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| Identification | Subject | CHEM 226 Organic Chemistry 4 ECTS | |
| | Department | Chemistry and Chemical Engineering | |
| | Program | Undergraduate | |
| | Term | Fall 2023 | |
| | Instructor | Khatira Garazadeh | |
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| | Phone: | +(994)556057466 | |
| | Classroom/hours | 11 Mahsati Street, 206O/11.50-13.20; 416O 13.40-15.10 | |
| Prerequisites | Chemistry 1, Chemistry 2 | | |
| Language | English | | |
| Compulsory/Elective | Compulsory | | |
| Required textbooks and course materials | <p><u>Organic Chemistry: methane to macromolecules</u>, John D.Roberts, Ross Stewart, Marjorie C. Caserio [1]</p> <p>Organic Chemistry A Brief Course, Robert C. Atkins & Francis A. Carey [2]</p> <p>ORGANIC CHEMISTRY, AN ACID-BASE APPROACH, Michael B. Smith</p> <p>A.M.Maharramov, M.N.Maharramov Organic chemistry, textbook for high school students, 2006 [3]</p> | | |
| Teaching methods | Lecture | | x |
| | Group discussion | | x |
| | Research from internet | | x |
| | Others | | x |
| Evaluation | Methods | Date/deadlines | Percentage (%) |
| | Participation | Every week | 5 |
| | Quiz | Week 8, 14 | 10 |
| | Midterm Exam | Week 9 | 30 |
| | Activity | Every week | 5 |
| | Presentation | Week 10-15 | 10 |
| | Final Exam | | 40 |
| | Total | | 100 |
| Course outline | <p>Organic chemistry is one of the fundamental fields of modern chemistry. Its teaching is the most important stage in the training of modern chemists. This field of science is closely related to other fields of chemistry, biochemistry, pharmacology, physiology, etc. It is also closely related to the fields of medical and biological sciences. An organic chemistry course covers topics ranging from first concepts to modern concepts of atomic structure, electrons, chemical bonds, acid-base theory, fundamentals of stereochemistry, and a number of classes organic compounds with their</p> | | |

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| | preparation methods and chemical properties . |
| Course objectives | <p>After completing the course, students ought to be able to:</p> <ul style="list-style-type: none"> - know the theoretical foundations of organic chemistry and applying them in the explanation of multistage reactions; - know what are the main issues to be addressed when preparing answers to laboratory and exam questions; - use different methods of laboratory practice; - use periodicals of world literature in the field of organic chemistry |
| Learning outcomes | <ul style="list-style-type: none"> • To write the mechanism of various organic reactions freely. • To know the methods of obtaining organic compounds in industry and in the laboratory • To know the industrial applications of various organic compounds • To know properties of the most important organic compounds. • To have the skills to work in modern educational and scientific equipment for chemical experiments • Be able to apply the basic laws of chemistry when discussing the results obtained, including with involving information databases |
| Policy | <ul style="list-style-type: none"> • Participation <p>The students are required to attend all classes as a part of their studies and those having legitimate reasons for absence (illness, family bereavement, etc.) are required to inform the instructor. Students exceeding the 25% absence limit will not be allowed to participate at final exam. Participation will account for 5 percent of the total course grade.</p> <ul style="list-style-type: none"> ▪ Quiz <p>At least two (2) quizzes (in written form) will be held in order to evaluate factual standing points of students in terms of the covered topics. The total score for two quizzes is 10 points. A main purpose of carrying out quizzes is to enforce students' focuses on covered lectures and provide students experience in solving several types of questions.</p> <ul style="list-style-type: none"> ▪ Activity <p>A student can get an activity grade. There are several ways to get activity points: engage in discussions; contribute with insights and feedback; solve problems in the class etc. Activity will account for 5 percent of the total course grade, which depends on a student's good class attendance and active participation in class discussions.</p> <ul style="list-style-type: none"> ▪ Presentation |

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| | <p>Presentation will be conducted by each student. The presentation includes the following: title, introduction, literature review, methodology, and proposed data analysis. Presentation will constitute 10 % of the total course grade. Students must present the research paper they have prepared during the session at the end of the session (last two weeks). The presentation is presented in the "Power Point" program, consisting of at least 20 slides. The student presents a brief summary of the topic and results of the research.</p> <ul style="list-style-type: none"> • Withdrawal (pass / fail) <p>The School of Science and Engineering grading guidelines are carefully adhered to throughout this course. In order to pass, a student must typically receive a mark of at least 60%. In case of failure, he/she will be referred or required to repeat the course the following term or year. For referral, the student will be required to take examination scheduled by instructor.</p> <ul style="list-style-type: none"> • Cheating / plagiarism <p>Any form of plagiarism or cheating on a test, quiz, or project will result in the cancellation of the assignment. In this scenario, the student will receive a score of zero (zero) without any further consideration.</p> <ul style="list-style-type: none"> • Professional behavior guidelines <p>During class hours, students are expected to conduct themselves in a way that fosters a positive academic and professional atmosphere. Discussions without permission and unethical conduct are absolutely forbidden.</p> <ul style="list-style-type: none"> • Ethics <p>Use of any electronic devices is prohibited in the classroom. All devices should be turned off before entering class. This is a university policy and <u>violators will be reprimanded accordingly</u></p> <ul style="list-style-type: none"> • For successful completion of the course, the students shall take an active part during the class time, raising questions and involving others to discussions. | |
| Tentative Schedule (Can be changed) | | |
| Weeks | Topics | Reference books |

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| 1 | <p>Introduction to Organic Chemistry Properties of the atoms Electronic orbitals Types of bonds in organic chemistry Acids and bases. Hard and soft acids and bases. Electronic effects in organic compounds Types of chemical reactions</p> | [1], [3] |
| 2 | <p>Open chain compounds. Alkanes Systematic IUPAC nomenclature of alkanes and isomerism Applying IUPAC rules Conformations of Ethane and butane Preparation methods Physical properties of alkanes Chemical properties of alkanes The main provisions of stereoisomerism</p> | [1], [3] |
| | Review of the topic “Introduction to Organic Chemistry” | |
| 3 | <p>Alkenes Nomenclature/Structure and Bonding in ethylene, propene & higher alkenes//Isomerism in alkenes. Classification/Preparation of alkenes/Elimination Reactions/Dehydration of alcohols Addition reactions of alkenes Hydrogenation/Electrophilic addition of Hydrogen Halides to Alkenes/Markovnikov’s rule/Acid–catalysed hydration of alkenes/Hydroboration Oxidation/Addition of Halogens to alkenes/Free–Radical Addition of Hydrogen Bromide to alkenes Polymerisation of alkenes</p> | [1], [3] |
| 4 | <p>Alkadienes and Alkynes</p> <p>Alkadienes Classes of Dienes/Diene Nomenclature/Bonding in conjugated dienes/preparation of alkadienes xii. Electrophilic Addition reactions of Dienes xiii. The Diels Alder Reaction</p> <p>Alkynes Alkyne Nomenclature/Structure and Bonding in Alkynes/Preparation of Alkynes by Elimination reactions Addition reactions of alkynes Cleavage of alkynes Acidity of Alkynes Preparation of Alkynes by Alkylation Reactions</p> | [2], [3] |
| | Review of the topic Alkanes and Alkenes | |

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| 5 | <p>Halogenated derivatives of hydrocarbons. Preparation of alkyl halides Alkyl halides from alcohols and hydrogen halides Physical and Chemical properties of alkyl halides Mechanism of the reaction of alcohols with Hydrogen Halides Nucleophilic substitution reactions S_N1 and S_N2</p> | [1], [3] |
| 6 | <p>Alcohols Nomenclature of alcohols Classes of alcohols, Bonding and Physical properties of alcohols Chemical properties of alcohols Alcohols as Brønsted Bases Nucleophilic Substitution Reactions $SN1$ and $SN2$</p> | [1], [3] |
| | <p>Review topics: Alkadienes and Alkynes; Halogenated derivatives of hydrocarbons.</p> | |
| 7 | <p>Carbonyl compounds: aldehydes and ketones Structure, nomenclature, reactivity Carbonyl group. Aldehydes and ketones: Nomenclature (Ketones, aldehydes, diketones, dialdehydes and ketoaldehydes) Chemical reactivity of ketones and aldehydes Reactions of aldehydes and ketones Chemical reactivity of Carbonyl group Reaction of aldehydes or ketones with strong nucleophiles Reaction of aldehydes or ketones with weak nucleophile Reactions with Amines</p> | [1], [3] |
| 8 | <p>Carbonyl compounds: Carboxylic acids Nomenclature and properties Dicarboxylic acids Dicarboxylic acids derivatives: structure and nomenclature Acyl substitution with Carboxylic acid derivatives Sulfonic acids Chemical properties of carboxylic acids</p> | [2], [3] |
| | <p>Review topics: Alcohols, Carbonyl compounds</p> | |
| 9 | <p>Nitrocompounds Nomenclature and structure Preparation methods Physical and chemical properties Tautomerism in nitrocompounds</p> | [1], [3] |
| | MID EXAM | |

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| 10 | Amines Nomenclature and structure Preparation methods Physical and chemical properties | [1], [3] |
| | Review topics: Nitrocompounds, Presentation | |
| 11 | CLOSE CHAIN COMPOUNDS Alicyclic hydrocarbons Isomerism, nomenclature Conformations of alicyclic compounds Physical and chemical properties | [3] |
| 12 | Arenes and Aromaticity Aromatic compounds Structure and Bonding of Benzene An orbital Hybridization model of Bonding in Benzene Polycyclic Aromatic Hydrocarbons | [1], [3] |
| | Review topics: Amines, Alicyclic hydrocarbons. Presentation | |
| 13 | Nomenclature of Substituted Derivatives of Benzene Reactions of Arenes: Electrophilic Aromatic Substitution Rate and Orientation in Electrophilic Aromatic Substitution Reactions Rate effects of substituents/Orientation effects of substituents Mechanistic explanation of rate and orientation effects Synthesis of Disubstituted aromatic compounds Aromatic side-chain reaction A general view of Aromaticity. Hückel rule Heterocyclic Aromatic Compounds | [1], [3] |
| 14 | Phenols Monoatomic phenols Structure and properties | [1], [3] |
| | Review topics: Aromatic compounds. Presentation | [1] |
| 15 | Presentation | [1] |
| Final exam | | |