

Sardar Patel University
B.Sc. Advanced Organic Chemistry (UG) Semester III
Effective from June 2025

Course Code	Course Title	Course Type	T/P	Credits	Number of Hours per Week
UT03MAAOC01	Essential Organic Chemistry	Disciplinary Major	T	4	4

Course Objective	To make students familiar with: <ul style="list-style-type: none"> - Classification and bonding in organic chemistry - Nature and types of bonding in organic chemistry - Introduction of electrophiles and nucleophiles and reaction intermediate - Introduction of cycloalkanes
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Course Content		
Unit	Description	Weightage (%)
1.	Basic Concepts in Organic Chemistry: Classification of Organic Compounds: Alkanes, alkenes, alkynes, aromatic compounds, and heterocyclic compounds. Bonding in Organic Compounds: Covalent bonding, sigma and pi bonds, hybridization (sp , sp^2 , sp^3). Structural Formulas: Molecular formula, empirical formula, structural formula, condensed formula, and skeletal formula.	25
2.	Structure and Bonding in Organic Compounds: Covalent Bonding: Bond formation between atoms in organic compounds, polarity of bonds. Types of Bonding: Single, double, and triple bonds; pi and sigma bonding. Resonance: Concept of resonance, resonance structures, and their importance in organic compounds.	25
3.	Concept of Electrophiles and Nucleophiles: Electrophiles: Definition, examples, and significance in organic reactions. Nucleophiles: Definition, examples, and role in organic reactions. Reaction intermediates: Carbocations, carbanions, free radicals, and their stability.	25
4.	Alkanes and Cycloalkanes: Alkanes: Structure and Nomenclature, Preparation of Alkanes, Conformations of Alkanes: Newman projections, staggered and eclipsed conformations in ethane and butane. Cycloalkanes: Structure and Nomenclature: Cyclohexane, cyclopropane, cyclobutane, and their properties, Conformations of Cyclohexane: Chair, boat, and twist forms, Baeyer's Strain Theory: Strain in small cycloalkanes (cyclopropane, cyclobutane) due to bond angles.	25

Course Outcomes	After completion of course, students will be able to learn: <ul style="list-style-type: none">- Classification, bonding and structural formulas of organic compounds- understanding bonding in organic molecules- knowledge of electrophiles, nucleophiles, and reaction intermediates- the significance of alkanes and cycloalkanes
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Reference Books:

1. Organic Chemistry by Morrison and Boyd, 7th edition, Pearson Education India.
2. Organic Chemistry by J. Clayden, N. Greeves, and S. Warren, 2nd edition, O.U.P India.
3. Stereochemistry of Organic Compounds by D. Nasipuri, 4th edition, New age international publisher.
4. Advanced Organic Chemistry by F. A. Carey and R. J. Sundberg, 5th edition, Springer.

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Course Code	Course Title	Course Type	T/P	Credits	Number of Hours per Week
UT03MAAOC02	Organometallic Chemistry	Core Course	T	4	4

Course Objective	<ul style="list-style-type: none"> - To make students aware of fundamental concepts, bonding and reactions of organometallic compounds. - Make students aware of role of organometallics in catalysis and their use in modern synthetic methodologies.
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Course Content		
Unit	Description	Weightage (%)
1.	Introduction to Organometallic Compounds Definition of organometallic compounds, Historical background, Organic ligands and Nomenclature of organometallic compounds, Classifications and General characteristics of organometallic compounds, Scope of organometallic compounds in various fields	25
2.	Bonding and Structure of Organometallic Compounds Types of metal-carbon bonds(σ -bonded and π -bonded organometallics), Classifications and General characteristics of organometallic compounds, Electron counting in organometallic compounds(18 electron rule and exceptions)	25
3.	Synthesis and Reactions of Organometallic Compounds Synthesis of Organometallic Compounds: Oxidative addition reactions, Metal-Metal exchange reactions, Carbanion-Halide exchange reactions, Metal-Hydrogen exchange reactions Reactions of Organometallic Compounds: Oxidative addition, Reductive elimination, Migratory insertion, β -H elimination reactions	25
4.	Catalytic Application of Organometallic Compounds: Introduction to homogeneous and heterogeneous catalysis, Organometallic compounds as homogeneous catalysts(Hydrogenation of alkenes, Hydroformylation reaction, Polymerization of alkene, Water gas reaction	25

Course Outcomes	<ol style="list-style-type: none"> 1. Learner will be able to understand the basic concepts and significance of organometallic compounds. 2. Students will be able to understand the bonding and structure of organometallic compounds and apply electron-counting rules to determine stability. 3. Students will be able to analyze reaction mechanisms involved in their formation and apply these in synthetic problem solving. 4. Students can be able to explain the catalytic cycles of key industrial processes.
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Reference Books:

1. Organometallic & Bioinorganic Chemistry by Ajai Kumar, Aaryush Education Publication.
2. Organometallic Chemistry by R.C.Mehrotra & Anirudh Singh, New Age International (P) Limited, Publishers, New Delhi
3. Inorganic Chemistry by James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Harper Collins College Publishers.
4. Organometallic Compounds by G.E. Coates, John Wiley & Sons, Inc., New York.
5. Inorganic Chemistry by C.E. Housecroft and Alan G. Sharpe, Pearson Publication.

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Course Code	Course Title	Course Type	T/P	Credits	Number of Hours per Week
UT03MAAOC03	Organic Chemistry Practical	Disciplinary Major	P	4	8

Course Objective	To make students familiar with: <ul style="list-style-type: none"> - Practical in organic chemistry as a subject - Practical aspects of qualitative analysis of binary organic mixture
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Course Content		
Practical	Description	Weightage (%)
	<p>Practical-I: Separation and Identification of Binary Solid Organic Mixture (A/B/P/N) such as Solid + Solid.</p> <ul style="list-style-type: none"> • Solid Carboxylic Acid: (Benzoic Acid, Salicylic Acid, Cinnamic Acid, Phthalic acid etc.) • Solid Phenol: (α-naphthol, β-naphthol etc.) • Solid Base: (<i>o</i>, <i>m</i>, and <i>p</i>-nitroaniline etc.) • Solid Neutral: (<i>p</i>-dichlorobenzene, naphthalene, anthracene, benzamide, acetanilide, <i>m</i>-dinitrobenzene etc.) <p>Practical-II: Preparation of the following organic compounds.</p> <p>i) Synthesis of bis azo acid dye</p> <p>ii) Synthesis of methyl orange</p> <p>iii) Synthesis of mordent yellow</p>	100
Course Outcomes	After completion of the course, students will be able to learn: <ul style="list-style-type: none"> - Learn about the separation and identification of binary organic mixtures, which will be beneficial for them in higher study. - Improve the practical skills of students. 	

Reference Books:

1. Elementary Practical Organic Chemistry Qualitative Organic Analysis by A. I. Vogel, Pearson publisher.
2. Advanced Practical Organic Chemistry by N. K. Vishnoi, 3rd edition, S Chand.
3. Vogels Textbook of Practical Organic Chemistry by B. S. Furniss, A. J. Hannaford, P W. G. Smith, A. R. Tatchell, 5th edition, Pearson publisher.
4. Comprehensive Practical Organic Chemistry: Qualitative Analysis by V. K. Ahluwalia and Sunita Dhingra, University Press.
5. Systematic Identification of Organic Compounds by Ralph L. Shriner, cbspd publisher.

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Course Code	Course Title	Course Type	T/P	Credits	Number of Hours per Week
UT03MDAOC01	Bioinorganic Chemistry	Multidisciplinary	T	2	2

Course Objective	<ul style="list-style-type: none"> - To introduce the principles of bioinorganic chemistry - Function and Transport of Alkali and Alkaline earth metals, Metalloporphyrins / Metalloenzymes
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Course Content		
Unit	Description	Weightage (%)
1.	<p>General Principles of Bioinorganic Chemistry Occurrence and availability of Inorganic elements in biological systems. Basics of Bio mineralisation. Function and Transport of Alkali and Alkaline earth metals Uptake, transport and storage of metal ions by organisms - structure and functions of biological membranes - the generation of concentration gradients (the Na⁺ - K⁺ pump) - mechanisms of ion-transport across cell membranes – bleomycin - siderophores (e.g. enterobactin and desferrioxamine) - transport of iron by transferring - storage of iron by ferritin - bio chemistry of calcium as hormonal messenger. Metals at the Center of Photosynthesis: Primary Processes in Photosynthesis – Photosystems I and II.</p>	50
2.	<p>Metalloporphyrins/Metalloenzymes Dioxygen transport and storage - hemoglobin and myoglobin: electronic and spatial structures - heme-thyrin and hemocyanine - synthetic oxygen carriers, model systems - blue copper proteins (Cu) - iron-sulfur proteins (Fe)- cytochromes electron transport chain - carbon monoxide poisoning - iron enzymes - peroxidase, catalase and cytochrome P-450, copper enzymes - superoxide dismutase, carboxypeptidase, carbonicanhydrase, vitamin B12 and B12 coenzymes, nitrogen fixation. Medicinal bioinorganic chemistry: platinum complexes in cancer therapy – cis-platin and its mode of action – metal toxicity.</p>	50
Course Outcomes	After completion of course, students will be familiar with: - Ensures the students to understand, concepts concepts of Bioinorganic Chemistry, Function and Transport of Alkali and Alkaline earth metals, Metalloporphyrins / Metalloenzymes,	

Reference Books:

1. Purcell, K. F. and Kotz, J. C., Inorganic Chemistry, Cengage Learning, 2012.
2. Cotton, F. A., Wilkinson, G., Carlos A. Murillo, Manfred Bochmann, Advanced Inorganic Chemistry, 6th ed., A Wiley - Interscience Publication, John -Wiley & Sons, USA, 2007. Chem. Education, 62, No. 11, Bioinorganic Chemistry, State of the Art. 1985.
3. Eichorn, G. L., Inorganic Biochemistry, Volumes 1 & 2, 2nd ed., Elsevier Scientific Publishing Company, New York, 1973.
4. Atkins, P., Overton, T., Rourke, J., Weller M., and Armstrong, F., Inorganic Chemistry, 5th edition, Oxford University Press, 2010.
5. Lehninger, A., Nelson, D. L., Cox, M. M, Principles of Biochemistry, 5th edition, W.H Freeman, 2008.
6. Alessio, E., Bioinorganic Medicinal Chemistry, 1st Edition, Wiley-VCH Verlag GmbH Co. KGaA, 2012.

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Course Code	Course Title	Course Type	T/P	Credits	Number of Hours per Week
UT03MDAOC02	Bioinorganic Chemistry Practical	Multidisciplinary	P	2	2

Course Objective	To make students aware of: <ul style="list-style-type: none"> - Multidisciplinary approach to biological systems. - Physical and Chemical Aspects of Biological molecules.
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Course Content	
Sr. No.	Description
1.	Determination of Iron Content in Hemoglobin.
2.	UV-Visible Spectroscopy of Metalloproteins.
3.	Estimation of Zinc in a Biological Sample.
4.	Extraction and Analysis of Bioavailable Metals in Soil.
5.	Study of Redox Reactions of Metal Ions.
6.	Preparation of Schiff Base Metal Complexes.
7.	Preparation of a Copper (II)-Glycinate Complex.
Course Outcomes	After completion of course, students will be familiar with: Basic of physical and chemical aspects of biological systems.

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Course Code	Course Title	Course Type	T/P	Credits	Number of Hours per Week
UT03AEAOC01	Functional Grammar and Composition	AEC (Compulsory)	T	2	2

Course Objective	<ul style="list-style-type: none"> - To enhance student's understanding of functional grammar in academic and scientific writing. - To develop effective writing skills for various forms of composition, including essays, reports, and research papers. - To promote clarity and coherence in communication, particularly in scientific contexts.
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Course Content		
Unit	Description	Weightage (%)
1.	Functional Grammar <ul style="list-style-type: none"> - Introduction to Functional Grammar - Sentence Structure - Tenses and Aspect - Punctuation and Cohesion - Practical Application: Writing exercises focused on grammar skill 	50
2.	Composition Skills <ul style="list-style-type: none"> - Writing Structure: Understanding the components of a well-structured paragraph and topic sentences - Essay Writing - Technical Reports: Components and structure of technical reports; clarity and precision in scientific writing - Research Papers: Understanding the format and style of research papers; citing sources and avoiding plagiarism - Final Assessment: Review of key concepts 	50

Course Outcomes	<ul style="list-style-type: none"> - Demonstrate proficiency in functional grammar and effective use of various sentence structures and punctuation in writing. - Compose well-structured technical reports and research papers, adhering to scientific writing conventions. - Develop critical skills in peer review, providing and receiving constructive feedback to enhance writing quality.
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Reference Books:

1. Bansal, R. K., & Kaur, S. (2014). *English Grammar: A Practical Approach*. New Delhi: Macmillan India.
2. Rao, V. S. (2015). *Academic Writing: A Handbook for International Students*. New Delhi: PHI Learning.
3. Murphy, R. (2019). *English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Learners of English*. Cambridge: Cambridge University Press.

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Course Code	Course Title	Course Type	T/P	Credits	Number of Hours per Week
UT03SEAOC01	Finance For everyone	SEC	T	2	2

Course Objective	<p>To make students familiar with:</p> <ul style="list-style-type: none"> - to understand the fundamental principles of finance - to focus on personal finance, corporate finance, and financial markets - to empowering them with the knowledge to make informed financial decisions
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Course Content		
Unit	Description	Weightage (%)
1.	<p>Introduction to Finance: Overview of Finance: Definition and scope of finance, Importance of finance in daily life and business, Key concepts: Time value of money, risk, and return. Personal Finance Basics: Budgeting and financial planning, Saving and investing strategies, Managing credit and debt: Credit scores and loans. Financial Institutions and Markets: Role of banks, stock exchanges, and regulatory bodies, Introduction to financial instruments: Stocks, bonds, mutual funds.</p>	25
2.	<p>Corporate Finance Essentials: Introduction to Corporate Finance: Objectives of financial management: Wealth maximization vs. profit maximization, Key financial decisions: Investment, financing, and dividend decisions. Understanding Financial Statements: Components of balance sheets, income statements, and cash flow statements, Financial ratio analysis: Liquidity, profitability, and solvency ratios. Capital Budgeting: Principles of investment decisions, Techniques: Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period.</p>	25

Course Outcomes	<p>After completion of course, students will be able to learn:</p> <ul style="list-style-type: none"> - Understand key concepts and principles in personal and corporate finance. - Develop the ability to analyzed financial statements and make informed decisions. <p>This syllabus balances theoretical knowledge and practical applications, preparing students for personal financial decision-making and entry-level finance roles.</p>
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Reference Books:

1. Principles of Corporate Finance by Richard A. Brealey, Stewart C. Myers, Franklin Allen, Alex Edmans, and Pitabas Mohanty, 14th edition, McGraw Hill.
2. Fundamentals of Financial Management by Eugene F. Brigham and Joel F. Houston, 14th edition, Cengage India Private Limited.
3. Corporate Finance: Core Principles and Applications by Stephen A. Ross, Randolph W. Westerfield, Jeffrey Jaffe, Bradford D. Jordan, Ram Kumar Kakani, 11th edition, McGraw Hill Education.
4. Essentials of Investments by Zvi Bodie, Alex Kane, and Alan J. Marcus, 10th edition, McGraw Hill.
5. A Random Walk Down Wall Street by Burton G. Malkiel, W W Norton & Co Inc.
6. The Intelligent Investor by Benjamin Graham, Harper Business.

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Course Code	Course Title	Course Type	T/P	Credits	Number of Hours per Week
UT03VAAOC01	Intellectual Property Right (IPR)	VAC	T	2	2

Course Objective	The course will enable the learners to: <ul style="list-style-type: none"> - To introduce students to the concept of intellectual property and its various forms. - To provide insights into the relevance of IPR in the field of chemistry and related industries. - To enable students to understand the procedures for protecting innovations, inventions, and works of authorship.
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Course Content		
Unit	Description	Weightage (%)
1.	Introduction to Intellectual Property and Key Forms of Protection <ul style="list-style-type: none"> - Introduction to Intellectual Property - Overview of Patents - Patent Filing Process - Patent Specification and Claims - Copyrights and Trademarks - Trade Secrets and Confidentiality 	50
2.	Applications, Infringement, and Global IPR Frameworks <ul style="list-style-type: none"> - Industrial Designs and Geographical Indications - IP in Organic Chemistry and Pharmaceuticals - Infringement and Enforcement of IPR - International Treaties and IPR Organizations - IPR in Academic Research and Publishing 	50

Course Outcomes	By the end of the course, students will be able to: <ul style="list-style-type: none"> - Understand the fundamentals of intellectual property (IP) and its importance in chemistry-related fields. - Describe the patent filing process and interpret patent specifications and claims. - Differentiate between various forms of IP protection and assess their applications in industry and research. - Recognize IP infringement and enforcement mechanisms, including relevant international treaties.
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References:

1. Ganguli, P. (2001). Intellectual Property Rights: Unleashing the Knowledge Economy. Tata McGraw-Hill Education.
2. Miller, A. R., & Davis, M. H. (2020). Intellectual Property: Patents, Trademarks, and Copyright in a Nutshell (6th ed.). West Academic Publishing.
3. Durham, A. L. (2018). Patent Law Essentials: A Concise Guide (4th ed.). Praeger.