapy of stem cell deficient corneas
19. Title: Molecular interactions in histopathological diagnosis: applying FRET in a confocal fluorescence digital pathology slide scanner
20. Title: Optimizing reprogrammed, chimeric antigen receptor (CAR) -transduced human T cells for tumor therapy
21. Title: Role of receptor tyrosine kinases and integrins in the therapy resistance of tumors
Tutor: György Vereb M.D., Ph.D., D.Sc.

22. Title: Ion channel expression of engineered T cells used in cancer immunotherapy
23. Title: Ion channel expression of tumor infiltrating T cell populations
Tutor: Péter Hajdu M.Sc., Ph.D.

24. Title: Genetically engineered NK cells as off-the-shelf living drugs in cancer therapy
25. Title: Universal chimeric antigen receptors (CARs): new weapons for lymphocytes fighting autoimmune diseases
Tutor: Árpád Szöőr M.D., Ph.D.

Department of Anesthesiology and Intensive Care

1. Title: Experimental testing of the neuromuscular junction
Tutor: Ákos Fábián M.D., Ph.D.

2. Title: Preemptive and preventive analgesia
Tutor: Béla Fülesdi M.D., Ph.D., D.Sc.

3. Title: The role of hypotermia in neuroprotection
Tutor: Csilla Molnár M.D., Ph.D.

4. Title: Clinical studies in the field of neuromuscular block and its reversal
Tutor: Adrienn Pongrácz M.D., Ph.D.

Department of Behavioural Sciences
1. Title: Basic issues of psy-complex (psychology, psychotherapy, psychiatry)
2. Title: Changing attitudes towards human phenomena in Western medicine
3. Title: Changing attitudes towards human phenomena in Western medicine
4. Title: Contemporary problems of Psy-complex
5. Title: Contemporary problems of Psy-complex
6. Title: Health and disease in cultural context
7. Title: Health and disease in cultural context
8. Title: Medicalization and its social context
9. Title: Medicalization and its social-cultural context
10. Title: Prolongation of life as a modern Western project
11. Title: Prolongation of life as a modern Western project
12. Title: The importance of the point of view of psychoanalysis for a humanistic medicine.
Tutor: Attila Bánfalvi M.A., Ph.D., C.Sc.

13. Title: End of life decisions
Tutor: Sándor Kőmüves M.A., Ph.D.

14. Title: Evolutionary Psychopathology
15. Title: Humor and Mental Health
16. Title: Life History Strategy elements in mate choice, attachment, and mental health
Tutor: Roland Tisljár M.A., Ph.D.

17. Title: Bioethical and biopolitical challenges of modern health care (Faculty of Medicine)
18. Title: Ethical and health policy aspects of the research and clinical use of controlled substances (Faculty of Medicine)
Tutor: János Kristóf Bodnár M.A., Ph.D.

Department of Inorganic and Analytical Chemistry
1. Title: Application of citrate buffers in clinical analysis and diagnosis. (A literature survey)
Tutor: Imre Tóth D.Sc.

2. Title: Experimental methods for the study of redox properties of copper (II) complexes (A literature survey)
Tutor: Katalin Várnagy M.Sc., Ph.D., D.Sc.

3. Title: The role of oxidation of biomolecules by catalysation of metal ions in the development and onset of neurodegenerative disorders. (A literature survey)
Tutor: Csilla Kállay M.Sc., Ph.D.

Division of Cardiac Surgery
1. Title: Mid-term results of transcatheter aortic valve implantations - review of the literature
Tutor: Tamás Maros M.D.

2. Title: Composite grafts in coronary surgery - review of the literature
Tutor: Ambrus Horváth M.D.

3. Title: Sutureless aortic valve implantation - rewiew of the literature
Tutor: Lehel Palotás M.D.

4. Title: Non-occlusive mesenteric ischaemia after cardiac surgery-review of the literature
Tutor: Tamás Debreceni M.D.

Department of Public Health and Epidemiology
1. Title: 1. Migration of health workers in the European Union with a focus on regulation 2. Mutual recognition of diplomas in the European Union: a historical overview 3. Prevention and management of diabetes in the EU Member States, with reference to regulation 4. The burden of diabetes in the EU Member States 5. Burden of disease of complications of diabetes mellitus in the EU Member States
Tutor: Orsolya Varga M.D., Ph.D.

2. Title: 1. Mental health of youth 2. Interventions to improve the mental health of youth 3. Mental health of health care workers 4. Interventions to improve the mental health of health care workers 5. Relationship between health literacy and health status (only for dentist students) 6. Relationship between health literacy and medication adherence (only for pharmacist students) 7. Social support among university students
Tutor: Éva Bíró M.D., Ph.D.

3. Title: 1. Sociodemographic, environmental and lifestyle determinants of obesity 2. The effect of neighborhood environment on physical activity and diet 3. The effect of dietary interventions on the risk of chronic non-communicable diseases 4. Use of Healthy Eating index for the characterization of diet quality 5. Prevalence and determinants of dietary supplement use (only for pharmacist students) 6. Patterns and correlates of anabolic androgenic steroid use (only for pharmacist students) 7. Associations between diet quality and dental caries (only for dentist students) 8. Socioeconomic and lifestyle determinants of dental caries (only for dentist students)
Tutor: Helga Bárdos M.D., M.Sc., Ph.D.

4. Title: 1. Contaminants of traditional Chinese and Indian medicines 2. Morbidity and mortality from oral cavity cancers in selected European countries 3. Toxicology of fluorides 4. Effect of smoking on drug metabolism 5. Toxicology of zinc
Tutor: Sándor Szűcs M.Sc., Ph.D.

5. Title: 1. Conducting systematic review on selected diagnostic research topics 2. Conducting systematic review on selected prognostic research topics 3. Conducting systematic review on selected intervention research topics
Tutor: Szilvia Fiatal M.D., Ph.D.

6. Title: 1. Evaluation of chronic care for adult overweighted in general medical practice 2. Evaluation of chronic care for adult smokers in general medical practice 3. Evaluation of chronic care for diabetes mellitus in general medical practice 4. Evaluation of chronic care for hypertension in general medical practice 5. Social inequalities in health 6. Disease burden of rare diseases 7. Evaluating effectiveness of population based screenings 8. Nutritional habit in the first trimester of pregnancy
Tutor: János Sándor M.D., Ph.D.

7. Title: 1. Assessment of health risks of micro- and nano-encapsulated plant protection products: a systematic literature review 2. Investigation of the DNA damaging potential of plant protection products using genotoxicological methods 3. Comparative assessment of the cytotoxic effect of glyphosate and glyphosate based herbicides 4. Assessment of health risks of micro- and nanoencapsulated plant protection products: a systematic literature review 5. Assessment of ergonomic risk factors among workers in different professions
Tutor: Károly Nagy Ph.D.

8. Title: 1. Alcohol consumption and human immunodeficiency virus infection 2. Pharmacological treatment of alcohol use disorders 3. Alcohol use by adolescents in Europe between 1993 and 2019 4. Alcohol use in the European Union 5. Health effects of flame retardants
Tutor: László Pál Ph.D.

9. Title: 1. Analyses of workforce crisis in Hungarian general practices 2. Frequency of influenza vaccination among chronic diseased patients in Hungary: A general practice based investigation 3. Frequency of influenza vaccination among the elderly: A general practice based investigation 4. The effectiveness of hypertension care in Hungary 5. Are serum uric acid levels are associated with cardiovascular risk score among hypertonic patients? 6. Investigation of stroke frequency in adult and mixed general practices 7. Investigation of AMI frequency in adult and mixed general practices

Tutor: Ferenc Vincze M.Sc.

10. Title: 1. Investigation of the global burden of chronic non-communicable diseases 2. Investigation of the global burden of chronic non-communicable diseases regarding socio-economic development 3. Trends in mortality from non-communicable diseases 4. Prevalence of complications due to diabetes mellitus in Europe 5. Socioeconomic determinants of diabetes mellitus complications across Europe
Tutor: Nóra Kovács M.Sc.

11. Title: 1. Health and health behaviour of adolescents 2. Problematic internet use among adolescents 3. Health promotion opportunities among school-aged children
Tutor: Gabriella Pénzes M.Sc.

Division of Cardiology

1. Title: Evaluation of "Flow separation resistance index" in coronary artery disease.
Tutor: Zsolt Kőszegi M.D., Ph.D.

2. Title: Pericardial fat tissue
3. Title: Safety antidiabetic therapy
Tutor: Tibor Fülöp M.D., Ph.D.

4. Title: Feasibility of pulmonary balloon angioplasty in CTEPH patients.
5. Title: Percutaneous interventional strategies in patients with chronic coronary artery occlusion.
Tutor: Tibor Szűk M.D., Ph.D.

6. Title: Structural interventions in cardiology
Tutor: Attila Kertész M.D., Ph.D.

7. Title: Pre-TAVI investigations - CT in focus.
8. Title: The role of cardiac-CT - general overview.
Tutor: Rudolf Kolozsvári M.D., Ph.D.

9. Title: Assessment of the right heart side by 3D echocardiography
10. Title: The role of 3D echocardiography in mitral valve disease
Tutor: Csaba Jenei M.D.

11. Title: Examining the correlation of immunohistochemistry parameters of patients with HER2 positive breast cancer and trastuzumab-induced cardiotoxicity.
Tutor: Dániel Czuriga M.D., Ph.D.

12. Title: Comparison of STEMI and NSTEMI cases after primary PCI: the role of secondary prevention
Tutor: László Fülöp M.D., Ph.D.

13. Title: Atrial fibrillation and new oral anticoagulant therapy
Tutor: Gábor Kolodzey M.D.

14. Title: Gestational hypertension management at the Department of Cardiology, University of Debrecen.
Tutor: Alexandra Kiss M.D., Ph.D.

15. Title: Investigating the effects of therapeutic hypothermia in patients after out-of-hospital arrest.
Tutor: Árpád Kovács M.D., Ph.D.

Department of Botany

1. Title: Stress tolerance and resistance mechanisms of higher plants
Tutor: Ilona Mészáros M.Sc., Ph.D., C.Sc.

2. Title: The study of chromatin and microtubule organization in cells of higher plants
Tutor: Csaba Máthé M.Sc., Ph.D.

3. Title: Plant bioactive compounds
Tutor: Gábor Vasas M.Sc., Ph.D., D.Sc.

4. Title: Role of glycoproteins in infection and immunology (bibliographic)
Tutor: János Kerékgyártó M.Sc., Ph.D., C.Sc.

Division of Clinical Physiology

1. Title: Improvement of myocardial inotropy under physiological and pathological conditions
Tutor: Zoltán Papp M.D., Ph.D., D.Sc.

2. Title: The role of angiotensin II in cardiovascular diseases

3. Title: Vascular alterations leading to hypertension.
Tutor: Attila Tóth M.Sc., Ph.D., D.Sc.

4. Title: Angiotensin converting enzymes in the laboratory diagnostics
5. Title: Endogenous regulation of the renin-angiotensin-aldosterone system and its clinical significance
Tutor: Miklós Fagyas M.D., Ph.D.

6. Title: Investigating mechanisms contributing to the myogenic tone of the coronary arteries
Tutor: Viktória Csató M.Sc., Ph.D.

Division of Nuclear Medicine and Translational Imaging

1. Title: Development of interactive E-learning material for nuclear medicine
Tutor: József Varga M.Sc., Ph.D.

2. Title: Importance of FDG PET/CT in cardiology
3. Title: Metabolic parameters in correlation with different oncological therapies
4. Title: Targeted radionuclide therapies in metastatic prostate cancer
5. Title: Targeted radionuclide therapies in neuroendocrin tumors
Tutor: Ildikó Garai M.D., Ph.D.

Division of Radiology and Imaging Science

1. Title: Analysis of Pediatric Radiology Examinations
Tutor: Nóra Vrancsik M.D.

Department of Medical Imaging

1. Title: Posttherapeutic I-131 whole body SPECT/CT in patients with thyroid cancer
2. Title: The role of Tc99m-Tektrotyd SPECT/CT to evaluate metastatic neuroendocrine tumors
Tutor: Ildikó Garai M.D., Ph.D.

3. Title: Localisation of anatomical regions of CT scans with machine learning methods
Tutor: Zoltán Barta M.D.

Department of Human Genetics

1. Title: Transcriptional regulation of immune responses.
Tutor: Lajos Széles M.Sc., Ph.D.

2. Title: Analysis of mono-ADP-ribosylated proteins from pro- and eukaryotic cells.
Tutor: András Penyige M.Sc., Ph.D.

3. Title: Analysis of an A factor non-producer bald mutant Streptomyces griseus strain with respect of antibiotic production and cell differentiation.
Tutor: Zsuzsanna Birkó M.Sc., Ph.D.

4. Title: Overview of the background of an arbitrary genetic disorder.
5. Title: Overview of the genetic background influencing the pharmacokinetics and pharmacodynamics of a drug.
Tutor: Judit Keserű M.Sc., Ph.D.

6. Title: MiRNA-profiling of regressive Wilms' tumors.
7. Title: Studying the role of long non-coding RNAs in glioblastoma.
Tutor: Gergely Buglyó M.D., Ph.D.

8. Title: Investigation the diet–microbiota interactions due to regular sport and personalized nutrition.
9. Title: Next-generation sequencing for the investigation of the small RNA transcriptome in hemato-oncology patients.
Tutor: Melinda Paholcsek M.Sc., Ph.D.

10. Title: Exosomes, as possible biomarkers.
Tutor: Beáta Soltész M.Sc., Ph.D.

11. Title: Study the role of microRNAs in ovarian cancer.
Tutor: Melinda Szilágyi-Bónizs M.Sc., Ph.D.

Department of Immunology

1. Title: The role of the HOFI/SH3PXD2B adaptor protein in the regulation of the tumor microenvironment
Tutor: Árpád Lányi M.Sc., Ph.D.

2. Title: The role of innate immune cells in the development of allergic responses
3. Title: The role of innate lympoid cells (ILC) in human diseases
Tutor: Attila Bácsi M.Sc., Ph.D., D.Sc.

4. Title: Altered differentiation of monocyte derived dendritic cells and their functional differences
Tutor: Péter Gogolák M.Sc., Ph.D.

5. Title: Investigation of phytocannabinoid effects on human monocyte-derived dendritic cells
6. Title: Investigation of transient receptor potential channels on human monocyte-derived dendritic cells
Tutor: Attila Szöllősi M.D., Ph.D.

7. Title: Identification of new viral senzors and new regulatory mechanisms in the antiviral responses of human dendritic cells
8. Title: Role of dendritic cells in the development of autoimmune diseases
Tutor: Kitti Pázmándi M.Sc., Ph.D.

9. Title: Study of non-apoptotic cytotoxic processes during immune response, new way of killing apoptosis resistant tumor cells
Tutor: Gábor Koncz M.Sc., Ph.D.

Department of Clinical Oncology
1. Title: Prognostic factors in colorectal cancer
Tutor: Csilla András M.D., Ph.D. habil.

2. Title: Treatment modalities in pancreas cancer
Tutor: Péter Árkosy M.D., Ph.D. habil.

3. Title: Current treatment of metastatic bladder cancer
4. Title: Treatment options of metastatic castration-resistant prostate cancer
Tutor: Balázs Juhász M.D.
5. Title: Cardiological side effects of fluorouracyl in oncological patients
Tutor: Anita Árokszállási M.D., Ph.D.

6. Title: Palliation in oncology
Tutor: Éva Szekanecz M.D., Ph.D.

7. Title: Prognostic factors in low grade and high grade gliomas
8. Title: Treatment options in advanced and metastatic breast cancer
Tutor: József Virga M.D., Ph.D.

Department of Laboratory Medicine
1. Title: Evaluation of known and novel autoantibodies in the diagnostics of autoimmune and immune-mediated disorders
2. Title: Identification of novel biomarkers for the detection and prediction of cirrhosis associated infections
Tutor: Péter Antal-Szalmás M.D., Ph.D.

3. Title: Vitamin D status in colorectal carcinoma
Tutor: Harjit Pal Bhattoa M.D., Ph.D.

4. Title: Cytogenetic aberrations in infertility
5. Title: Genetic examinations in t(12;21) positive childhood acute lymphoblastic leukemia
Tutor: Anikó Ujfalusi M.D., Ph.D.

6. Title: Analysis of serum human epididymis protein 4 (HE4) in the follow-up of cystic fibrosis patients
7. Title: Investigation of platelet microRNA expressions in septic conditions
Tutor: Béla Nagy Jr. M.D., Ph.D.

Division of Clinical Laboratory Science
1. Title: Effect of alfa2-plasmin inhibitor heterogeneity on the risk of thrombosis
2. Title: Method development for the detection of various antithrombin isoforms
Tutor: Éva Katona M.Sc., Ph.D. habil.

3. Title: Inherited hemostasis disorders; laboratory and molecular genetic aspects
4. Title: Laboratory monitoring of the new generation oral anticoagulants
Tutor: Zsuzsanna Bereczky M.D., Dr. habil., Ph.D.

5. Title: Characterization of the heparin-antithrombin interaction with surface plasmon resonance

6. Title: New methods for investigating the interactions of blood coagulation proteins
Tutor: Krisztina Pénzes-Daku M.Sc., Ph.D.

7. Title: Fibrinolytic marker levels and polymorphisms in inflammatory bowel diseases
8. Title: Investigation of fibrinolytic markers on the outcome of thrombolytic therapy in patients with ischaemic stroke
Tutor: Zsuzsa Bagoly M.D., Ph.D.

Department of Dermatology

1. Title: Ablative laser treatment in Hailey-Hailey disease
2. Title: DNA repair mechanisms
3. Title: Indications in ablative Er:YAG laser
4. Title: Methods of sunprotection
Tutor: Éva Remenyik M.D., Ph.D., D.Sc.

5. Title: Chemical burns - special features and treatment options
6. Title: Dermatofibrosarcoma protuberans - therapeutic possibilities
7. Title: Possibilities of skin grafting in the reconstruction of defects after removal of skin tumors
8. Title: Role of NPWT (Negative Pressure Wound Therapy) in the treatment of burns
9. Title: Role of subcutaneous island pedicle flap in the reconstruction of defects after removal of skin tumors
Tutor: István Juhász M.D., Ph.D., C.Sc.

10. Title: Deformities and discolorations of the nails: relation to other medical conditions. Overview of the literature and case reports.
Tutor: Éva Szabó M.D., Ph.D.

11. Title: Different applications of the latissimus dorsi musculocutaneous flap
Tutor: Zoltán Péter M.D.

12. Title: Characteristics of chronic urticaria – analysing our patients' data
13. Title: Methotrexate use in psoriasis – the diagnosis of liver fibrosis as a possible side effect
Tutor: Krisztián Gáspár M.D., Ph.D.

14. Title: Lipid disorder associated dermatological symptoms
15. Title: Pathogenesis and therapy of acne
16. Title: Role of lipid environment in the activation of dermal macrophages
Tutor: Dániel Törőcsik M.D., Ph.D.

17. Title: New therapies in severe psoriasis vulgaris
18. Title: Omalizumab therapy in chronic urticaria
Tutor: Andrea Szegedi M.Sc., Ph.D., D.Sc

19. Title: Drug hypersensitivity reactions: types and diagnostic approach
20. Title: Penicillin allergy: diagnostics and management
Tutor: Irina Sawhney M.D.

21. Title: Correlation of clinicopathological classification of melanoma with disease outcome
Tutor: Gabriella Emri M.D., Ph.D.

Department of Medical Chemistry

1. Title: Investigation of Ser/Thr protein phosphatase in pathogenic fungi
Tutor: Viktor Dombrádi M.Sc., Ph.D., D.Sc.

2. Title: Interaction of protein phosphatase 1 catalytic subunit with regulatory proteins
Tutor: Ferenc Erdődi M.Sc., Ph.D., D.Sc.

3. Title: Regulation of macrophage activation
Tutor: László Virág M.D., Ph.D., D.Sc.

4. Title: Signal transduction pathways in pulmonary endothelial cells
Tutor: Csilla Csortos M.Sc., Ph.D., D.Sc.

5. Title: Study of metabolic processes with special regard to the involvement of mitochondrial activity.
Tutor: Péter Bay M.Sc., Ph.D., D.Sc.

6. Title: Application of High-Content Screening in Life Sciences
Tutor: Endre Kókai M.Sc., Ph.D.

7. Title: Overcoming insulin resistance by

SMTNL1-mimicking peptide
8. Title: Signalling pathways in endometriosis
Tutor: Beáta Lontay M.Sc., Ph.D.

9. Title: Inhibition of sodium-glucose cotransporter of kidney by glucose-based compounds also interfering with glycogenolysis
Tutor: Tibor Docsa M.Sc., Ph.D.

10. Title: Regulation of protein phosphatase-1 by inhibitory proteins and the translocation of the targing subunit
Tutor: Andrea Kiss M.Sc., Ph.D.

11. Title: High-Throughput Screening
Tutor: Csaba Hegedűs M.D., L.D.S., Ph.D.

12. Title: Autophagy in physiological and pathological processes
Tutor: Katalin Kovács M.Sc., Ph.D.

13. Title: Posttranslational modifications of the mitochondrial fission protein Drp1 and their role on mitochondrial morphology.
14. Title: The effect proteasomal inhibition in Huntington's disease.
Tutor: Krisztina Tar M.Sc., Ph.D.

15. Title: The role of mechanotransduction in the upregulation of CXCL1 in the small intestine
Tutor: Karen Uray M.Sc., Ph.D.

Department of Medical Microbiology

1. Title: Antimicrobial cell-mediated immunity measured by mRNA tests
Tutor: József Kónya M.D., Ph.D., D.Sc.

2. Title: Role of HPV in head and neck cancers
Tutor: Krisztina Szarka M.Sc., Ph.D.

3. Title: Evaluation of fungicidal effect of antifungal agents using time-kill curves
4. Title: New and older agents in antifungal chemotherapy
Tutor: László Majoros M.D., Ph.D.

5. Title: Prevalance of human polyomaviruses
Tutor: Eszter Csoma M.Sc., Ph.D.

6. Title: Effects of human papillomavirus oncoproteins on cellular signaling pathways in keratinocytes
Tutor: Anita Szalmás M.Sc., Ph.D.

7. Title: Molecular epidemiology of aminoglycoside resistance in nosocomial Gram negative bacteria
Tutor: Gábor Kardos M.D., Ph.D.

8. Title: Intratypical variation of human papillomaviruses
Tutor: György Veress M.Sc., Ph.D.

9. Title: The importance of fungal quorum-sensing in antifungal therapy against Candida biofilms.
Tutor: Renátó Kovács M.Sc., Ph.D.

Department of Internal Medicine

1. Title: Immunotherapy of B cell lymphomas.
2. Title: Safety profile of prolonged rituximab therapy in lymphomas.
3. Title: Targeted therapy in non-Hodgkin's lymphomas
Tutor: Lajos Gergely M.D., D.Sc.

4. Title: Lipid abnormalities in hypothyreoidism.
5. Title: The function of LDL in lipid metabolism
Tutor: György Paragh M.D., Ph.D., D.Sc.

6. Title: Diagnostic tests and imaging techniques in endocrinology.
Tutor: Endre Nagy M.D., Ph.D., D.Sc.

7. Title: Adipokines and Insulin Resistance
8. Title: Insulin resistance and non-alcoholic fatty liver disease
9. Title: Obesity: Diagnosis and Treatment
10. Title: Obesity: Etiology and Co-morbidities
Tutor: Péter Fülöp M.D., Ph.D. habil.
11. Title: Diabetic neuropathy and oxidative stress
Tutor: Ferenc Sztanek M.D., Ph.D.

12. Title: Autoimmune disorders and GI tract
Tutor: Zsolt Barta M.D., Ph.D.

13. Title: The disease course after stent inplantation in peripheral arterial disease
Tutor: György Kerekes M.D., Ph.D.

14. Title: Novel therapeutical approaches in multiple myeloma
15. Title: The impact of multi-drug resistance genes in the prognosis of lymphoproliferative disorders
Tutor: László Váróczy M.D., Ph.D. habil.

16. Title: Inherited and acquired thrombophilia
17. Title: New direct oral anticoagulants
18. Title: Stem cell therapy in peripheral arterial disorders
Tutor: Zoltán Boda M.D.,Ph.D.,D.Sc.

19. Title: Gastric cancer: clinics and treatment
20. Title: Gastrointestinal bleeding
21. Title: Gluten sensitive enteropathy
22. Title: Inflammatory bowel diseases.
23. Title: Lymphomas in the gastrointestinal tract.
Tutor: István Altorjay M.D., Ph.D., D.Sc.

24. Title: Langerhans histiocytosis
25. Title: Osteosclerotic myeloma
26. Title: Therapeutic challenges in rare haemostatic disorders
Tutor: György Pfliegler M.D., Ph.D. habil.

27. Title: Epidemiology, diagnostics and therapy of chronic hepatitis C
28. Title: Pathomechanism of alcoholic hepatitis
29. Title: Signs, diagnostics and treatment of portal hypertension.
30. Title: Therapeutic options in primary sclerotizing cholangitis
31. Title: Treatment of autoimmune hepatitis
Tutor: István Tornai M.D., Ph.D. habil.

32. Title: A case history of an interesting acute myeloid leukaemia patient in the 2nd Department of Medicine (connection with the literature data)
Tutor: Attila Kiss M.Sc., Ph.D. habil.

33. Title: Chronic neutrophilic leukaemia
Tutor: Béla Telek M.D., Ph.D.

34. Title: Biological treatment of ulcerative colitis
35. Title: Extraintestinal association in IBD
Tutor: Károly Palatka M.D., Ph.D. habil.

36. Title: The role of Willebrand factor in various internal diseases.
Tutor: Ágota Schlammadinger M.D., Ph.D.

37. Title: Bacterial infection in liver cirrhosis
38. Title: Clinical significance of chronic pancreatitis
39. Title: Current therapeutic options of acute pancreatitis
Tutor: Zsuzsa Vitális M.D., Ph.D.

40. Title: Diagnosis and treatment of chronic lymphocytic leukemia
41. Title: Novel therapeutic approches in the treatment of multiple myeloma
42. Title: Philadelphia negative chronic myeloproliferative neoplasms - novel genetic and therapeutic improvements
43. Title: Recent advances in the management of chronic ITP
Tutor: Péter Batár M.D., Ph.D.

44. Title: Are the bacterial infections predictable in liver cirrhosis?
45. Title: Role of serological markers in prediction of disease course and response to therapy in inflammatory bowel diseases.
Tutor: Mária Papp M.D., Ph.D. habil.

46. Title: Gastoesophageal reflux disease
Tutor: László Dávida M.D.

Department of Pathology

1. Title: Molecular classification of glial neoplasms
2. Title: Overview of non-adenohypophysaer neoplastic lesion within and around the sella
3. Title: Use of IDH-1 immunohistochemistry in surgical neuropathology
Tutor: Péter Molnár M.D., D.Sc.

4. Title: Functional analysis of malignant lymphomas using image analysis
5. Title: Mitotic failures and cancer progression

6. Title: Molecular diagnostics of solid tumors
Tutor: Gábor Méhes M.D., D.Sc.

Department of Internal Medicine

1. Title: Familiar antiphospholipid syndrome
Tutor: Pál Soltész M.D., Ph.D., D.Sc.

Department of Pharmacology and Pharmacotherapy

1. Title: Cardiovascular risk factors
2. Title: Metabolic link between obesity and insulin resistance
Tutor: Zoltán Szilvássy M.D., Ph.D., D.Sc.

3. Title: Anxiety in the dental chair: pharmacological treatment
4. Title: Arrhythmic patient in dentistry
5. Title: Optional title in pharmacology
6. Title: Parkinson patient in the dental chair
7. Title: Pharmacological and clinical significance of adenosine receptor antagonists
8. Title: Pharmacological and non-pharmacological treatment of endothelial dysfunction
9. Title: Pharmacology of antidepressive drugs: dental implications
10. Title: Pharmacotherapy of trigeminal neuralgia
Tutor: József Szentmiklósi M.D., Ph.D.

11. Title: Emerging roles of prostaglandin DP1 and DP2 receptors in acute and chronic aspects of allergic diseases
12. Title: Optional title in pharmacology
13. Title: Pharmacological treatment of acute decompensated heart failure (ADHF)
14. Title: Pharmacology of herbal remedies
15. Title: Pharmacology of neurogenic inflammation
16. Title: Pharmacotherapy of Amyotrophic Lateral Sclerosis (ALS)
17. Title: Pharmacotherapy of Duchenne Muscular Dystrophy (DMD)
18. Title: Possible pharmacological exploitations of TRPV1 receptors
19. Title: Use of Histone deacetylase inhibitors (HDI): Novel advances in cancer treatment
Tutor: Róbert Pórszász M.D., Dr. habil., MBA, Ph.D.

20. Title: Effect of colony stimulating factors or other drugs on bone marrow-derived cell lines
21. Title: How insulin resistance influences drug effects
22. Title: Selected topic in field experimental hemato-oncology
Tutor: Ilona Benkő M.D., Ph.D.

23. Title: Connections between rheumatoid arthritis and periodontal disease with a focus on pharmacotherapy
24. Title: Immune checkpoint inhibitors in advanced oral cancer
25. Title: Optional title on cancer chemotherapy
Tutor: Attila Megyeri M.D., Ph.D.

26. Title: Class I antiarrhythmic agents: dental implications
27. Title: COX-3 inhibitors in the dental practice
28. Title: Optional title in pharmacology
29. Title: Pharmacotherapy of bronchial asthma: dental implications
30. Title: Reflux disease and the dental patient
Tutor: Ágnes Cseppentő M.D.

31. Title: Optional title on antibacterial chemotherapy
Tutor: Zsuzsanna Gál M.Sc., Ph.D.

32. Title: Optional title in pharmacology
Tutor: Béla Juhász D.Pharm., Dr. habil., Ph.D.

33. Title: Optional title in pharmacology
Tutor: Balázs Varga D.Pharm., Ph.D.

34. Title: Optional title in pharmacology
Tutor: Mariann Bombicz D.Pharm.

35. Title: Optional title in pharmacology
Tutor: Dániel Priksz D.Pharm.

Department of Physiology

1. Title: Expression and significance of the TASK channels in physiological and pathological conditions
Tutor: Péter Szücs M.D., Ph.D.

2. Title: Alterations of intracellular calcium concentration in pathological conditions
Tutor: László Csernoch M.Sc., Ph.D., D.Sc.

3. Title: Regional differences in the electrophysiological properties of cardiomyocytes
Tutor: Péter Nánási M.D., Ph.D., D.Sc.

4. Title: Role of afterdepolarization mechanisms in the arrhythmogenesis
Tutor: Tamás Bányász M.D., Ph.D., D.Sc.

5. Title: Electrophysiological properties of mammalian cardiac tissues
Tutor: János Magyar M.D., Ph.D.,D.Sc.

6. Title: Beat-to beat variability of cardiac repolarization
Tutor: Norbert Szentandrássy M.D., Ph.D.

7. Title: Studies on ion channels incorporated into artificial membranes
Tutor: István Jóna M.Sc., Ph.D., D.Sc.

8. Title: Role of late sodium current in the arrhythmogenesis
Tutor: Balázs Horváth M.D., Ph.D.

9. Title: Role of potassium channels in neuron function
Tutor: Balázs Pál M.D., Ph.D.

10. Title: Properties of vanilloid receptors
Tutor: István Balázs Tóth M.Sc., Ph.D.

11. Title: Role of Protein Kinase C isoforms in cell function.
Tutor: Gabriella Czifra M.Sc., Ph.D.

Department of Emergency Medicine

1. Title: Cardiac rhythm disturbances. Hypertensive emergencies.
Tutor: Zoltán Szabó M.D., Ph.D.

Division of Gastroenterology

1. Title: Gastric cancer: clinics and treatment
2. Title: Gastrointestinal bleeding
3. Title: Gluten sensitive enteropathy
4. Title: Inflammatory bowel diseases
5. Title: Lymphomas in the gastrointestinal tract
Tutor: István Altorjay M.D., Ph.D., D.Sc.

6. Title: Epidemiology, diagnostics and therapy of chronic hepatitis C
7. Title: Pathomechanism of alcoholic hepatitis
8. Title: Signs, diagnostics and treatment of portal hypertension
9. Title: Therapeutic options in primary sclerotizing cholangitis
10. Title: Treatment of autoimmune hepatitis
Tutor: István Tornai M.D., Ph.D. habil.

11. Title: Biological treatment of ulcerative cholitis
Tutor: Károly Palatka M.D., Ph.D. habil.

12. Title: Are the bacterial infections predictable in liver cirrhosis?
13. Title: Role of the serological markers in prediction of disease course and response to therapy in inflammatory bowel diseases
Tutor: Mária Papp M.D., Ph.D. habil.

14. Title: Bacterial infection in liver cirrhosis
15. Title: Current therapeutic options of acute pancreatitis
Tutor: Zsuzsanna Vitális M.D., Ph.D.

Department of Internal Medicine

1. Title: Ischemic colitis.
2. Title: Life quality of Raynaud syndrome
Tutor: Zoltán Csiki M.D., Ph.D.

Division of Haematology

1. Title: Immunotherapy of B-cell lymphomas
2. Title: The role of PET/CT imaging in lymphomas
Tutor: Lajos Gergely M.D., D.Sc.
3. Title: Diagnosis and treatment of chronic lymphocytic leukemia
4. Title: Novel therapeutic approaches in the treatment of multiple myeloma
5. Title: Philadelphia negative myeloproliferative meoplasms - novel genetic and therapeutic improvements

6. Title: Recent advances in the management of chronic ITP
Tutor: Péter Batár M.D., Ph.D.

Department of Internal Medicine

1. Title: Langerhans histiocytosis
2. Title: Osteosclerotic myeloma
3. Title: Therapeutic challenges in rare haemostatic disorders
Tutor: György Pfliegler M.D., Ph.D. habil.

Division of Rheumatology

1. Title: Osteoporosis in systemic sclerosis
2. Title: Quality of life in systemic sclerosis
Tutor: Szilvia Szamosi M.D., Ph.D.

3. Title: Diagnosis and therapy of early arthritis
4. Title: Modern therapy of vasculitides
Tutor: Edit Végh M.D.

5. Title: Extra-articular manifestations in ankylosing spondylitis
Tutor: Nóra Bodnár M.D., Ph.D.

6. Title: Clinical and serological features, therapeutic possibilities of myositis-overlap syndromes at the Department of Rheumatology, University of Debrecen
Tutor: Levente Bodoki M.D., Ph.D.

7. Title: Therapeutic opportunities in psoriatic arthritis
Tutor: Zsófia Pethő M.D.

Department of Neurology

1. Title: Cerebral hemodynamics and cognitive dysfunction in treated and non-treated stroke patients
2. Title: Misdiagnosis in neurology: causes and consequences
3. Title: Neurosonological investigations in acute and chronic stroke patients
4. Title: Non-invasive investigation of endothelial dysfunction.
5. Title: The autopsy as the ultimate yardstick of medicine. Is it still true?
Tutor: László Csiba M.D., Ph.D., D.Sc., M.H.A.Sc.

6. Title: COVID-19 and Multiple Sclerosis
7. Title: Diagnosis and differential diagnosis of multiple sclerosis
8. Title: Exercise in Multiple Sclerosis
9. Title: Multiple sclerosis - treatment in 2021
10. Title: Pregnancy in multiple sclerosis
Tutor: Tünde Csépány M.D., Ph.D.

11. Title: Cerebral vasoreactivity after epileptic seizure
12. Title: Cerebral vasoreactivity after sleep deprivation
13. Title: Clinical outcome of patients with acute ethanol consumption and acute ischemic stroke out of the time window
14. Title: Clinical outcome of patients with acute intracerebral hemorrhage and acute alcohol consumption
15. Title: COVID and stroke
16. Title: Effect of rheology abnormalities on neurovascular coupling
17. Title: Effect of sleep deprivation on neurovascular coupling
18. Title: Short-term changes in cerebral vasoreactivity after decrease of elevated blood pressure
Tutor: László Oláh M.D., Ph.D., D.Sc.

19. Title: Immunological relations of narcolepsy
20. Title: Wearable devices in epilepsy and sleep disorders
Tutor: Norbert Kozák M.D., Ph.D.

Department of Neurosurgery

1. Title: Treatment of silent cerebral aneurysms
Tutor: Sándor Szabó M.D., Ph.D.

2. Title: Craniocerebral injuries of early childhood
3. Title: Surgical strategies in meningiomas invading venous sinuses
4. Title: Treatment of brain tumors of first year of life
Tutor: László Novák M.D., Ph.D. habil.

5. Title: The role of extracellular matrix in neurosurgical pathologies
Tutor: Álmos Klekner M.D., Ph.D. habil.

6. Title: Treatment of trigeminal neuralgia, the role of stereotactic radiosurgery
Tutor: József Dobai M.D.

7. Title: Epidemiology and treatment strategies of spinal tumors
8. Title: Treatment options of spinal metastatic tumors
Tutor: Péter Ruszthi M.D.

9. Title: Diffusion tensor imaging possibilities in deep brain stimulation
Tutor: Gábor Fekete M.D., Ph.D.

10. Title: Instrumentation in spinal degenerative pathologies
Tutor: Rahmani Mohammad Tayeb M.D.

Department of Obstetrics and Gynecology

1. Title: Clinical trials of new drugs for the treatment of osteoporosis
Tutor: Ádám Balogh M.D., Ph.D., D.Sc.

2. Title: Diagnosis and Treatment of Endometrial Cancer
3. Title: Diagnosis and Treatment of Ovarian Cancer
4. Title: Screening /Diagnosis and Treatment of Cervical Cancer
Tutor: Zoltán Hernádi M.D., Ph.D., D.Sc.

5. Title: Non-invasive prenatal testing for chromosomal aneuploidies
Tutor: Olga Török M.D., Ph.D. habil.

6. Title: Efficiency and safety of first line chemotherapy in ovarian cancer
7. Title: Efficiency and safety of second and subsequent line chemotherapy in ovarian cancer
8. Title: Efficiency of HPV vaccination
Tutor: Róbert Póka M.D., Dr. habil., Ph.D.

9. Title: Meiotic abnormalities and their clinical significance in human reproduction
10. Title: Role of Doppler ultrasound in antenatal care
Tutor: Tamás Szilveszter Kovács M.D., Ph.D.

11. Title: Anovulatory infertility
12. Title: Examination of genetic concerns about the safety of assisted reproduction
13. Title: Role of antimullerian hormone (AMH) in clinical practice
14. Title: Ultrasound dating in pregnancy
Tutor: Attila Jakab M.D., Ph.D. habil.

15. Title: Cervical cancer prevention: the role and the future of HPV vaccination besides conventional screening
16. Title: New treatment strategies in ovarian cancer
Tutor: Zoárd Krasznai M.D., Ph.D. habil.

17. Title: Pregnancy in unknown location (PUL)
Tutor: Péter Daragó M.D.

18. Title: Analysis of perioperative results of endometriosis surgery
19. Title: Role of endoscopy in infertility work-up
Tutor: Péter Török M.D., Ph.D. habil.

20. Title: Autoimmune diseases in human reproduction
Tutor: Szilvia Vad M.D., Ph.D.

21. Title: Screening of preeclampsia in the first trimester of pregnancy
Tutor: László Orosz M.D., Ph.D.

22. Title: Pregnancy care in PCOS patients
23. Title: Special aspects of pregnancy care in patients with endocrine disorders
24. Title: Thyroid autoimmunity - clinical significance, prevention and treatment in human reproduction
Tutor: Tamás Deli M.D., Ph.D.

25. Title: Diagnosis and therapy in urogynecology
Tutor: Bence Kozma M.D., Ph.D.

26. Title: Laparoscopic techniques in benign gynecologic pathologies
27. Title: New surgical methods in gynecologic oncology

28. Title: Types and methods of labour induction and correlation with caesarean section rate
Tutor: Rudolf Lampé M.D., Ph.D. habil.

29. Title: Contraception in the 21st century
Tutor: Balázs Erdődi M.D.

30. Title: New methods in radical surgery of ovarian cancer
Tutor: Szabolcs Molnár M.D.

31. Title: Comparative study of caesarean sections in Europe
32. Title: The influence of mode of delivery on neonatal and maternal health
Tutor: Jashanjeet Singh M.D.

Department of Obstetrics and Gynecology

1. Title: Chemotherapy of ovarian cancer
2. Title: Prognostic relevance of HPV-infection in cervical cancer
3. Title: Surgical treatment of HPV-infection
4. Title: The prognostic role of CA-125 in ovarian cancer
Tutor: Zoltán Hernádi M.D., Ph.D., D.Sc.

5. Title: Chemotherapy of cervical cancer
6. Title: Epidemiology and therapy of vulvar cancer
7. Title: Epidemiology of metastatic ovarian cancer
8. Title: Follow-up of endometrial cancer patients, analysis of prognostic factors
9. Title: Prothrombotic states in gynaecologic cancer
10. Title: Superoxid anion production of granulocytes in gynecologic cancer
Tutor: Róbert Póka M.D., Dr. habil., Ph.D.

11. Title: Prognostic factors and treatment of cervical cancer
12. Title: The role of CA125 and HE4 in the follow-up of ovarian cancer
Tutor: Zoárd Krasznai M.D., Ph.D.

Department of Ophthalmology

1. Title: Advanced dry eye diagnostics
2. Title: Corneal topography/tomography
3. Title: Ocular manifestations of COVID infection
Tutor: László Módis M.D., Ph.D., D.Sc.

4. Title: Intraocular tumors
Tutor: Judit Damjanovich M.D., Ph.D.

5. Title: Presentation of non arteritic ischaemic optic neuropathy, its ophthalmologic and neuro-ophthalmologic importance
Tutor: Valéria Nagy M.D., Ph.D.

6. Title: Examination of keratoconus progression
7. Title: Longitudinal non-contact evaluation of the anterior segment of the eye in healthy humans
8. Title: Ophthalmological manifestations of immune-mediated diseases
9. Title: Treatment of non-infectious uveitis
Tutor: Mariann Fodor M.D., Dr. habil., Ph.D.

10. Title: Contact lens wear and complications
11. Title: Orthokeratology
Tutor: Beáta Kettesy M.D., Ph.D.

12. Title: Corneal measurments with Pentacam
13. Title: Refractive laser-surgical interventions
Tutor: Bence Lajos Kolozsvári M.D., Ph.D.

14. Title: Treatment of Graves' orbitopathy
Tutor: Zita Steiber M.D., Ph.D.

15. Title: Change in treatment of intraocular tumors from the first application of brachytherapy till now in Hungary
16. Title: Investigation of vascular endothelial growth factor level in the tear of uvel melanoma patients
Tutor: Éva Surányi M.D., Ph.D.

17. Title: Pathogenesis of Graves' orbitopathy
18. Title: Proliferation and hyaluronan production of retrobulbar fibroblasts in thyroid associated orbitopathy
Tutor: Bernadett Ujhelyi M.D.,Ph.D.

19. Title: Assessing the safety and efficacy of intravitreal ranibizumab as a preoperative adjunct treatment before vitrectomy surgery in

severe proliferative diabetic retinopathy (PDR) compared to standard vitrectomy alone
20. Title: Evaluate and demonstrate the results of the Hungarian Lucentis National Patient Registry
Tutor: Attila Vajas M.D.

21. Title: Ocular manifestations in systemic autoimmune diseases
Tutor: Anikó Rentka M.D., Ph.D.

22. Title: Dry eye in blepharospasm
Tutor: Annamária Nagy M.D., Ph.D.

23. Title: BCVA change after intravitreal ranibizumab injection
24. Title: IOP change after intravitreal ranibizumab injection
Tutor: Erika Papp M.D.

25. Title: Treatment options for intraocular vascular disorders.
Tutor: Szabolcs Balla null

26. Title: Artificial intelligence in ophthalmology, review of the literature
Tutor: Beáta Bajdik M.D.

27. Title: Examination and treatment of diabetic maculopathy
28. Title: Stem cells of the cornea
29. Title: Surgical treatment of retinal diseases
Tutor: Lili Takács M.D., Ph.D.

Department of Orthopedic Surgery
1. Title: Topic will be discussed personally
Tutor: Zoltán Karácsonyi M.D.

2. Title: Topic will be discussed personally
Tutor: Csenge Szeverényi M.D., Ph.D.

3. Title: Topic will be discussed personally
Tutor: Tamás Bazsó M.D.

4. Title: Topic will be discussed personally
Tutor: Zsolt Hunya M.D.

Department of Otorhinolaryngology and Head and Neck Surgery
1. Title: The role of cochlear implant
2. Title: The role of the bone anchored hearing aids
Tutor: László Tóth M.D., Ph.D. habil.

3. Title: Analysis of the aetiology and patomechanism of the development of the otitis media with effusion
4. Title: Modern aspects of tonsillectomy versus tonsillotomy
5. Title: Rehabilitation of speech after total laryngectomy
6. Title: The effectiveness of surgical treatment of focal oto-rhino-laryngological diseases on dermatologic diseases
7. Title: The utility of the neuromonitor during surgeries of the big salivary glands
Tutor: Szilárd Gyula Rezes M.D., Ph.D.

8. Title: Diagnostic possibilities of hearing loss and rehabilitation of sensorineural hearing loss
Tutor: Judit Szilvássy M.D., Ph.D. habil.

Department of Pediatrics
1. Title: Prognostic factors in childhod acute lymphoblastic leukemia
Tutor: Csongor Kiss M.D., Ph.D., D.Sc.

2. Title: Adding an Electrocardiogram to the Pre-participation Examination in Competitive Athletes. Review.
Tutor: Gábor Mogyorósy M.D., Ph.D.

3. Title: Malformations of the central nervous system in newborns.
Tutor: Andrea Nagy M.D.

4. Title: Anti-TNF use in pediatric inflammatory bowel disease
Tutor: Éva Nemes M.D., Ph.D.

5. Title: Characteristics of Graves' disease in childhood
6. Title: Primary immunedeficiency in childhood: case reports
7. Title: Systemic autoimmune diseases in childhood
Tutor: Rita Káposzta M.D., Ph.D.

8. Title: Mutational analysis of x-linked hyperphosphatemic ricket (XLH) in children
Tutor: Tamás Szabó M.D., Ph.D.

9. Title: Treatment options of resistant/relapsed pediatric Hodgkin lymphoma
Tutor: István Szegedi M.D., Ph.D.

10. Title: Diagnosis of medinastinal masses in children
Tutor: Imre Gáspár M.D.

11. Title: Implantable venous access systems in pediatric use: implantation, management and complications
Tutor: Ágnes Magyar M.D.

12. Title: Controversies in the surgical management of congenital diaphragmatic hernias
Tutor: László Sasi Szabó M.D.

13. Title: Prognostic importance of ultrasound in small bowel invagination
Tutor: Klára Nagy-Erdei M.D.

14. Title: Laparoscopic versus open pyeloplasty in children - A single centre experience and rewiev of the literature
Tutor: Levente Szabó M.D.

15. Title: Negative pressure wound therapy (NPWT) in pediatric surgery
Tutor: Péter Juhász M.D.

16. Title: Pediatric haemophilia - diagnostic approaches and novel therapies
Tutor: Zsuzsa Zele M.D.

17. Title: Cytogenetic and molecular genetic alterations in pediatric acute leukemias between 2015 and 2020
Tutor: Zsuzsanna Gaál M.D., Ph.D.

18. Title: Bioinformatic systems in childhood acute lymphoblastic leukemia
Tutor: Katalin Megyesán null

Department of Pediatrics

1. Title: Neurodevelopmental outcome in preterm and low birth weights infants
Tutor: Nóra Katona M.D.

2. Title: In utero circulation and preterm birth
3. Title: Perinatal consequences of maternal autoimmune diseases
4. Title: Respiratory and circulatory adaptation after birth
5. Title: Respiratory treatment of preterm neonates
6. Title: Screening and treatment of perinatal infections
7. Title: Special nutrition of neonates with congenital heart defect
Tutor: Balázs Kovács-Pászthy M.D.

8. Title: Mortality and morbidity of very low birth weight preterm infants
Tutor: Magdolna Riszter M.D.

9. Title: Less Invasive Surfactant Administration - a narrative rewiev
10. Title: Lung ultrasound in the Critically Ill Neonate
Tutor: Gergely Balázs M.D.

Department of Physical Medicine and Rehabilitation

1. Title: Testing the effectiveness of the upper-extremity repetitive task practice and forced aerobic training added to ergotherapy to improve upper limb and cognitive functions
2. Title: The efficiency test of the electromyogram-triggered FES treatment in hemiparetic patients and the visual feedback training in the development of upper limb functions
3. Title: The relationship of physiological and functional changes observed in complex rehabilitation programs (obesity and stroke rehabilitation) with adipocytes
Tutor: Zoltán Jenei M.D., Ph.D.

Department of Psychiatry

1. Title: The dietetic and gastrointestinal basis of autism
Tutor: Csaba Móré E. M.D.

2. Title: Cognitive theory and therapy of depression
3. Title: Cognitive theory and therapy of generalized anxiety disorder
4. Title: Effectiveness of Cognitive Behaviour Therapy in OCD
5. Title: Effectiveness of schema therapy in personality disorders
6. Title: Emotion dependent and independent cognitive functions in unipolar depression
7. Title: Significance of disfunctional attitudes in depression and anxiety disorders
8. Title: Theory of mind and mentalization deficits in patients with personality disorders
Tutor: Anikó Égerházi M.D., Ph.D.

9. Title: Pharmacological and non - pharmacological treatment methods in OCD
10. Title: The psychosocial effects of obesity
Tutor: Katalin Tolvay M.D.

11. Title: Brain imaging in psychiatry.
12. Title: Oxidativ stress and chronic inflamation in psychiatric disorders
13. Title: Post-traumatic stress disorder and post-traumatic growth.
14. Title: The neurobiology of depression.
15. Title: The role of mikrobiota in mental health
16. Title: The therapeutic potentials of psychodelics
Tutor: Ede Frecska M.D., M.A., Ph.D.

Department of Pulmonology

1. Title: New perspectives in the treatment of lung cancer.
Tutor: Andrea Fodor M.D.

2. Title: New perspectives in the treatment of community acqiured pneumonia
Tutor: László Brugós M.D., Ph.D.

3. Title: The role of bronchoscopy in the therapy of lung cancer
Tutor: Imre Varga M.D., Ph.D.

4. Title: Modern Therapy of NSCLC
Tutor: Tamás Kardos M.D.

5. Title: Cachexia as prognostic factor in treatment of NSCLC
Tutor: Attila Lieber M.D.

Department of Surgery

1. Title: Surgical treatment of Graves disease with ophthalmopathy
Tutor: Ferenc Győry M.D.

2. Title: Surgical treatment of bowel obstruction in colorectal diseases
Tutor: László Damjanovich M.D., Ph.D., D.Sc.

3. Title: Surgical and endovascular interventions in critical limb ischemia
Tutor: Sándor Olvasztó M.D.

4. Title: Histopathologic examination of the carotid plaques regarding their possible prognostic value
Tutor: Krisztina Litauszky M.D.

5. Title: Liver resections for metastases of colorectal cancer
Tutor: János Pósán M.D.

6. Title: Prevention of bronchial stump insufficiency after lung resections
Tutor: István Takács M.D.,Ph.D.

7. Title: The surgical treatment of hyper-parathyroidism
Tutor: Roland Fedor M.D., Ph.D.

8. Title: Different forms of hereditary colorectal cancer among our patients.
Tutor: Miklós Tanyi M.D., Ph.D.

9. Title: Mesh implantation in the surgical treatment of thoracic defects
Tutor: Attila Enyedi M.D.

Department of Operative Techniques and Surgical Research

1. Title: Anesthesia in experimental animals
2. Title: Experimental animal models for metabolic diseases (diabetes, metabolic syndrome) in research

3. Title: Laser-Doppler in experimental surgery
Tutor: Ádám Deák D.V.M., Ph.D.

4. Title: Changes of red blood cells' micro-rheology in surgical pathophysiological processes
5. Title: Microvascular anastomosis techniques
Tutor: Norbert Németh M.D., MBA, Ph.D., D.Sc.

6. Title: Hemostatic agents (bioplasts) in surgery
7. Title: Ischemia-reperfusion injury and its prevention with different methods - experimental models
Tutor: Katalin Pető M.D., Ph.D.

8. Title: Analysis for laparoscopic skills assessment
9. Title: Hand hygiene and surgical scrub
Tutor: Erzsébet Ványolos M.Sc., Ph.D.

10. Title: Instruments and devices used in pharmacological care
Tutor: Tamás Lesznyák M.D., D.Pharm.

11. Title: Basic Microsurgical Training course at the Microsurgical Education and Training Center of the Department of Operative Techniques and Surgical Research
12. Title: Famous surgeons: William Halsted, Halsted principles
Tutor: Irén Mikó M.D., Ph.D.

Department of Urology
1. Title: Role of laparoscopy in urology
Tutor: Tibor Flaskó M.D., Ph.D.

2. Title: Assessment of urinary incontinence
Tutor: László Lőrincz M.D.

3. Title: Different topics regarding prostate and kidney cancer
Tutor: Csaba Berczi M.D., Ph.D.

4. Title: Bladder replacement after radical cystectomy
Tutor: Antal Farkas M.D., Ph.D.

5. Title: Different topics regarding andrology
Tutor: Mátyás Benyó M.D., Ph.D.

6. Title: Pathology of clear cell renal cancer
Tutor: Krisztián Szegedi M.D.

7. Title: Treaement of urethral stricture Reconstructive urological surgeries
Tutor: Mihály Murányi M.D.

8. Title: Assessment of bening prostate hyperplasia
Tutor: József Zoltán Kiss M.D.

9. Title: Effect of ochidopexy on male fertility
Tutor: Gyula Drabik M.D.

Department of Pharmacology
1. Title: Antibiotics and their application
2. Title: Antitumor agents and applications
3. Title: Asthma and antiasthmatic agents
4. Title: Degenerative disorders and treatments in the central nervous system
5. Title: Epilepsies and treatments (antiepileptics)
6. Title: Hypercholesterolemia and pharmacotherapy
7. Title: Hypertension and treatments
8. Title: Inflammation and nonsteroid and steroid antiinflammatory drugs
9. Title: Neurodegenerative diseases and treatments
10. Title: Optional title in cardiovascular pharmacology.
11. Title: Sedatohypnotics and applications
12. Title: Sleep disorders, sedation and treatments
13. Title: The blood and its pharmacological interventions
Tutor: Árpád Tósaki D.Pharm., Ph.D., D.Sc.

14. Title: Free topic from instrumental analytical chemistry.
15. Title: Model systems used in drug metabolism studies.
16. Title: Sampling and sample preparation used in the analysis of drug substances.
17. Title: Small molecular gases (NO, CO, H_2S, CH_4, H_2) in the treatment of different disorders.

18. Title: Treatment of heart failure.
19. Title: Treatment of ischemic heart diseases.
Tutor: István Bak M.Sc., Ph.D. habil.

20. Title: Characterisation of new H2S-releasing-NSAIDs
21. Title: Diuretics and their application
22. Title: Hemeoxygenase/CO system and autophagy (experimental)
23. Title: Pharmacotherapy a pregnancy
24. Title: Pharmacotherapy and lactation
25. Title: Pharmacotherapy in childhood
26. Title: Pharmacotherapy in elderly patient
27. Title: Role of H2S in cardiovascular system
Tutor: István Lekli D.Pharm., Ph.D.

28. Title: Doxorubicin induced cardiotoxicity
29. Title: Isoproerenol induced hypertrophy
30. Title: Pharmacologic therapies in Gastrointestinal Diseases
31. Title: Pharmacotherapy and dietotherapy of metabolic syndrome
32. Title: The role of autophagy in hem toxicity
Tutor: Alexandra Gyöngyösi Ph.D.

Department of Pharmaceutical Technology

1. Title: Nanoparticles and their potential for application in bone.
2. Title: The connection between the regulation of the endocrine and the immune system.
Tutor: Miklós Vecsernyés D.Pharm., Ph.D.

3. Title: Biocosmetics.
4. Title: Communication in the pharmacy in the COVID-19 pandemia
5. Title: Modern rectal preparations
6. Title: Pharmaceutical care. Selected chapters from pharmaceutical care, creating and evaluate questionnaires.
7. Title: Pharmaceutical Communication Skills. Description of problems.
8. Title: Pharmaceutical technology. Modified-Release Therapeutic systems.
9. Title: Vaginal therapy
Tutor: Ildikó Bácskay D.Pharm., Ph.D.

10. Title: Examination of the antioxidant effect of (natural) substrates on HaCaT keratinocyte cell line.
11. Title: Formulation of creams and topical SMEDDS (self-microemulsifying drug delivery systems).
Tutor: Pálma Fehér D.Pharm., Ph.D.

12. Title: Formulation options for antibody therapies
13. Title: Formulation possibilities of probiotics
14. Title: Lipid-based nanocarrier systems
Tutor: Judit Váradi D.Pharm., Ph.D.

15. Title: Application of cyclodextrins in nano-scale drug delivery systems
16. Title: Drug absorption: problems and models of biological barriers
17. Title: Drug absorption: problems, improvement and models.
18. Title: Modified-release solid dosage forms.
Tutor: Ferenc Fenyvesi D.Pharm., Ph.D.

19. Title: Formulation and pharmaceutical technology characterization of therapeutic systems.
Tutor: Zoltán Ujhelyi D.Pharm., Ph.D.

Department of Pharmaceutical Chemistry

1. Title: Synthesis of new teicoplanin aglycon derivatives
Tutor: Pál Herczegh Ph.D., D.Sc.

2. Title: Bisphosphonate drugs (literature compilation)
3. Title: Newly approved antibiotics (literature compilation)
4. Title: Synthesis of antiviral molecules
5. Title: The history of ristocetin and ristocetin aglycon (literature compilation)
Tutor: Ilona Bakai-Bereczki Ph.D.

6. Title: Oral anticoagulants (literature compilation)
7. Title: Sulfated oligosaccharides as inhibitors of angiogenesis, tumor growth, and metastasis saccharides (literature compilation)
8. Title: Synthesis of thio-linked glycomimetics by photoinduced hydrothiolation of glycals
Tutor: Anikó Borbás Ph.D., D.Sc.

9. Title: Application of thiol-addition in the synthesis of glycoconjugates
10. Title: Synthesis of chimera-type antibiotics
11. Title: Synthesis of potential ligands of bactericidal lectines
Tutor: Magdolna Csávás M.Sc., Ph.D. habil.

12. Title: Efficient synthesis of idose/iduronic acid monosaccharide building blocks
13. Title: Synthesis and biological study of sulfonic-acid containing maltooligomers
14. Title: Synthesis and characterisation of carbohydrate based nitrogen containing tricycles
15. Title: Synthesis of heparin analogue anticoagulant oligosaccharides
16. Title: Synthesis of multivalent dirhamnoside derivatives
Tutor: Mihály Herczeg Ph.D.

Department of Pharmaceutical Surveillance and Economics

1. Title: Clinical pharmacy
2. Title: Drug utilization research
3. Title: Pharmacoepidemiology
Tutor: László Horváth D.Pharm., Ph.D.

4. Title: Aspects of Pharmacoecomony in Therpy menegement
5. Title: Interactions in the practice of Pharmacovigilance by the aspects of a patient
6. Title: Management of compliance by patient profile and risk evaluation
7. Title: Pharmacovigilance in pactice by the aspects of pharmacists and the patients
Tutor: Béla Tóth E. M.D., MBA, Ph.D.

Department of Biopharmacy

1. Title: Any subject from the field of biopharmacy
Tutor: Gábor Halmos D.Pharm., Ph.D.

CHAPTER 23
WRITING AND DEFENDING A THESIS

(1) The thesis topics, and names of the supervising teachers are available in the faculty bulletin, in the program description and on the website of the faculty.
(2) The Educational Units [departments] put together the list of theses to be announced (with the names of the consultants), which is included in the program description. The student is to choose from this list, and any deviation from it, has to be approved by the heads of the aforementioned Educational Units. The student is required to choose the topic of his/ her thesis before the last week of the second semester in the fourth academic year. In case the student intends to choose an experimental topic, he/she is expected to declare it before the last week of the first semester of the fourth academic year. The titles of the thesis must be submitted to the Dean's Office in the last week of the first or second semester of the fourth academic year.
(3) The thesis can be done as part of research under the auspices of the Students' Scientific Association (SSA). An essay can be accepted as a thesis, on condition it has been acknowledged by the panel of judges of the local SSA conference as a thesis and thereby the specific essay was graded 'excellent'; in case of an essay with multiple authors it can be accepted as a thesis in its original form if the declaration of waiver by the other authors is attached. The documents regarding the acceptance of the thesis (evaluations, answers) must be submitted in an attachment. It is also necessary to fill in and submit a questionnaire containing details (title, authors, departments, supervisors) of the essay and SSA presentation.
(4) The deadline to submit the thesis at the Faculty of Pharmacy is three months before the written final exam. In case the student fails to do this by the deadline, he/she can take his/her comprehensive exams, but cannot take the state exam. The deadline to submit the thesis can be postponed up to two weeks in specific cases, with the supervisor's suggestion and with the permission from the head of the Education Committee.
(5) The thesis must be submitted in two copies at the Education Office and electronically uploaded to the electronic archive of the University and National Library of the University of Debrecen before the beginning of the written final exam. It should not exceed 40 typed pages in length. The typed or word processed and printed thesis must be submitted bound and in an aesthetic design. Margins must be 2.5 cm at the top and bottom, and 3 cm on the left and right. Its structure and the process of evaluation must meet requirements as follows:

a) The thesis can outline the author's own experimental activities; it can be a case study, a clinicopathological or statistical analysis or even a summary of scientific literature. It should not necessarily contain new scientific results but is should definitely sum up the author's individual work in a specific field. Results other than the author's own should be specified exactly. The front page should contain information as follows: the title of the thesis, author's name, supervisor's name, name of the educational unit in which the thesis was written, name of the head of department and date of accomplishment. The thesis can be submitted in the possession of signatures from the supervisor and head of department. (Specimen documents/forms can be downloaded from the homepage of the Faculty). Introduction, aims, results and discussion should be arranged in separate chapters. Furthermore, the thesis should also contain a summary (of maximum two printed pages). Bibliographic information should be organized as follows: authors' names (first names by initials), full title of publication, name of journal where it appeared, number of volume, page(s) and year of publication. In case a book is referred to, the name(s) of the book's author(s) and of the publisher should both be provided. The number of references should fall in the range of 20-50 publications.
b) On evaluating a thesis, referees will consider its logical organization and professional relevance,

the methods applied and the accuracy through which results have been presented.
c) The supervisor of the thesis will evaluate the author's professional activities and, together with the thesis, submit the written evaluation in two copies to the Education Office and the person(s) in charge at the specific department. (Specimen documents/forms can be downloaded from the homepage of the Faculty).
d) The submitted thesis will be allocated to two referees at the official request of a professional board appointed by the Educational Committee of the Faculty. In case a referee fails to fulfil his commitment, he should return the thesis to the Education Office without delay. Referees should prepare and send two printed copies of their written evaluation to the Education Office, while the electronic version should be sent to both the Education Office and student (author) within two weeks of submission. If neither referee accepts the thesis, the student has to re-write it with due consideration of the critical remarks made by the referees. If only one of the two referees accepts the thesis, it should be allocated to a third judge whose opinion will be exclusively considered in the future. A candidate can orally defend his/her thesis if both referees have accepted it.
Students will get a written evaluation from the referees and they must respond – even if they agree with the remarks – in both written and electronical form within one week of receipt and send their (written) response to both the Education Office and referees. Referees should electronically declare their acceptance of the student's response within five days.
The thesis must be defended in the educational unit in which the topic was announced, in front of thesis defense committees appointed by the Dean's Office. The defense itself will take place in front of a committee including three members. The chairperson of the defense committee should be a head tutor of the faculty, while the members are selected as follows: one of the certified tutors of the faculty and a person keeping the minutes, the head of the education unit or a head tutor (chairperson) appointed by him/her, and the referees. The supervisor and the referees must be invited to participate at the event of defense. The committee evaluates the thesis in a closed session.
A thesis defense report is made in three copies containing the student's name, the title of the thesis, date and place of defense and the mark/grade approved by the committee. One of the copies belongs to the educational unit of the faculty, the other two are sent to the Education Office by the institute.
One copy of the thesis shall be kept in the educational unit of the faculty for five years, one copy is returned to the student and one copy is sent to the Life Science Library where it can be read but not borrowed.
The following should be attached to the thesis:
the supervisor's report which is the written evaluation of the candidate
a summary of the thesis with name and title
plagiarism declaration form in which the student declares that the thesis is his/her own work
a request for limited access to thesis form - if needed
The final exam (test) consists of a practical and oral part.
The chair and the members of the committee are appointed by the Dean or the Vice Dean.
The date of the written state exam is appointed by the Ministry of Education.
The dates of the practical and oral state exams are assigned by the Dean's Office. The exam is conducted in front of a state examining committee of three to five people. The examination committee at the practical final exam at the Faculty of Pharmacy consists of two tutors of the university appointed by the Dean's Office. The examination board at the theoretical exam is presided by a recognized scientist in the field of pharmacy, while the members are two head tutors of the Faculty and a person keeping the minutes. The Dean's Office can appoint more than one examination board to conduct simultaneous theoretical exams.

CHAPTER 24
LIST OF TEXTBOOKS

BMC

Introduction to Biophysics I.:
Serway/Vuille: College Physics.
10th edition. Cengage Learning, 2014. ISBN: 978-1285737027.
Gáspár R.: Physics for BMC students.
University of Debrecen.

Introduction to Medical Chemistry I.:
McMurry, J., Fay, R.C.: Chemistry.
7th edition. Pearson Education, 2015. ISBN: 978-0321943170.

Introduction to Medical Chemistry II.:
McMurry, J., Fay, R.C.: Chemistry.
7th edition. Pearson Education, 2015. ISBN: 978-0321943170.
F., Erdődi, Cs., Csortos: Organic Chemistry for Premedical Students.
University of Debrecen, 2011.

Hungarian Language for BMC students:
Gerő Ildikó-Kovács Judit: Színesen magyarul. 2017.

Introduction to Biology I.:
Sadava, Hillis, Heller, Berenbaum: Life: The Science of Biology.
10th edition. Sinauer Macmillan, 2013. ISBN: 978-1-4641-4124-9.

Introduction to Biophysics II.:
Serway/Vuille: College Physics.
10th edition. Cengage Learning, 2014. ISBN: 978-1285737027.
Gáspár R.: Physics for BMC students.
University of Debrecen.

Introduction to Biology II.:
Sadava, Hillis, Heller, Berenbaum: Life: The Science of Biology.
10th edition. Sinauer Macmillan, 2013. ISBN: 978-1-4641-4124-9.

English for BMC students:
Clive Oxenden-Christina Latham-Koenig. Paul Seligson: English File 3E Pre-Intermediate Student's Book With Itutor.
3.. Oxford University Press, 2013. ISBN: 9780194598651.
Clive Oxenden-Christina Latham-Koenig. Paul Seligson: English File 3E Pre-Intermediate Student's Book With Itutor.
3.. Oxford University Press, 2013. ISBN: 9780194598651.

SBMC

Introduction to Biophysics:
Serway/Vuille: College Physics.
10th edition. Cengage Learning, 2014. ISBN: 978-1285737027.

Introduction to Medical Chemistry:
McMurry, J., Fay, R.C.: Chemistry.
7th edition. Pearson Education, 2015. ISBN: 978-0321943170.
F., Erdődi, Cs., Csortos: Organic Chemistry for Premedical Students.
University of Debrecen, 2011.

Introduction to Biology:
Sadava, Hillis, Heller, Berenbaum: Life: The Science of Biology.
10th edition. Sinauer Macmillan, 2013. ISBN: 978-1-4641-4124-9.

1st year

Hungarian Crash Course:
Gerő Ildikó-Kovács Judit: Színesen magyarul. 2017.

Mathematics:
Fong Yuen, Wang Yuan: Calculus.
Springer, Singapore, 2000.

General Chemistry Theory:
J. McMurry, R. C. Fay: General Chemistry.
4th edition. Pearson Education Inc., 2004. ISBN:

0-13-121631-7.

General Chemistry Practice:

J. McMurry, R. C. Fay: General Chemistry.
4th edition. Pearson Education Inc., 2004. ISBN: 0-13-121631-7.

Pharmaceutical Biology I.:

Alberts B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P.: Essential Cell Biology.
4th edition. Garland Science, 2014. ISBN: 978-0-8153-4455-1.

Latin Language I.:

Takácsné Tóth Emőke: Latin for Pharmacy Students.
Debrecen.2012.

Computer Science:

Greg Perry: Microsoft Office.
2007. ISBN: 9789-6396-3737-5.

Hungarian Language I/1.:

Mezei Zsuzsa Lívia- Fodor Marianna: Szívből magyarul.
.

Latin Language II.:

Takácsné Tóth Emőke: Latin for Pharmacy Students II..
Debrecen.2012.

Inorganic and Qualitative Analytical Chemistry Theory:

McMurry, J., Fay, R.C.: Chemistry.
7th edition. Pearson Education, 2015. ISBN: 978-0321943170.
G. Svehla (reviser): Vogel's qualitative inorganic analisis.
6th edition. Longman Scientific & Technical, copublished in the United States with John Wiley & Sons, Inc., 1994. ISBN: 0-582-45090-x.
N. N. Greenwood and A. Earnshaw: Chemistry of the elements.
2nd edition. Butterworth-Heinemann, Reed Educational and Professional Publishing Ltd., 1997. ISBN: 0-7506-3365-4.
H. F. Holtzlaw, Jr. W. R. Robinson: College Chemistry with Quantitative Analysis.
8th edition. D. O. Health and Company, Lexington, Massachusetts, Toronto, 1988. ISBN: 0-669-12862-7.
T. Moeller, J. C. Bailer, Jr., J. Kleinbert, C. O. Guss, M. E. Castellion, C. Metz: Chemistry with inorganic qualitative analysis.
8th edition. Academic Press Inc., 1980.
T. Moeller, R. O' Connor: Ions in Aquenous Systems, an introduction to chemical equilibrum and solution chemistry.
McGraw-Hill Book Companies, 1972. ISBN: 07-042647-3-.

Inorganic and Qualitative Analytical Chemistry Practice:

McMurry, J., Fay, R.C.: Chemistry.
7th edition. Pearson Education, 2015. ISBN: 978-0321943170.
G. Svehla (reviser): Vogel's qualitative inorganic analisis.
6th edition. Longman Scientific & Technical, copublished in the United States with John Wiley & Sons, Inc., 1994. ISBN: 0-582-45090-x.
N. N. Greenwood and A. Earnshaw: Chemistry of the elements.
2nd edition. Butterworth-Heinemann, Reed Educational and Professional Publishing Ltd., 1997. ISBN: 0-7506-3365-4.
H. F. Holtzlaw, Jr. W. R. Robinson: College Chemistry with Quantitative Analysis.
8th edition. D. O. Health and Company, Lexington, Massachusetts, Toronto, 1988. ISBN: 0-669-12862-7.

Biophysics:

Biophyisics laboratory manual.
Department of Biophysics and Cell Biology, 2001.
Wayne W. Daniel: Biosatatistics: a foundation for analysis in the health sciences.
7th edition. John Wiley and Sons, New York, 1991. ISBN: 0-471-52988-5.
M. Shinitzky: Biomembranes. Physical aspects.
Vch. Weinheim, 1993. ISBN: 3-527-3021-x.
Edited by János Szőllősi: Medical Biophysics.
Medicina, 2009.
Materials.

URL: www.biophys.dote.hu
Textbook online.
URL:
http://www.biophysics.org/education/resources.htm

Physical Chemistry I.:

Peter Atkins and Julio de Paula: Physical chemistry for life sciences.
or newer edition. Oxford University Press, 2006.
R. Chang: Physical chemistry with applications to biological systems.
Macmillan, New York, 1977.
P. W. Atkins, J. de Paula: Elements of Physical Chemistry.
4th or later edition. Oxford Univ. Press, 2005.

Organic Chemistry Theory I.:

T. W. G. Solomon, C. B. Fryhle: Organic chemistry.
8th edition. John Wiley and Sons Inc., 2004.
E. K. Meislich, H. Meilich, J. Sharefkin: 3000 solved problems in organic chemistry.
McGraw Hill Inc., 1994.
T. Eicher, S. Hauptmann,: Chemistry of heterocycles: Structures, reactions, synthesis and applications.
2nd edition. John Wiley and Sons Inc., 2003.
E. L. Eliel, S. H. Wilen: Stereochemistry of organic compounds.
1st edition. John Wiley and Sons Inc., 1994.
R. Norman, J. M. Coxon: Principles of organic synthesis.
3rd edition. Blackie academic & Professional, 1993.
L.G. Wade Jr.: Organic Chemistry .
4th edition.1999.
J.A. Miller, E.F. Neuzil: Modern Experimental Organic Chemistry.
D.C. Heath and Company, 1980.

First Aid and Reanimation:

József Betlehem: First Things to Be Done in Emergencies – Providing First Aid for Health Professionals.
Medicina Könyvkiadó Zrt. 2012.

Pharmaceutical Biology II.:

Hartl D. L.: Essential Genetics: A Genomics Perspective.
6th edition. Jones & Bartlett Publishers, 2014.
ISBN: 978-1-4496-8688-8.
Practical Courses in Genetics.
University Medical School of Debrecen, 2002.
Thomas D. Gelehrter, Francis S. Collins, David Ginsburg: Principles of Medical Genetics.
2nd. Williams and Wilkins, 1998. ISBN: 0-683-03445-6.
Tom Strachan, Andrew P. Read: Human Molecular Genetics.
4th. Garland Science, 2011. ISBN: 0-8153-4184-9.
Robert L. Nussbaum, Roderick R. McInnes, Huntington F. Willard, Ada Hamosh: Thompson and Thompson Genetics in Medicine.
8th edition. Saunders Elsevier, 2016. ISBN: 978-1-4377-0696-3.
Campbell, A. M., Heyer, L. J.: Discovering genomics, proteomics and bioinformatics.
Pearson Education Inc., ISBN: 0-8053-4722-4.
Eberhard Passarge: Color Atlas of Genetics.
2nd edition. Georg Thieme Verlag, 2001. ISBN: 3-13-100362-6.
Csaba Szalai, Valéria László, Sára Tóth, Erna Pap, András Falus: Medical genetics and genomics.
URL: https://elearning.med.unideb.hu

Hungarian Language I/2.:

Győrffy Erzsébet-Mezei Zsuzsa Lívia: Magyarules.
2018.

Pharmaceutical Anatomy:

Moore, K. L., Agur, A. M. R.: Essential Clinical Anatomy.
5th edition. Lippincott Williams & Wilkins, 2014. ISBN: 1-4511-8749-1.
T. W. Sadler: Langman's Medical Embriology.
10th edition. Lippincott Williams & Wilkins, 2006. ISBN: 0-7817-9485-4.
Sobotta: Atlas of Human Anatomy I.-II..
14th edition. Urban & Schwarzenberg, . ISBN: 978-0-443-10349-0.
L.P. Gartner: Concise Histology.
Saunders, Elsevier, 2011. ISBN: 978-0-7020-3114-4.

2nd year

Hungarian Language II/1. :

Fodor Marianna - Rozman Katalin: Beszélek magyarul?! I..
2016. ISBN: 978-963-12-6413-5.

Organic Chemistry Theory II.:

T. W. G. Solomon, C. B. Fryhle: Organic chemistry.
8th edition. John Wiley and Sons Inc., 2004.
E. K. Meislich, H. Meilich, J. Sharefkin: 3000 solved problems in organic chemistry.
McGraw Hill Inc., 1994.
T. Eicher, S. Hauptmann,: Chemistry of heterocycles: Structures, reactions, synthesis and applications.
2nd edition. John Wiley and Sons Inc., 2003.
E. L. Eliel, S. H. Wilen: Stereochemistry of organic compounds.
1st edition. John Wiley and Sons Inc., 1994.
R. Norman, J. M. Coxon: Principles of organic synthesis.
3rd edition. Blackie academic & Professional, 1993.
L.G. Wade Jr.: Organic Chemistry.
4th edition.1999.
J.A. Miller, E.F. Neuzil: Modern Experimental Organic Chemistry.
D.C. Heath and Company, 1980.

Quantitative Analytical Chemistry I.:

1. Skoog, D. A., West, D. M., Holler, F. J.: Fundamentals of Analytical Chemistry.
Saunders College Publ., 1988.
Braun, R. D.: Introduction to Instrumental Analysis.
Marcel Dekker Inc., 1987.
Fifield, F. W., Kealey, D.: Principles and Practice of Analytical Chemistry.
Blackie Academic and Professional, 1995.
Harris, D. C.: Quantitative Chemical Analysis.
W.H. Freeman and Company, 2003.

Human Physiology I.:

A. Fonyó: Principles of Medical Physiology.
Medicina Publishing House, Hungary, 2002.
ISBN: 963-242-726-2.
R. M. Berne, M. N. Levy, B. M. Koeppen, B. A. Stanton: Physiology.
5th edition. V.C. Mosby Co., 2003.

Pharmaceutical Biochemistry I.:

Berg J.M., Tymoczko, J. L., Stryer, L.: Biochemistry.
7th edition. W. H. Freeman, 2010. ISBN: 1-4292-2936-5.
C.K. Mathews, K.E van Holde, K..G. Ahern: Biochemistry.
3. ed. Addison Wesley Longman, 2000. ISBN: 0-8053-3066-6.
Lehninger Albert L, Nelson David L: Principles of biochemistry.
3. ed. Worth, 2000. ISBN: 1572591536.

Physical Chemistry II.:

Katalin Ősz, Attila Bényei: Physical Chemistry Laboratory Measurements (for students of Pharmacy, Chemistry and Chemical Engineering).
Egyetemi Kiadó, 2011.
Peter Atkins and Julio de Paula: Elements of Physical Chemistry.
4th edition. Open University Press, 2005.
Dr. Katalin Ősz, Dr. Attila Bényei: Physical Chemistry (practice information).
URL: http://fizkem.unideb.hu/physchem.html

Colloid and Surface Chemistry Theory:

Pashley, RM, Karaman, ME: Applied and Surface Chemistry.
Barnes, GT, Gentle, IR: Interfacial science.
Cosgrowe T.: Colloid Science.
Blackwell, 2005.

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