M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme Name: M.Sc. in Organic Chemistry
Programme Code: 096

Programme Outcome (PO)
Programme Specific Outcome (PSO)
Program Educational Objectives (PEO)
Course Outcomes (CO)

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Bangalore-560058

Registrar
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Bangalore - 560 054

Faculty of Mathematical & Physical Sciences

Programme Name: M.Sc. (Organic Chemistry)

Programme Outcomes (PO's)

M.Sc. graduates will be able to:

PO-1. Scientific Knowledge: Apply fundamental knowledge of chemical Sciences to solve real life problemsin their chosen domain

PO-2. Knowledge, Dissemination and Administration: Teach in schools, colleges and universities with relevant training and perform administrative duties in government, semi-government, private and public sector organizations

PO-3. Problem Solving: Understand and solve scientific problems by conducting experimental investigations

PO-4. Modern Tool Usage: Apply appropriate tools, techniques and understand utilization of resources appropriately in various laboratories

PO-5. Research: Conduct scientific research and disseminate the knowledge in the chosen domain

PO-6. The Science, Society and Ethics: Understand the effect of scientific solutions on legal, cultural, social,public health and safety aspects, and apply ethical principles to scientific practices and professional responsibilities

PO-7. Environment and sustainability: Develop sustainable solutions and understand their effect on societyand environment

PO-8. Individual and teamwork: Work as a member of a team, to plan and to integrate knowledge of variousdisciplines and to lead teams in multidisciplinary settings

PO-9. Communication: Make effective oral presentations and communicate technical ideas to a broad audience using written and oral means

PO-10. Life-long learning: Adapt to the changes and advancements in science and engage in independent and life-long learning

Programme Specific Outcomes (PSOs)

At the end of the M.Sc. (Organic Chemistry) programme, the graduate will be able to:

PSO-1. Apply the knowledge of Chemistry to identify and explain basic laws and principles governing physicaland chemical systems, use mathematical, statistical and computational methods to manufacture industrially important materials, explain their properties, adopt suitable methods to obtain the required products out of these materials.

PSO-2. Model and explore alternative materials and processes in an industry, develop strategies for commercial viability of a processes and products, solve and interpret results obtained through experimentation, design ways to recycle industrial wastes adopting safe handling practices and perform duties as per scientific protocols, demonstrate to work as an individual, and as a leader.

PSO-3. Demonstrate ethics, leadership qualities, communication, managerial, entrepreneurial skills andinvolvement in lifelong learning for the betterment of organization, environment and society.

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Program Educational Objectives (PEOs)

The objectives of the M.Sc. (Organic Chemistry) Programme are to:

PEO-1. To provide students the fundamental knowledge of chemistry to enable them to deliver efficientsolutions for complex scientific problems using analytical and cognitive skills in their chosen domain.

PEO-2. To enable students to apply appropriate tools, techniques and understand utilization of resources in laboratories and computational skills in conducting research in their chosen domains and work as an individual as well as lead team in multidisciplinary settings.

PEO-3. To inculcate ethics, environmental sustainability, communication, soft, managerial and entrepreneurial skills for a successful career in industries and to engage in lifelong learning and also work towards developing sustainable society.

Course Outcomes (COs)

Course Title & Code: Physical Chemistry 1 (CYC511A)

After the successful completion of this course, the student will be able to:

CO-1. Explain the laws of thermodynamics, concepts in photochemistry, JT effect, Raoult's law, and Henry's law to the physical transformation of substances

CO-2. Discuss the theories of kinetics, concepts in quantum mechanics, phase diagram construction and electrochemistry

CO-3. Illustrate quantum mechanical systems such as particle in a box, hydrogen atom, orbitals, electron systems, kinetics of complex & fast reactions

CO-4. Apply the principles of chemical & enzyme kinetics to determine the energetics of chemical reactions and assess the effect of catalyst on the outcome of reaction kinetics, laws of electrochemistry to estimate chemical compounds, applications of Schrodinger wave equation and thermodynamic processes

CO-5. Solve problems based on quantum mechanics and chemical/enzyme kinetics, electrochemistry, colloids, colligative properties, Phase equilibria and thermodynamics

Course Outcomes (COs)

Course Title & Code: Inorganic Chemistry 1 (CYC512A)

After the successful completion of this course, the student will be able to:'

CO-1. Outline the principles of electron filling in the atomic orbitals, VSEPR theory, molecular orbital theory, wades rule, polymorphism, magnetic property d and f-block elements and acid-base concepts and non-aqueous solutions.

CO-2. Differentiate between VSEPR and MO theory/CFT, closo/nido/arachno boranes, structure of silicates and phosphates, electronic configuration in d and f-block elements and its consequences

CO-3. Explain with examples the industrially important compounds, inorganic molecules by VSEPR theory, structure of ionic crystals, defects in crystals, acid- base concepts, closo/nido/ arachno boranes, structure of silicates and phosphates, super heavy elements

CO-4. Discuss the structure and bonding in solids, borazines, metallocarboranes, oxyacids of

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nitrogen, phosphorous sulfur halogens, intercalated compounds, silicates, concepts of non-aqueous solvents, polarizability and partial covalent character

CO-5. Illustrate the potential applications of main group compounds, d and f block elements, boranes carboranes silicates phosphates, metallo carboranes and non-aqueous solvents

Course Outcomes (COs)

Course Title & Code: Organic Chemistry 1 (CYC513A)

After the successful completion of this course, the student will be able to:

CO-1. Discuss the principles of structure and bonding, acid base concepts, reactive intermediates, stereochemistry, vitamins and carbohydrates

CO-2. Illustrate the reaction mechanism and stereochemistry of the molecules and structural elucidation of natural products

CO-3. Identify the reagents, reactive intermediates, reaction mechanism, stereochemistry of heterocyclic compounds, carbohydrates and other molecules

CO-4. Apply the basic concepts of synthesis of heterocyclic molecules, carbohydrates, reactive intermediates for the synthesis of new molecules

CO-5. Recommend reagents, reactive intermediates, reaction mechanism, stereochemistry for synthesis of small organic molecules

Course Outcomes (COs)

Course Title & Code: Instrumental Methods of Analysis (CYC514A)

After the successful completion of this course, the student will be able to:

CO-1. Outline the working principle and instrumentation of mass, optical, electron and X-ray and NMR spectroscopic techniques, chromatography, microscopy, thermal, X-ray diffraction, electrochemical and radio analytical techniques

CO-2. Analyze the morphology of materials using optical, electron and probe type microscopy techniques

CO-3. Interpret thermal properties of materials using TGA, DTA and DSC techniques

CO-4. Identify and analyze the appropriate chromatographic techniques for separation and analysis of chemical compounds

CO-5. Interpret the structure and/or determine concentration of chemical compounds using UV-Visible, Infrared, Raman, NMR, mass spectroscopy and voltammetry techniques.

Course Outcomes (COs)

Course Title & Code: Physical Chemistry Laboratory (CYL515A)

After the successful completion of this course, the student will be able to:

CO-1. Setup the experimental apparatus required to achieve the stated aim

CO-2. Conduct experiments as per the standard procedures and tabulate the measured values

CO-3. Calculate the required parameters and plot the results

CO-4. Interpret and draw conclusions

CO-5. Write laboratory report as per the prescribed format.

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Course Outcomes (COs)

Course Title & Code: Qualitative & Quantitative Analysis of Inorganic Compounds (CYL516A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Setup the experimental apparatus required to achieve the stated aim
- **CO-2.** Conduct experiments as per the standard procedures and tabulate the measured values
- **CO-3.** Calculate the required parameters and plot the results
- **CO-4.** Interpret and draw conclusions
- **CO-5.** Write laboratory report as per the prescribed format.

Course Outcomes (COs)

Course Title & Code: Seminar 1 (CYS517A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Conduct a thorough literature review and submit a review article / scientific report
- **CO-2.** Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Physical Chemistry 2 (CYC521A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Classify the polymers, mechanisms of enzyme, chemical kinetics, adsorption isotherms, wave functions and thermodynamic functions
- **CO-2.** Outline the chemistry & properties of polymers, mechanism & kinetics of polymerization, term symbols, perturbation theory, factors affecting surface activity and overpotential, RS and JJ-coupling. Spin-orbital interaction and term multiplicities, Zeeman effect
- **CO-3.** Discuss the principles of quantum mechanics approximate methods, rotational, vibrational, Raman and electronic spectra, theories & kinetics of electrochemistry, corrosion of metals, polarography, amperometry, effect of various parameters on activity of catalysts/enzymes, theories of unimoleuclar reactions, radial and angular distribution function and their significance
- **CO-4.** Apply the spectroscopic information to determine structure & properties of compounds, thermodynamic concepts & laws to determine nature of chemical interactions, various parameters which can influence catalysis to predict the surface activity/chemical reactions, electrochemical theories and properties to understand various electrochemical systems and quantum mechanical concepts in real life problems
- **CO-5.** Solve numerical based on electrochemistry, polymers, quantum chemistry, spectroscopy, kinetics, thermodynamics and surface chemistry

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Course Outcomes (COs)

Course Title & Code: Inorganic Chemistry 2 (CYC522A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Outline the principles of the character table construction, Orgel diagrams and molecular orbital theory and correlate to the crystal structures, spectroscopic and magnetic properties of coordination complexes, stereochemistry of the co-ordination numbers from 2 to 6
- **CO-2.** Differentiate between closo/nido/arachno boranes, ligand substitution mechanism in square planar and octahedral complexes, d-d transition and charge transfer spectra
- **CO-3.** Predict the properties of a coordination complexes from the molecular orbital theory and LFT, and explain Metal ion storage and transport properties of biological systems, Factors affecting stability constant in solution
- **CO-4.** Discuss the concepts of group theory, chemistry of solid state materials, bonding and structures in organometallic compounds, the relevance of Orgel diagrams and transport and storage of dioxygen; haemoglobin, myoglobin and phenomenon of cooperativity, stability constants
- **CO-5.** Illustrate the potential applications of organometallic compounds and metal complexes; gold complexes and platinum complexes in medicine; Photosynthesis; chlorophyll, PS I, PS II, Biochemical importance of NO, Role of Ca in signal transduction, porphyrins, nitrogen fixation

Course Outcomes (COs)

Course Title & Code: Organic Chemistry 2 (CYC523A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the reactive intermediates, stereochemistry, oxidation and reduction, molecular rearrangements reaction mechanisms, pericyclic reactions, sigmatropic reactions, heterocyclic compound synthesis, named reaction, natural products, nucleic acids, protein structure and reagents in organic synthesis
- **CO-2.** Illustrate nucleophilic, electrophilic, radical reactions, specific reagents for oxidation and reduction, heterocyclic reactions and organometallic reagents
- **CO-3.** Identify heterocyclic motifs, reagents, named reaction, molecular rearrangements, stereochemistry in natural products and drug molecules
- **CO-4.** Apply named reaction, heterocyclic synthesis, and organic reagents for synthesis of natural and pharmaceutically important products
- **CO-5.** Design small organic molecules considering factors such as stereochemistry and reagents for various applications

Course Outcomes (COs)

Course Title & Code: Computational Methods in Chemistry (CYC524A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Differentiate theoretical approaches such as HF(Hartree-Fock), DFT(Density Functional Theory) and force field methods
- **CO-2.** Identify various methods for simulating/modeling various scientific problems and discuss their advantages/disadvantages

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CO-3. Illustrate the principles of differentiation, integration and data modeling
CO-4. Assess and recommend suitable computational chemistry tool for theoretical predictions
CO-5. Apply semi-empirical and computational modeling to make theoretical predictions of outcome of a reaction, suitable methods for calculating electronic properties of simple molecules and crystals

Course Outcomes (COs)

Course Title & Code: Computational Techniques in Chemistry (CYL525A)

After the successful completion of this course, the student will be able to:

CO-1. Plan the experimental setup to achieve the stated aim
CO-2. Conduct experiments as per the standard procedures and tabulate the measured values
CO-3. Calculate the required parameters and plot the results
CO-4. Interpret, compare with standard results and draw conclusions
CO-5. Write laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Qualitative and Quantitative Analysis of Organic Compounds (CYL526A)

After the successful completion of this course, the student will be able to:

CO-1. Setup the experimental apparatus required to achieve the stated aim
CO-2. Conduct experiments as per the standard procedures and tabulate the measured values
CO-3. Calculate the required parameters and plot the results
CO-4. Interpret and draw conclusions
CO-5. Write laboratory report as per the prescribed format.

Course Outcomes (COs)

Course Title & Code: Seminar 2 (CYS527A)

After the successful completion of this course, the student will be able to:

CO-1. Conduct a thorough literature review and submit a review article / scientific report
CO-2. Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Retrosynthetic, Stereo chemical and Spectroscopic Analysis (CYC651A)

After the successful completion of this course, the student will be able to:

CO-1. Discuss the use of Stereo selective reactions, Retrosynthetic and Spectroscopic Analysis for the
CO-2. Illustrate the retrosynthetic strategy, reagents named reactions, stereochemistry to construct
CO-3. Identify the retro synthetic pathways, synthons, reagents, reaction mechanism, Stereochemistry and structural elucidation of organic molecules

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CO-4. Apply the retrosynthetic strategy, reagents, named reactions, stereochemistry during the synthesis of new entities

CO-5. Recommend spectroscopic methods to identify the synthesizednatural and pharmaceutical products

Course Outcomes (COs)

Course Title & Code: Photochemical, Pericyclic and Organocatalytic Reaction (CYC652A)

After the successful completion of this course, the student will be able to:

CO-1. Discuss the principles of Photocycloaddition, Norrish type I and type II, photo degradation, electrocyclic, pericyclic addition, sigma tropic rearrangements and Organocatalytic reactions

CO-2. Identify the use of Photochemical, Pericyclic and Organometallic reactions in organic synthesis and in biomedical applications

CO-3. Illustrate photocycloaddition, Norrish type I and type II, photo degradation, pericyclic cyclo addition, sigma tropic rearrangements, radical chemistry and methods for synthesizing complex organic molecules

CO-4. .Recommend Organo metallic complexes, oxidative addition and reductive elimination, nucleophilic and electrophilic addition for synthesis of industrially important molecules

CO-5. Assess the suitability of photochemical, pericyclic reaction, organometallic Chemistry for synthesis of natural and pharmaceutical products

Course Outcomes (COs)

Course Title & Code: Natural Products and Green Chemistry (CYC653A)

After the successful completion of this course, the student will be able to:

CO-1. Discuss the sources, physical, chemical properties and synthesis of alkaloids, steroids, and plant pigments, pyrethroids using nucleophilic, electrophilic, radical chemistry, elementary organometallic reactions and principles of green synthesis

CO-2. Identify the new synthetic methods for the synthesis of various natural products using green chemistry principles

CO-3. Evaluate the greener approach for the synthesis of industrially important chemicals such as alkaloids, steroids, plant pigments, pyrethroids

CO-4. Apply heterocyclic synthesis, green synthesis, named reaction, pericyclic, photochemistry to synthesize various natural products

CO-5. Recommend suitable reagents for maximizing the yield, minimizing the synthetic steps and to introduce stereoselectivity in natural products and synthetic molecules

Course Outcomes (COs)

Course Title & Code: Advanced Heterocyclic Chemistry and Pharmaceutical Products Synthesis (CYC654A)

After the successful completion of this course, the student will be able to:

CO-1. Discuss the use of organic reagents, protection and deprotection of various functional groups, functional group interconversion in organic synthesis and principles of 2D NMR techniques

CO-2. Illustrate the combinatorial, heterocyclic, green and photochemical synthesis to synthesize

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monomers used in various industrial applications

CO-3. Identify the reagents, synthons, reaction conditions for the synthesis of organic molecules and correlation spectroscopic techniques to assess the coupling pattern within the molecule

CO-4. Apply the combinatorial, C-C, C-N, C-O etc., bond forming reactions in the synthesis of various heterocyclic molecules

CO-5. Recommend the stereochemical feature, named reactions, pericyclic, photochemical reactions, for synthesis and spectroscopic techniques to identify the sythesised natural product or pharmaceutical molecules by the combinatorial, C-C, C-N, C-O etc., bond forming reactions in the synthesis of various heterocyclic molecules

Course Outcomes (COs)

Course Title & Code: Research Methodology (MPF615A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the value, scope, relevance and mandatory steps of research as well as principles of effective research

CO-2. Discuss and demonstrate the application and utility of the Systematic approach and out of box thinking concepts for research to be effective

CO-3. Explain and apply the procedures outlined for a systematic Literature Review

CO-4. Outline the principles to prepare a well-structured research proposal and research paper

CO-5. Identify and apply the essential skills desirable for an effective technical presentation

Course Outcomes (COs)

Course Title & Code: Advanced Organic Chemistry Laboratory I (CYL656A)

After the successful completion of this course, the student will be able to:

CO-1. Setup the experimental apparatus required to achieve the stated aim

CO-2. Conduct experiments as per the standard procedures and tabulate the measured values

CO-3. Calculate the limiting reagent, theoretical yield, and percent yield

CO-4. Evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

CO-5. Maintain a detailed scientific notebook

Course Outcomes (COs)

Course Title & Code: Advanced Organic Chemistry Laboratory 2 (CYL657A)

After the successful completion of this course, the student will be able to:

CO-1. Setup the experimental apparatus required to achieve the stated aim

CO-2. Conduct experiments as per the standard procedures and tabulate the measured values

CO-3. Calculate the limiting reagent, theoretical yield, and percent yield

CO-4. Evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

CO-5. Maintain a detailed scientific notebook

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Course Outcomes (COs)

Course Title & Code: Seminar 3 (CYS658A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Conduct a thorough literature review and submit a review article / scientific report
- **CO-2.** Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Internship (CYI661A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Write a report on experiences during internship
- **CO-2.** Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Seminar (CYS661A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Conduct a thorough literature review and submit a review article
- **CO-2.** Make a presentation to a panel of examiners

Course Outcomes (COs)

Course Title & Code: Dissertation (CYP662A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Recognize the need for developing a new or improving an existing scientific problem through an organized survey of literature
- **CO-2.** Define scientific problem
- **CO-3.** Design and perform the experiments
- **CO-4.** Analyse the results obtained
- **CO-5.** Write a technical Report and give presentation

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