Sveučilište u Rijeci • Fakultet dentalne medicine
University of Rijeka • Faculty of Dental Medicine

Course: MEDICAL CHEMISTRY
Course Coordinator: Lara Batičić, PhD, Associate Professor
Course Collaborators: Robert Domitrović, PhD, Full Professor
Srećko Valić, PhD, Full Professor
Gordana Čanadi Jurešić, PhD, Associate Professor
Marin Tota, PhD, Associate Professor
Mirna Petković Didović, PhD, Assistant Professor
Damir Klepac, PhD, Assistant Professor
Iva Potočnjak, PhD, Assistant
Iva Vukelić, PhD, Assistant
Hrvoje Križan, MMLSc
Dolores Kovačić, chem. tech.

Department: Medical Chemistry, Biochemistry and Clinical Chemistry, Faculty of Medicine, University of Rijeka
Study program: Integrated Undergraduate and Graduate University Study of Dental Medicine in English
Study year: first
Academic year: 2022/23

SYLLABUS

Course description (a brief description of the course, general instructions, where and in what form the lessons are organized, necessary equipment, instructions for attendance and preparation for classes, student obligations, etc.):

The course "Medical Chemistry" is a compulsory course in the first year of the Integrated Undergraduate and Graduate University Study of Dental Medicine. It consists of 30 hours of lectures, 30 hours of seminars and 20 hours of numerical exercises and laboratory practicals, comprising of a total of 80 hours of teaching (7 ECTS credits).

Course objectives:
The main goal of the course “Medical Chemistry” is to give insights into most important characteristics of chemical compounds and principles of reactions through selected chapters of chemical disciplines. The aim is to provide students of the Study of Dental Medicine bases for understanding chemical processes leading to biological and biochemical pathways. Acquiring the capability to apply chemical knowledge on biological systems is important for understanding the human metabolism, both in physiological and pathological conditions.

Course content:
The course “Medical Chemistry” includes following topics: Basic chemical laws. Atom structure. Intra- and intermolecular bonds and forces. Biologically significant inorganic compounds. Complex compounds. Biological chelates. Solutions. The structure and properties of water. Colligative properties of aqueous solutions. Electrolyte solutions. pH and buffers. The mechanism

of action of buffers. Biological buffers. Chemical kinetics. The rate of chemical reactions and factors that affect chemical kinetics. Catalysis. Collision theory. Transitional theory. The order and molecularity of the reaction. Thermodynamics. Gibbs energy. Bioenergetics. Chemical equilibrium. Kinetic and thermodynamic equilibrium condition. The impact of external factors on chemical equilibrium. Le Chatelier's principle. Balance in homogeneous and heterogeneous systems. Electrochemical processes. Nernst equation. Organic chemistry. Classification and reactivity of organic compounds. Types of reactions in organic chemistry. Organic compounds containing oxygen: alcohols and phenols, ethers, aldehydes and ketones, carbohydrates, carboxylic acids, and fatty acids and their derivatives. Isomerism. Chemical properties and characteristic reactions of each group of organic compounds. Biologically significant representatives.

Development of general and specific competencies (knowledge and skills):
Developing awareness of the similarity and inseparability of chemical reactions within living and non-living matter, the relationship between structure and reactivity, chemical and energetic transitions, and the laws of thermodynamics. Developing skills to use acquired knowledge for understanding the biochemical reactions in human organisms. Expanding the knowledge on relations between the structure and physical/chemical properties of matter based on simple molecules and applying it to biomolecules. Solving numerical and logical probin from the field of Medical Chemistry. Developing skills necessary for experimental work, mastering the basic laboratory techniques and methods. Encouraging students to apply information technology and use scientific literature. Building a sense of teamwork and developing their ability of creative and critical thinking needed for drawing conclusions based on data obtained through analysis. Developing methods and skills necessary for the presentation of obtained results.

Course correlativity and correspondence:
The content of the course "Medical Chemistry" correlates with and is complementary to the following courses: Medical Physics and Biophysics, Medical Biology, Biochemistry.

Approaches to teaching and learning:
The course "Medical Chemistry" is conducted through lectures, seminars, and numerical and laboratory practicals.

Assigned reading:

Petrucc RH, Herring FG, Madura JD. General Chemistry: Principles and Modern Applications, 11th edition. Bissonnette, Pearson, 2016.
McMurry J. Fundamentals of Organic Chemistry, 7th edition, Brooks/Cole, 2011.
Manual for Laboratory practicals for Dental Medicine students, Internal material, Faculty of Medicine, University of Rijeka, 2018.

Optional/additional reading:

Reed, D.: Chemistry for Biologists, Pearson Education Ltd., Harlow, UK, 2013;
Mahaffy, P., Tasker, R., Bucat, B., Kotz, J.C., Weaver, G.C. and Treichel, P.M.: Chemistry – Human activity, Chemical Reactivity, Nelson Education, USA, 2015.

COURSE TEACHING PLAN:

The list of lectures (with topics and descriptions):

L1,2 The importance of Medical Chemistry in the Study of Dental Medicine.

Main chemical laws. Atom structure.
Define and explain main chemical laws.
Describe the structure of the atom.

L3 Intermolecular interactions and chemical bonds.
Define and describe chemical bonds.
Define and describe interactions within molecules and particles.

L4 Complex Compounds. Complex Salts. Chelates. Biological Chelates. Application of Chelators in Dental Medicine.
Describe the role of chelation in biological systems.
Explain the effect of chelators and their use in medicine and dental medicine.
Explain the principles of the complexometric method.
Relate the structure and properties of apatite minerals (hydroxyapatite, fluorapatite).

L5 Water and Water Solutions. Solutions of Electrolytes.
Provide basic facts about the quantity, distribution and the role of water in the human body.
Explain the structure and properties of water.
Explain the dissolution of gasses and solid compounds in water.
Distinguish electrolytes and nonelectrolytes.

L6 Colligative Properties. Colloids.
Define the principle of colligative properties.
Explain vapour-pressure lowering, freezing point depression and boiling point elevation.
Explain osmosis and dialysis. Define osmotic pressure.
Explain colloids. Name and describe the types and properties of colloids.

L7 Acids and Bases, pKw.
Define acids and bases according to Arrhenius, Brønsted and Lewis.

L8 Buffers.
Define buffers.
Explain the mechanism of buffer action.
Describe the importance of buffering systems in the human body.

L9,10 Thermochemistry. Thermodynamic Quantities.
Thermodynamics. The First Law of Thermodynamics.
State Functions of Thermodynamic Systems. Extensive and Intensive Properties.
Define the basic concepts of thermodynamics and basic thermodynamic quantities.
Apply the first law of thermodynamics to biochemical systems.
Define the Second Law of Thermodynamics. Gibbs Energy and the Direction of Chemical Reactions. Heat Capacity and Temperature.
Relate Gibbs energy with the equilibrium constant.

L11 Chemical Kinetics. Rate, Order and Molecularity of Reaction.
Define the basic principles of chemical kinetics.
Define the rate of reaction and reaction order.
Explain how various factors affect the rate of reaction.
Describe the mechanism of action of catalysts and explain the difference between chemical and biochemical catalysts.

L12 Chemical Equilibrium.
Define Le Chatelier's principle.

Explain the impact of external factors on equilibrium.
Distinguish dynamic equilibrium and consistent flow and its importance in biological systems.

L13 Electrochemical Reactions. Galvanic Cells. Standard Redox Potential.
Explain the structure of the galvanic cell.
Explain the meaning of standard reduction potential.

L14 Electromotive Force. The Nernst Equation. Biological Redox Systems.
Write down and explain the Nernst equation.
Name biologically important oxidation-reduction systems.
Define the standard redox potential of biological systems.
Explain Gibbs energy of redox-systems.

L15, 16 Structure of Organic Compounds. Types of Reactions in Chemistry of Organic Compounds. Hybridization. Resonance, Inductive Effect.
Classify organic compounds according to functional groups and explain their chemical properties.
Define the types of reactions of organic compounds.
Explain the concept of nucleophile and electrophile.
Explain hybridization.
Explain resonance and inductive effect.

L17, 18 Biologically Important Oxygen Compounds: Alcohols, Phenols and Ethers.
Explain the chemical properties of these classes of compounds and their reactivity.
Explain the reactions of oxygen compounds.
L19, 20 Thiols and Amines.
Explain the chemical properties and reactivity of this thiols and amines.
List biologically important representatives.

L21, 22 Biologically Important Oxygen Compounds: Aldehydes and Ketones.
Explain the significance of this group of compounds, their chemical properties and their reactivity.
Define tautomerism.
Explain aldol condensation.

L23, 24 Stereochemistry.
Define isomerism.
Explain the types of isomerism (structural, positional, stereoisomerism, geometrical isomerism and conformational isomerism)
Define chiral molecules.
Explain D,L-steric order and R,S-system.

L25, 26 Carbohydrates.
Explain their structure and chemical properties.
Name and explain the structure of biologically most important monosaccharides, disaccharides and polysaccharides.

L27, 28 Carboxylic Acids and their Derivatives. Substituted Carboxylic Acids.
Explain the chemical properties of this class of compounds and their reactivity.
Name biologically important mono- and polycarboxylic acids.
Name biologically significant representatives.
Explain the structure and synthesis of organic derivatives of carboxylic acids.

L29, 30 Fatty Acids and Lipids.
Explain the chemical properties of fatty acids and lipids and their reactivity.

Explain the physical properties of lipids.
Define fatty acids and lipids and name important biological representatives.

The list of seminars with descriptions:

S1,2 Elements and Compounds.
Explain the structure of atoms, the periodic system and properties of elements that change periodically
List the biogenic elements and define their biological role.
Explain the structure and define the properties of compounds.

S3,4 Acids and Bases.
Define acids and bases according to Arrhenius, Brønsted and Lewis.
Explain the strength of acids and bases

S5,6 Salts. Hydrolysis.
Define simple salts. Write neutralization equations.
Explain the hydrolysis of salts.

S7,8 Buffers. Buffers in human body.
Define buffers and explain the mechanism of buffer action.
Explain the mechanism of acid-base equilibrium.
Write and explain Henderson-Hasselbalch equation.
Calculate pH of buffer solutions.

S9,10 Solutions. Concentrations.
Define the concept of mole and the concentration of solutions (fractions, molar and mass concentration, molality). Define intensive and extensive properties.
Solve the exercises with concentrations.

S11 Chemical Kinetics.
Define the basic principles of chemical kinetics.
Define the rate of reaction and reaction order.
Explain how various factors affect the rate of reaction.
Describe the mechanism of action of catalysts.

S12 Chemical Equilibrium.
Define Le Chatelier's principle.
Explain the impact of external factors on chemical equilibrium.

S13,14 Redox reactions
Define the oxidant and reductant in redox reactions.
Balance the redox reactions.

S15,16 Hydrocarbons.
Classify and name hydrocarbons.
Write down the characteristic reactions of hydrocarbons and aromatic compounds.

S17,18 Reactions of Organic Compounds.
Describe and solve characteristic reactions of organic compounds.

S19,20 Alcohols, Ethers, Phenols.
Classify and name alcohols, ethers and phenols

Explain the chemical properties and reactivity of these groups of compounds.
List biologically important representatives.

S21, 22 Thiols. Amines.
Classify and name thiols and amines.
Explain the chemical properties and reactivity of these groups of compounds.
List biologically important representatives.

S23,24 Aldehydes and Ketones.
Classify and name aldehydes and ketones
Explain the chemical properties and reactivity of these groups of compounds.
List biologically important representatives.

S25,26 Stereochemistry. Carbohydrates.
Explain different types of isomerism.
List biologically important representatives among carbohydrates.
Explain the formation of cyclic form.
Explain the reactivity of monosaccharides and specify their stereoisomers.

S27, 28 Carboxylic Acids and their Derivatives.
Explain the chemical properties and reactivity of Carboxylic acids and their derivatives.

S29,30 Substituted Carboxylic Acids. Fatty Acids. Lipids.
Name and define substituted carboxylic acids (halogen-, oxo-, hydroxy-, amino acids).
Explain chemical properties of fatty acids and lipids.
Explain the physical properties of fatty acids and lipids.

The list of practicals with descriptions:

NP 1,2 Structural formulas of inorganic compounds (acids, bases, salts).
Draw Lewis's structural formulas of different inorganic compounds.
Explain and identify chemical bonds and intermolecular forces.

LAB1 (LP 3,4) General Laboratory Safety Procedures and Rules. Introduction to Qualitative Analysis – Identification of Cations and Anions. Qualitative Inorganic Analysis: Testing Salt Solutions for Anions and Cations.
Basic chemistry lab equipment and techniques.
Detection and identification of different cations and anions in a solution.
Detection and identification of cations and anions in salt solutions.
NP 5,6 Solutions. Solution Concentration.
Define the concept of mole and the concentration of solutions (fractions, molar and mass concentration, molality). Solve numerical exercises.

LAB2 (LP 7,8) Quantitative Chemical Analysis.
Name the main types of quantitative chemical analysis.
Describe and exemplify the volumetric methods.
Volumetric analysis.
Employ the alkalimetric, manganometric and complexometric methods.

NP 9-11 Hydrolysis. Buffers.
Solve examples of salt hydrolysis.
Explain the mechanism of buffer action in body fluids.
Describe acid-base equillibrium in the human body

Write and explain Henderson-Hasselbalch equation.
Calculate the pH value of buffer solutions.

LAB3 (LP 12,13) Chemical Kinetics.
Investigate experimentally the influence of temperature, concentration, pH and catalyst on rate of reaction.

NP 14 Chemical Equilibrium.
Define Le Chatelier's principle and apply Le Chatelier's principle.
Explain the impact of external factors on equilibrium.

LAB4 (LP 15,16) Buffer Solutions.
Prepare the phosphate buffer solution.
Measure the pH and buffer capacity.

LAB5 (LP 17,18) Qualitative Organic Analysis.
Detect and identify functional groups of different organic compounds.
Detect and identify amides and purines in solution.

NP 19,20 Nomenclature of organic compounds and reactions of organic compounds.
Give IUPAC and trivial names to organic compounds.
Solve typical reactions of different organic compounds.

Students' obligations:

Class attendance including test attendance is mandatory. Students may be absent from 30% of each form of teaching provided they have a justifiable cause. Absence from laboratory practicals is obligatory compensated by an oral colloqy.

Assessment (exams, description of written / oral / practical exam, the scoring criteria):

Assessment of students' work:
Student grading is conducted according to the current Ordinance on Studies of the University of Rijeka.
Students can obtain a total of 100 credits: a maximum of 70 credits during the course (writing two midterm exams and on laboratory practicals) and a maximum of 30 credits on the final exam. Students are allowed to take the final exam if they gain a minimum of 35 credits during the course.
At all written and oral exams, the student must give at least 50% of the correct answers. Students who did not obtain 50% on each midterm may once retake the midterms, which will be held during the final exam period. Students who are not satisfied with the obtained credits are also allowed to retake their midterm exams, but thereafter only the credits gained from the retaken midterms will be considered.

Table 1. Evaluation of students' progress during classes, midterms and the final exam

		CREDITS
Midterm exams	I General and inorganic chemistry with Stoichiometry	30 (x % of score)
	II Organic chemistry	30 (x % of score)
	Total	**60**

Laboratory practicals	Practicals and reports	10
TOTAL		**70**
Final exam	Written exam	15 (x % of score)
	Oral exam	15
	Total	**30**
TOTAL		**100**

Midterm exams:
Two midterm exams will be held during the course The first one covers the content of bioinorganic, general and physical chemistry with stoichiometry while the second one covers organic chemistry (theory, nomenclature, reactivity and structural formulas).

Laboratory practicals:
Students can gain a maximum of 10 credits through 5 laboratory practicals. Each completed practical brings 2 credits: 1 for successfully executed laboratory work and 1 for a completed written report after each practical. An absence (for any reason) from a laboratory practical must be compensated by an oral colloquy within a week from the practical; successful colloquy brings a total of 0,5 credits. Retakes of the colloquy will not be allowed.

Final exam:
The final exam comprises a written exam (15 credits) and an oral exam (15 credits). Students are required to pass both parts of the final exam.

Assessment of the oral part of the final exam:
7.5 – 8 credits: minimum criteria satisfied
9 – 11 credits: average criteria satisfied with noticeable errors
12 – 13 credits: answer with a few errors
14 – 15 credits: outstanding answer.

The ECTS grading system is defined by the following criteria:
A (5, excellent) 90-100 credits
B (4, very good) 75-89.9 credits
C (3, good) 60-74.9 credits
D (2, sufficient) 50-59.9 credits
F (1, insufficient, fail) less than 50 credits

Retaking the course:
A student who gains less than 35 credits during the pre-exam period, has failed the course.

COURSE SCHEDULE
(for the academic year 2022/2023)

Date	Lectures (time and place)	Seminars (time and place)	Practicals (time and place)	Instructor
Tuesday 24/01/2023	L1,2 (8:15-10:00) Lecture room P1			Assoc. prof. Lara Batičić, PhD
	L3,4 (10:15-12:00) Lecture room P2			Assist. prof. Mirna Petković Didović, PhD Assoc. prof. Marin Tota, PhD
		S1,2 (13:15-15:00) Lecture room P4		Assoc. prof. Lara Batičić, PhD
Wednesday 25/01/2023		S3,4 (8:15-10:00) Lecture room P1		Assist. prof. Mirna Petković Didović, PhD
	L5,6 (10:15-12:00) Lecture room P1			Assist. prof. Mirna Petković Didović, PhD Assoc. prof. Lara Batičić, PhD
			NP1,2 (12:15-14:00) Lecture room P2	Assoc. prof. Lara Batičić, PhD
Thursday 26/01/2023			LAB1 (LP3,4) (8:00-10:00) Laboratory*	Iva Potočnjak, PhD
	L7 (11:00-12:00) Lecture room P2			Assist. prof. Mirna Petković Didović, PhD
		S5,6 (12:15-14:00) Lecture room P4		Assist. prof. Mirna Petković Didović, PhD
Friday 27/01/2023	L8 (8:15-9:00) Lecture room P2			Assoc. prof. Lara Batičić, PhD
		S7,8 (9:15-11:00) Lecture room P6		Assoc. prof. Lara Batičić, PhD
		S9,10 (11:15-13:00) Lecture room P6		Assoc. prof. Lara Batičić, PhD
			NP 5,6 (14:15-16:00) Lecture room P6	Assist. prof. Mirna Petković Didović, PhD
Tuesday 31/01/2023			LAB2 (LP7,8) (8:00-10:00) Laboratory*	Iva Potočnjak, PhD

			NP 9-11 (11:15-14:00) Lecture room P2	Assoc. prof. Lara Batičić, PhD
Wednesday 01/02/2023	L9,10 (08:15-10:00) Lecture room P6			Assist. prof. Mirna Petković Didović, PhD
	L11 (10:15-11:00) Lecture room P6			Assist. prof. Damir Klepac, PhD
		S11 (11:15-12:00) Lecture room P6		Assist. prof. Damir Klepac, PhD
			LAB3 (LP 12,13) (13:15-15:00) Laboratory*	Iva Potočnjak, PhD
Thursday 02/02/2023	L12 (8:15-9:00) Lecture room P4			Full prof. Srećko Valić, PhD
		S12 (9:15-10:00) Lecture room P4		Full prof. Srećko Valić, PhD
			NP14 (10:15-11:00) Lecture room P4	Full prof. Srećko Valić, PhD
Friday 03/02/2023	L13,14 (08:15-10:00) Lecture room P2			Assoc. prof. Marin Tota, PhD
		S13,14 (10:15-12:00) Lecture room P2		Assist. prof. Damir Klepac, PhD
			LAB4 (LP 15,16) (13:00-15:00) Laboratory*	Iva Potočnjak, PhD
Tuesday 07/02/2023	**MIDTERM I** (9:00-11:00) Lecture room*/ONLINE			Assoc. prof. Lara Batičić, PhD
Wednesday 08/02/2023	L15,16 (8:15-10:00) Lecture room P2			Assoc. prof. Lara Batičić, PhD
		S15,16 (10:15-12:00) Lecture room P2		Assoc. prof. Lara Batičić, PhD
Thursday 09/02/2023		S17,18 (8:15-10:00) Lecture room P2		Assoc. prof. Lara Batičić, PhD
	L17,18 (10:15-12:00) Lecture room P2			Assoc. prof. Marin Tota, PhD
		S19,20 (13:15-15:00) Lecture room P2		Assist. prof. Damir Klepac, PhD
Friday	L19,20			Assoc. prof. Lara Batičić, PhD

10/02/2023	(8:15-10:00) Lecture room P2			
		S21,22 (10:15-12:00) Lecture room P2		Assoc. prof. Lara Batičić, PhD
Tuesday 14/02/2023	L21,22 (08:15-10:00) Lecture room P2			Assoc. prof. Gordana Čanadi Jurešić, PhD
		S23,24 (10:15-12:00) Lecture room P2		Assoc. prof. Gordana Čanadi Jurešić, PhD
Wednesday 15/02/2023	L23,24 (08:15-10:00) Lecture room P2			Assoc. prof. Gordana Čanadi Jurešić, PhD
	L25,26 (10:15-12:00) Lecture room P2			Assoc. prof. Gordana Čanadi Jurešić, PhD
Thursday 16/02/2023		S25,26 (08:15-10:00) Lecture room P2		Assoc. prof. Gordana Čanadi Jurešić, PhD
	L27,28 (10:15-12:00) Lecture room P2			Assoc. prof. Lara Batičić, PhD
		S27,28 (12:15-14:00) Lecture room P2		Assoc. prof. Lara Batičić, PhD
Friday 17/02/2023	L29,30 (8:15-10:00) Lecture room P2			Assoc. prof. Lara Batičić, PhD
		S29,30 (10:15-12:00) Lecture room P2		Assoc. prof. Lara Batičić, PhD
Tuesday 21/02/2023			LAB5 (LP17,18) (08:15-10:00) Laboratory*	Iva Potočnjak, PhD
Wednesday 22/02/2023			NP19,20 (8:15-10:00) Lecture room P2	Assist. prof. Damir Klepac, PhD
Friday 24/02/2023	**MIDTERM II** (9:00-11:00) Lecture room*/ONLINE			Assoc. prof. Lara Batičić, PhD
Wednesday 01/03/2023	**FINAL EXAM**			

List of lectures, seminars and practicals:

	LECTURES (Topics)	Teaching hours	Location/Lecture room
L1,2	The importance of Medical Chemistry in the Study of Dental Medicine. Main chemical laws. Atom structure.	2	Lecture room *
L3	Intermolecular interactions and chemical bonds.	1	Lecture room *
L4	Complex Compounds. Complex Salts. Chelates. Biological Chelates. Application of Chelators in Dental Medicine.	1	Lecture room *
L5	Water and Water Solutions. Solutions of Electrolytes.	1	Lecture room *
L6	Colligative Properties. Colloids.	1	Lecture room *
L7	Acids and Bases, pKw.	1	Lecture room *
L8	Buffers.	1	Lecture room *
L9,10	Thermochemistry. Thermodynamic Quantities.	2	Lecture room *
L11	Chemical Kinetics. Rate, Order and Molecularity of Reaction.	1	Lecture room *
L12	Chemical Equilibrium.	1	Lecture room *
L13	Electrochemical Reactions. Galvanic Cells. Standard Redox Potential.	1	Lecture room *
L14	Electromotive Force. The Nernst Equation. Biological Redox Systems.	1	Lecture room *
L15,16	Structure of Organic Compounds. Types of Reactions in Chemistry of Organic Compounds. Hybridization. Resonance, Inductive Effect.	2	Lecture room *
L17,18	Biologically Important Oxygen Compounds: Alcohols, Phenols and Ethers.	2	Lecture room *
L19,20	Thiols and Amines.	2	Lecture room *
L21,22	Biologically Important Oxygen Compounds: Aldehydes and Ketones.	2	Lecture room *
L23,24	Stereochemistry.	2	Lecture room *
L25,26	Carbohydrates.	2	Lecture room *
L27,28	Carboxylic Acids and their Derivatives. Substituted Carboxylic Acids.	2	Lecture room *
L29,30	Fatty Acids and Lipids.	2	Lecture room *
	TOTAL TEACHING HOURS	**30**	

	SEMINARS (Topics)	Teaching hours	Location/Lecture room
S1,2	Elements and Compounds.	2	Lecture room *
S3,4	Acids and Bases.	2	Lecture room *
S5,6	Salts. Hydrolysis.	2	Lecture room *
S7,8	Buffers. Buffers in human body.	2	Lecture room *
S9,10	Solutions. Solution Concentration.	2	Lecture room *
S11	Chemical Kinetics.	1	Lecture room *
S12	Chemical Equilibrium.	1	Lecture room *
S13,14	Redox reactions	2	Lecture room *
S15,16	Hydrocarbons.	2	Lecture room *
S17,18	Reactions of Organic Compounds.	2	Lecture room *

S19,20	Alcohols, Ethers, Phenols.	2	Lecture room *
S21,22	Thiols. Amines.	2	Lecture room *
S23,24	Aldehydes and Ketones.	2	Lecture room *
S25,26	Stereochemistry. Carbohydrates.	2	Lecture room *
S27,28	Carboxylic Acids and their Derivatives.	2	Lecture room *
S29,30	Substituted Carboxylic Acids. Fatty Acids. Lipids.	2	Lecture room *
	TOTAL TEACHING HOURS	**30**	

	PRACTICALS (Topics)	**Teaching hours**	**Location/Lecture room**
NP1,2	Structural formulas of inorganic compounds (acids, bases, salts).	2	Lecture room *
LP3,4 (LAB1)	General Laboratory Safety Procedures and Rules. Introduction to Qualitative Analysis – Identification of Cations and Anions. Qualitative Inorganic Analysis: Testing Salt Solutions for Anions and Cations.	2	Laboratory (Department of Medical Chemistry, Biochemistry and Clinical Chemistry)*
NP5,6	Solutions. Solution Concentration.	2	Lecture room *
LP7,8 (LAB2)	Quantitative Chemical Analysis.	2	Laboratory (Department of Medical Chemistry, Biochemistry and Clinical Chemistry)*
NP9-11	Hydrolysis. Buffers.	3	Lecture room *
LP12,13 (LAB3)	Chemical Kinetics.	2	Laboratory (Department of Medical Chemistry, Biochemistry and Clinical Chemistry)*
NP14	Chemical Equilibrium.	1	Lecture room *
LP15,16 (LAB4)	Buffer Solutions.	2	Laboratory (Department of Medical Chemistry, Biochemistry and Clinical Chemistry)*
LP17,18 (LAB5)	Qualitative Organic Analysis.	2	Laboratory (Department of Medical Chemistry, Biochemistry and Clinical Chemistry)*
NP19,20	Nomenclature of organic compounds and reactions of organic compounds.	2	Lecture room *
	TOTAL TEACHING HOURS	**20**	

	FINAL EXAM DATES
1.	01/03/2023
2.	15/03/2023
3.	12/04/2023