FACULTY OF MEDICINE

BASIC MODULE

STUDY PROGRAMME

Important: New curriculum has been introduced since the 2016/2017 academic year!

First year						
1st semester						
Subject code	**Compulsory Subjects**	**Lectures**	**Practicals**	**Credit Points**	**Examination**	**Prerequisite**
AOKFIZ325_1A	Basics of Biostatistics and Informatics	1	2	3	semi-final	–
AOKFIZ326_1A	Medical Biophysics I.	1,5	2	3	semi-final	–
	Medical Chemistry	3	3,5	6	semi-final#	–
	Medical Biology	2	1	3	semi-final	–

AOKMAG425_1A	Medical Sociology*	1	1	2	semi-final	–
AOKANT003_1A	Anatomy, Histology, and Embryology I.	2,5	6	8	semi-final	_
AOKLEK228_1A	Hungarian Medical Terminology I.	–	4	4	pract. mark	–
AOVLEK229_1A	Medical Terminology (Latin)	–	2	2	pract. mark	–
AOKTSI009_1A	Physical Education I.	–	1	–	signature	–
Total Number of Credit Points from Obligatory Subjects				**31** (in case Med. Soc. is taken in the 1st semester) or **29** (in case Med. Soc. is taken in the 2nd semester)		

4 credit points from obligatory elective/elective subjects must be collected in each semester. See the detailed list of obligatory elective subjects and elective subjects after the 3rd year curriculum
*** The subject must be registered for, as well as completed, in the first or second semesters of the first year**
# The grade influences the qualification of the Diploma.

STUDY PROGRAMME

First year						
2nd semester						
Subject code	**Compulsory Subjects**	**Lectures**	**Practicals**	**Credit Points**	**Examination**	**Prerequisite**
AOKFIZ326_2A	Medical Biophysics II.	1,5	2	3	final	Medical Biophysics I.
AOKOBI463_1A	Medical Biochemistry I.	2	1,5	3	pract. mark	Medical Chemistry

	Molecular Cell Biology I.	2,5	4	6	semi-final	Medical Chemistry Medical Biology
AOKANT003_2A	Anatomy, Histology, and Embryology II.	3	6	9	semi-final	Anatomy, Histology, and Embryology I.
AOKOMS218_1A	First Aid	6 hours / sem.	8 hours / sem.	0	signature	–
AOKLEK228_2A	Hungarian Medical Terminology II.	–	4	2	pract. mark	Hungarian Medical Terminology I.
AOKTSI009_2A	Physical Education II.	–	1	0	signature	–
AOKNSG331_1A	Summer Nursing Practice	–	1 month / 170 hours	–	signature	–
AOKMAG425_1A	Medical Sociology*	1	1	2	semi-final	
AOVINF244_1A	Introduction to Medical Informatics (Obligatory elective subject) **	–	1	1	pract. mark	–
AOVCSA248_1A	Medical Profession (Obligatory elective subject) **	0.67	1.33	2	pract. mark	–
Total Number of Credit Points from Obligatory Subjects				**28** (in case Med. Soc. is taken in the 2nd semester) **26** (in case Med. Soc. is taken in the 1st semester)		

4 credit points from obligatory elective/elective subjects must be collected in each semester. See the detailed list of obligatory elective subjects and elective subjects after the 3rd year curriculum
*** The subject must be registered for, as well as completed, in the first or second semesters of the first year**
** The subject must be registered for, and must be completed during the first 2 years of studies

LIST OF TEXTBOOKS (The list may change!)

1 McMinn and Abrahams' Clinical Atlas of Human Anatomy with STUDENT CONSULT Online Access , 7th Edition By Abrahams, Spratt, Loukas & van

Schoor ISBN-13: 9780723436973 Publication Date: 22/03/2013
2 Sobotta Atlas of Human Anatomy (Package), 15th English ed. Musculoskeletal system, internal organs, head, neck, neuroanatomy, By Waschke & Paulsen, ISBN-13: 9780702052507 Publication Date: 25/06/2013
3 Gray's Anatomy for students with STUDENT CONSULT Online Access, 3rd Edition by R. Drake, A. W. Vogl, A. Mitchel Elsevier; 03/04/2014; ISBN 9780702051319
4 C.Rosse-P.Gaddum-Rosse: Hollinshead's Textbook of Anatomy. Lippincott-Raven. 4th ed. 1997. ISBN 0-397-51256-2
5 Stevens & Lowe's Human Histology , Elsevier, 4th ed. 2015 ISBN 978-0-723435020
6 Wheater's Functional Histology, A Text and Colour Atlas, 6th Edition by B Young, G O'Dowd and P Woodford Churchill Livingstone, Edinburgh, 2013, ISBN 9780702047473
7 Histology: A Text and Atlas: With Correlated Cell and Molecular Biology; 7th Edition by MH Ross and W Pawlina ; Wolters Kluwer 2015, ISBN 9781451187427
8 Langmann's Medical Embryology, 13th Edition by TW Sadler, Wolters Kluwer 2014, ISBN 9781469897806
9 Ebbing,D.D-Grammon,S.D: General Chemistry**.** 9th ed. 2009. Houghton Mifflin Co. Boston. ISBN 10:0-618-85478-6 / 13:978-0-618-85478-7
10 Harper's Illustrated Biochemistry, 30th edition, Lange, ISBN-10: 0071825347
11 Seminar manuals: published on homepage: semmelweis.hu/biokemia/
12 Tóth: Concise Inorganic Chemistry for Medical Students. Bp. Semmelweis Kiadó
13 Laboratory Manual; Medical Chemistry and Biochemistry. Bp. Semmelweis Kiadó
14 Bauer-Csermely-Hrabák: Principles of Organic Chemistry (ed. A. Hrabák) Bp. Semmelweis Kiadó
15 Hrabák: Selected Collection of Chemical Calculations and Biochemical Exercises. Bp. Semmelweis -Kiadó
16 Garzó-Müllner-Sasvári: Bioorganic compounds. Bp. Semmelweis Kiadó
17 Damjanovich – Fidy – Szöllõsi (eds) Medical Biophysics, Medicine, Budapest, 2009. ISBN 978-963-226-127-0
18 Miklós Kellermayer: Medical Biophysics Practices. Semmelweis Publishers, Budapest, 2015. ISBN 978-963-331-349-7.
19 1st semester: Gyöngyösi L. & Hetesy B., 2012. Jó reggelt! Bp. Semmelweis Egyetem Egészségtudományi Kar (available at Vas u. 17. Bookshop)
20 2nd-3rd semesters: Gyöngyösi L. & Hetesy B., 2011. Jó napot kívánok! Bp. Semmelweis Egyetem Egészségtudományi Kar (available at Vas u. 17. Bookshop)
21 Lodish: Molecular Cell Biology, 8th edition (2016); ISBN-13: 978-1-4641-8339-3
22 Alberts et al.: Essential Cell Biology. Garland Science/Taylor & Francis Group Publ. 2013. (4th edition, ISBN: 9780815344544)
23 Anne-Marie Barry, Chris Yuill: Understanding the Sociology of Health: An Introduction. Sage, London, 2016.

Recommended textbooks:

1 Gray's Anatomy. The Anatomical Basis of Clinical Practice; 41st edition by S.Standring: 2015 ISBN : 9780702052309
2 RMH McMinn: Last's Anatomy, Regional and Applied. Churchill Livingstone, Edinburgh 1990. ISBN 0-443-03484-4
3 A.L. Kierszenbaum Histology and Cell Biology: An Introduction to Pathology 3rd Edition, Paperback with STUDENT CONSULT Online Access and E-Book ISBN: 9780323085885 Copyright: 2012
4 Junqueira's Basic Histology: Text and Atlas; 13th Edition by Anthony Mescher, New York, McGraw-Hill Medical, 01/03/2013 ISBN13 9780071780339
5 W.Kahle-H.Leonhardt-W.Platzer: Color Atlas and Textbook of Human Anatomy (in 3 volumes) 3rd revised ed. Thieme Inc. New York, 1986.

6 Human Anatomy, Color Atlas and Textbook, 6th Edition by J Gosling, P Harris, J Humpherson, I Whitmore and P Willan; Elsevier, 2016 , ISBN 9780723438274
7 Stryer: Biochemistry. 4th ed. 1995. ISBN 0-7167-2009-4
8 Zumdahl: Chemical Principles. 3rd ed. 1998. Houghton-Mifflin Co. Boston. ISBN 0-395-83995-5
9 First Aid Manual: The Authorised Manual of St. John Ambulance, St. Andrew's Ambulance Association and the British Red Cross by the British Red Cross Society published on 21/03/2011 by Dorling Kindersley Publishers Ltd ISBN 9781405362146
10 Cooper-Hausman: The Cell: A Molecular Approach, 5th Edition, Sinauer Associates, 2006, ISBN 0-87893-300-X
11 Graham Scambler: Sociology as Applied to Medicine. 6th edition. 2008, Saunders Elsevier, London
12 Belák E. Medical Terminology for Beginners (earlier title: Medical Latin), Bp. Semmelweis Kiadó

ANATOMY, HISTOLOGY AND EMBRYOLOGY I – II.

Department of Anatomy, Histology & Embryology
Course Director: **Dr. Andrea D. Székely**
Dr. Sándor Katz

LEARNING OBJECTIVES

Aims of the lectures in anatomy: Presentation of the important and/or complicated chapters such as introductory chapters, thorax, pelvis, hand, foot, skull, heart, chapters of the visceral organs, central nervous system**, organs of special senses, topographical anatomy.**
Aims of the lectures in cell biology and histology: Presentation of the cell, basic principles in cell biology (mitosis, cytoskeleton, cellular motility), detailed presentation of the basic tissues (epithelial, connective, muscle and nervous). Complementing gross anatomy with a detailed presentation of the fi ne structure of organs, including the ultrastructural details together with the molecular background.
Important chapters: basic tissues, viscera, central nervous system.
Aims of the lectures in embryology: Presentation of the early development from the diff erentiation of the germ cells to the formation of the human embryo (general embryology). Presentation of the development of the organs and functional systems parallel with the gross anatomical and histological lectures including the frequently occurring malformations.
Aims of the practical sessions in the dissecting room: Based on the weekly programs (see separate), students will both observe prosected cadaver specimens (bones, joints, muscles, viscera, brain) and perform dissections on parts of, or on an entire, enbalmed cadaver. Students are supervised by the lab instructors. Bones, joints, muscles and peripheral nervous system will be primarily taught in the dissecting room.
Discussion of the more complicated chapters of embryology is presented on small group discussions connected to the practical sessions in the dissecting room.
Aims of the practical sessions in the histology room: Facilitate the understanding of ground (-epithelial, connective, muscle and nervous) tissues and the fi ne structure of the organs through the observation and interpretation of histological specimens.
The knowledge of the students will be checked by mid-term tests.

TOPICS OF THE LECTURES:

Lectures: first semester: 3×45 min; second semester: 3×45 min; third semester: 3×45 min; fourth semester: 1×45 min.

First semester: Gross anatomy of musculoskeletal system (i.e. bones, joints and muscles), basic cytology, general histology, general embryology, development of the skull, spine and limbs.
Second semester: Heart and vessels, lymphatic organs, viscera and body cavities; integrated gross anatomy, cytology, histology and embryology.
Third semester: Central and peripheral nervous system, organs of special senses, endocrine organs; integrated gross anatomy, cytology, histology and embryology.
Fourth semester: Topographical anatomy of the head, neck, limbs and trunk including body cavities (thorax, abdomen, pelvis), ventral and dorsal regions, cross sectional anatomy.

PRACTICAL COURSE

6×45 min; second semester: 6×45 min; third semester: 4×45 min; fourth semester: 2×45 min

First semester: Gross anatomy of the musculoskelatal system (i.e. bones, joints, muscles, vessels ans nerves), basic cytology, general histology, general embryology, development of the skull, spine and limbs.
Second semester: Heart and vessels, lymphatic organs, viscera, topography of body cavities; integrated gross anatomy, cytology, histology and embryology.
Third semester: Central and peripheral nervous system, organs of special senses, endocrine organs; integrated gross anatomy, cytology, histology and embryology. Topographical anatomy of the dorsal regions of limbs and the trunk, including spinal cord. Topographical anatomy of the viscerocranium, neurocranium and the internal organs of the neck.
Fourth semester: Topographical anatomy of the ventral and dorsal regions of the body, including the limbs and body cavities (thorax, abdomen, pelvis), cross sectional anatomy.

Type of exams: oral and written.
First semester: semifinal; second semester: semifinal; third semester: semifinal; fourth semester: final exam from the subjects of the four semesters.
ECTS credits: four semesters together: 27 (first semester: 8; second semester: 9; third semester: 7; fourth semester: 3)

Anatomy books

LIST OF TEXTBOOKS (The list may change!)

1 **Sobotta Atlas of Human Anatomy** (Package), 15th English ed. Musculoskeletal system, internal organs, head, neck, neuroanatomy, By Waschke & Paulsen, ISBN-13: 9780702052507 2013
2 **Gray's Anatomy for students** with STUDENT CONSULT Online Access, 3rd Edition by R. Drake, A. W. Vogl, A. Mitchel Elsevier; 2014; ISBN 9780702051319
3 **McMinn and Abrahams' Clinical Atlas of Human Anatomy** with STUDENT CONSULT Online Access , 7th Edition By Abrahams, Spratt, Loukas & van Schoor ISBN-13: 9780723436973 , 2013
4 **Netter: Atlas of Human Anatomy**, Including Student Consult Interactive Ancillaries and Guides, 6th Edition, 2014.
5 Human Anatomy, Color Atlas and Textbook, 6th Edition by J Gosling, P Harris, J Humpherson, I Whitmore and P Willan;, ISBN 9780723438274 Elsevier, 2016.
6 **Loukas, Benninger & Tubbs: Gray's Clinical Photographic Dissector of the Human Body**, with STUDENT CONSULT Online Access, Saunders, 2012.
7 **Stevens & Lowe's Human Histology** , Elsevier, 4th edISBN 978-0-723435020, 2015.
8 **Langmann's Medical Embryology**, 13th Edition by TW Sadler, Wolters Kluwer, ISBN 9781469897806, 2014
9 **Fitzgerald's Clinical Neuroanatomy and Neuroscience**, 7th Edition, Elsevier, 2015.
10 **Histology: A Text and Atlas:** With Correlated Cell and Molecular Biology; 7th Edition by MH Ross and W Pawlina ; Wolters Kluwer 2015, ISBN 9781451187427

Recommended textbooks:

1 **Gray's Anatomy. The Anatomical Basis of Clinical Practice**; 41st edition by S.Standring: 2015 ISBN : 9780702052309
2 **Bräuer: Sobotta Flashcards** (Muscles; Bones, Ligaments, and Joints) URBFI, 2013.
3 **KL Moore–AF Dalley:Clinically Oriented Anatomy**. 4th ed. Lippincott William and Wilkins, 1999.
4 **RMH McMinn: Last's Anatomy, Regional and Applied**. Churchill Livingstone, Edinburgh 1990. ISBN 0-443-03484-4
5 **A.L. Kierszenbaum Histology and Cell Biology**: An Introduction to Pathology 3rd Edition, Paperback with STUDENT CONSULT Online Access and E-Book ISBN: 9780323085885:, 2012
6 Wheater's Functional Histology, A Text and Colour Atlas, 6th Edition by B Young, G O'Dowd and P Woodford Churchill Livingstone, Edinburgh, 2013, ISBN 9780702047473
7 Junqueira's Basic Histology: Text and Atlas; 13th Edition by Anthony Mescher, New York, McGraw-Hill Medical, 01/03/2013 ISBN13 978007178033
8 **The Developing Human – Clinically Oriented Embryology**, 10th ed. by KL Moore, TVN Persaud and M Torchia, Saunders, 2015; ISBN 9780323313384
9 **Regional Anatomy**, by T Tömböl, Medicina 2008, ISBN 963 242 186 8
10 **Anatomy of the Living Human**. by A Csillag, Könemann, 1999.
11 **Imaging Atlas of Human Anatomy**, 4th Edition by Jamie Weir, Peter Abrahams, Jonathan D. Spratt, and Lonie Salkowski ISBN: 9780723434573 Copy-

right: 2011
12 Sectional Anatomy – Workbook, by A. Nemeskéri; István Apáthy's Foundation, 2001.
13 Histology Manual 1-3. by A. Nemeskéri and K. Kocsis: István Apáthy's Foundation, 2001.
14 Alberts,.Bray, Hopkin, Johnson, Lewis, Raff , Roberts, Walter: Essential Cell Biology, third edition Garland Science, New York and London 2010.
15 Neuroanatomy An Illustrated Colour Text, 4th Edition by Crossman & Neary Publication Date: 13/04/2010 ISBN-13: 9780702030864

1st year 1st semester

English Program

Anatomy: Macroscopy and clinically oriented anatomy of the parts of the musculoskeletal system, i.e. osteology, arthrology and myology, together with the vascular and nervous supply of the limbs and the trunk. Skull.

Histology: Microscopy of the ground (basic) tissues (epithelia, glandular tissues, connective and supporting tissues, types of muscle tissues. Histology of the corpuscular elements of the blood, cells of the red bone marrow.

Embryology: Basic principles of human development, introduction to the clinical embryology. General embryology, including spermatogenesis, oogenesis, fertilization, cleavage, blastulation, formation of germinal layers, body axes, molecular basis of right-left asymmetry, Hox genes, formation of the placenta, fetal membranes. Organ development including the early onset of fetal circulations. and the development of the limbs, together with the trunk and the skull. Factors inducing congenital malformations.

Credits: 8
Lectures: 2,5 hours/week **Dissection classes: 4** hrs/week
Histology laboratory classes: **2** hrs/week

Week	Lectures	Practical sessions	
		Dissection room	**Histology lab**
Week 1	1. The role of anatomy, histology and embryology in the medical curriculum. Terminology 2. The cell, cellular membrane,	General introduction to practical work in the dissection room, tools and rules Upper limb	Light and electron microscopical techniques, the principles of practical histology

Week	Lectures	Practical sessions	
		Dissection room	**Histology lab**
	endoplasmic reticulum 3. Cell nucleus, mitochondrium, peroxysome	Bones	classes
Week 2.	4. Adhesion molecules, intercellular connections, epithelial cells 5. Types of epithelia. Glandular epithelium 6. The cellular framework, microtubules, IM filaments, actin microfilaments	Upper limb Bones and joints	Simple epithelia Stratified epithelia I.
Week 3.	7. Exocytosis, Golgi apparatus, , vesicular transport, sorting. Endocytosis, cellular organelles. Apoptosis 8. General arthrology and myology. Joints , muscles and movements of the shoulder and the upper girdle 9. Muscles and actions of the elbow joint	Upper limb Dissection of the muscles, vessels and nerves of the flexor side	Stratified epithelia II. Glandular epithelium
Week 4.	10. Joints, muscles and actions of the wrist and the hand 11. Connective tissue cells 12. Connective tissue fibres, types and formation. Extracellular matrix	Upper limb Dissection of the muscles, vessels and nerves of the flexor and extensor sides	Connective tissue I. Cells
Week 5.	13. The principles of cell division, differentiation. Cell cycle, mitosis, meiosis 14. Supporting tissues (cartilage,	1. Upper limb Dissection of the muscles, vessels and nerves of the extensor side, dissection of joints	Connective tissue II. Fibrous elements

Week	Lectures	Practical sessions	
		Dissection room	**Histology lab**
	bone) 15. Ossification, bone remodelling	**2. Midterm test 1** Upper limb	
Week 6.	16. Components, muscles, joints and ligaments of the vertebral column. Intervertebral, atlantooccipital and atlantoaxial joints 17. Ribs, components and movements of the thorax. Abdominal muscles, rectus sheath. 18. Muscles, fasciae and movements of the neck. Back muscles, occipital muscles	Bones and muscles of the trunk. Demonstration of the muscles of the neck, back and abdomen.	Connective tissue III. Connective tissue types
Week 7.	19. Bones, joints, construction of the pelvis. 20. Muscles and actions of the hip joint 21. Muscles and actions of the knee joint	Lower limb and pelvis Dissection of joints of the lower limb	Supporting tissues Cartilage, bone
Week 8.	22. Subinguinal hiatus. Inguinal canal. Adductor and femoral canals 23. Muscles and joints of the foot. Architecture of the foot 24. Blood. Corpuscular elements. Red bone marrow, erythropoiesis, Formation of leukocytes	Lower limb Dissection of the muscles, vessels and nerves of the dorsal side	Types of ossification

Week	Lectures	Practical sessions	
		Dissection room	Histology lab
Week 9.	25. Muscle tissue 26. Gametes, fertilization, cleavage and blastulation 27. Implantation, bilaminar embryo. Fetal membranes, umbilical cord. Structure of the placenta, placentar circulation	Lower limb Dissection of the muscles, vessels and nerves of the dorsal side	Blood and red bone marrow
Week 10.	28. Molecular basis for gastrulation.Formation, differentiation and derivatives of the germinal layers. 29. Neurulation, folding of the embryo. Body axes, left-right lateralizationm asymmety. 30. Formation of the primary tissues. Homeobox genes, stem cells	Lower limb Dissection of the muscles, vessels and nerves of the ventral side	Smooth,skeletal and cardiac muscle types Revision
Week 11. Nov. 14-18.	31.Histology of vessels. 32. Bony framework of the skull. Sphenoid and ethmoid 33. Temporal bone. Internal and external skull base	Lower limb Dissection of the muscles, vessels and nerves of the ventral side	**Midterm test 2:** Epithelia, connective and supporting tissue. General embryology
Week 12.	34. Facial skeleton. Orbit, nasal cavity 35. Skull. Infratemporal and pterygopalatine fossae 36. Nervous tissue. Glial cells	Bones of the skull Internal and external skull bases	Vessels: arteries, veins, arterioles, venules, capillaries.
Week 13.	37. Temporomandibular joint, muscles of mastication; muscles of facial	Bones of the facial skeleton, mandible. Orbit, nasal cavity, pterygopala-	Nervous tissue

Week	Lectures	Practical sessions	
		Dissection room	Histology lab
	expression 38. Development of the skull, fontanelles. 39. Development of the limbs and the vertebral column together with the trunk	tine fossa Temporomandibular joint	
Week 14.	40. Developmental malformations 41. Clinical anatomy of the musculoskeletal system 42. Clinical anatomy of the musculoskeletal system	Muscles of mastication and facial expression	Placenta, umbilical cord Revision

Topic lists for the semifinal examination

Histology

Concept of basic tissues
Definition and classification of epithelial tissue
Simple epithelia
Stratified epithelia
Membrane specializations of epithelia
Glandular epithelia
Cells of connective tissue
Ground substance and fibres of connective tissue
Types of connective tissue
Umbilical cord and placenta

Blood and the formed elements of blood
Histology of the bone marrow, maturation of erythrocytes and platelets
Differentiation of granulocytes, lymphocytes and monocytes
Histology of cartilage
Histology of the bone tissue
Intramembranous ossification
Endochondral ossification
Growth and remodeling of bone
Smooth muscle and myoepithelial cells
Skeletal muscle tissue
Cardiac muscle tissue
Histology of the peripheral nervous system (sensory and autonomic ganglia)
Supporting cells in the peripheral nervous system
Nerve fibers, myelin sheath
Motor end-plate

Anatomy

General osteology, classification of bones
Bones, spaces and connections of the skull, external and internal skull bases
Neurocranium, components and cavities (anterior, middle and posterior cranial fossae)

Viscerocranium, components and cavities (walls and connections of the nasal cavity, orbit, oral cavity, pterygopalatine and infratemporal fossae)
Bones of the axial and appendicular skeleton
Vertebrae, ribs, sternum
Bones of the girdles and limbs
General arthrology
Fibrous and cartilaginous joints
Components of the synovial joints
Classification of synovial joints; movements and mechanisms
Structure of the vertebral column, the gross anatomy of the muscles acting upon it
Movements and muscles of the head&neck (atlantooccipital and atlantoaxial joints)
Joints of the shoulder girdle, the gross anatomy of the muscles acting upon them
Shoulder joint, the gross anatomy of the muscles acting upon it

Elbow joint, the gross anatomy of the muscles acting upon it
Structure and movements of the radiocarpal joint, gross anatomy of the muscles acting upon it

Metacarpophalangeal and interphalangeal joints, the gross anatomy of the muscles concerned with the movements

Carpometacarpal, metacarpophalangeal and interphalangeal joints of the thumb, the gross anatomy of the muscles concerned with the movements
Hip joint and the gross anatomy of the muscles concerned with the movements
Knee joint and the gross anatomy of the muscles concerned with the movements
Ankle joint together with the gross anatomy of the muscles acting upon it
Subtalar and talocalcaneonavicular joints, the muscles acting upon them
Temporomandibular joint and the gross anatomy of the muscles acting on it
Architecture and classification of bones
Structure and actions of somatic muscles
Osteofibrous structure of the thoracic cage (bones, joints, ligaments, movements)
Muscles and movements of the thorax
Muscles of the back and nape (occipital region)
Axilla, the quadrangular and triangular spaces
Cubital fossa
Muscles and cross section of the arm
Muscles and cross section of the forearm
Osteofibrous spaces and muscle compartments of the hand, tendinous sheaths
Composition of the pelvis (bones, ligaments and membranes)

Muscles of the buttock, the posterior abdominal wall and the pelvis (external and internal muscles of the hip)
Osteofibrous compartments, muscles and cross section of the thigh
Popliteal fossa
Subinguinal hiatus, vascular and muscular compartments; adductor canal, femoral canal
Osteofibrous compartments, muscles and the cross section of the leg
Structure of the foot, arches of the foot
Osteofibrous compartments of the foot, tendinous sheaths
Muscles of mastication
Superficial muscles of the neck and the muscle triangles
Deep muscles of the neck and the laminae of the cervical fascia

Muscles of facial expression

Embryology

Spermatogenesis, spermiogenesis
Oogenesis
Fertilization, cleavage of the zygote
Blastocyst formation; the bilaminar embryonic disc
Implantation
Formation of the intraembryonic mesoderm; the notochord
Neurulation (neural tube and neural crest)
Differentiation of the intraembryonic mesoderm; formation and derivatives of the somites
Derivatives of the intermediate mesoderm
Lateral plate mesoderm and its derivatives
Folding of the embryo
Development of the primitive cardiovascular system, the fetal circulation
The structure and function of the placenta
Development of the fetal membranes (chorion and amnion) and the umbilical cord
Periods of embryonic / fetal life
Twin formation
Development of the limbs
Development of the vertebral column
Development of the skull
Development of the skeletal muscular system

1st year 2nd semester

English Program

Anatomy: Morpholgy, topography and clinically oriented anatomy of the internal organs (i.e. cardiovascular, gastrointestinal, respiratory and the urogenital systems)
Histology: Microscopical strucure of the internal organs (cardiovascular, gastrointestinal, respiratory and the urogenital systems)

Embryology: Development of the internal organs together with their malformations
Credits: **9**
Lectures: **3** hours/week
Dissection class: 6 hours /week
Histology laboratory: **2** hrs/week

Week	Lectures	Practical sessions	
		Dissection room	**Histology lab**
Week 1	1. Lymphatic tissue and cellular elements. Thymus, tonsils, MALT. 2. Lymph node, spleen. Structure and circulation 3. Muscles, triangles and fasciae of the neck	Dissection of head and neck region	Lymphatic organs: thymus, tonsils
Week 2.	4. Gastrointestinal tract. Oral cavity, morphology and histology of the tongue and salivary glands 5. Morphology, histology and development of teeth. 6. Morphology and histology of soft palate, isthmus of fauces and pharynx	Dissection of head and neck region	Lymphatic organs: lymph node, spleen
Week 3.	7. Development of the branchial apparatus, congenital malformations 8. Morphology of the nasal cavity and paranasal sinuses 9. Larynx, cartilages, joints, muscles connective tissue skeleton, mucous membrane.	Oral cavity, tongue, salivary glands, teeth, nasal cavity, larynx	Gastrointestinal tract: lip, tongue, including the filiform, fungiform and vallate papillae

Week	Lectures	Practical sessions	
		Dissection room	**Histology lab**
Week 4.	10. Development of the face, and palate, congenital malformations 11. Morphology of the trachea and the lung. Pleura 12. Histology of the respiratory tract. Development of the lungs,	Surface projections of the internal organs of the thorax, dissection of the thoracic cavity. Lungs, pleura, mediastinum	Ground teeth, tooth bud. Submandibular, sublingual glands
Week 5.	13. Chambers of the heart, external features. Structure of heart wall, myocardium, valves, anuli fibrosi 14. Vessels, conducting system, surface projection of the heart, pericardium. Auscultation points. Divisions of the mediastinum. 15. Structure and development of the diaphragm	Dissection of the heart	Respiratory system: larynx, trachea, lung
Week 6.	16. Development of the heart (primitive heart tube, development of atria) 17. Development of the heart (development of ventricles, malformations). Fetal circulation 18. Morphology and histology of the esophagus and the stomach.	Dissection of the heart	Heart Esophagus, cardia, fundus, pylorus of the stomach
Week 7.	19. Morphology and histology of the duodenum and the pancreas 20. Morphology and histology of the jejunum and ileum 21. Morphology and histology of the large intestine and rectum.	1.Revision 2**. Midterm test 1** Heart, great vessels, development of the heart . Morphology and development of the internal organs of the	Duodenum, jejunum ileum, colon, vermiform appendix

Week	Lectures	Practical sessions	
		Dissection room	**Histology lab**
		head, neck, thorax and diaphragm.	
Week 8.	22. Morphology of the liver and biliary system. Portal vein 23. Histology of the liver and biliary system 24. Development of the mid- and hindgut. Development of the liver and the pancreas	Dissection of abdominal internal organs Dissection of the visceral complex. Celiac trunk, liver, duodenum	Liver, gall bladder, pancreas
Week 9.	25. Peritoneum. Development of the serous membranes and the omental bursa. Separation of body cavities 26. Morphology and topography of the kidney. Capsules. Urinary passages, urinary bladder 27. Histology of the urinary system	Cadaver dissection Organs supplied by the superior mesenteric artery	Urinary system: kidney, ureter, urinary bladder
Week 10.	28. Morphology and coats of the testicle. 29. Histology of the testicle. Spermatogenesis 30. Morphology and histology of the epididymis, spermatic cord, seminal vesicle and prostate	Cadaver dissection Organs supplied by the inferior mesenteric artery	**Midterm test 2**, Lymphatic organs, respiratory system, gastrointestinal tract , urinary system
Easter break			

Week	Lectures	Practical sessions	
		Dissection room	**Histology lab**
Week 11.	31. Development of the arteries; malformations. 32. Development of the veins. 33. Morphology and histology of penis and male urethra.	Cadaver dissection Retroperitoneum, pelvic organs Dissection of the visceral complex	Male genital system: testis, epididymis, spermatic cord
Week 12.	34. Structure of pelvic floor, male perineum 35. Morphology and histology of the ovary and the uterine tube, oogenesis 36. Morphology and histology of the uterus, divisions and content of the broad ligament	Cadaver dissection Male genital system	Male genital system: Seminal vesicle, prostate, penis, glans penis.
Week 13.	37. Morphology and histology of the vagina and the external genital organs, female perineum 38. Development and malformations of the urinary system 39. Development and malformations of the genital system. Disorders of the sexual differentiation.	Cadaver dissection Female genital system	Female genital system: ovary, corpus luteum, uterine tube
Week 14.	40. Major lymphatic ducts 41. Lymphatic drainage of the head&neck, thoracic and abdominal regions 42. Clinical and radiologic anatomy of the internal organs	Revision Abdominal and pelvic organs	Female genital system: uterus (proliferation, secretion), vagina

TOPICS OF THE SEMIFINAL EXAMINATION

LYMPHATIC ORGANS

Tonsils (anatomy, histology, embryology)
Spleen (anatomy, histology, embryology)
Thymus (anatomy, histology, embryology)
Lymphatic vessels and nodes of head and neck
Lymphatic vessels and nodes of mediastinum
Lymphatic vessels and nodes of retroperitoneal space
Lymphatic vessels and nodes of pelvis
Thoracic duct and right lymphatic duct

Microscopic structure of lymphatic system (reticular cells, lymphocytes, plasma cells, antibodies, lymphatic follicles)
Microscopic anatomy of lymph nodes

CIRCULATORY SYSTEM

Shape, external features of heart
Chambers of heart
Endocardium, ostia, valves of heart
Skeleton of heart, anuli fibrosi
Structure of heart wall
Cardiac muscle, myocardium
Impulse generating and conducting system of heart
Pericardium
Position and surface projections of heart
Percussion and auscultation (area of cardiac dullness, heart sounds)
Radiology of heart
Development of heart tube
Development of atria (septum primum and secundum, foramen ovale)
Development of ventricles (interventricular septum)

Pulmonary circulation
Ascending aorta, arch of aorta and its branches
Common and external carotid artery and their branches
Maxillary artery and its branches
Subclavian artery and its branches
Thoracic aorta and its branches
Abdominal aorta and its branches
Coeliac trunk and its branches
Superior mesenteric artery and its branches
Inferior mesenteric artery and its branches
External and internal iliac artery and its branches
Internal pudendal artery and its branches
Superior vena cava and its tributaries
Inferior vena cava and its tributaries
Azygos and hemiazygos veins and their tributaries
Portal vein and its tributaries, portocaval anastomoses
Veins of face and neck
Cutaneous veins and lymphatic vessels of trunk
Microscopic structure of arterial and arteriolar wall
Microscopic structure of capillary wall
Development of aorta and branchial (pharyngeal) arch arteries
Development of great veins (caval, portal, azygos)
Fetal circulation
Microscopic structure of the wall of venules, veins and lymphatic vessels

DIGESTIVE SYSTEM

Oral cavity (divisions, boundaries)
Floor of mouth, sulcus lateralis linguae
Types and morphology of teeth
Orientation and supporting structures of teeth
Dental arch and dental formula, blood and nerve supply of teeth

Microscopic anatomy of oral tissues (enamel, dentin, cementum, periodontal ligament, alveolar bone, gum)

Development of teeth
Microscopic anatomy of dental development
Tongue (parts, vessels, innervation)
Microscopic anatomy and development of the tongue
Salivary glands (anatomy, histology, embryology)
Isthmus of fauces
Palate, palatine muscles
Development of face, hare lip
Development of nasal cavity and paranasal sinuses
Development of palate, cleft palate
Pharynx, (shape, position, parts, muscles)
Topography of the pharynx, para and retropharyngeal spaces
Structure and development of branchial (pharyngeal) arches
Derivatives of branchial (pharyngeal) arches
Development and derivatives of branchial (pharyngeal) pouches
Branchial (pharyngeal) grooves
Esophagus (anatomy, histology, embryology)
Derivatives of foregut (pharynx, oesophagus, stomach, duodenum)
Stomach (shape, position, parts)
Peritoneal relations of stomach

Blood supply and innervation of stomach Microscopic anatomy of stomach
Microscopic anatomy of the stomach
Duodenum (shape, position, divisions, vessels)
Jejunum-ileum (shape, position, vessels)
Microscopic anatomy of small intestine
Fine structure of the intestinal villi
Rectum, anal canal (shape, position, vessels)
Microscopic anatomy of rectum and anal canal
Liver (shape, position; development)
Gall bladder and biliary passages (anatomy, histology, embryology)
Liver (peritoneal relations, vessels)
Microscopic anatomy of the liver

Circulation of liver, liver sinusoids
Microscopic anatomy of gall bladder and extrahepatic biliary tracts
Pancreas (shape, position, vessels)
Microscopic anatomy and development of the pancreas
Peritoneum omenta, mesentery, omental bursa
Rotation and derivatives of midgut, physiological umbilical hernia
Development of hindgut

RESPIRATORY SYSTEM

Nose, nasal cavity (boundaries, nasal meatus, vessels)
Paranasal sinuses (connections, vessels)
Larynx (shape, position, vessels, nerves)
Skeleton and joints of larynx
Laryngeal ligaments (fibroelastic membranes, mucous membrane)
Muscles of larynx, innervation
Microscopic structure and development of the larynx
Trachea and bronchial tree (anatomy, histology and development)
Lung (shape, parts, surfaces, hilum)
Lung (position, topography, vessels, nerves)
Surface projection of pleura and lung
Microscopic structure and development of the lung

BODY CAVITIES

Thoracic wall
Pleura, pleural cavity
Mediastinum (divisions and content)
Diaphragm
Abdominal cavity (divisions and surface projections)
Abdominal wall (muscles, fasciae)
Rectus sheath
Hernia sites
Development and separation of body cavities
Development of the diaphragm

Development of the peritoneum

UROGENITAL SYSTEM

Kidney (shape, position, hilum, sinus, capsules)
Kidney (section, vascular architecture)
Microscopic anatomy of kidney
Microscopic anatomy of juxtaglomerular apparatus
Vascular architecture of kidney
Development of kidney and ureter (pronephros, mesonephros, metanephros)
Renal pelvis and calyces
Ureter (anatomy, histology and embryology)
Urinary bladder (shape, position, muscles, vessels)
Microscopic anatomy and development of the urinary passages
Differentiation of the urogenital sinus
Female urethra (anatomy, histology and embryology)
Testis (shape, position, vessels)
Microscopic anatomy of testis, spermatogenesis
Development of testis
Epididymis, vas (ductus) deferens, spermatic cord (anatomy, histology and embryology)
Scrotum, coats of testis
Seminal vesicle (anatomy, histology and embryology)
Prostate (anatomy, histology and embryology)
Development of male genital ducts and glands
Male urethra, bulbourethral gland (anatomy, histology and embryology)
Penis (shape, position, mechanism of erection, vessels, nerves)
Microscopic anatomy of penis and male urethra
Pelvic floor, male perineum
Hernia canals (inguinal and femoral)
Development of the male external genital organs
Ovary (shape, position, vessels)
Microscopic anatomy of ovary, oogenesis
Microscopic anatomy of corpus luteum
Development of ovary

Uterine tube (shape, position, vessels; histology, embryology)
Uterus (shape, parts, wall, cavity)
Uterus (position, supporting structures, vessels)
Broad ligament (lig. latum) and its components
Microscopic anatomy of uterus, menstrual cycle
Vagina, female perineum

External female genital organs (mons pubis, labia, vestibule of vagina, greater vestibular gland, vessels)
Development of female genital tracts
Microscopic anatomy of vagina and external genitalia
Development of the female external genital organs

BASICS OF BIOSTATISTICS AND INFORMATICS

Tutor: ***Dr. István Voszka***

Week	Lecture (1 hour/week)	Practice (2 hours/week)
1.	Introduction	Graphical representation of functions
2.	Role of „change" in theory and in practice	The most important functions and their representation by computer
3.	Descriptive statistics	Use of excel tables
4.	Elements of probability calculus	Mean, standard deviation, variance, standard error
5.	Probability calculus and statistics	Descriptive statistics
6.	Principles of hypothesis testing	Hypothesis testing 1.: t-tests
7.	Parametric and non-parametric tests for comparison of two groups	Hypothesis testing 2.: non-parametric tests
8.	Comparison of more groups, analysis of variance	Hypothesis testing 3.: Mann-Whitney U-test

9.	Examination of dependence relations of variables	Analysis of variance
10.	Evaluation of diagnostic tests	Categorical variables, contingency table
11.	Human body as signal source, signal processing	Regression analysis
12.	Concept of information, databases	Calculation of correlation
13.	Clinical databases	Bioinformatical databases
14.	Evidence based medicine, role of mathematical logics in diagnostics	Publication databases, clinical databases

MEDICAL BIOPHYSICS I.

Tutor***: Dr. István Voszka***

First Semester

Week	**Lecture** (1.5 hours per week)	**Laboratory** (2 hours per week)
1	Radiations (basic concepts)	Laboratory safety rules
2	Properties of electromagnetic radiations; wave and corpuscular nature	Resonance
3	Attenuation of radiation	Emission spectroscopy. Light sources
4	Luminescence and its applications	Spectrophotometry
5	Lasers and their medical applications	Optical lenses; light microscope
6	Thermal radiation, thermography. Biological effects of light	Detection of nuclear radiations
7	Production and spectrum of X-radiation Cyclotron; Linear accelerator;	Oscilloscope
8	Attenuation of X-radiation, interactions	Special light microscopes X-ray diagnostics

9	Atomic structure; Radioactive decay law Gamma-radiation and its detection	Optics of the eye
10	Radiotherapy, radiosurgery; Isotope diagnostics	Polarimeter
11	SPECT, PET Beta-radiation, beta-decay	Coulter counter
12	Alpha-radiation, alpha-decay Interaction with matter	Determination of skin-impedance
13	Dosimetry	Concentration determination with refractometer
14	Radiation protection; estimation of risk	Repetition

MEDICAL BIOPHYSICS II.

Second Semester

Week	**Lecture** (2 hours per week)	**Laboratory** (2 hours per week)
1	Bonds and their significance in macromolecular structure; Boltzmann distribution, examples	The attenuation of gamma-radiation
2	Liquid crystals, membranes	Dosimetry
3	Electronic properties of condensed materials (solids, macromolecules)	Amplifier
4	Ultrasound properties, generation of ultrasound	Gamma energy determination
5	Ultrasonography, Doppler methods	Pulse generators (e.g. pacemaker, defibrillator)
6	Methods for structure examination	Sine wave oscillators (high frequency heat therapy, ultrasound)
7	Basic concepts of Thermodynamics, First law	Audiometry
8	General description of transport phenomena,	Isotope diagnostics

	Onsager`s equation, examples		
9	Diffusion; transport across membrane	Densitography (CT)	
10	Resting potential and its local changes	Flow of fluids. Electric model of vascular	circulation
11	Action potential, properties, interpretation	Electrocardiography	
12	General characteristics of sensory function, hearing, vision	Diffusion	
13	Biophysics of muscle function	Sensory function	
14	Motor proteins	Repetition	

MEDICAL CHEMISTRY

Department of Medical Chemistry, Molecularbiology and Pathobiochemistry

First Semester

credits: 6

Director of the course:
Prof. Gábor Bánhegyi M. D., Ph. D., D. Sc.

Description of the curriculum
The principal aim of the course is to prepare students for the understanding of Biochemistry and Molecular Biology. This requires a firm knowledge of the basics of general, organic and inorganic chemistry.

I. General Chemistry

Structure of atoms, ions and molecules. Chemical bonds

Relation of atomic radius, ionization energy, electron affinity and electronegativity to the periodic table. Ionic bond, ion radius, ions. Covalent bonding, σ and π bonds, hybrid orbitals, hybridization of carbon. Electron pair repulsion, geometry of molecules, bond angle. Molecular orbital theory.

Polar covalent bonds. Molecules composed of more than two atoms. Coordinative bond. Structure and geometry of ions. Metallic bonding. Interactions between molecules: electrostatic interactions, van der Waals and hydrogen bonds. Structure of water, its properties. Physical states. Types of crystals, characteristic crystal lattices.

Solutions, laws of aqueous solutions, their biological and medical aspects

Solute, solvent, solution. The solution process. Solubility of ions in water, dissociation. Enthalpy of hydration. Concentration, % and molar concentration, normality, molality, molar fraction. Saturated solutions. Solubility, partition, solubility product. Demonstration on calculation problems. Laws of dilute solutions. Vapor pressure, freezing point, boiling point of pure solvents. Vapor pressure of solutions, Raoult's law. Freezing point depression and boiling point elevation of aqueous solutions. Osmotic pressure, dependence on temperature, solute concentration and ionic dissociation. Biological and medical importance of osmosis.

Electrolytes

Electrolytes, degree of dissociation and the ionization constant, their correlation. Conductance of electrolytes, specific and equivalent conductance of strong and weak electrolytes. Acid-base theories. The Arrhenius theory. Classification of acids and bases, their anhydrides. The Bronsted-Lowry concept. The Lewis concept (e.g. coordination compounds). Acidic strenght and the molecular structure. The ionization of water. Water product, definition of pH and pOH. The pH scale. Calculation of pH for strong electrolytes. The effect of strong acids and bases on the ionization of weak acids and bases, respectively. The effect of strong acids and bases on the salts of weak acids and bases. Buffers, calculation of pH of buffers. Buffers of polyprotic acids. Buffers of physiological importance. The carbonic acid/hydrogencarbonate buffer.

Buffer capacity. Acid-base indicators. Titration curves of strong and weak electrolytes. The selection of indicator for titrations. The amphoteric character. Basic and acidic salts. Double salts, complexes. Geometry of complexes, chelates. Reaction of salts with water (hydrolysis).

Electrochemistry

Redox processes. Oxidation number, its definition. redox equations. The electrode potential, its explanation. Normal and standard potentials. Galvanic cells, Nernst equation. Concentration cells, the principle of electrometric pH measurement. Non-polarizable electrodes, their utilization in practice. Biological redox potential, redox electrodes. The application of redoxi potential for biological processes, the principle of mitochondrial energy production. Electrolysis.

Thermodynamics

Chemical thermodynamics. Internal energy and enthalpy, reaction heat, standard enthalpy. Hess' law. Combustion heat, atomic and molecular enthalpy of formation. Bonding energy. The I. and II. laws of thermodynamics, entropy, free energy and free enthalpy.

Relation between electromotive force and free enthalpy change. Exergonic and endergonic processes. The equilibrium constant. The direction of the processes and its relation to free energy change.

Chemical kinetics

Reaction kinetics, rate of reaction, order and molecularity. Half-time of reactions. The van't Hoff rule. Activated complex, transition state, activation energy. The Arrhenius equation. Catalysis, catalysts. Reversible processes, the law of mass action, equilibrium constant and its relation to free energy change. Consecutive reactions, the importance of rate-limiting steps in metabolic processes.

II. Inorganic chemistry

Properties of non-metals

Group of halogens, their biological significance. Oxygen group, oxygen, free radicals containing oxygen, air, air pollution, ozone. Sulfur, its compounds. The nitrogen group. Nitrogen, its important inorganic compounds. Nitrogen cycle. Phosphorus and its compounds. Carbon group, carbon and its important inorganic compounds. The air polluting effect of carbon dioxide. Hydrogen and noble gases. Inorganic compounds of medical importance.

Properties of metals

Alkali metals and their compounds. Alkali earth metals and their compounds, the biological significance of calcium and magnesium. Earth metals. Heavy metals and their biological importance. Precious metals. Medically important metals and metal-containing compounds.

III. Organic chemistry

General properties of organic compounds

Introduction, definition of organic compounds, their composition. Homologous series, constitution, constitution isomerism. Classification according to carbon skeletons and functional groups. Characterization of bondings in organic compounds, bonding energy, distance of atoms, dipole moment. Apolar and polar character, inductive and inductomeric, mezomeric and electromeric effects. The vectorial character of dipole moment. Optical isomerism: structural principles of rotation. Chirality, chiral carbon atoms, configuration, enantiomers. Principle of relative and absolute configuration. Projected formulas. Compounds with more than one chiral center: diastereomerism, mezo-forms. Separation of optical isomers.

Classification of hydrocarbons based on their carbon backbone

Alkanes, cycloalkanes, their homologous series. Steric forms, conformations, conformational isomerism. Physicochemical properties of paraffines. Steric structure of cycloalkanes. Alkenes, their homologous series. Constitutional and configurational isomerism. Chemical properties of alkenes, possible mechanisms of addition reactions. Hydrocarbones containing more double bonds, delocalization of π-electrons in compounds containing conjugated double bonds. Acetylene: physicochemical properties. Aromatic hydrocarbons: homologous series, isomerism. The explanation of the aromatic character by the electronic structure. Chemical behavior of benzene and its homologues. Substitution, oxidation, reduction, direction rules in repeated substitutions. General characterization of heteroaromatic compounds, important heteroaromatic compounds.

Functional groups. Classification and chemical characterization of compounds containing various functional groups

I.

Classification of organic compounds according to their functional groups.

Halogenated hydrocarbons, their physicochemical properties.

II.

Organic compounds containing hydroxyl groups. Classification. Alcohols, physical properties, chemical reactions. Enols and phenols, their chemical reactions. Synthesis of ethers, their reactions.

III.

Oxo compounds: classification, nomenclature, physical properties. Chemical reactions of aldehydes and ketones, nucleophilic addition reactions. Condensation reactions of oxo-compounds, oxidation reduction, substitution on the carbon chain.

IV.

Carboxylic acids and their derivatives. Classification, nomenclature, their synthesis, physical properties. The explanation of the acidic character of carboxylic group, the effects of substituents on the acidic character. Chemical reactions of monoprotic carboxylic acids, formation of esters, haloids, amides and anhydrides. Substitution of the carbon chain: synthesis of halogenated, hydroxy-, keto- and amino acids. Acidic character of dicarboxylix acids, important reactions. Chemical reactions of hydroxy- and ketoacids. Important representatives of dicarboxylic, hydroxy- and ketoacids.

V.

Organic compounds containing sulfur: thiols, thiophenols and thioethers, their synthesis and physicochemical properties.

VI.

Organic compounds containing nitrogen: classification, physicochemical properties of nitro compounds. Amines, classification, synthesis, basicity. Important chemical reactions of amines (e.g. Schiff base formations). Amides of carbonic acids.

Lectures and practical lessons

Two lectures and a laboratory lesson (practical) are held every week; schedules can be found in separate uploaded files.

Students are expected to keep records and write protocols on the performed experiments (suggested structure: aim of the experiment, applied methods/devices/reactions, results and evaluation). Hand-written protocols might be presented either at the end of the lab lesson or at the beginning

of the next practical to the lab teacher. Students might get two points for each acceptable protocol, and points collected this way are added to the total score they achieve in the corresponding midterm exams. Thus, bonus points collected in weeks 2 – 4 (at most 6) are added to the scores of midterm I and those obtained in weeks 7 – 11 (at most 10) to midterm II, respectively. Importantly, these bonus points not only improve your midterm grades but might help you pass the midterm, too.

Requirements for acknowledgement of the semester

(1) Participation in the laboratory practicals is obligatory; students should sign the attendance sheets at the end of the practicals. In case of more than three absences from the practicals for any reason, the semester will not be acknowledged and the student is not going to be allowed to sit for the semifinal exam. Missed practicals can be completed only in the same week at another group; certificate from the host teacher should be presented by the student to the assigned teacher.

(2) It is compulsory to pass both midterm examinations; see next paragraph for details.

Midterm examinations

Two midterm written examinations will be held in weeks 6 and 12 of the semester, respectively, during regular laboratory practicals.

Midterm tests consist of four theoretical questions (10 points each) and four problems (calculations; 10 points each). The material of midterm I covers that of lectures given in the first 5 weeks, while midterm II is based on the lecture material of weeks 6-11. Midterm tests will be evaluated by lab teachers and marked as 0, 2, 3, 4 or 5. These 'midterm bonus points' are added to the scores achieved at the semifinal exam (see below).

Grading of midterms (total scores including points obtained from lab reports):

0 – 40 points:	0
41 – 50 points:	2
51 - 60 points:	3
61 – 70 points:	4
71 or more points:	5

Passing both midterms is a prerequisite to acknowledgement of the semester.

Failed midterms might be retaken twice.

The first retake is written, comprising four theoretical questions and four calculations. It should be performed in week 7 (retake of midterm I) and week 13 (retake of midterm II), supervised by the student's own lab teacher.

Students having failed the first retake might sit for the second retake in the last week of the semester. The second retake is an oral exam conducted by an examination committee. Students having failed the first retake of both midterms I and II will be examined in the material of both midterms at the same time.

Semifinal examination

Only those students who have fulfilled both acknowledgement criteria, thus obtained an official electronic Neptun signature, are entitled to sit for the semifinal exam.

The semifinal is a written exam that consists of two theoretical parts and a practical exam.

First theoretical part (50 min): drawing 10 structures within 15 min (both inorganic and organic, 1 point each), answering two short questions (providing definitions of two 'important terms' taken from the topic list; one point each) and solving four chemical calculations (2 points each).

The list of structures to be memorized can be found on the last page of this document. Please note that any inorganic base or salt might be asked that can be formed by combining any cations and anions provided there. Moreover, any normal or branched-chain alkane, alkene or alkyne (up to eight carbon atoms) can be asked such as 2,3-dimethyl-penthane, 3-methyl-2-hexene etc.

Second theoretical part (80 min): 40 multiple choice questions (1 point each).

Lab exam (practical exam) (15 min): writing an essay on a laboratory experiment performed during the semester (evaluation: 0, unacceptable; 1 point, minor mistakes; 2 points, clear, detailed and correct). Exact quantities (mass, volume of reagents, incubation times etc.) are not expected here.

Therefore, the maximal score is 20 + 40 + 2 = 62.

The exam is unsuccessful with

- 10 or less points in part 1, OR
- 20 or less points in part 2, OR
- 0 point from the practical exam.

Students who pass both part 1 AND part 2 but fail the practical essay have to retake only the practical essay when they repeat the semifinal exam. Those who want a better grade are entitled to rewrite the first 2 parts as well; however, risking that they might perform worse.

Students who pass the practical exam but fail either part 1 or part 2 (or both parts) are obliged to retake both theoretical parts but not the practical exam.

In case of successful exams, i. e. when both theoretical units and the practical exam are successfully completed (at least 11, 21 and 1 points are obtained in blocks 1, 2 and the practical essay, respectively), bonus points from the midterms (at most 10) are added to the scores acquired during the exam. Therefore, successful semifinals are evaluated as follows:

33-39 points = grade 2 (pass)
40-49 points = grade 3 (satisfactory)
50-59 points = grade 4 (good)
60-72 points = grade 5 (excellent).

It is possible to write the practical essay in week 14, in the first 15 minutes of the last laboratory practical of the semester. Students successfully completing this test (getting 1 or 2 points) are exempted from writing the practical exam at the semifinal exam.

It is to note that this is an extra opportunity for passing the practical exam prior to the beginning of the exam period and in case of failure the semifinal exam should proceed as outlined above.

For CV and FM students
CV students might keep their partial results for the CV exam (either the lab or the theoretical part). In contrast, FM students have to retake the lab or the theoretical part of the exam even if they successfully passed either of them previously.

Competition
Those students who have passed BOTH midterm examinations with a grade of 3 or better are entitled to participate in the competition. Eligible students should sign up at their lab teachers. The competition is organized in week 14 (the exact date and venue will be announced later). It is based on the whole material of the semester and has the same format as the written semifinal except that no lab essays will be asked. Students achieving at least 75% of the maximal score will be exempted from the semifinal exam.

Exemption from the semifinal exam
Students who learned general, inorganic and organic chemistry at a university level prior to the commencement of their studies at Semmelweis University might sit for an exemption exam that takes place in the middle of September. Students are kindly asked to present their official documents (transcripts with exam results and a detailed syllabus on the courses they completed) to the tutor (Gergely Keszler, EOK building, room 2.132).
The exemption exam encompasses parts 1 and 2 of the semifinal (structures, short definitions of important terms, calculations and multiple choice questions); lab essays will not be asked.

Registration and modification of examination dates:
Electronically, via the Semmelweis University Neptun System.
Retakes are not possible within 3 days following the exam.
All our examination rules comply with the official examination regulations of the Semmelweis University.

Recommended textbooks, manuscripts, handouts:

General chemistry: Ebbing-Gammon: General Chemistry, latest edition
Mortimer: Chemistry
Organic chemistry: Hrabák-Csermely-Bauer: Principles of Organic Chemistry (2nd edition, 2007, editor: A. Hrabák); Sasvári: Bioorganic compounds (manuscript)
Inorganic chemistry: Tóth: Concise inorganic chemistry for Medical Students (manuscript)
Laboratory: Hrabák: Selected Collection of Chemical Calculations and Biochemical Exercises (2007); Hrabák: Laboratory Manual - Medical Chemistry and Biochemistry (third edition, 2007)
Manuscripts and textbooks can be purchased in the bookshops of Semmelweis Publisher (on the ground floor of the NET and EOK buildings).

TOPIC LIST AND IMPORTANT TERMS

GENERAL CHEMISTRY TOPICS (1 – 37)

Note: Chapter numbers correspond to the 9th edition of D.D. Ebbing – S. D. Gammon: General Chemistry (2009)
Important terms are written in italics.

ATOMIC STRUCTURE
(Ebbing: Chapter 7. Quantum theory of the atom)

1. **Atomic structure: The nuclear structure and the electronic structure of atoms. The Bohr theory of the hydrogen atom. Quantum numbers and atomic orbitals.**
   Nucleus, electrons, proton, neutron, atomic number, mass number, atomic weight, isotopes, atomic orbitals, principal quantum number, angular momentum quantum number, magnetic quantum number, spin quantum number

ELECTRON CONFIGURATION OF ELEMENTS
(Ebbing: Chapter 8. Electron configurations and periodicity)

2. **Electronic structures of atoms: electron configurations and orbital diagrams.**
3. **Periodic properties of the elements (atomic radius, ionization energy and electron affinity) and the electronic structure of main-group elements.**
   Orbital diagram, Pauli exclusion principle, building-up (Aufbau) principle, Hund's rule, noble gas core, pseudo-noble-gas core.
   Periodic law, effective nuclear charge, first ionization energy, electron affinity; electronegativity
   Skills: Writing the orbital diagram for the ground state of any atom if the mass number is given.

IONIC AND COVALENT BONDING
(Ebbing: Chapter 9. Ionic and Covalent bonding. Chapter 10: Molecular geometry and chemical boding theory)

4. **Formation of ionic bonding and description of ions.**
5. **The covalent bond. Transition between ionic and covalent bonding.**
   Cation, anion, lattice energy, ionic radius.
   Bonding and non-bonding (lone) electron pairs, coordinate covalent bond, octet rule, multiple bonds, polar covalent bond, electronegativity, delocalized bonding, resonance, bond length (bond distance), covalent radius, bond energy.
   Skills: Writing the Lewis-electron-dot symbols and valence-shell electron configurations for the atoms of the second and third periods.

INTERMOLECULAR FORCING

(Ebbing: Chapter 11: States of matter: Liquids and solids/11.5. Intermolecular forces: explaining Liquid properties)

6. **Intermolecular forces: dipole-dipole forces, London (dispersion) forces, Van der Waals forces. Importance of hydrogen bonding in biology.**
   Dipole-dipole forces, London (dispersion) forces, Van der Waals forces, hydrogen bonding.

CHEMICAL EQUILIBRIA

(Ebbing: Chapter 14: Chemical equilibrium)

7. **Chemical equilibria (basic principles): The equilibrium constant. The law of mass action. Predicting the direction of a reaction. Changing the reaction conditions: LeChatelier principle.**
   Chemical equilibrium, equilibrium constant, law of mass action, homogenous equilibrium, heterogenous equilibrium, reaction quotient, LeChatelier principle.
   Exergonic vs. endergonic reactions, reversible vs. irreversible reactions.

CONCENTRATIONS OF ACIDS AND BASES

(Ebbing: Chapter 3: Calculations with chemical formulas and equations: Mass and moles of substance; Chapter 4: Molar concentrations; Diluting solutions.
Chapters 15 and 16: Electrolytes; Acids and Bases, Neutralization. Equivalents and normality)

8. **Concentrations (basic principles): The mole concept. Neutralization. Calculation of various concentrations (percentage concentrations, molarity and normality).**
   Molecular weight, formula weight, molar mass (mole, "mol"), Avogadro's number, molar mass, mass percentage, molar concentration (molarity, M), titration

ACID-BASE CONCEPTS

(Ebbing: Chapter 15. Acid-base concepts; Chapter 16: Acid-base equilibria; Lecture)

9. **Acid base theories: The Arrhenius concept. Self ionization of water, the pH and pOH of a solution. The pH scale. Calculation of pH for strong acids and bases.**
10. **Titration curves of strong electrolytes. Relative strength of acids and bases. Acidic strength and the molecular structure of hydrides and oxoacids.**
11. **Acid-base equilibria: pH of weak acids and bases. Degree of ionization and the ionization -constants (K_a and K_b). Definition of pK_a and pK_b. Acid base theories: Bronstadt-Lawry concept. Conjugated acids and bases. Lewis concept of acids and bases.**
12. **Common ion effect: The Henderson-Hasselbalch equation. pH dependence of acid/base equilibriums. Acid-base indicators**
13. **Buffers. Principle of maintaining a constant pH (examples). Buffer capacity. Comparison of acid and base capacity. Titration curves of**

monoprotic and polyprotic (phosphoric and carbonic acid) weak acids.

14. **Buffers of physiological importance. Buffer effect of the phosphate group. The carbonic acid / hydrogen carbonate buffer. The pH-bicarbonate diagram. Effect of stabilization of carbon dioxide and bicarbonate concentration on the buffer capacity. Total acidity of the urine. Respiratory acidosis. (Lecture)**
15. **Acid-base properties of salt solutions (hydrolysis). Anion-hydrolysis (example: acetate) and cation-hydrolysis (example: ammonium ion). pH of acidic salts (examples: $NaHSO_4$, $NaHCO_3$, NaH_2PO_4 and $NaHPO_4$).**

Acid (Arrhenius theory), base (Arrhenius theory), self ionization of water, ion-product constant for water (water product, Kw), pH, pOH, the pH scale; acid-base titration curve, equivalence point.

Acid (Bronsted-Lowry theory), base (Bronsted-Lowry theory), conjugate acid-base pair, Lewis-acid, Lewis base.

Acid ionization (dissociation) constant, base ionization (dissociation) constant, degree of ionization.

– common ion effect, buffer, Henderson-Hasselbalch equation

– acid-base indicators, buffer capacity (acid capacity and base capacity

Skills: Drawing the titration curves of strong and weak (monoprotic and polyprotic) acids/ bases

(Lecture): Intracellular and extracellular buffer systems of the body, average charge of phosphoric acid at various pH, components of the bicarbonate buffer in the blood, role of the ventilation in pH stabilization role of the red blood cells in pH stabilization, role of the kidney in pH stabilization, metabolic acidosis, metabolic alkalosis, respiratory acidosis, total acidity of the urine; anion-hydrolysis (example), cation-hydrolysis (example), cation and anion hydrolyis (example), acidic salts with acidic pH (example), acidic salts with basic pH (example)

SOLUBILITY AND COMPLEX IONS

(Ebbing: Chapter 17: Solubility and complex-ion equilibria)

16. **Solubility of salts. The solubility product. Saturated solutions, solubility. Conditions for precipitation. Examples of well soluble and mainly water insoluble compounds.**
17. **Complex ions. Lewis theory and complex formation. Central ions and ligands, coordination number. Geometry and isomerism of complexes. IUPAC nomenclature of complexes. Principles of valence shell and crystal field theory.**
18. **Unidentate, bidentate, ambidentate and polydentate ligands in complexes. Chelate complexes, complexometric titration. EDTA and biological complexes (heme, vitamin B_{12}, calmodulin, EF hand). Elimination of heavy metal ions from the body.**

Solubility, solubility product constant (K_{sp}), ion product (Q), conditions for precipitation

Complex salts, double salts, ligands, central ions, coordination number of complexes, unidentate-, bidentate-, ambidentate- and multidentate ligands (examples), chelate complexes (examples), Lewis acid-base theory, geometric isomerism, chiral isomerism, crystal field theory, high and low spin complex; structure of EDTA, biological complexes of iron and calcium, EF hand protein motif

SOLUTIONS

(Ebbing: Chapter 11: States of Matter; Liquids and Solids; Chapter 12: Solutions)

19. **Solutions. Solute, solvent. Solubility. The solution process. Solubility of iodine in organic solvents and in water. Lugol solution. Solution of ionic crystals (NaCl) and crystals of polar substances (glucose) in water. Hydrated ions.**
20. **Enthalpy of solution of solids and gases. Lattice energy and enthalpy of hydration. Enthalpy of solvation. Role of the change of entropy in the solution process. Effects of temperature and pressure on solubility of solids and gases. Henry's law. Bunsen (absorption) coefficient. Calculation of molar concentration of dissolved gases.**
21. **Vapor pressure of solutions. Raoult's law. Ideal and "real" solutions, vapor pressure depression of solutions of nonvolatile solutes. Mole fraction and molality. Vapor pressure depression of dilute solutions of nonvolatile solutes.**
22. **Solutions of gas in gas. Partial pressure. Composition of air. ppm as concentration unit. Decompression sickness. Arteficial air.**
23. **Boiling point and freezing point of solutions. Molal freezing point depression and boiling point elevation of aqueous solutions. Colligative properties. Anomalous behavior of ionic solutions, interionic attractions, van't Hoff factor. Formula mass of ionic compounds. Determination of concentration or molar mass by freezing point depression measurements.**
24. **The phenomenon of osmosis. Osmotic pressure, dependence on temperature, solute concentration and ionic dissociation. Isotonic, hypertonic and hypotonic solutions. Determination of molecular mass or concentration by measuring osmotic pressure. Biological and medical significance of osmosis.**

    Change of state (phase transition), melting, freezing, vaporization, sublimation, condensation, vapor pressure, boiling point, freezing point, heat of vaporization, phase diagram, surface tension

    Solute, solvent, hydration of ions, Lugol solution, Henry's law, Bunsen (absorption) coefficient, colligative properties, molality, mole fraction, vapor-pressure lowering, Raoult's law, boiling-point elevation, freezing point depression, osmosis, osmotic pressure, **isotonic-,** *hypertonic-, hypotonic solutions*

    Partial pressure of gases, ppm, decompression sickness, arteficial air

THERMODYNAMICS

(Ebbing: Chapter 6: Thermochemistry; Chapter 18: Thermodynamics and Equilibrium)

25. System and surroundings. Internal energy, mechanical work and reaction heat, the first law of thermodynamics. Enthalpy and Hess's law. Standard enthalpy change.
26. **Enthalpy change of physical processes (phase transitions, temperature change, solution process).**
27. Enthalpy change of chemical processes (formation, combustion). Average bond enthalpy. Energy diagrams and thermochemical equations.
28. Entropy change, spontaneous and reversible processes, the 2nd law of thermodynamics. The 3rd law of thermodynamics, absolute and standard entropies.
29. Gibbs free enthalpy change, exergonic and endergonic processes. Free enthalpy change under standard and non-standard conditions. The equilibrium constant. Thermodynamic coupling.

Internal energy, work, heat, enthalpy change, standard enthalpy change.
Standard enthalpy of fusion/vaporization/sublimation/solution/solvation, lattice enthalpy, molar heat capacity.
Standard enthalpy of formation/combustion, average bond enthalpy.
Entropy change, standard and absolute entropy.; Standard free enthalpy change, exothermic- , endothermic-, exergonic-, endergonic reactions.
First, second and third laws of thermodynamics.

REACTION KINETICS

(Ebbing: Chapter 13: Rates of reaction)

30. **Spontaneity and speed of chemical reactions. Reaction rate. Rate equation, rate law. Rate constant and its unit, initial rate. Collision and transition state theories of the mechanism of chemical reactions.**
31. **Molecularity and order of chemical reactions. Determination of reaction order. Single and multistep reactions. First, pseudo-first, second, third, zero and fractional orders. Half-life of chemical reactions.**
32. **Reaction rate and temperature. Activation energy. Potential energy diagrams. Catalysis. Enzymes as biocatalysts; strong specificity of enzymes**
    reaction rate, rate law, rate constant, rate equation, initial rate, collision theory, transition-state theory, frequency factor, reaction order, molecularity, reaction mechanism, mono- bi- and termolecular reactions, first, pseudo-first, second, zero orders, overall order of a reaction, rate determining step, half-life.
    catalysis, catalyst, activation energy, activated complex, Arrhenius equation; energy diagrams of catalysed and non-catalysed reactions, homogeneous and heterogeneous catalysis, chemisorption, enzyme, substrate, stereospecificity

ELECTROCHEMISTRY

(Ebbing: Chapter 19: Electrochemistry; Lectures)

33. Voltaic cells: Notation for a voltaic cell. Electrode potentials (reduction potentials) and the electromotive force. Normal and standard electrode potential. Calculation of equilibrium constants from the electromotive force.
34. Dependence of electrode potentials on concentrations: the Nernst equation. Concentration cells. The hydrogen electrode. Measurement of pH, the glass electrode.
35. Non-polarizable electrodes. Principle of maintaining constant concentration in reference electrodes. Examples: the calomel electrode and the silver electrode.
36. Direction of redox reactions. Biologically important redox systems (examples for reversible and for irreversible redox reactions).
37. Specific and equivalent conductance. Determination of the degree of dissociation and the ionization constant by conductometry. (Practice book and lecture)
    Voltaic (galvanic) cell, half cell, salt bridge, electromotive force, standard electrode potential, Nernst equation, concentration cell, hydrogen electrode, glass electrode, non- polarizable electrodes, calomel electrode, silver electrode; specific and equivalent conductance; Daniell ele-

ment; non-polarizable electrode

INORGANIC CHEMISTRY TOPICS (1 – 14)

Important terms are written in italics.

1. Alkali and alkaline earth metals and their compounds.
   structure of sodium and potassium chloride, hydroxide, alkali and alkali earth metal ions, structure of magnesium and calcium chloride, sulfate and carbonate, role of calcium in biological systems, structure and utilization of barium sulfate
2. Boron and aluminium family metals. Arsenic, antimony, bismuth and their compounds. *boric acid as a Lewis acid, Amphoteric hydroxides. Double salts of aluminium. Poisonous property of arsenic.*
3. Carbon. Allotropes of carbon. CO and carbon dioxide, carbonic acid, cyanides.
   different hybridization of diamond and graphite, coordinative bond in CO, CO as a poison, structure of carbon dioxide, green house gases, equilibrium of carbonic acid, hardness of water caused by alkali earth metal hydrocarbonates; cyanides as poisonous compounds.
4. Silicon and derivatives. Tin and lead and their compounds.
   silicon as semiconductor, poisonous effects of lead, removal of lead ions by EDTA, different oxidation states of Sn and Pb
5. Properties of nitrogen. The nitrogen cycle. Ammonia, hydrazine and hydroxylamine. Oxides of nitrogen. Oxiacids containing nitrogen. Nitrites and nitrates.
   structures of nitrite/nitrate, oxides of nitrogen, ammonia, possible oxidation states of nitrogen.
6. Phosphorus and its compounds: allotropes, oxides, oxiacids, phosphates.
   different phosphoric acids, biological role of phosphates
7. Oxygen and its compounds: allotropes, oxides, peroxides, superoxides.
   ozone, ozone shield, free radicals of oxygen, Haber-Weiss reaction, Fenton-reaction.
8. Properties of water.
   surface tension, maximal density at 4°C, hydrogen bondings and their role in the high boiling point, constant and removable hardness of water
9. Sulfur and its compounds: allotropes, oxides, oxiacids, sulfides, sulfites, sulfates, thiosulfates.
   structures of sulfide, sulfite, sulfate, thiosulfate ions, practical aspects of the dilution of sulfuric acid
10. Characteristics of halogens. Fluorine, bromine, iodine and their compounds.
    electron configuration of halogens, H-bond formation of fluorine in compounds, fluorine in teeth, structures of the oxyanions of bromine and iodine, Lugol solution, reaction of iodine with starch, principles of iodometry
11. Chlorine and its compounds.
    structures of oxyanions of chlorine, formation of NaOCl, properties of HCl and NaCl
12. Hydrogen. Noble gases. Air and air pollution.
    *isotopes of hydrogen, ions of hydrogen, explosive mixtures of hydrogen, electron configuration of nobloe gases, artefici*al *air, composition of*

air, main pollutants (NO, CO, carbon dioxide, oxides of sulfur)

13. Transition elements. Manganese, iron, cobalt and their compounds. Copper, zinc, mercury and their compounds. Precious metals.
    role of KMnO4, different oxidation states of iron, organic iron compounds, poisonous effect of heavy metals, photosensitivity of silver halogenides, utilization of platinum electrodes
14. Nomenclature of inorganic compounds.
    system of the endings of differently oxidized salts of inorganic acids, nomenclature of acidic and basic salts, names of compounds containing more identical atoms or ions.

ORGANIC CHEMISTRY TOPICS (1 – 22)

Note: Chapter numbers correspond to the 2nd edition of Bauer-Csermely-Hrabák: Principles of Organic Chemistry (2007).
Important terms are written in italics.

COVALENT BONDING IN ORGANIC COMPOUNDS
(Chapter 2)

1. The central role of carbon atoms in organic chemistry. Chemical bonds. Hybridization of atomic orbitals, the hybrid states of carbon, resonance and delocalization in organic compounds.
   sp, sp2, sp3 hybridization, promotion of carbon, aromatic compound, antiaromatic compounds, benzenoid compound

DIPOLE MOMENTUM AND GENERAL ACID-BASE PROPERTIES OF ORGANIC COMPOUNDS
(Chapter 3)

2. Polar covalent bond, dipole moment, molecular dipoles. Acid-base character of organic compounds.
   Dipole momentum, Debye unit, polar covalent bond, resonance structure, resonance energy, ring strain, torsional strain

THE STERIC STRUCTURE OF ORGANIC MOLECULES. ISOMERISM AND TERMINOLOGY.
(Chapter 4)

3. Principles of constitution, configuration and conformation isomerism
4. Types of constitution isomerism: branching (backbone) isomerism, position isomerism and tautomerism.
5. Configuration in organic chemistry: geometric (cis-trans) and optical (stereo) isomerism. Chirality and prochirality, stereogeneic (chiral) centers, enantiomers and diastereomers. Racemic mixtures and meso compounds.
6. Terminology of chiral compounds: relative and absolute configuration, the D/L and the R/S systems. Stereochemical numbering.
7. Conformation in organic chemistry
   Configuration, conformation, connectivity, isomer, constitutional isomer, chiral molecule, achiral molecule, angle strain, asymmetric carbon, absolute configuration, relative configuration, enantiomers, meso compound, Newman projection, optically active compound, plane of

symmetry, plane polarized light, prochiral, R/S system, D/L system (Fisher projection), racemic micture, stereogenic center, geminal substituents, vicinal substituent, disjunct, conjugated double bonds, cumulated double bonds, isolated double bonds, prochirality, diastereomers

CLASSIFICATION OF ORGANIC COMPOUNDS

(Chapter 5)

8. Classification of organic compounds according to the main functional groups
9. Reaction types and reaction mechanisms in organic chemistry.
   SN1 reaction, SN2 reaction, functional group, homologous series, homolytic bond breaking, heterolytic bond breaking, nucleophile reactant, electrophile reactant, electrophilic, nucleophilic, radical reactions, addition, substitution, elimination, Markownikow rule, 1-1 example for fundamental reaction types in organic chemistry (e.g. nucleophile addition), rearrangement reactions, regioselective reaction

MAJOR FUNCTIONAL GROUPS AND THEIR REACTIONS

(Chapter 6)

10. Structure and reactions of alkanes: nomenclature, conformational analysis, radical reactions.
11. Structure and reactions of alkenes and alkynes: nomenclature, sigma and pi bonds, the triple bond, the cis-trans and the Z/E nomenclature of isomers. Electrophilic addition type of reactions. Hydrohalogenation. Markownikow's rule. Dienes, conjugation and resonance. Electrophilic addition of 1,3-butadiene.
12. Structure, synthesis and typical reactions of alkyl halides. Nucleopihilic substitutions: the S_{N1} and S_{N2} rections.
13. Structure and reactions of homoaromatic compounds. Benzene and polycyclic compounds. Resonance stabilization in aromatic compounds and the Huckel's rule.
14. Mechanism of electrophilic substitution of aromatic compounds. Effect of substituents of the aromatic ring on the reaction rate and product formation in further electrophilic substitution type of rections.
15. Classification, structure, physical and chemical properties and reactions of organic hydroxyl compounds (alcohols, enols, phenols). Formation of ethers and esters.
16. Classification and nomenclature of ethers (epoxides, hemiacetals, acetals).
    Electronic structure of open-chain and cyclic ethers; physical properties, miscibility,
    chemical reactivity: coordinative bonding, basicity, Zeisel test, nucleophilic attack of epoxydes, peroxyethers.
17. Structure, nomenclature, chemical-physical properties, biological role and characteristic reactions of carbonyl compounds (aldehydes, ketones). Important nucleophilic addition reactions (addition of simple inorganic molecules; dimerisation, polymerisation, aldole formation, acetal formation, formation of ketimines, oximes, hydrazones, Schiff's bases).
18. The electronic structure of the carboxylate anion, the most important mono-, di- and tricarboxylic acids. Condensation type reactions of organic

acids: ester- and anhydrid-formation, lactones. Decarboxylation of organic acids. The decarboxylated products of amino-, hydroxy- and keto acids.

19. Halogen-, hydroxy--, oxo- and amino derivatives of carboxylic acids.
20. Organic thio-compounds. Thioalcohols, thioethers, sulfinic and sulfonic acids.
21. Amino- and imino-derivatives of hydrocarbons: their formation, classification and base character. The principal reactions of organic amines: acylation, reaction with HNO2, deamination, transamination.
22. The most important representatives of organic amines in living organisms. The amine derivatives of carbonic acid: carbamoyl-P, urea, guanidine, creatine, barbiturate.

Alkane, alkene, alkyne, Huckel's rule, olefin, paraffin, alcohols, enols, phenols, bond order, alkoxy, aryloxy, tautomer, α-unsaturated alcohol, ether formation, ester formation, dehydration, epoxide, hemiacetal, acetal, Zeisel test, peroxyethers, thiol, thion, thioether, disulfide, sulfide, sulfoxide, sulfone, sulfonate, carbonyl group, aldehyde, ketone, quinone, β-unsaturated carbonyl compounds, amphoterism, desmotropism, protective groups, dimerization, paraformaldehyde, glycosides, furanose, pyranose, Schiff-base, hydrazine, oxime, strong and mild oxidation of oxo-compounds; Tollens test; Fehling test, Cannizzaro reaction

ester, anhydride, amide, halogenide, azide, aminoacid, fatty acid, carboxylate, dimerization of carboxylic acids, nucleophilic acylation, alpha substitution, driving forces of esterification, cyclic esters, soaps, transesterification, transamination, polyesters

nitroso, nitro, oxime, amine, imine, amide, nitrile, isonitrile, cyanate, isocyanate, imide, hydrazine, hydrazide, azo, electron distribution within the most important functional groups: acid-base properties (primary, secondary… amines), conjugation effect, amphoterism of imidazole, structure of the amide bond, restricted rotation and isomerism, tautomerism of nucleotide bases, Schiff-base formation, isocyanate formation

TOPICS FOR THE LAB EXAM (1 – 19)

1. The factor of titrating solutions; factorization of HCl
2. The factor of titrating solutions; factorization of NaOH
3. Titration of strong acids with NaOH
4. Titration of acetic acid with NaOH
5. Titration of gastric fluid
6. Principles of the electrometric titration of phosphoric acid and plotting the titration curve
7. Determination of Cl^- concentration by means of precipitation titration
8. Permanganometry: principles, factorization of the titrating solution
9. Permanganometry: determination of Fe^{2+} concentration
10. Iodometry: principles, factorization of titrating solution
11. Iodometry: principles, determination of sodium hypochlorite concentration
12. Complexometric titration: determination of unknown Cu^{2+} concentration
13. Complexometric titration: determination of Ca^{2+} and Mg^{2+} concentration of the same solution

14. Conductometry: description of the conductometer, determination of the cell constant
15. Determination of the ionization constant of acetic acid by conductometry
16. Spectrophotometry: determination of the absorption spectrum of phenol red and plotting the calibration curve of the dissociated phenol red anion
17. Spectrophotometric determination of the ionization constant of phenol red
18. Electrochemistry: measurement of the electromotive force of the Daniell element; studying the effect of electrolyte concentration on the electromotive force
19. Electrochemistry: experiments with iron redox electrodes as well as with redox systems of biological relevance

The 10 structures asked in the semifinal exam will be selected from the following list

Inorganic acids and other compounds: sulfuric acid, sulfurous acid, nitric acid, nitrous acid, hydrochloric acid, hydrobromic acid, hypochlorous acid, chlorous acid, chloric acid, perchloric acid, hypobromous acid, bromous acid, bromic acid, perbromic acid, hydrogen cyanide, metaphosphoric acid, orthophosphoric acid, boric acid, carbonic acid, water, ammonia, hydrazine, hydroxylamine, hydrogen peroxide, superoxide anion, pyrophosphate anion, hydrogen sulfide, carbon monoxide, carbon dioxide, nitrous oxide, nitric oxide, sulfur dioxide, sulfur trioxide, hydroxyapatite, fluoroapatite, ferrous ammonium sulfate

Any inorganic salts and bases consisting of the following cations and anions:
Cations: ammonium, sodium, potassium, magnesium, calcium, ferrous, ferric, cuprous, cupric, zinc, silver, aluminium, mercurous, mercuric, manganese
Anions: hydroxide, oxide, fluoride, chloride, bromide, sulfide, sulfate, sulfite, hydrogen sulfate, thiosulfate, nitrate, nitrite, hypochlorite, chlorite, chlorate, perchlorate, hypobromite, bromite, bromate, perbromate, cyanide, phosphate, monohydrogen phosphate, dihydrogen phosphate, carbonate, hydrogen carbonate (bicarbonate), permanganate, chromate, ferricyanide

Hydrocarbons: alkanes, alkenes and alkynes (up to carbon number 8, both normal- and branched-chain isomers); 1,3-butadiene, 2-methyl-1,3-butadiene (isoprene)

Aromatic rings: benzene, naphthalene, phenanthrene, pyrrole, thiophene, furane, thiazole, oxazole, imidazole, pyrazole, pyridine, pyrane, pyrazine, pyrimidine, purine, indole, pteridine, acridine

Small organic compounds: methanol, ethanol, propanol, isopropanol, n-butanol, ethylene glycol, glycerol, inositol, phenol, diethylether, formaldehyde, acetaldehyde, acetone, mercaptoethanol, aniline, urea, guanidine

Organic acids: formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, oxalic acid, malonic acid, succinic acid, glutaric acid, maleic acid, fumaric acid, lactic acid, β-hydroxybutyric acid, pyruvic acid, acetoacetic acid, citric acid, cis-aconitic acid, isocitric acid, α-ketoglutaric acid, malic acid, oxaloacetic acid

Types of bondings and derivatives: ether, phenolether, thioether, ester, lactone, thioester, anhydride (including mixed and phosphoric acid anhydrides), hemiacetale, hemiketale (cyclic forms included), Schiff-base, oxime, hydrazone, hydroxamic acid, amide, thiol, sulfinic acid, sulfonic acid, sulfoxide, acyl chloride.

Teaching Secretary	Dr. Gergely Keszler Tel.: (+36-1) 4591500/ext. 60132
Student Affairs Secretary	Mr. Zsolt Ozsváth Tel: 4591500/ext. 60061
Lab coordinator	Dr. Gergely Keszler
Lab Staff	Mrs Mária Kövecses Mrs Márta Stroe Mrs Kinga Pelczer

Laboratory programs are on the 1st floor, Department of Medical Chemistry, Molecular Biology and Pathobiochemistry, „D" passage.

MEDICAL BIOCHEMISTRY I.

Department of Medical Biochemistry

Second (spring) semester

Neptun code: AOKOBI463_1A
Credit: 3
Director of the course: Tretter László MD, PhD, DSc
End semester requirement: practice mark

The aim of the curriculum is to learn and understand the structure-function aspects of biologically important macromolecules (proteins, nucleic acids, lipids and complex carbohydrates) and that of their building blocks (amino acids, nucleotides, sugars and lipids). The enzymology module deals with the mechanism and efficiency of the *in vivo* biochemical reactions focusing on their organization into metabolic pathways, their regulation and effectivity. The bioenergetics module focuses on the energy and metabolite fluxes of the human body and also settle the basis of the thermodynamically approach of intermedier metabolism.

The role of proteins in the living world. The chemical structure of proteinogenic amino acids. – Nucleotides and their carbohydrate components. *The peptide bond. The primary, secondary and tertiary structure of proteins.* Acid-base characteristics of amino acids, their titration curves. The isoelectric point of amino acids and their calculation.

The quaternary structure of proteins. The biochemical basis of protein-nucleic acid interactions. Covalent modifications of proteins. Important methods in protein chemistry.
Preprotein forms of proteins eg. procollagen-collagen. Comparison of the structure-function aspects of myoglobin and haemoglobin. – Methods of protein purification and the determination of concentrations of proteins.

General characteristics of enzymes. The thermodynamics of enzymatic reactions. Activation energy, transitional state. Isoenzymes. The role of coenzymes in the enzymatic reactions. Biochemical calculations

Enzyme kinetics. The initial rate. The Michaelis-Menten equation. The Michaelis-Menten constant and its meaning. Double reciprocal representation of the Michaelis-Menten equation. *The quaternary structure of proteins. The biochemical basis of protein-nucleic acid interactions. Covalent modifications of proteins*

Serine proteases and their mechanism of action. Reversible and irreversible inhibition of enzymes. Competitive, non-competitive and uncompetitive inhibition of enzyme activities. The theory of allostery and cooperativity. – Determination and biological importance of kinetic parameters in theory and in clinical practice.
Different levels of the regulation of enzymatic activities: regulation through compartmentalization, by the transcriptional regulation of enzyme protein expression and with the modification of their catalytic activities. Regulation of enzyme activity by proteolysis. The enzyme kinetics and thermodynamics of metabolic pathways. The strategy to find the regulated step(s) of metabolic pathways. Enzymology I. The most important carbohydrates of the body and their presence in foodstuffs. Enzymology 2.

The most important lipids of the body and their distribution in various foodstuffs. Role of the structures of carbohydrates and lipids int he human body
T*he thermodynamics of biochemical pathways Reversible and irreversible reactions. The coupling of endergonic and exergonic reactions in the*

human body. High energy compounds. The central role of ATP in the energetics of cells. Reducing equivalents. The macrocomponents of nutrients: carbohydrates, lipids and proteins.
The synthesis of ATP. ATP production by substrate level phosphorylation. Oxidative phosphorylation, the production of ATP in mitochondria. The redox reactions of terminal oxidation (electron transport chain, ETC). The enzyme complexes of ETC. The microcomponents of nutrients.
Exergonic reactions in the ETC and the production of ATP. The mechanism of action of ATP -synthase. The regulation of ATP production by the energy demand of cells. The P/O ratio. The inhibitors of oxidative phosphorylation. Uncoupling agents. Heat production in special tissues of the body. Bioenergetics I
The connections of mitochondrial energy production and different biochemical pathways of cells.
The reactions of the citric acid cycle and the regulation of the pathway. Bioenergetics II.
The sources of acetyl-CoA in the citric acid cycl

Participation at the practices and consultations are compulsory. There will be no make-up practices or consultations offered. If you miss more than three practices or consultations (unexcused absence) your semester will be taken as invalid. You must be on time when practices are started. Arriving more than ten minutes later than the start time that practice or consultation will be taken as a missed one (you can stay in the room and listen to the teacher or lecturer but cannot carry out the experiment at that occasion).
At each practice between the third and twelveth weeks small quizzes will be written (altogether ten times). The questions will be selected from the previous weeks' lecture and practice material. There are no make-ups given. Answers will be graded as passed (between 55-100%) or failed (below 55%) by your lab teacher. At the end of the semester failed quizzes can be corrected in an exam having a written and an oral part. At least eight successful quizzes have to be collected in order to get a signature validating your semester. Grading ≥75% excellent (750 points from the possible 1000); 74 – 55% satisfactory; 54 – 0 % fail. Failed students have to repeat the semester. Ps. **Unexcused absences from a quiz will be graded as zero. If you have an excused absence (based on written or other verifiable evidence) from a quiz, your final grade will be based on a percentage of the total possible points for the quizzes you have taken.**

MOLECULAR CELL BIOLOGY I.

Department of Medical Chemistry, Molecularbiology and Pathobiochemistry

Director of the course:
Prof. Gábor Bánhegyi M. D., Ph. D., D. Sc.

Mandatory course
credit: 6

Second (Spring) Semester

Description of the curriculum

1. Eucaryotic and procaryotic cell, the genetic information.
2. Basic concepts of molecular cell biology, structure and function of nucleic acids.
3. The chromosomes and the organization of DNA.
4. The replication, repair and recombination of DNA.
5. Mobile genetic elements, viruses.
6. Transcription, RNA processing and modification, snRNA, hnRNA. The RNA world.
7. The genetic code and translation.
8. Posttranslational modification of proteins, folding and quality control.
9. Proteostasis, the ubiquitin-proteasome system, the types of autophagy.
10. The regulation of gene expression, nuclear receptors.
11. Transcriptional factors, DNA-binding domains.
12. Evolution of genes and the genome, epigenetics.
13. Methods in molecular biology.
14. Bioinformatics, systems biology.

Textbooks
Lodisch, Berk, Kaiser, Krieger, Bretscher, Ploegh, Amon, Scott: Molecular Cell Biology
Alberts, Johnson, Lewis, Morgan, Raff, Roberts, Walter: Molecular Biology of the Cell

MEDICAL PROFESSION

Lecturer: Prof. László Kalabay MD PhD
Institute: Department of Family Medicine
Duration: One semester, lectures: 6x2 hours, practices: 6x3 hours/semester
Exam: Practical mark (written exam)

Credit value: 2 credit points
Minimum/maximum group size: 55/210

Second Semester

Thematic:

An overview of medical profession.
Formation of the consciousness of profession, personal careers.
The attitude of the medical doctor. Communication with colleagues and the members of the medical staff.
An overview of different levels of health care.
The organization, function activity of the clinical department and general medicine praxis.
Characteristics of the clinical work.
Overview of the scientific activity of the clinical department. Raising interest on joining to it.

Application: Péter Torzsa MD Tel: 355-8530 e-mail: ptorzsa@gmail.com
Application date: 30th January
Precondition: Only for students in the 1st year.

MEDICAL SOCIOLOGY

Semester: half class in the first semester and half class in the second semester

Credit: 2
Course leader: Zsuzsa Szanto (szanto.zsuzsa@med.semmelweis-edu.hu)
Teachers: Bence Döbrössy e-mail: dobrossy.bence@chello.hu

Katalin Kovács e-mail: kovacs@demografia.hu

Week	Class type	Themes
Week 1	Introduction: the changing patterns of disease; basic concepts of sociology	lecture
Week 2	Health and illness behaviour	lecture
Week 3	Professions and professional socialization	Lecture
Week 4	Social inequalities in health and in mortality	Lecture
Week 5	Health care	Lecture
Week 6	Contemporary problems of health care	Lecture
Week 7	Midterm exam	
Week 8	Introduction to practices, guide to reading the literature and doing the presentations	Practice
Week 9	Social class, income and work	Practice
week 10	Age, gender and marital status	Practice
Week 11	Ethnicity and migration	Practice
Week 12	Labelling and stigma	Practice
Week 13	Doctor-patient relationship, medicalization, pharmaceuticalization	Practice
Week 14	Social movements in the field of health	Practice

The course consists of: (lecture, seminar, laboratory exercise):

7 lectures, **7** seminars.

Course requirements, methods of monitoring:

To obtain signature for absolving the course students have to participate at a minimum of 10 classes. Participation is documented through catalogues. A midterm exam is taken after the 6th lecture. It is also required to submit a home paper or a class presentation in course-related topics by the end of the semester. The course ends with an exam; the grade may include the results of the midterm and the home assignment.

Supplement possibilities: based on the SE's exam regulation.

Absence may be justified by a medical a medical document at the next class. One seminar per semester can be supplemented by an extra assignment given by the teacher or attending the same class with another group.

Textbook:

1. Graham Scambler (2008): Sociology as Applied to Medicine. Saunders, London
2. Handouts for the lectures will be accessible on the homepage of the Institute of behavioural Sciences: www.magtud.sote.hu.

INTRODUCTION TO MEDICAL INFORMATICS

Institute of Digital Health Sciences

Type of the subject: 1 practice / week
code: AOVINF2441A
credit value: 1
Name of the lecturer of the subject:
Dr. Miklós Szócska

Teachers:
Dr. Tamás Iváncsy (PhD, lecturer)
Dr. Ádám Zoltán Tamus (PhD, associate professor)
Tamás Tóth (assistant lecturer)
Péter Dombai (lecturer)

Term: spring

The exercise of the subject in the in the realization of the aim of the education:

To introduce the students to the medical application of informatics, the characteristics of modern, integrated information systems with respect to quantitative aspects and to decision demands of the modern sciences. The medical informatics leans on methods of mathematics, statistics and computer sciences and it also includes from the different engineering, management and informatics procedures.

OPTIONAL courses:

I. SCIENTIFIC COMMUNICATION COURSE

The course gives an introduction to the paper based and oral publications and presentations. The students have to find a medical problem (a topic) to work out during the course.

1. **Creation and retrieval of medical knowledge. Finding and studying scientific publications via the electronic library of the university.**
2. **Structure of a scientific publication. The importance and meaning of the sections of the paper. Structure of an oral presentation.**
3. **Scientific publication in practice: finding and evaluating information and creating paper and presentation on the selected topic.**

II. DATABESES COURSE

The course gives an introduction to structuring and retrieving data using databases. The students perform practical examples of data management and query using a current software solution.

1. **Introduction to database theory and data modelling principles (the application, logical and physical models, basic concepts and objects).**
2. **Data handling in practice: planning a relational database, managing tables and fields**
3. **Information retrieval from databases: the role and structure of queries, performing basic queries**

4. Data management via user interfaces – basic concepts and principles

III. BIOMEDICAL SIGNAL PROCESSING COURSE

The students learn about the basics of biomedical signals, their acquisition, digital storage and processing. They perform practical analysis of selected signal examples.

1. **Introduction to biomedical signal processing, objectives of signal analysis, Components of human-instrument system**
2. **Examples of biomedical signals (electrical and mechanical signals), and transducers.**
3. **The basics of signal processing, the digitalizing (sampling, Shannon-theory, quantization).**
4. **Analysis of a phonocardiogram (heart sound, calculation of the pulse, murmurs). Spectral analysis.**
5. **Analysis of ECG signal. Basics of removing noise and artefacts.**

IV. PRESENTATION TOOLS

The course provides an overview of visual representation of medical information for various audience. The students learn the use of several related tools, and work up a selected topic.

1. **Introduction to presentation techniques: How to make a good presentation? – technical and non-technical skills, best practices**
2. **Types of medical information, online information sources**
3. **Visual representation of information: word cloud, infographic etc.**
4. **Online tools for creating and sharing presentations**

Requirements of participation of the lessons and the possibility of substitution of the absence:
According to rules of the Studies and Exam Code. The absence can be excused by the presentation of a medical certificate. Substitution is possible according to a discussion with the teacher.

The mode of the certificate in case of absence from the lessons and from the exams:
According to rules of the Studies and Exam Code.

The number, the topic, the time, the possibility of the substitution and improvement of checking during the term:
Acceptable solution of individual exercises.

The requirements of signature at the end of the term (including also the number and the type of the students' exercises which are solved individual by them):
Suitable percentage of participation.

The mode of acquisition of the mark:
Practical exercise

Type of the exam: –

Exam requirements: –

Mode of the application for the exam: –

Order of the modification of exam application:
According to Studies and Exams Code.

Mode of the certification in case of absence from the exam:
By a medical certification within three days.

List of lecture notes, course books, study-aids and literature which can be used to acquisition of the syllabus:
1 The use of educational materials on the institute website is obligatory: www.semelweis.hu/dei
2 Meskó Bertalan: The Guide to the Future of Medicine, Webicina 2014 ISBN 9789631200072

FIRST AID

Tutor: ***Dr. Hajnalka Mészáros***

Topics

Principles of first aid. Recognition of an emergency. Assessment of the scene. Dangerous scene. Safety measurements on the scene. Call for an ambulance. Emotional viewpoints of managing emergencies.
Assessment of the patient. Responsiveness – unresponsiveness. Assessment of the responsive patient: complaints, signs for the severe condition. Positioning of the patient in specific conditions.
The unconscious patient. Airway management. Assessment of the vital signs. Recovery position.
Heart attack. Sudden death. Chain of survival. Assessment of vital signs.
BLS (Basic Life Support)
BLS
AED (Automated External Defibrillator). PAD (Public Access Defibrillation)
BLS + AED (management of situations)
BLS + AED (Management of situations)
Chocking. Drowning. Electrocution.
Injuries. Extrication of the patient: Rautek maneuvers. Helmet removal. Mobilization and immobilization of injured patients.
Bleeding control. Bandages. Burns. Shock.
Fractures, dislocation, sprain. Slings.
Stroke. Convulsions. Diabetes mellitus: Hypoglycaemia. Shortness of breath. BLS

Poisoning. Drugs. Drunkenness.
BLS

Note: Participation at 75% of practices is necessary. Compensation of absences is possible in subsequent practices.
Development in learning skills will be controlled all the time during the practices in the semester.
Mode of certifying absences: oral – referring to practices
Requirements: The student should be able to recognize emergencies, and call for help start with BLS + AED provide airway management in unconscious patients provide first aid for patients complaining for chest-pain, shortness of breath, signs for hypoglycaemia and having suffered from fainting, shock condition, convulsion, injuries.
The performance of the above mentioned requirements at the last practice will be evaluated with "accepted" or "not accepted".

TERMINOLOGY OF MEDICINE (1st semester)

Responsible organisational unit:
Faculty of Health Sciences, Division of Foreign Languages and Communication

Programme director:
Zöldi Kovács Katalin PhD, Head of the Division

2 lessons per week, 2 credits

Assessment: 3 written tests

Role of subject in fulfilling the aim of training:
Students get familiarized with the Latin and Greek terminology of medicine in order to facilitate the acquisition of other subjects. Special focus is dedicated to anatomy, physiology, pathology and pharmaceutics. Furthermore, the course provides an introduction into general scientific terminology.
Brief description of subject:
The main aim of the subject is:
1.
to acquire a knowledge of about 500-600 Latin words and phrases as a minimum vocabulary (basic vocabulary of medical and scientific language),

2. the correct application of
   a) anatomical names,
   b) names of diseases
   c) names of drugs,
3. to understand diagnoses and prescriptions;
4. to learn about abbreviations used in prescriptions.
5. to be able to make a clear distinction between medical terms of English and Latin/Greek.

Course content of practical lessons:
1. Grammar**:**
Nouns: the 5 Declensions
Adjectives - construction of the most important attributive structures with the vocabulary of anatomy, clinical subjects and of pharmaceutics.
Prepositions (in anatomical, clinical and pharmaceutical phrases)
Numerals: Usage on prescriptions.
2. Texts containing**:**
   a) anatomical names;
   b) clinical and patho-anatomical diagnoses;
   c) prescriptions
3. Vocabulary

Latin and bilingual (Greek-Latin) nouns, adjectives, numerals and prepositions used in anatomy, the clinical subjects and pharmaceutics;
Course material, recommended text book(s), professional literature and supplementary reading(s)
Belák E. *Medical Terminology for Beginners* (earlier title: *Medical Latin*), Budapest: Semmelweis Kiadó.

Basics of Foreign Language (module 1.)
Magyar orvosi szaknyelv 1.

Responsible organisational unit:
Faculty of Health Sciences, Division of Foreign Languages and Communication

Programme director:
Zöldi Kovács Katalin PhD, Head of the Division
4 lessons per week, 4 credits,
Assessment: end-term written and oral exam

Role of subject in fulfilling the aim of training:
The role of this subject is to help students acquire the basic vocabulary, grammar and language skills they need for the effective communication in the language they use during their field practice both in their everyday life /'survival language'/ and in their academic studies. Raising students' awareness of cultural differences is one of our top priorities.

Brief description of subject:
The first three modules are dedicated to learning basic general vocabulary and grammar. In the first module students acquire basic structures and the vocabulary for everyday topics / e.g. shopping, food, housing etc./, language for „survival.". The course places special emphasis on phrases essential for everyday communications, e.g. introductions, greetings, getting/giving information etc. Grammar is of less importance in this phase of language studies.

Course content of practical lessons:

Lesson 1-2:	The alphabet
Lesson 3-4:	Greetings
Lesson 5-6:	Where are you from?
Lesson 7-8:	Introducing people
Lesson 9-10:	Numbers-phone numbers
Lesson 11-12:	What time is it?
Lesson 13-14:	Practising telling the time
Lesson 15-16:	Days
Lesson 17-18:	When do you study?
Lesson 19-20:	What is it? - food
Lesson 21-22:	Consolidation
Lesson 23-24:	Test 1 + situations
Lesson 25-26:	What is the food like? - adjectives
Lesson 27-28:	What do you think of English tea?- giving opinions
Lesson 29-30:	I would like a tea
Lesson 31-32:	Shopping for food

Lesson 33-34: Ordering food- in a café
Lesson 35-36: Rooms in the flat
Lesson 37-38: Furniture in the rooms
Lesson 39-40: Where are the furniture?
Lesson 41-42: As a guest
Lesson 11-12: At a party
Lesson 43-44: Where can I find the library?
Lesson 45-46: When shall we meet?
Lesson 47-48: Asking for information, setting programs
Lesson 49-50: Places in the city
Lesson 51-52: Consolidation
Lesson 53-54: Test 2 + situations and communication practice
Lesson 55-56: Assessment

Course material, recommended text book(s), professional literature and supplementary reading(s)
Gyöngyösi Lívia - Hetesy Bálint. *Hungarian language: Jó reggelt!* Semmelweis Egyetem Egészségtudományi Kar, 2010.

Basics of Foreign Language (module 2.)

Magyar orvosi szaknyelv 2.
Responsible organisational unit:
Faculty of Health Sciences, Division of Foreign Languages and Communication
Programme director:
Zöldi Kovács Katalin PhD, Head of the Division

4 lessons per week, 2 credits,
Assessment: midterm (written) and endterm (written and oral) tests
Role of subject in fulfilling the aim of training:
The role of this subject is to help students acquire the basic vocabulary, grammar and language skills they need for the effective communication in the language they use during their field practice both in their everyday life /'survival language'/ and in their academic studies. Raising students' awareness of cultural differences is one of our top priorities.

Brief description of subject:
The first three modules are dedicated to learning basic general vocabulary and grammar. In the second module students acquire basic structures and the vocabulary for everyday topics (e.g. family, relatives, at the doctor's etc.) language for "survival". The course places special emphasis on phrases essential for everyday communications, e.g. likes, dislikes, offering help, etc. Grammar is of less importance in this phase of language studies.

Course content of practical lessons:
Lesson 1-4: Forming questions
Lesson 5-6: Plural forms
Lesson 7-8: What do you like doing in your free time?
Lesson 9-10: I would like to…….
Lesson 11-12: Communication skills
Lesson 13-14: A date – what do you like?
Lesson 15-16: I like dancing, swimming etc.
Lesson 17-18: I can ride a bike, drive etc.
Lesson 19-20: Communication practice
Lesson 21-22: Can I help you? In a clothes shop
Lesson 23-24: Can I give you something else?
Lesson 25-26: Communication practice
Lesson 27-28: Consolidation
Lesson 29-30: Test 1 + situations
Lesson 31-32: I have a headache – at the doctor
Lesson 33-34: At the chemist's
Lesson 35-36: Communication practice – at the doctor, at the chemist's
Lesson 37-38: My family, family members
Lesson 39-40: Family relations
Lesson 41-44: Communication practice- introducing your family
Lesson 45-48: My boss' wife – social relations
Lesson 49-50: Consolidation
Lesson 51-54: Test 2 – situations, communication practice
Lesson 55-56: Assessment

Course material, recommended text book(s), professional literature and supplementary reading(s)
Gyöngyösi Lívia - Hetesy Bálint. *Hungarian language: Jó napot kívánok!* Semmelweis Egyetem Egészségtudományi Kar, 2011.

COMPULSORY SUMMER PRACTICE

Nursing Course - 1 month, 170 hours

Proof of completion (Certification of completed famulus practice) must be submitted prior to registration to the next academic year.
Students who do not submit the certificate of completion on time will have their registration placed on hold until the proof of completion is received by the English Secretariat. Certificates can be downloaded at http://www.semmelweis-english-program.org/index.php?option=com_content&task=view&id=79&Itemid=101
Please read more about the rules concerning the criteria of selecting the foreign clinical practice positions and accepting the practice period spent abroad: http://www.semmelweis-english-program.org

Week 1

An introduction to the structure of a hospital as an institution for attending patients.
1. In-patient department
2. Out-patient department
3. Auxiliary departments (X-ray, labs, physiotherapy, etc.)
4. Departments of Administration (warden's office, cashier's office, etc.)
5. Service departments (kitchen, storeroom, laundry, etc.)

Getting acquainted with the ward and its connected parts
The structure and hygiene of the ward
Daily active participation in keeping order in the ward
Getting acquainted with the equipment of the ward
Cleaning beds and bedside tables after discharging of patients (cleaning, disinfection)
Making beds with help and alone (for walking cases)
Helping with discharging patients

Week 2

(practicing the things learnt in the previous week)

Making beds with turnable bedcase (first with nurse's help)
Use of comfort equipment (under supervision)
Disinfectants in the ward

Cleaning and sterilization of bedpans, urinals and spittoons
Helping with taking temperatures, sterilization of thermometers
Helping with serving food
Helping with feeding bed patients

Week 3
(practicing the things learnt in the previous two weeks)
Helping with making the beds of patients unable to move
Helping with changing beds of patients unable to move
Helping with moving active and passive patients in bed
Helping with the patients' placing in chairs, stretchers and wheelchairs
Helping with the washing of not seriously ill patients, mouth hygiene and nail care
Helping with the dressing and undressing of the patients
Taking temperatures
Practicing how to feel the pulse
Helping with keeping linen cupboards, wardrobes and equipment clean and tidy

Week 4
(practicing the things learnt in the previous 3 weeks)
Attending patients in the morning without help (washing, cleaning the mouth and nails, combing, making beds)
Helping with comfort equipment without help
Helping with cold and warm treatment, applying compresses, stupes, ice bags, thermofors
Practicing to keep temperature and pulse charts
Working with syringe, practicing pumping
Helping to sterilize the syringe (the importance of sterilization)
Helping with preparing and sending samples to the labs, filling up guide slips
Staying in the lab for one or two days, or 12 hours per day favourably in the department's lab helping and practicing urine analysis

Before starting the practice, it is advisable that the head nurse or an experienced nurse should give introductory explanations.