
SCHOOL OF PHARMACY AND HEALTH SCIENCES

COURSE: CHE 2306: Synthetic Methods in Organic Chemistry

LECTURER : Dr. Edith Amuhaya

CREDIT: 3.0 units

OFFICE HOURS: By Appointment

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COURSE DESCRIPTION

The purpose of this course is to equip the learner with principles and strategies in the synthesis of organic compounds and explain the application of the compounds in pharmacy.

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 commonality 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 racially, 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 experiential forms of learning such as internships and field experiences.

Leadership and ethics. As part of their growth and development, students formulate and articulate the ethical standards and develop the leadership skills which will guide their professional and personal lives.

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.

Program Learning Outcomes

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

1. Produce pharmaceutical products utilizing appropriate procedures and standards;

2. Manage a supply chain for pharmaceutical materials and products;
3. Apply regulatory and ethical instruments that govern the practice of pharmacy;
4. Design therapeutic management regimens for patients;
5. Disseminate knowledge on health related issues;
6. Participate in health research

Course Learning Outcomes

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

1. Describe various strategies for syntheses of C-C, C-N, C-O, C-S and C-P bonds
2. Identify protecting groups for various functional groups used in synthesis
3. Describe various strategies for synthesis of heterocyclic compounds
4. Predict reaction outcomes using arrow pushing mechanisms
5. Describe polymers, their preparations and properties
6. Provide IUPAC names for polymers, and fused ring systems
7. Provide IUPAC names for Heterocyclic, fused ring systems and polymers.
8. Describe the properties of fused ring systems (Heterocyclic, fused ring systems and polymers)
9. Identify applications of heterocyclic compounds and polymers in pharmacy

COURSE CONTENT

WEEK 1

Course Learning Outcomes: 1,4

- Overview and description of the course
- Review of alcohols and alkyl halides
- Nucleophilic Substitution Reactions (Klein, pp 292 – 320, 875 – 882, Bruice pp 426 – 447)
 - S_N1 and S_N2
 - Preparation of alcohol and alkyl halides via S_N1 and S_N2
 - Mechanism of S_N1 and S_N2

WEEK 2

Course Learning Outcomes:1,4

- Nucleophilic Substitution Reactions (Klein, pp 292 – 320, 875 – 882, Bruice pp 426 – 447)
 - Aromatic electrophilic substitution reactions
 - Halogenation of alkanes (Bruice pp 570 - 572)
- Elimination Reactions (Klein, pp 356 – 382, Bruice pp 448 - 480)
 - E1 and E2
 - Preparation of alkenes via E1 and E2
 - Mechanism of E1 and E2

WEEK 3

Course Learning Outcomes:1,4

- Addition reactions of alkenes (Klein, pp 405 – 428, Bruice pp 271 - 295)
 - Addition of H-X, X-X, and H-OH
 - Markovnikov's rule
- Review of alkenes and carbonyl containing compounds
- Strategies for synthesis of C-C bond
 - Diels Alder
 - Stereoselectivity of Diels-Alder reaction

Assignment 1

WEEK 4

Course Learning Outcomes: 1,4 (Klein pp 1045-1071)

- Strategies for synthesis of C-C bond
 - Enolate chemistry
 - Stereoselective aspects of alkylation
 - Kinetic and thermodynamic control
 - Wittig Reaction

Assignment 1 Due

Quiz 1

WEEK 5

Course Learning Outcomes: 1,4 (Klein pp 1103-1128)

- Review of amines
- Strategies for synthesis of C-N bond
 - Preparation of amines via substitution reactions
 - Azide synthesis
 - Gabriel Synthesis
 - Synthesis of amines via reductive amination
- Strategies for synthesis of C-S bonds
 - Preparation of thiols via S_N2 reactions
 - Preparation of sulphides via oxidation reaction

WEEK 6

Course Learning Outcomes: 1,2,4 (Klein pp 663 – 667, 984 - 1027)

- Strategies for synthesis of carbonyl containing compounds
 - Preparation of aldehydes and ketones
 - Reactions of carboxylic acids
 - Reactions of acyl chlorides
- Strategies for synthesis of carbonyl containing compounds
 - Reactions of acid anhydrides
 - Reactions of esters
 - Reactions of amides
- Use of protecting groups in Organic Chemistry

WEEK 7

Mid-Semester Exam

WEEK 8

Course Learning Outcomes: 1,3,4,6,7,8,9

- Synthetic strategies for heterocyclic compounds
- Nomenclature and classification of Heterocyclic compounds
- A Study of Five Membered Heterocyclic Systems containing one heteroatom:

- Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene.

WEEK 9

Course Learning Outcomes: 1,3,4,6,7,8,9

- Aromatic and fused ring systems
 - Structure
 - Nomenclature
 - Properties
 - Conformations
 - Applications in pharmacy
 - A Study of Five Membered Heterocyclic Systems containing two heteroatoms:
 - Synthesis, Reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole, Isoxazole, Thiazole and isothiazole.

WEEK 10

Course Learning Outcomes: 1,3,4,6,7,8,9

- A study of Six membered ring systems with one and two heteroatoms:
 - Synthesis, Reactions and medicinal uses of following compounds/derivatives Pyridine, pyrazine, pyrimidine and pyridazine.
 - Fused ring systems with two heteroatoms: Benzimidazole, Benzthiazole, Indole, phenothiazine, Cinnoline, Quinazoline and Quinoxaline (Nomenclature, Numbering and important drugs having basic structure)

Assignment 2

WEEK 11

Course Learning Outcomes: 4,5,6,7,9

- Polymer Chemistry
 - Introduction to polymer chemistry
 - Nomenclature of synthetic polymers
 - Classification of polymers
 - Preparation of polymers
 - Applications of polymers

Assignment 2 Due

Quiz 2

WEEK 12

Revision

WEEK 13

Final Exam

WEEK 14

Final Exam

TEACHING METHODS

1. Lectures will be conducted using PowerPoint presentations, white board and marker, and class discussions.

- Lectures will be given in class to explain to students various topics in organic chemistry.
- 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
- 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.
- The instructor will be free to answer questions from students in the course of the lectures and available during office hours for consultations.

CORE and RECOMMENDED READING MATERIALS

CORE TEXTS

- Klein, D., Organic Chemistry, 2nd Edition, Wiley, 2015
- Bansal, Raj K. Heterocyclic chemistry
- Jacobi, Peter A., Introductory Heterocyclic Chemistry

Recommended Texts

- Bruice, P. Y. (2013). Organic Chemistry, 7th Edition. Pearson Prentice Hall.

COURSE EVALUATION

Attendance and participation	10%
Individual/Group Assignments	15%
Continuous Assessment Test/Quiz	20%
Mid-Semester Exam	25%
Final Exam	30%
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

- Any intentional giving or use of external assistance during an examination without the express permission of the faculty member giving the examination.
 - Fabrication:** any falsification or invention of data, citation or other authority in an academic exercise;
 - Plagiarism:** any passing off of another's ideas, words, or work as one's own;
 - Previously Submitted Work:** presenting work prepared for and submitted to another course
- More than seven absences from class will result in an automatic grade F
 - For the course to be considered complete student should:
 - Sit in for two Quizzes,
 - Hand in all assignments (individual and group).
 - Undertake all examinations (Mid semester and End semester)
 - 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
 - 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)

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

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