

UNIVERSITY OF ZAGREB
FACULTY OF VETERINARY MEDICINE
Heinzelova 55
Tel. 01/2390302
Division: Basic and Pre-clinical Sciences Division
Department / Clinic: Department of chemistry and biochemistry
Email: lkrstulovic@vef.hr
Register no.:
File no.:
Zagreb, 20.07.2018.

COURSE SYLLABUS

Course name: Medical chemistry

Academic year 2018-19

Course leader: assistant professor Luka Krstulović

Associate teachers: full professor Renata Barić Rafaj, Andrea Tumpa, mag. med. biochem.

First day of classes: 25.09.2018.

Last day of classes: 20.11.2018.

Timetable for LECTURES academic year 2018-2019

| LECTURES | | | | |
|-------------|---|-----------------------------|---|--|
| Date | Methodological unit | Teacher | Location / time | Literature |
| 25.09.2018. | <i>Introduction:</i> Role of the chemistry and biochemistry in veterinary medicine <i>Structure of substance:</i> atoms, molecules, electronegativity, ionic and covalent bond | Asst. prof. Luka Krstulović | Lecture room of Department of Forensic and Judicial Veterinary Medicine 8-10h | A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill |
| 26.09.2018. | <i>Dispersed systems I:</i> suspensions, colloids, solutions, aqueous solutions, hydrogen bonds, electrolytes | Asst. prof. Luka Krstulović | Lecture room of Department of Chemistry and Biochemistry 16-18h | A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill |
| 03.10.2018. | <i>Dispersed systems II:</i> Diffusion, osmosis, colligative properties <i>Acids and bases:</i> acids and bases | Asst. prof. Luka Krstulović | Lecture room of Department of Forensic and Judicial Veterinary Medicine 10-12h | A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill |
| 09.10.2018. | <i>Acids and bases:</i> pH, buffers, biological buffers <i>Reaction energy:</i> Activation energy, endothermic and exothermic reactions, catalysts (biocatalysts) | Asst. prof. Luka Krstulović | Lecture room of Department of Veterinary pathology 8-10h | A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of |

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| | | | | Matter and Change, McGraw Hill |
| 10.10.2018. | <i>Isomers and Isomerism: Constitutional and Stereoisomers</i> <i>Organic compounds with oxygen: alcohols, phenols</i> | Asst. prof. Luka Krstulović | Lecture room of Department of Chemistry and Biochemistry 10-12h | A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill |
| 11.10.2018. | <i>Organic compounds with oxygen: ethers, aldehydes, ketones, carboxylic acids and their derivatives</i> | Asst. prof. Luka Krstulović | Lecture room of Department of Chemistry and Biochemistry 8-10h | A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill |
| 15.10.2018. | <i>Organic compounds with nitrogen: amines, heterocyclic compounds, alkaloids</i> | Asst. prof. Luka Krstulović | Lecture room of Department of Chemistry and Biochemistry 10-12h | A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill |
| 16.10.2018. | <i>Carbohydrates: classification and stereoisomers, monosaccharides, disaccharides, polysaccharides</i> | Asst. prof. Luka Krstulović | Lecture room of Department of Chemistry and Biochemistry 8-10h | A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill |
| 19.10.2018. | <i>Lipids: structure, classification</i> | Asst. prof. Luka | Lecture room of | A. Bettelheim, W. H. Brown, J. March |

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| | <i>Amino acids</i> : structures and properties | Krstulović | Department of Chemistry and Biochemistry 10-12h | (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill |
| 23.10.2018. | <i>Proteins</i> : Protein structure, enzymes, coenzymes <i>Nucleic acids</i> : Purine and pyrimidine bases, nucleosides, nucleotides | Asst. prof. Luka Krstulović | Lecture room of Department of Chemistry and Biochemistry 10-12h | A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic and Biochemistry, Thomson M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. 3. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill |

Timetable for PRACTICALS academic year 2018-2019

| PRACTICALS | | | | | | |
|-------------|--|--|---------------------------|-------|---|--|
| Date | Methodological unit | Teacher | Type of practical | Group | Location / time | Literature |
| 28.09.2018. | Chemical calculations- Basis of chemical calculations | Asst. prof. Luka Krstulović full professor Renata Barić Rafaj | Exercises in lecture room | 1,2 | Lecture room of Department of Chemistry and Biochemistry 8-10h | Stolić, I: Chemical calculations I, page 5-14 |
| 01.10.2018. | Chemical calculations- Composition of | Asst. prof. Luka Krstulović Andrea Tumpa | Exercises in lecture room | 1,2 | Lecture room of Department of Veterinary pathology | Stolić, I: Chemical calculations I, page 15-23 |

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|-------------|---|---|---------------------------|-----|--|---|
| | solutions I | | | | 8-10h | |
| 03.10.2018. | Qualitative chemical analysis- Detection of cations and anions | Asst. prof. Luka Krstulović Andrea Tumpa | Laboratory exercises | 1,2 | Laboratory of Department of Chemistry and Biochemistry 12-14h | Laboratory exercise in medicinal chemistry, page: 1-12 |
| 04.10.2018. | Chemical calculations- Composition of solutions II | Asst. prof. Luka Krstulović full professor Renata Barić Rafaj | Exercises in lecture room | 1,2 | Lecture room of Department of Chemistry and Biochemistry 12-14h | Stolić, I: Chemical calculations I, page 15-23 |
| 05.10.2018. | Chemical calculations- Reaction of neutralisation I | Asst. prof. Luka Krstulović full professor Renata Barić Rafaj | Exercises in lecture room | 1,2 | Lecture room of Department of Chemistry and Biochemistry 10-12h | Stolić, I: Chemical calculations I, page 25-29 |
| 9.10.2018. | Qualitative chemical analysis – Detection of organic compounds I | Asst. prof. Luka Krstulović Andrea Tumpa | Laboratory exercises | 1,2 | Laboratory of Department of Chemistry and Biochemistry 12-14h | Laboratory exercise in medicinal chemistry, page: 13-24 |
| 15.10.2018. | Qualitative chemical analysis – Detection of organic compounds II | Asst. prof. Luka Krstulović Andrea Tumpa | Laboratory exercises | 1,2 | Laboratory of Department of Chemistry and Biochemistry 12-14h | Laboratory exercise in medicinal chemistry, page: 13-24 |
| 22.10.2018. | Chemical calculations- Reaction of neutralisation II | Asst. prof. Luka Krstulović full professor Renata Barić Rafaj | Exercises in lecture room | 1,2 | Lecture room of Department of Chemistry and Biochemistry 8-10h | Stolić, I: Chemical calculations I, page 25-29 |
| 24.10.2018. | Qualitative | Asst. prof. Luka Krstulović | Laboratory | 1,2 | Laboratory of | Laboratory exercise in |

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| | chemical analysis – Acidimetry | Andrea Tumpa | exercises | | Department of Chemistry and Biochemistry 10-12h | medicinal chemistry, page: 25-28 |
| 25.10.2018. | Chemical calculations-Redox reactions I | Asst. prof. Luka Krstulović full professor Renata Barić Rafaj | Exercises in lecture room | 1,2 | Lecture room of Department of Chemistry and Biochemistry 12-14h | Krstulović, L: Chemical calculations II, page 4-7 |
| 30.10.2018. | Qualitative chemical analysis – Iodometry | Asst. prof. Luka Krstulović Andrea Tumpa | Laboratory exercises | 1,2 | Laboratory of Department of Chemistry and Biochemistry 10-12h | Laboratory exercise in medicinal chemistry, page: 28-30 |
| 31.10.2018. | Chemical calculations-Redox reactions II | Asst. prof. Luka Krstulović full professor Renata Barić Rafaj | Exercises in lecture room | 1,2 | Lecture room of Department of Chemistry and Biochemistry 10-12h | Krstulović, L: Chemical calculations II, page 4-7 |
| 06.11.2018. | Chemical calculations-Colligative properties I | Asst. prof. Luka Krstulović full professor Renata Barić Rafaj | Exercises in lecture room | 1,2 | Lecture room of Department of Chemistry and Biochemistry 8-10h | Laboratory exercise in medicinal chemistry, page: 31-34 |
| 14.11.2018. | Experimental determination of pH | Asst. prof. Luka Krstulović full professor Renata Barić Rafaj | Laboratory exercises | 1,2 | Laboratory of Department of Chemistry and Biochemistry 12-14h | Krstulović, L: Chemical calculations II, page 14-19 |
| 15.11.2018. | Chemical calculations-Colligative properties II | Assist. prof. Ivana Stolić Luka Krstulović, PhD | Exercises in lecture room | 1,2 | Lecture room of Department of Physics and Biophysics 14-16h | Krstulović, L: Chemical calculations II, page 14-19 |
| 19.11.2018. | Chemical | Asst. prof. Luka Krstulović | Exercises in | 1,2 | Lecture room of | Krstulović, L: Chemical |

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|-------------|---|--|---------------------------|-----|---|--|
| | calculations-Dissociation, pH, buffer I | full professor Renata Barić Rafaj | lecture room | | Department of Physics and Biophysics 12-14h | calculations II, page 8-13 |
| 20.11.2018. | Chemical calculations-Dissociation, pH, buffer II | Asst. prof. Luka Krstulović full professor Renata Barić Rafaj | Exercises in lecture room | 1,2 | Lecture room of Department of Physics and Biophysics 10-12h | Krstulović, L: Chemical calculations II, page 8-13 |

STUDENT OBLIGATIONS

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| Lecture attendance | There are 20 lecture lessons. A student must attend 1 lessons to gain 0.3 point. The maximum number of points is 6 (20 lessons) and the minimum number of points is 3 (10 lessons). |
| Seminars attendance | There are 22 exercise lessons in a lecture-room (11 programmes). Each analyzed programme, two exercise lessons, is worth 0.55 point. A student must attend 7 programmes (14 lessons) in order to gain 4 points max. Maximal number of points: 6 (22 hours – 11 programmes) Minimal number of points: 4 (14 hours – 7 programmes) |
| Practicals attendance | There are 12 exercise lessons in a lab (6 programmes). Each realized programme, two exercise lessons, is worth 1 point. A student must attend 4 programmes (8 lessons) in order to gain minimal 4 points. Maximal number of points: 6 (6 programmes) Minimal number of points: 4 (4 programmes) |
| Active participation in seminars and practicals | Lab exercises: A student must solve a task from an exercise (programme) and present a report in order to get a signature for the exercise. Each well done and signed exercise is worth 1.67 points. A student must gain minimal 5 points. The maximum number of points: 10 points (6 programmes – coefficient 1.67) 8 points (5 programmes), 7 points (4 programmes) The minimal number of points: 5 (3 programmes). Chemical calculations: There will be 6 preliminary exams from chemical calculation organized during the session. Each preliminary exam is worth 2 points. A student must gain minimal 8 points. For students who do not gain the minimal number of points a makeup preliminary exam will be organized. The maximum number of points: 12 (6 preliminary exams) The minimal number of points: 8 (4 preliminary exams). A preliminary exam from attended lectures will be organized during the session. The exam consists of 10 questions and each correct answer is worth 2 points. A student can gain maximal 20 points (10 correct answers), and she/he must gain a total of minimal 12 points (6 correct answers). A student who does not gain the minimal 12 points has a right to take a makeup preliminary exam. Preliminary exams: the maximum number of points: 20, the minimal number of points: 12. |
| Final exam | In order to take the final exam a student must gain the minimal number of points from each evaluation element, i.e. the total of minimal 36 points from the first four evaluation elements. The final exam is in written form and it consists 20 questions. Each correct answer is worth 2 points. A student can gain 40 points max. (20 correct answers). The minimal number of points a student must gain at the final exam is 24 (12 correct answers). |

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| Examination requirements | Student requirements are defined in the Regulations on the Integrated Undergraduate and Graduate Study of Veterinary Medicine. Given the above, the student must acquire a minimum number of points from all assessment elements in order to take the final exam. Article 45: a student can justifiably be absent from up to 50 % of the lectures; 30% of the seminars and 30 % of the exercises. |
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GRADING AND EVALUATING STUDENT WORK

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| Continuous knowledge-checking (mid-terms) | Preliminary exam, 11.10.2018. |
| Final exams (dates) | 12.11.2018.; 17.12.2018.; 17.1.2019.; 31.1.2019.; 14.2.2019. |
| Form of final exam | Written form |

LITERATURE

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| Obligatory literature | F. A. Bettelheim, W. H. Brown, J. March (2004): Introduction to General, Organic, and Biochemistry, Thomson. M. M. Bloomfield (1992): Chemistry and the Living Organism, John Wiley & Sons, Inc. M. S. Silberberg (2000): Chemistry, The Molecular Nature of Matter and Change, McGraw Hill. Stolić, I. (2013): Chemical calculation I, Veterinary faculty, Zagreb Krstulović, L. (2013): Chemical calculation II, Veterinary faculty, Zagreb |
| Optional literature | F. A. Carey (2003): Organic chemistry, McGrawHill, New York J. G. Smith (2006): Organic chemistry, McGrawHill, New York |

OBJECTIVES AND LEARNING OUTCOMES

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| Course objectives | Chemistry covers an important part in the study of medicine and veterinary medicine, dealing with basic molecular structures and their changes within the organism, and nature as such. World around us is made of chemical compounds that rule our lives, all functions of life organisms from their birth to death. In order to comprehend functioning of the human and animal organism, in health and disease, and ways of curing, students will learn to understand chemical processes that are responsible for these reactions. All macroscopic occurrences are results of processes in macroscopic world of molecules and atoms and cannot be explained without changes that provoke |
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| | <p>them. For that reason, it is necessary for the students of veterinary medicine to get reasonable level of chemical knowledge – in particular chemical composition of matter, principal chemical reactions, and principal groups of natural compounds. By using models of small and simple molecules, students should understand the relationship between structure and reactivity that will be extended further on for on bio molecules. The achieved knowledge will help students in better comprehending of other fields and courses during their study, such as Biochemistry, Physiology, Pathophysiology, Pharmacology, Toxicology and others.</p> |
| Learning outcomes | <p><i>Learning outcomes at the level of the programme:</i></p> <ol style="list-style-type: none"> 1. Understanding the basic science on which veterinary medicine is based 2. The ability to search the literature, databases and other information sources 3. The ability to design and conduct experiments in the field of veterinary medicine, to interpreter results and draw conclusions 4. The ability of use laboratory equipment and make critical analysis of test results 5. The ability of consolidation of the theoretical knowledge and practical skills within the fields of veterinary medicine 6. The ability of conduct independent research and work in team 7. The ability of presenting the results – oral and writing. <p><i>Learning outcomes at the level of the course:</i></p> <p>After successful completion of the course the student will be able to:</p> <ul style="list-style-type: none"> - apply basic chemical reactions and physicochemical processes; - compare the structure and properties of simple organic compounds and complex biologically important molecules; - connect the relationship of chemical structure of a molecule and its physical and chemical properties; - independently use basic methods of analytic chemistry for quantitative and qualitative analysis; apply chemical calculations to solve the tasks. |

GRADING SCHEME

| <i>Points</i> | <i>Grade</i> |
|---------------|--------------|
| Up to 59 | 1 (F) |
| 60-68 | 2 (E) |
| 69-76 | 2 (D) |
| 77-84 | 3 (C) |
| 85-92 | 4 (B) |
| 93-100 | 5 (A) |

Course leader:

Head of Department/Clinic:

Note: The course leader is required to submit a Course Syllabus to all teachers and associates pertaining to the Course.

**GRADING AND EVALUATION OF STUDENT WORK ON COURSES WITH LECTURES,
SEMINARS and PRACTICALS**

| Type of activity | Minimum number of points | Maximum number of points |
|---|---------------------------------|---------------------------------|
| Lectures attendance | 3 | 6 |
| Seminar attendance | 4 | 6 |
| Practicals attendance | 4 | 6 |
| Active participation in seminars and practicals | 5 | 10 |
| Continuous knowledge checking (mid-terms) | 20 | 32 |
| Final exam | 24 | 40 |
| TOTAL | 60 | 100 |

**GRADING AND EVALUATION OF STUDENT WORK ON COURSES WITH LECTURES and
SEMINARS**

| Type of activity | Minimum number of points | Maximum number of points |
|---|---------------------------------|---------------------------------|
| Lecture attendance | 3 | 6 |
| Practicals attendance | 8 | 12 |
| Active participation in practicals | 5 | 10 |
| Continuous knowledge checking (mid-terms) | 20 | 32 |
| Final exam | 24 | 40 |
| TOTAL | 60 | 100 |

**GRADING AND EVALUATION OF STUDENT WORK ON COURSES WITH SEMINARS and
EXERCISES**

| Type of activity | Minimum number of points | Maximum number of points |
|---|---------------------------------|---------------------------------|
| Seminar / practicals attendance | 11 | 18 |
| Active participation in seminars and practicals | 5 | 10 |
| Continuous knowledge checking (mid-terms) | 20 | 32 |
| Final exam | 24 | 40 |
| TOTAL | 60 | 100 |