

---

**SCHOOL OF PHARMACY AND HEALTH SCIENCES**

---

COURSE: CHE 2305: Introduction to Organic Chemistry

LECTURER : Dr. Edith Amuhaya

CREDIT: **4.5 units**

OFFICE HOURS: F2F: Mon – Thur : 11:00 – 1:30 pm/

EMAIL [eamuhaya@usiu.ac.ke](mailto:eamuhaya@usiu.ac.ke)

---

### **COURSE DESCRIPTION**

The purpose of this course is to lay a firm foundation in organic chemistry by introducing the student to basic concepts in organic chemistry. Of particular interest is to introduce the student to various functional groups, their properties, chemical reactivity and their role in drug function.

#### **Link to University Mission and Program Learning Outcomes:**

- **High order thinking:** The ability to collect, analyze and evaluate information and formulate conclusions. Students develop and demonstrate the ability to think critically, analytically and creatively.
- **Literacy:** Competence in oral, written, quantitative, and technological skills. Students develop and demonstrate competency in oral and written communication as well as demonstrate scientific, quantitative and technological literacy.
- **Global understanding and multicultural perspective:** Awareness, knowledge and appreciation of both the diversity and commodity of cultures. Students acquire these perspectives through formal study of languages, history, literature and the arts and through working, studying and living cooperatively in a radically, ethnically, and culturally diverse environment. Further, students acquire an understanding of economic, historical, political, geographic and environmental relationships on a global basis.
- **Preparedness for career:** Mastery of a field of knowledge and its multi-cultural and multinational application. Such mastery is accomplished through both formal study and various experienced forms of learning such as internships and field experiences.

- **Community service and development:** A sense of being part of a community and a desire to be of service to it. Students are given opportunities to participate in community service, citizenship, or social action projects or activities.
- **Leadership and ethics:** As part of their growth and development, students formulate and articulate the ethical standards which will guide their professional and personal lives.

### **Program Learning Outcomes**

By the end of their training the graduates should be able to:

1. Plan, organize and control the manufacturing, compounding, packaging and quality of pharmaceutical products.
2. Plan, organize and manage the procurement, storage and distribution of pharmaceutical materials and products.
3. Interpret and uphold the laws, regulations and ethics that govern the practice of pharmacy.
4. Provide pharmacist-initiated care to patients and ensure the rational use of medicines.
5. Provide information, advice and education on disease, health, community health and medicines-related issues.
6. Participate in pharmaceutical and medical research and evaluate critically new therapies and current advances in formulation and modes of drug action to ensure the optimal selection and use of medicines.

### **Course Learning Outcomes**

At the end of the course, the student should be able to:

1. Recognize, name and draw the structures of the main organic functional groups
2. Name selected organic molecules using International Union of Pure & Applied Chemists (IUPAC) based on condensed or structural formulas
3. Draw structural or condensed formulas from IUPAC names
4. Describe the hybridization of carbon in organic molecules
5. Describe and relate physical and chemical properties of organic compounds to the nature of bonds, molecular weight, and functional groups
6. Relate the characteristics of functional groups to the Structure Activity Relationships of pharmaceuticals
7. Professionally and safely discharge responsibilities related to working with organic compounds
8. Carry out tests to identify different functional groups
9. Prepare, purify and determine yield of organic compounds
10. Draw and describe the physical properties of conformations

## **COURSE CONTENT**

### **WEEK 1**

#### **Course Learning Outcomes**

**1,2,3,4,5**

- Overview and description of the course
- Introduction to Organic Chemistry (Klein, pp139-156; Bruice, pp 55-61, 128 -135, 146 – 147, 151-152)
- Alkanes and cycloalkanes
  - Sources
  - Structure
  - $sp^3$  hybridization

- Nomenclature
- Structural isomerism
- Physical properties

## WEEK 2

### Course Learning Outcomes

1,2,3,4,5,6

- Alkenes (Klein, pp 341-353; Bruice, pp 65 – 67, 226 – 231, 245 – 247, 146-147 )
  - Sources
  - Structure
  - sp<sup>2</sup> hybridization
  - Nomenclature
  - Isomerism in alkenes
  - Alkene stability
  - Physical properties
- Alkynes (Klein, pp 464-470; Bruice, pp 67-69, 324 -330-331, 340-341)
  - Sources
  - Structure
  - sp hybridization
  - Nomenclature
  - Acidity of acetylene and terminal alkynes

*Practical: Laboratory Safety*

## WEEK 3

### Course Learning Outcomes

1,2,3,6,7,8,9

- Aromatic compounds (Klein pp 833 – 845, Bruice pp 398- 406, 904 -907, 920)
  - Aromaticity
  - Huckel's Rule
  - Structure of Benzene
  - Stability of Benzene
  - Nomenclature of Benzene derivatives
- Alkyl halides (Klein, pp 289 – 292, Bruice pp 137-138)
  - Nomenclature
  - Structure of alkyl halides
  - Uses of alkyl halides

*Practical 1: Determination of boiling points of organic compounds*

**Assignment 1: SECTION B: Wednesday 23<sup>rd</sup> September 2020**

**SECTION A: Thursday 24<sup>th</sup> September 2020**

## WEEK 4

### Course Learning Outcomes

1,2,3,5,6,7,8,9

- Alcohols and Phenols (Klein pp 577 -583, Bruice pp 140 – 152)
  - Structure and properties of alcohols
  - Nomenclature
  - Physical properties of alcohols
  - Acidity of alcohols and phenols
- Ethers and epoxides (Klein pp 634 – 641, 647 – 648, Bruice pp 139 - 152)
  - Nomenclature of ethers and epoxides

- Structure and properties of ethers and epoxides

*Practical 2: Simple and Fractional Distillation of a hydrocarbon mixture*

**QUIZ 1: SECTION B: Wednesday 30<sup>th</sup> September 2020**

**SECTION A: Thursday 1<sup>st</sup> October 2020**

**Assignment 1 Due: SECTION B: Wednesday 30<sup>th</sup> September 2020**

**SECTION A: Thursday 1<sup>st</sup> October 2020**

## **WEEK 5**

### **Course Learning Outcomes**

**1,2,3,5,6,7,8,9**

- Thiols and Sulfides (Klein pp 663 -665, Bruice pp 530 - 534)
  - Nomenclature of thiols and sulphides
  - Physical properties

*Practical 3: Crystallization and filtration of an organic compound*

## **WEEK 6**

### **Course Learning Outcomes**

**5,6,7,8,9**

### **Revision**

*Practical 4: Identification and properties of alcohols*

## **WEEK 7**

### **Mid-Semester Exam**

## **WEEK 8**

### **Course Learning Outcomes**

**1,2,3,5,6,7,8,9**

- Amines (Klein, pp 1103 – 1115, Bruice pp 142 – 152, 960 – 965, 734-737, 756)
  - Nomenclature
  - Classes
  - Physical properties
- Carbonyl compounds (aldehydes and ketones)(Klein, pp 932 – 951, Bruice pp 775-812)
  - Structure of aldehydes and ketones
  - Nomenclature

*Practical 5: Identification of hydrocarbons, aldehydes, ketones, carboxylic acids and derivatives*

## **WEEK 9 and 10**

### **Course Learning Outcomes**

**1,2,3,5,6,7,8,9**

- Carbonyl compounds (Carboxylic acids and derivatives) (Klein, pp 984 – 1025, Bruice pp 722 - 757)
  - Nomenclature
  - Structure and properties of carboxylic acids and derivatives
- Stereoisomerism (Klein, pp 192 – 226, Bruice pp 179 - 211)
  - Introduction to stereoisomerism
  - Designation of configuration using Cahn-Ingold-Prelog system
  - Optical activity
  - Enantiomers and Diastereomers

- Resolution of enantiomers

*Practical 6: Synthesis of aspirin*

**Assignment 2: SECTION B: Wednesday 11<sup>th</sup> November 2020 (WEEK 10)**

**SECTION A: Thursday 12<sup>th</sup> November 2020 (WEEK 10)**

## **WEEK 11**

### **Course Learning Outcomes**

**6, 7,8,9,10**

- Conformations
- Importance of conformations in drug activity
  - Ethane and propane
  - Cyclopropane, cyclobutane, cyclopentane
  - Cyclohexane
    - Energy associated with different conformations
    - Drawing chair conformations
    - Stability of monosubstituted and disubstituted conformations

**QUIZ 2: SECTION B: Wednesday 18<sup>th</sup> November 2020**

**SECTION A: Thursday 19<sup>th</sup> November 2020**

**Assignment 2 Due: SECTION B: Wednesday 18<sup>th</sup> November 2020**

**SECTION A: Thursday 19<sup>th</sup> November 2020**

## **WEEK 12**

Revision

Group Work

## **WEEK 13**

Revision

Final Exam

## **WEEK 14**

Practical Exam

### **TEACHING METHODS**

1. Lectures will be conducted using PowerPoint presentations, white board and marker, and class discussions.
2. Lectures will be given in class to explain to students various topics in organic chemistry.
3. Lectures will take a participatory approach where the instructor will involve students by frequently asking them questions that are meant to keep them alert and trigger class discussions
4. **Laboratory learning and Experiments:** The lecturer, together with the laboratory technical staff, will take the students through practical sessions, beginning with **demonstrations**. The students will thereafter be expected to use pre formulated laboratory manuals to carry out various practical exercises then write out their findings in their laboratory workbooks.
5. **Assignment criteria:** Students will be given several individual or group research assignments on topics relevant to the course. These could include lectures, discovery learning, problem-based learning, experimental learning, group-based learning, independent studies and e-learning.
6. The instructor will be free to answer questions from students in the course of the lectures and available during office hours for consultations.

7. It is MANDATORY for students to do ALL their practicals, and submit the reports one week after the practical session.
8. The Practical Exam is MANDATORY for all students. It carries 10% of the final grade.

## CORE and RECOMMENDED READING MATERIALS

### CORE TEXTS

1. Bruice, P. Y., Organic Chemistry, 7th Edition, Pearson, 2013.
2. Klein, D., Organic Chemistry, 2<sup>nd</sup> Edition, Wiley, 2015

### RECOMMENDED TEXTS

1. Solomons, G.T.W., Fryhle, C.B., Snyder, S.A., Organic Chemistry, 11th Edition, John Wiley and sons, 2014.
2. McMurry, J., Organic Chemistry, 8th Edition, Cengage Learning, 2011

### COURSE EVALUATION

Attendance and participation	10%
Group Assignments	10%
Continuous Assessment Test/Quiz	10%
Laboratory Practicals	15%
Mid-Semester Exam	20%
Final Exam	25%
End semester practical exam	10%
Total	100%

### KEY INSTITUTIONAL ACADEMIC POLICIES

Students should note the following are key policies as outlined in the University Catalogue and Students Handbook

#### 1. Academic dishonesty

- a. Any intentional giving or use of external assistance during an examination without the express permission of the faculty member giving the examination.
  - b. **Fabrication:** any falsification or invention of data, citation or other authority in an academic exercise;
  - c. **Plagiarism:** any passing off of another's ideas, words, or work as one's own;
  - d. **Previously Submitted Work:** presenting work prepared for and submitted to another course
2. Seven absences from class will result in an automatic grade F

#### 3. For the course to be considered complete student should:

- Sit in for two Quizzes,
- Hand in all assignments (individual and group).
- Attend all practical sessions and hand in Practical reports/ sit for weekly lab tests
- Undertake all examinations (Mid semester, End semester, oral and Practical examination)
- Assignments should be done and submitted on the due dates shown
- No make ups are given for tests assignments and exams
- All references used to do assignments should be cited correctly

4. No student will be allowed to sit for examinations if they show up 20 minutes after the examination has been administered (See the university policy)

### **LockDown Browser Requirement**

This course requires the use of LockDown Browser for online exams. Watch this video to get a basic understanding of LockDown Browser:

<https://www.respondus.com/products/lockdown-browser/student-movie.shtml>

### **Download Instructions**

Download and install LockDown Browser from this link:

<https://download.respondus.com/lockdown/download.php?id=335121814>

### **Once Installed**

- Start LockDown Browser
- Log into Blackboard Learn
- Navigate to the test

Note: You won't be able to access tests with a standard web browser. If this is tried, an error message will indicate that the test requires the use of LockDown Browser. Simply start LockDown Browser and navigate back to the exam to continue.

### **Guidelines**

When taking an online test, follow these guidelines:

- Select a location where you won't be interrupted
- Before starting the test, know how much time is available for it, and also that you've allotted sufficient time to complete it
- Turn off all mobile devices, phones, etc. and don't have them within reach
- Clear your area of all external materials - books, papers, other computers, or devices
- Remain at your desk or workstation for the duration of the test
- LockDown Browser will prevent you from accessing other websites or applications; you will be unable to exit the test until all questions are completed and submitted

### **Getting Help**

Several resources are available if you encounter problems with LockDown Browser:

- The Windows and Mac versions of LockDown Browser have a **"Help Center"** button located on the toolbar. Use the **"System & Network Check"** to troubleshoot issues. If an exam requires you to use a webcam, also run the **"Webcam Check"** from this area
- Respondus has a Knowledge Base available from support.respondus.com. Select the "Knowledge Base" link and then select **"Respondus LockDown Browser"** as the product. If your problem is with a webcam, select **"Respondus Monitor"** as your product
- If you're still unable to resolve a technical issue with LockDown Browser, go to **support.respondus.com** and select **"Submit a Ticket"**. Provide detailed information about your problem and what steps you took to resolve it

## GRADING

A	90 -100
A-	87 - 89
B+	84 - 86
B	80 - 83
B-	77 - 79
C+	74 - 76
C	70 - 73
C-	67 - 69
D+	64 - 66
D	62 - 63
D-	60- 61
F	0 - 59