School of Chemistry
Faculty of Science
University of the Punjab, Lahore
Course Outline

BS Chemistry Semester-III					
Programme	**BS Chemistry**	**Course Code**	**Chem-231**	**Credit Hours**	**3**
Course Title	**Reaction Mechanism-I**		**Course Type**	**Major**	

Course Introduction

The course is designed to provide an adequate knowledge about the mechanisms and applications of a set of classes and well-known reactions in organic synthesis.

Active Methylene Compounds

Enols and enolates, Kinetic and thermodynamic enolates, alkylation, acylation and halogenation of active methylene compounds, acid and base catalyzed reactions of mono-functional and bi-functional active methylene compounds e.g. malonic ester, β-ketoester, cyanoester, malononitrile, and dinitro compounds etc. Cyclization and decarboxylation.

Name Reactions

Description, Conditions, mechanism and synthetic applications of the following named reactions; Aldol, Claisen, Diekmann, Perkin, Henry, Knoevenagel, Reformatsky, Darzen's (glycosidic ester synthesis), and Mannich reaction.

Acid baseElectronic (Inductive and resonance) effects, steric and solvent effects, hyper-conjugation, hydrogen bonding, tautomerism, strength of acids and bases (pKa and Ka values), Influence of all these phenomena on the strength of acids and bases, aromaticity along with non- and anti-aromaticity.

Learning Outcomes

On the completion of the course, the students will:

1. The students are expected to be familiarized with the basics of active methylene compounds.
2. They will learn about the named reactions.
3. They will learn about the basic concepts of acids and bases.

Course Content		Assignments/Readings
Week 1	**Active Methylene Compounds** Enols and enolates	Enlist bases and reagents used in synthesis starting from active methylene compounds
	Kinetic and thermodynamic enolates	Literature survey
	Alkylation of active methylene compounds.	Practice problems
Week 2	Alkylation of active methylene compounds.	
	Acylation of active methylene compounds	Practice problems
	Acylation of active methylene compounds	
Week 3	Halogenation of active methylene	Practice problems
	Acid catalyzed reactions of mono-functional active methylene compounds	
	Acid catalyzed reactions of bi-functional active	Practice problems

	methylene compounds	
Week 4	Base catalyzed reactions of mono- functional active methylene compounds	
	Base catalyzed reactions of bi-functional active methylene compounds	
	Name Reactions Description, Conditions, mechanism and synthetic applications of Aldol condensation reaction.	
Week 5	Description, Conditions, mechanism and synthetic applications of Claisn condensation reaction.	Practice problems
	Description, Conditions, mechanism and synthetic applications of Diekmann reaction.	
	Description, Conditions, mechanism and synthetic applications of Perkin condensation reaction.	Practice problems
Week 6	Description, Conditions, mechanism and synthetic applications of Henry reaction.	
	Description, Conditions, mechanism and synthetic applications of Knoevenagel condensation reaction.	Practice problems
	Description, Conditions, mechanism and synthetic applications of Reformatsky reaction.	
Week 7	Description, Conditions, mechanism and synthetic applications of Darzen's (glycosidic ester synthesis) reaction.	Practice problems
	Description, Conditions, mechanism and synthetic applications of Mannich reaction.	
	Quiz	
Week 8	**Mid-Term Week**	
Week 9	Acid Base Electronic (Inductive and resonance) effects	
	Electronic (Inductive and resonance) effects	Practice problems
	Steric effect	
Week 10	Solvent effect	
	Hyperconjugation	Practice problems
	Hydrogen bonding	
	Tautomerism	
Week 11	Strength of acids (pKa and Ka values)	
	Strength of bases (pKa and Ka values)	
Week 12	Influence of electronic effect on the strength of Acids.	

	Influence of steric and solvent effect on the strength of Acids.	
	Influence of hyper-conjugation on the strength of Acids.	
Week 13	Influence of hydrogen bonding on the strength of Acids.	
	Influence of tautomersim on the strength of Acids.	
	Influence of electronic effect on the strength of Bases.	Practice problems
Week 14	Influence of steric and solvent effect on the strength of Bases.	
	Influence of hyperconjucation on the strength of Bases.	
	Influence of hydrogen bonding on the strength of Bases.	
Week 15	Influence of tautomersim on the strength of Acids.	
	Aromaticity	Search out reasons of aromaticity.
	Non- and anti-aromaticity	Practice problems
Week 16	**Final-Term Week**	

Textbooks and Reading Material

1. J.G.Smith,Organic chemistry,3rd Ed,McGraw Hill companies,2012. Organic Chemistry, Vol. I (6th Ed.) and II (5th Ed.) by I.L. Finar, Pearson Education (Singapore) Pvt. Ltd. 2008.
2. A Text-Book of Organic Chemistry by M. Younas, ILMI, Pakistan.
3. Organic Chemistry, (5th Ed.) by S.H. Pine, McGraw Hill, New York, USA, 1987.
4. Organic Chemistry, (6th Ed.) by R.T. Morrison, R.N. Boyd and R.K. Boyd, Benjamin Cummings, 1992.
5. Modern Synthetic Reactions, (2nd Ed.) by H.O. House, W.A. Banjamin Inc., Menlo Park, CA.
6. Principals in Organic Synthesis, by R.O.C. Norman and M.J. Coxon, Chapman and Hall, 1993.
7. T.W.G. Solomons and C.B. Fryhle, *Organic Chemistry*, John Wiley and Sons, New York (2014).
8. J. Clayden, N. Greeves, S. Warren and P. Wothers, *Organic Chemistry*, 2nd ed., Oxford University Press, New York (2012).
9. J. March, *Advanced Organic Chemistry*, 7th ed.,John Wiley and Sons, New York (2013).
10. F.A. Carey, *Organic Chemistry*, 8th ed., McGraw-Hill, New York (2010).
11. R.O.C. Norman and J.M. Coxon, *Principles of Organic Synthesis*, Nelson Thornes Cheltenham (2013).

Teaching Learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work/Numerical problem sets
4. Seminar/ Workshop

Assignments: Types and Number with Calendar

1. Practice questions from the exercises from the recommended textbook.
2. Literature review based assignment relevant to the course will also be given during the course

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.