Course Syllabus
Gyanmanjari Science College
Semester-5 (B.Sc)

Subject: Reaction Mechanism - BSCCM15316

Type of course: Major

Prerequisite: A basic understanding of chemical bonding, hybridization, and general principles of acid-base behavior is essential to grasp the concepts of organic reaction mechanisms.

Rationale: The study of organic reaction mechanisms provides a foundational framework for understanding how and why chemical reactions occur, enabling the prediction and design of new reactions and compounds in organic chemistry.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				ESE		CCE			
CI	T	P	C	Theory	Practical	MSE	LWA/V	ALA	
3	0	2	4	75	25	30	20	50	200

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; MSE- Mid Semester Examination; LWA - Lab Work Assessment; V – Viva voce; CCE-Continuous and Comprehensive Evaluation; ALA- Active Learning Activities.

3 Credits * 25 Marks = 75 Marks (each credit carries 25 Marks) Theory
1 Credits * 25 Marks = 25 Marks (each credit carries 25 Marks) Practical
SEE 100 Marks will be converted in to 50 Marks
CCE 100 Marks will be converted in to 50 Marks
It is compulsory to pass in each individual component.

Course Content:

Unit No	Course Content	Hrs	% Weightage
1	**Chemical Kinetics and Reaction Pathways** Introduction, Homolytic bond fission, Heterolytic bond fission, Nucleophiles and electrophiles, Leaving group, solvent, Low and High reactivity of vinyl and aryl halides, Addition reactions :-Electrophilic additions, Nucleophilic addition, and Free radical additions, Elimination Reactions:- Biomolecular elimination reactions, Unimolecular elimination reactions. Electrophilic substation in aromatic systems.	15	25%
2	**Oxidation** Introduction, oxidation of alcohols/Phenols using chromic acid and sodium or potassium dichromate, Jones reagent, chromium trioxide – pyridine complex, pyridinium chlorochromate, pyridinium dichromate, oxidation of alkanes, oxidation of alkenes, oxidation of aromatic side chains and aromatic nucleus, oxidation with peracids, oxidation of ketones, oxidation of N-heterocylces, oxidation of primary, Secondary and tertiary alcohols, oxidation of diols, oxidation of phenols, oxidation of aldehyde, oxidation of ketones, oxidation of amines and cyanides.	10	25%
3	**Reduction** Introduction, reduction of alkenes, reduction of alkynes, reduction of aromatic compounds, reduction of aldehydes and ketones, reduction of nitriles, oximes, and nitro compounds, reduction with metal hydrides using Lithium aluminium hydride, sodium borohydride, sodium cyanoborohydride, reduction by dissolving metals using sodium- alcohol, sodium – liquid ammonia, magnesium.	10	25%
4	**Some reactions, mechanisms and applications** Acetoacetic ester synthesis, Aldol condensation, Barton reaction, Benzoin condensation, Cannizzaro reaction, Chichibabin reaction, Diels-alder reaction, Ene reaction, Etrad reaction, Haloform reaction, Henery reaction, Hofmann Elimination, Mannich reaction, Perkin reaction, Riemer-Tiemann Reaction, Skraup synthesis, Stephen reaction, Wolff-kishner reduction, Wurtz reaction.	10	25%

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Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Blank Mechanism Challenge** Provide reactants and conditions, and students draw the full reaction mechanism, starting from scratch, including intermediates and electron flow and upload it on GMIU web Portal.	10
2	**Flowcharts** Students draw step-by-step reaction mechanisms, including all intermediates and arrows, to visualize the flow of electrons and upload it on GMIU web portal.	10
3	**Identify the Errors**: Give students a reaction mechanism with deliberate mistakes (e.g., incorrect arrow directions or missing steps) and ask them to correct them and upload it on the GMIU Web Portal.	10
4	**Predict the Product**: Students analyze a reaction mechanism and predict the product(s), explaining their reasoning step-by-step and upload it on GMIU web Portal.	10
5	**Attendance**	10
Total		50

List of Practical:

Sr. No	Descriptions	Unit No	Hrs
1	To synthesize acetanilide from aniline.	ALL	3
2	To synthesize p-bromoacetanilide from acetanilide.		3
3	To synthesize p-bromoaniline from p-bromoacetanilide.		3
4	To synthesize p-nitroacetalnilide from acetalnilide.		3
5	To synthesize p-nitroaniline from p-nitroacetalnilide.		3
6	To synthesize m-dinitrobenzene from nitrobenzene.		3
7	To synthesize picric acid from phenol.		3
8	To synthesize β – Naphthylacetate from β – naphthol.		3
9	Synthesis of di-benzylacetone from benzaldehyde.		3
10	Synthesis of p-chlorotoluene from toluidine.		3
		Total	30

Suggested Specification table with Marks (Theory):75

Distribution of Theory Marks **(Revised Bloom's Taxonomy)**						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	30%	30%	30%	10%	00	00

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Explain homolytic and heterolytic bond fission and their role in reaction mechanisms.
CO2	Analyze the oxidation of alcohols using reagents like Jones reagent and predict the products.
CO3	Examine the reduction of aldehydes, ketones, and nitriles to their respective products.
CO4	Utilize reactions like Stephen reduction, Mannich reaction, and Wurtz reaction to design synthetic pathways for complex molecules.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
From the content 10% topics are suggested for flipped mode instruction.
Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory
The internal evaluation will be done on the basis of Active Learning Assignment
Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Organic Reaction Mechanisms by V.K Alhuwalia.
[2] Advanced Organic Chemistry: Reaction Mechanisms by Reinhard Bruckner.
[3] Mechanism and Theory in Organic Chemistry by Peter Sykes.
[4] Organic Chemistry: Structure and Mechanisms by Robert J. Ouellette and J. David Rawn.
[5] Organic Reaction Mechanisms: A Step-by-Step Approach by Michael Edenborough.

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