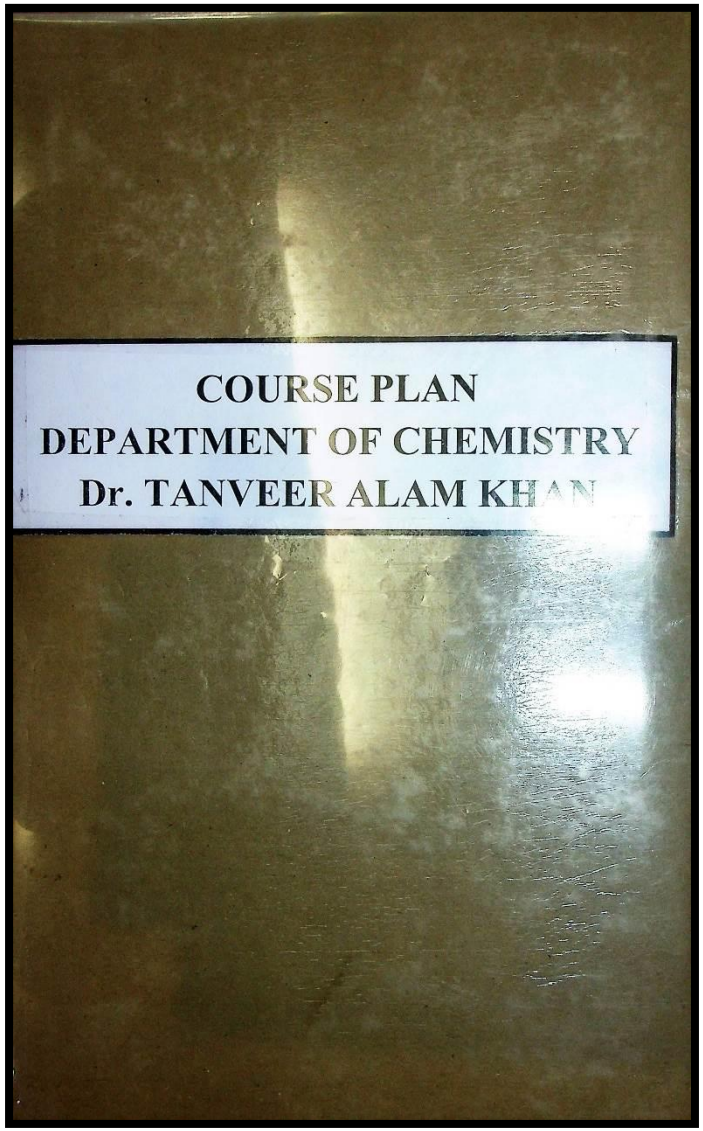
COURSE PLAN
DEPARTMENT OF CHEMISTRY
Dr. TANVEER ALAM KHAN

COURSE PLAN

U.G. & P.G. Programs

2021-22

ODD SEMESTER

SOPHIA GIRLS' COLLEGE (*AUTONOMOUS*), AJMER
B. Sc. I (SEMESTER-I)

INORGANIC CHEMISTRY (PAPER I) (CHE-101)

Max. Marks: 75 (50 Ext; 25 Int) Min. Marks: 30 (20 Ext; 10 Int) Credit: 03

COURSE PLAN

SEM / Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM I / DECEMBER	**UNIT III** **Nuclear Chemistry** Introduction, fundamental particles of nucleus, concept of nuclides and its representation, types of nuclides-isotopes, isobars, isotones and nuclear isomers, stability of nucleus (n/p ratio)	Basic concepts of nuclides and their importance	PPT, Chart, Audio-visual tutorials, Quizzes	Discuss the concept of nuclear chemistry and radioactivity.	*Knowledge Based* -Define isotopes, isobars and isotones. *Understanding Based* -Describe the applications and importance of half-life of radioactive substances. *Higher Order Thinking Skills Based* -Explain the concept of nuclear fission and	Knowledge-60 Understanding-30 Higher Order-10
	Radiochemistry Introduction to radioactivity, Natural and Artificial radioactivity, Radioactive Disintegration, disintegration series, Radioactive Displacement Law, rate of radioactive decay, Half-life and Average life, applications of radioactivity, binding energy and its	Concepts of radiochemistry, radioactive decay, half-life and average life of radioactive substances	Chart, PPT, Diagrams, Quizzes			

	calculation, mass defect and its calculation, Nuclear reactions: Bethe's Notation for nuclear reactions, Spallation, Nuclear fission and Nuclear fusion.				nuclear fusion.	

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SOPHIA GIRLS' COLLEGE (*AUTONOMOUS*), AJMER
B. Sc. I (SEMESTER-I)

ORGANIC CHEMISTRY (PAPER II) (CHE-102)

Max. Marks: 75 (50 Ext; 25 Int) Min. Marks: 30 (20 Ext; 10 Int) Credit: 03

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM I / SEPTEMBER	Unit–I **Structure and Bonding** Hybridization, bond length and bond angles, bondenergy, Vander Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, inductive and field effects, hydrogen bonding.	Structure and electronic effects in reference to organic molecules.	PPT, Diagrams, 3D-models, Audio-visual tutorials, Flow Chart	Predict structure and bonding in common organic molecules and mechanism of organic reactions.	*Knowledge Based* -Define Saytzeff rule. -Why peroxide effect is observed in addition of H-Br and not for H-Cl and H-I ?	Knowledge-60 Understanding-30 Higher Order-10

	Mechanism of Organic Reactions Curved arrow notation, drawing electron movements with arrows, half-headed and full headed arrows, homolytic and heterolytic bond fission, Types of reagents- electrophiles and nucleophiles, Types of organic reactions, Energy considerations, Reactive intermediates- carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with example).	Reagents and Intermediate in various Organic reactions			*Understanding Based* -Arrange the following alkenes in the decreasing order of their stabilities explain with reason $CH_2=CH_2$, $R_2C=CH_2$, $R_2C=CR_2$ -Compare the stability of cyclopropane and cyclohexane. *Higher Order Thinking Skills Based* -Justify the unequal formation of 1,2 and 1,4 products in 1,3-butadiene at different temperatures. -Evaluate substitution at the allylic and vinylic positions of alkenes.	
SEM I / OCTOBER	**Unit–II** **Alkanes** Methods of preparation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.	Structure and reactivity of alkanes	PPT, 3D-models, Demonstration, Audio-visual tutorials	Review the preparation and chemical reactions of alkanes and cycloalkanes		

	Cycloalkanes Nomenclature, methods of preparation, chemical reactions, Baeyer's strain theory and its limitations, Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings, cyclopropane ring: banana bonds.	Structure , stability and reactivity of cycloalkanes				
SEM I / NOVEMBER DECEMBER	**Unit-III** **Alkenes** Methods of preparation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration- Saytzeff rule, Hoffmann elimination, physical properties and relative stabilities of alkenes, Chemical reactions of alkenes- mechanisms involved in hydrogenation, electrophilic and free radical additions, halogenation, hydrohalogenation, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, epoxidation, ozonolysis, hydration, hydroxylation and	Structure and reactivity in context to regioselectivity in different alkenes.	Flow chart, Diagrams, 3D-Models, Demonstration	Summarize the chemical behaviour of alkenes, dienes and alkynes.		

	oxidation with $KMnO_4$, Substitution at the allylic and vinylic positions of alkenes.					
	Alkynes Methods of preparation, chemical reactions of alkynes- hydrogenation, halogenation, hydrohalogenation, hydration, hydroboration and hydroxylation, ozonolysis of alkynes, acidity of alkynes, mechanism of electrophilic and nucleophilic addition reactions, metal-ammonia reductions and oxidation.	Electrophilic addition and reactions of alkynes	Diagrams, Models, Demonstration, Flow Charts			
	Dienes Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene method of formation, polymerization. Chemical reactions- 1,2 and 1,4 additions, Diels-Alder reaction.	Structure of dienes and thermodynamic and kinetic control of reactions	PPT, Demonstration, Flipped Classroom			

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SOPHIA GIRLS' COLLEGE (*AUTONOMOUS*), AJMER
M.Sc. CHEMISTRY (FINAL)
SEMESTER III (M.Sc. F)

SPECTROSCOPY (CHEM-301)

Max. Marks: 100 (70 Ext; 30 Int) Min. Marks: 40 (28 Ext; 12 Int) Credit: 06

COURSE PLAN

SEM/ Month	Unit/Topic	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM III/ SEPTEMBER-OCTOBER	**Unit- I** **^{13}C NMR Spectroscopy** Difficulties and solution for recording ^{13}C–NMR spectra, recording of ^{13}C-NMR spectra-scale, solvent, solvent signals, their positions and multiplicity, Chemical shifts in ^{13}C-spectra- correlation chart, chemical shift calculations for alkanes, alkenes, alkynes and aromatic compounds, proton coupled and decoupled, ^{13}C spectra- broad band	Concepts and principles of ^{13}C – NMR Spectroscopy and practical applications based upon various types of ^{13}C NMR-spectroscopy	Diagrams, PPT, Charts, Quizzes	Summarize the concepts of ^{13}C-NMR spectroscopy	*Knowledge Based* -Why ^{13}C is NMR active while ^{12}C is not? -Define base peak in mass spectrometry. *Understanding Based* -Compare ^{13}C-NMR and ^{1}H-NMR spectroscopy.	Knowledge-25 Understanding-45 Higher Order-30

	decoupling, off resonance technique, ^{13}C-DEPT Spectra-differentiation in primary, secondary and tertiary carbons by DEPT-45, DEPT-90, DEPT-135 Spectra, Nuclear Overhauser Effect.				-Compare the natural abundance of ^{1}H and ^{13}C nuclei with their respective isotopes in context of NMR spectroscopy. *Higher Order Thinking Skills Based* -Elaborate the use of ^{13}C- spectra in differentiating the primary, secondary and tertiary carbons by DEPT-45, DEPT-90 and DEPT- 135 spectra. - Explain High Resolution Mass Spectrometry (HRMS) in detail.	
SEM III/ NOVEMBER	**Unit-II** **Mass Spectroscopy** Introduction, Instrumentation- sample inlet, ion production- EI, CI, FD and FAB, separations of ions in mass analyser, ion detector- recorder, Isotope abundances, molecular ion, metastable ions, Nitrogen rule, Fragmentation- general modes, factors affecting fragmentation, Mass spectral fragmentation of some classes of organic compounds and common functional groups- Alkanes, cycloalkanes, alkenes, cycloalkenes, alkynes,	Instrumental and spectral aspects of Mass Spectroscopy	Quizzes, Diagrams, Audio-visual tutorials	Analyse the mass spectral fragmentation of organic compounds for their structure determination.		

	cycloalkynes, aromatic compounds, Alcohols, Phenols, ethers, ketones, aldehydes, carboxylic acids, esters, amides, amines, nitriles. High Resolution Mass Spectrometry.					
SEM III/ DECEMBER	**Unit-III** UV-Visible, IR, ^{1}H- NMR, ^{13}C- NMR, MASS- interpretation of common organic compounds.	Applications of various spectroscopic techniques	PPT, Flow charts, quizzes, audio-visual tutorial	Interpret the structure of different organic compounds with the help of spectroscopic data.		

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SOPHIA GIRLS' COLLEGE (*AUTONOMOUS*), AJMER
M.Sc. CHEMISTRY (PREVIOUS)
SEMESTER III (M.Sc. F)

Practical (CHEM-305)

Max. Marks: 100 (70 Ext; 30 Int) Min. Marks: 40 (28 Ext; 12 Int) Credit: 06

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM III/ SEPTEMBER-OCTOBER	**A. INORGANIC PREPARATIONS** 1. Prepare sodium amide 2. Prepare calcium oxalate 3. Prepare magnesium oxalate 4. Prepare sodium tetrathionate $Na_2S_4O_6$ 5. Prepare vanadyl acetylacetonate $VO(acac)_2$ 6. Prepare $Fe(acac)_2$ 7. Prepare $R_2Sn(acac)_2$ 8. Prepare $Cr(acac)_2$ 9. Prepare $Cu(acac)_2\ H_2O$ 10. Prepare $Al(acac)_3$ 11. Prepare tris (acetyl acetanato) manganese(II) 12. Prepare Fe(II) chloride 13. Prepare ferrocene 14. Prepare copper glycine complex. 15. Prepare $CuCl_2.2DMSO$	Methods of Synthesis of various inorganic compounds	Demonstration of the exercises with use of different apparatus and glassware, Diagrams	Understand the practical applications of various aspects of chemistry	*Knowledge Based* -Practical File Work *Understanding Based* -To study the effect of addition of an electrolyte on the solubility of an organic acid. -To study the Beer-Lambert's law	Knowledge-20 Understanding-40 Higher Order-40

SEM III / DECEMBER	**B. PHYSICAL CHEMISTRY** 1. Determine the partial molar volume of solute and solvent in a binary mixture. 2. Study the effect of addition of an electrolyte on the solubility of an organic acid. 3. Determine the composition of binary mixture containing $K_2Cr_2O_7$ and $KMnO_4$ using spectrophotometer. 4. Determine the heat of neutralization of hydrochloric acid by sodium hydroxide. 5. Determine the heat neutralization of two acids eg HCl and CH_3COOH and hence their relative strengths. 6. Study the adsorption of iodine form alcoholic solution on charcoal. 7. Study the adsorption of certain dyes such as methyl violet, picric acid or malachite green on charcoal.	Use of various instruments like colorimeter, pH meter.	Demonstration of Exercises with use of different instruments like pH meter, colorimeter etc., Diagrams	Understand the practical applications of various aspects of chemistry	using absorption phenomenon by colorimeter. *Higher Order Thinking Skills Based* -Viva- Voce	

	8. Study the influence of added impurity on rotation of a solute. 9. Estimate the amino acid using ninhydrin method. 10. Verify Beer's law for the solubility and determine the concentration of the given unknown aqueous solution of $KMnO_4$.					

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