# SHRI GURU RAM RAI UNIVERSITY

Patel Nagar, Dehradun-248001, Uttarakhand, India

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 23 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]

# SYLLABUS FOR

## Master of Science (M.Sc.)-Chemistry

### (One Year Course- Semester System)

### National Education Policy-2020

## School of Basic & Applied Sciences

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(W.E.F 2025-2026)

Manav

Vinod Kumar

# Master of Science (M.Sc.)-Chemistry

## OUTCOME BASED EDUCATION

## Programme outcome (POs)

Students will be able to

| | |
|---|---|
| PO 1 | Implement strong theoretical and practical knowledge of physics to solve complex scientific problems. |
| PO2 | Identify the situation-based problems, formulation, and action is taken based on analytical thinking and principles of science. |
| PO3 | Formulate, design, experimental techniques, scientific tools, analysis of scientific data, interpretation of data, and establish a hypothesis for various interdisciplinary research problems. |
| PO4 | Execute effective communication through interactive and presenting skills, technical report writings, and proper documentation of ideas. |
| PO5 | Create a new conceptual, theoretical and operational approach to address various problems in interdisciplinary fields. |
| PO6 | Enables individuals to function effectively in cross-cultural environments as an individual, and as a member or leaders. |
| PO7 | Understand the contribution of scientific knowledge in environmental contexts for sustainable development. |
| PO8 | Understand ethical issues, academic and research ethics, the need and value of lifelong learning, and the scientific misconduct of a scientist to serve society. |
| PO9 | Enhance and adopt employability skills through research, internship, and dissertation. |
| PO10 | Successfully compete in the state level, national level, and international level exams or competitions. |
| PO11 | Lifelong learning of knowledge of physics |
| PO12 | Implement the learning of physics in project management and finance |

## Program Specific Outcome (PSOs)

| | |
|---|---|
| PSO 1 | Associate the fundamental and advanced concepts in diverse branches of physics including classical mechanics, quantum mechanics, electrodynamics, statistical mechanics, atomic, nuclear, and particle physics, condensed matter physics, and electronics. |
| PSO2 | Apply suitable methods to solve a wide range of problems and handle interdisciplinary projects as well as experimental data interpretation independently. |

| | |
|---|---|
| PSO3 | Employ experimental skills for multi-disciplinary research work in cutting-edge areas of physics. |
| PSO4 | Develop job-oriented analytical skills needed in research, consultancy, defense, entrepreneurial pursuit, and industry. |

**Duration of the Programme: 1 Years**

## STUDY & EVALUATION SCHEME: Choice Based Credit System (CBCS)

**Only for four-year Bachelor in Science (Hons) Chemistry/ Bachelor in Science (Hons) Chemistry with Research**

**First Semester**

| S. No. | Course Category | Couse Code | Course Name | Periods | | | | Evaluation scheme | | Subject Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L* | T* | P* | C* | IA* | ESE* | |
| Theory | | | | | | | | | | |
| 1 | Core | MCHC101 | Organic Synthesis & Photochemistry | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | Core | MCHC102 | Heterocyclic Chemistry | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 3 | Core | MCHC103 | Seminar | 0 | 3 | 0 | 3 | 40 | 60 | 100 |
| | Core | MCHL104 | Laboratory Course | 0 | 0 | 10 | 5 | 40 | 60 | 100 |
| 4 | Elective (Choose any two) | MCHE105 | Bioinorganic, Bioorganic & Biophysical Chemistry | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | | MCHE106 | Advance Analytical Methods | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | | MCHE107 | Drug Delivery System | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 7 | | MCHE108 | Stereochemistry and reaction Mechanism | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | | MCHE109 | Computer and Biostatistics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | | MCHE110 | Research methodology and publication ethics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | | | Total | 12 | 3 | 10 | 20 | 240 | 360 | 600 |

*L – Lecture, T – Tutorial, P – Practical, C – Credit, IA-Internal Assessment, ESE-End Semester Examination, SSC- Self-Study course



Shalini Manav Vishal Kumar

**Second Semester**

| S. No. | Course Category | Couse Code | Course Name | Periods | | | | Evaluation scheme | | Subject Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L* | T* | P* | C* | IA* | ESE* | |
| Thesis | | | | | | | | | | |
| 1 | Core | MCHR201 | Dissertation | 0 | 0 | 0 | 20 | 120 | 480 | 600** |
| | | | **Total** | 0 | 0 | 0 | 20 | 120 | 480 | 600 |

*L – Lecture, T – Tutorial, P – Practical, C – Credit, IA-Internal Assessment, ESE-End Semester Examination, SSC - Self-Study course

**The distribution of marks for the Dissertation will be as below:

| | |
|---|---|
| Periodical Presentation | 120 Marks |
| Thesis | 360 Marks |
| Viva Voce | 120 Marks |
| **Total** | **600 Marks** |

The Thesis work report shall be evaluated jointly by the supervisor and one external examiner.

**Summary of the Credit**

| Year | Semester | Max Credit |
|---|---|---|
| 1 | 1 | 20 |
| | 2 | 20 |
| **Total** | | **40** |

**Examination Scheme (Except project):**

| Components | I[st] Internal | II[nd] Internal | External (ESE) |
|---|---|---|---|
| Weightage (%) | 20 | 20 | 60 |

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated



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| | | | | | |
|---|---|---|---|---|---|
| Course code | : MCHC101 | | | | |
| Course Name | : Organic Synthesis & Photochemistry | | | | |
| Semester /Year | : I/ I | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**Course Objective:** The objective of this course is to gain knowledge about disconnection approach, reaction mechanisms and photochemical reactions.

**Course Contents**

**Unit I**

**Disconnection Approach**: An introduction to synthons and synthetic equivalents disconnection approach, functional group interconversions, the importance of order of events in organic synthesis, one group C-X and two group C-X disconnections, chemo selectivity, reversal of polarity, cyclisation reactions and amine synthesis.

**Unit II**

**Protecting Groups**: Principle of protection of alcohols, amine, carbonyl and carboxyl groups

**Unit III**

**One Group and Two Group C-C Disconnections**: Alcohols and carbonyl compounds regioselectivity. Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis. Diels-Alder reaction, 1,3-difunctional compounds, α,β-unsaturated carbonyl compounds, control in carbonyl condensations. Micheal addition and Robinson annelation.

**Unit IV**

**Determination of Reaction Mechanism**: Classification, rate constants and life times of reactive energy states-determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions, photo-dissociation, gas-phase photolysis.

**Unit V**

**Photochemical Reactions**

Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4-and 1,5-dienes. Intramolecular reactions of carbonyl compounds saturated cyclic and acyclic, β,γ-unsaturated and α,β-unsaturated compounds. Cyclohexadienones. Intramolecular cycloaddition reactions-dimerisation and oxetane formation. Isomerisation, additions and substitutions. Photo-Fries rearrangement, Barton reaction.

**Text book [TB]:**

TB1. Fundamentals of Photochemistry, K.K. Rohtagi-Mukherji, New Age International
TB2. Essentials of Molecular Photochemistry, A. Gilbert and J. Baggott, Blackwell Scientific Publication

**Reference books [RB]:**

RB1.Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge Univ. Press.
RB2. Advanced Organic Chemistry, Reactions Mechanisms and Structure, J. March, John Wiley.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1 | Get Knowledge about the various photochemical reactions and organic synthesis. |
| CO2 | Understand about the various photochemical reactions and organic synthesis. |
| CO3 | Apply various photochemical reactions and organic synthesis. |
| CO4 | Analyse various photochemical reactions and organic synthesis. |
| CO5 | Distinguish the mechanism of various photochemical reactions and organic synthesis. |
| CO6 | Design various synthetic routes of photochemical reactions and organic synthesis. |

| | | | | | |
|---|---|---|---|---|---|
| **Course code** | **: MCHC102** | | | | |
| **Course Name** | **: Heterocyclic Chemistry** | | | | |
| **Semester /Year** | **: I/ I** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**Course Objective:**

The objective of this course is to gain knowledge about nomenclature, classification, chemical and physical properties of various heterocyclic compounds.

**Course Contents**

**Unit I**

**Nomenclature of Heterocycles:**

Replacement and Systematic nomenclature (Hantzsch Widman system) for monocyclic, fused and bridged heterocycles

**Unit II**

**Aromatic and Non-aromatic Heterocycles:**

General chemical behaviour of aromatic heterocycles, classification (structural type), Heteroaromatic reactivity and tautomerism in aromatic heterocycles Strain –bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interactions. Stereo-electronic effects, aromatic and related effects. Attractive interactions - hydrogen bonding and intermolecular nucleophilic, electrophilic interactions.

**Unit III**

**Small Ring Heterocycles:**

Three-membered and four-membered heterocycles-synthesis and reactions of aziridines, oxiranes, thiiranes, azetidines, oxetanes and thietanes.

**Unit IV**

**Benzo-Fused Five-Membered Heterocycles:** Synthesis and reactions including medicinal applications of benzopyrroles, benzofurans and benzothiophenes.

**Unit V**

**Six-Membered Heterocycles with One, Two or More Heteroatoms:**

Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium & thiopyrylium salts. Synthesis and reactions of benzopyrylium salts and coumarins. Synthesis and reacitons of diazines, triazines, tetrezines and thiazines.

**Unit VI**

**Seven-and Large-Membered Heterocycles:**

Synthesis and reactions of azepines, oxepine, diazepines, azocines and oxocines.

**Text book [TB]:**

TB1.Heterocyclic Chemistry Vol. 1 & 2, R.R. Gupta, M. Kumar and V. Gupta, Springer Verlag

TB2.The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme

**Reference books [RB]:**

RB1. Heterocyclic Chemistry, J.A. Joule, K. Mills and G.F. Smith, Chapman and Hall.
RB2.Heterocyclic Chemistry, T.L. Gilchrist, Longman Scietific Technical

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1 | Get knowledge about basics of heterocyclic compounds. |
| CO2 | Understand nomenclature, general behaviour, synthesis and properties of |

| | |
|---|---|
| | heterocyclic compounds. |
| CO3 | Explain synthesis, properties and uses of heterocyclic compounds. |
| CO4 | Explain aromatic, nonaromatic features, synthesis and properties of different heterocyclic compounds. |
| CO5 | Predict the reactivity, isomerism , conformers etc. of heterocyclic compounds. |
| CO6 | Write the synthesis and applications of six and seven membered heterocyclic compounds. |

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|---|---|---|---|---|
| **Course code : MCHC103** | | | | |
| **Course Name : Seminar** | | | | |
| **Semester /Year : I/ I** | | | | |
| | **L** | **T** | **P** | **C** |
| | **0** | **3** | **0** | **3** |

**Course Objective:** The main objective of this course to analyze, construct and evaluate scientific information and research topics. Students will make a quality scientific presentation and speak in front of a scientific audience.

**Course Contents**

Presentation topic must be related to the student's current research and innovation, nanoscience and technology, any material characterization and analytical techniques, and current thesis or project.

**Text book [TB]:**

1. R. Williams, Non-Designer's Presentation Book, The: Principles for effective presentation design
2. N. Duarte, Slide: ology: The Art and Science of Creating Great Presentations

**Reference books [RB]:**

1. G. Reynolds, Presentation Zen: Simple Ideas on Presentation Design and Delivery

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1 | Remember scientific information. |
| CO2 | Develop and understand quality scientific presentation. |
| CO3 | Present and explain and apply scientific information. |



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| | |
|---|---|
| CO4 | Classify and analyze scientific work for presentation. |
| CO5 | Evaluate scientific information and then analyse it. |
| CO6 | Develop scientific understanding towards research oriented topics |

## CO- PSO-PO Mapping:

| Course | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

| | | | | | |
|---|---|---|---|---|---|
| **Course code** | **: MCHL303** | | | | |
| **Course Name** | **: Laboratory Course** | | | | |
| **Semester /Year** | **: I/ I** | | | | |
| | **L** | **T** | **P** | **C** | |
| | **0** | **0** | **10** | **5** | |

**Course Objective:** The objective of this course is to gain practical knowledge about separation, purification and identification of the components of a mixture.

**Course Contents**

1. **Qualitative Analysis**

Separation, purification and identification of the components of a mixture of three organic compounds (three solids or two liquids and one solid, two solids and one liquid), using TLC for checking the purity of the separated compounds. Preparation of derivatives and spectral analysis.

2. **Extraction of Organic Compounds from Natural Sources**

- Isolation of caffeine from tea leaves.
- Isolation of casein from milk (the students are required to try some typical colour reactions of proteins).
- Isolation of lactose from milk (purity of sugar should be checked by TLC and PC and Rf value reported).
- Isolation of nicotine dipicrate from tobacco.
- Isolation of cinchonine from cinchona bark.
- Isolation of piperine from black pepper.
- Isolation of lycopene from tomatoes.
- Isolation of -carotene from carrots.
- Isolation of oleic acid from olive oil (involving the preparation of complex with urea and separation of linoleic acid).
- Isolation of eugenol from cloves.

- Isolation of limonene from citrus fruits.

**3. Paper Chromatography**

Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of Rf values.

**4. Spectroscopy**

Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR & MS)

**5. Spectrophotometric (UV/VIS) Estimations**

1. Amino acids
2. Proteins
3. Carbohydrates
4. Cholesterol
5. Ascorbic acid
6. Aspirin
7. Caffeine

**Text Books:**

TB1. Microscale Organic Experiments KL Willianson, DC Health & Co. Le Xington. TB2. Laboratory Manual of Organic Chemistry, RK Bansal, New Age International, Delhi.

**Reference Books:**

RB1. Introduction to Organic Laboratory Techniques (Third Edition), DL Pavia, GM Lampman and GS Kriz, Saunders College Publishing, Philadelphia, New York.
RB2. Operational Organic Chemistry, A Laboratory Course, Second Edition, JW Lehman, Allyn & Bacon, Inc. Boston.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1 | Describe the practical concepts underlying the purification, separation and analysis of organic mixture of a compound. |
| CO2 | Distinguish a range of practical techniques used in science such as the analysis of substances, the separation of substances and the use of instruments/ glassware's. |
| CO3 | Develop the ability of performing accurate quantitative measurements with an understanding of the theory and use of contemporary instrumentation. |
| CO4 | Analyse the practical concept qualitatively and quantitatively. |
| CO5 | Test the purity of separated compounds. |
| CO6 | Develop Preparation of derivatives and spectral analysis. |

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|---|---|---|---|---|---|
| **Course code** | : **MCHE105** | | | | |
| **Course Name** | : **Bioinorganic, Bioorganic & Biophysical Chemistry** | | | | |
| **Semester /Year** | : **I/ I** | | | | |
| | | **L** | **T** | **P** | **C** |
| | | 3 | 0 | 0 | 3 |

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

**Course Objective:**

The objective of this course is to gain knowledge about bioinorganic, bioorganic and biophysical chemistry.

**Course content:**

**Unit I**

**Bioinorganic Chemistry:** Metal Ions in Biological Systems, Na+/K+ Pump, Essential and trace metals. Role of metal ions in biological processes Na+/K+ Pump. Bioenergetics and ATP Cycles DNA polymerization, glucose storage, metal complexes in transmission of energy; chlorophylls, photosystem I and photosystem II in cleavage of water. Transport and Storage of Dioxygen Heme proteins and oxygen uptake, structure and function of hemoglobin, myoglobin, hemocyanins and hemerythrin.

**Unit II**

**Bioorganic Chemistry:** Enzymes & Mechanism of Enzyme Action

Introduction and historical perspective, chemical and biological catalysis, properties of enzymes- catalytic power, specificity and regulation. Fischer's lock and Koshland's induced fithypothesis, Enzyme kinetics, Michaelis-Menten and Lineweaver-Burkplots, reversible and irreversible inhibition. Transition-state theory,acid base catalysis, covalent catalysis, strain of distortion.

**Kinds of Reactions Catalysed by Enzymes**

Nucleophillic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in isomerization reactions,-cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.

**Unit III**

**Biophysical Chemistry**

**Biological Cell and its Constituents, Cell Membrane and Transport of Ions**

Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coil transition. Structure and functions of cell membrane, ion transport through cell membrane.

**Bioenergetics**

Standard free energy change in biological reactions, exergonic, endergonic. Hydrolysis of ATP. Synthesis of ATP from ADP.

**Text book [TB]:**

TB1. Bioinorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-Verlag

TB2. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.

**Reference books [RB]:**

RB1. Enzyme Chemistry: Impact and Applications, Ed. Colliins J Sucking, Chapman and Hall. RB2.Enzymes Mechanism Ed, M.I. Page and A. Williams, Royal Society of Chemistry.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1 | Gain Knowledge about bioinorganic, bioorganic and biophysical chemistry. |
| CO2 | Understand the basics of bioinorganic, bioorganic and biophysical chemistry. |
| CO3 | Explain the role of metal ions in biological systems, transport and storage of oxygen. |
| CO4 | Illustrate about mechanism of enzyme action and types of reaction catalyzed by enzymes,Na/K pump,biological cell and its constituent. |
| CO5 | Summarize structure and functions of protiens, enzymes ,nucleic acids and cell membrane. |
| CO6 | Express standard free energy change in biological reactions, hydrolysis of ATP and its synthesis. |

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlate

| | | |
|---|---|---|
| **Course code** | : | **MCHE106** |
| **Course Name** | : | **Advance Analytical Methods** |
| **Semester /Year** | : | **I/ I** |

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objective:** This course provides in-depth knowledge of advanced analytical techniques used in chemical analysis. It covers the principles, instrumentation, applications, and data interpretation for various modern analytical methods.

**Course contents:**

**Unit 1: Spectroscopic Methods**

**UV-Visible Spectroscopy:** Principles of electronic transitions, Instrumentation (light sources, monochromators, detectors), Applications in quantitative analysis

**Nuclear Magnetic Resonance (NMR) Spectroscopy:** Basics of NMR, chemical shifts, and spin-spin coupling, 1H NMR, 13C NMR, and advanced techniques (2D NMR, NOESY, COSY), Applications in structural elucidation of organic molecules

**Unit 2: Chromatographic Techniques**

**Gas Chromatography (GC):** Principles of gas-liquid partitioning, Columns (packed and capillary), injectors, and detectors (FID, TCD, ECD), Applications in environmental analysis and petrochemical industries

**High-Performance Liquid Chromatography (HPLC):** Principles of liquid chromatography, stationary and mobile phases, Types of HPLC: reversed-phase, normal-phase, ion-exchange, size-exclusion, Detectors: UV, PDA, fluorescence, and mass spectrometry

**Unit 3: Thermal methods** : Theory, instrumentation and applications of thermogravimetric analysis (TGA),Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), thermometric titrations

**Unit 4: Surface and Structural Analysis**

**X-ray Diffraction (XRD):** Principles of X-ray diffraction, Powder XRD vs. Single-crystal XRD, Applications in material science and crystallography

**Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM):** Electron-sample interaction and image formation, Sample preparation techniques and Applications in nanomaterials and biological samples analysis.

**Text Books:**

TB1.Principles of instrumental analysis by Douglas A. Skoog, F. James holler, Stanley R. crouch, Cengage learning.

TB2.. Vogel's quantitative chemical analysis by J. Mendham, R.C.Denney, M.J. Kthomas, David J. Barnes, Pearson

**Reference Books:**

RB1. Instrumental methods of analysis by Willard, Merritt, Dean, CBS Publishers & Distributors pvt. ltd.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1 | Demonstrate an in-depth understanding of advanced spectroscopic techniques such as UV-Vis. and NMR. Interpret spectra and apply these methods to solve complex chemical problems. |
| CO2 | Gain proficiency in chromatographic techniques like GC and HPLC, including the ability to select appropriate methods for specific analytical challenges and optimize conditions for separation.. |
| CO3 | Develop competence in thermo analytical methods with the ability to apply these methods to real-world applications in material science and environmental chemistry. |
| CO4 | Acquire expertise in surface and structural analysis techniques such as XRD, SEM and TEM. Analyze and interpret data to understand the composition, structure, and properties of materials at the atomic and molecular levels. |
| CO5 | Develop strong skills in data analysis |
| CO6 | Integrate knowledge from various analytical techniques to address complex chemical problems in a multidisciplinary context and its synthesis. |

| | | | | | |
|---|---|---|---|---|---|
| **Course code** | : **MCHE107** | | | | |
| **Course Name** | : **Drug Delivery System** | | | | |
| **Semester /Year** | : **I/ I** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**Course Objective:** To understand various approaches for development of novel drug delivery systems and to understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

**Course contents:**

**Unit I**

**Introduction:** History of medicinal chemistry, general mechanism of drug action on lipids, carbohydrates, proteins and nuleic acids, drug metabolism and inactivation, receptor structure and sites, drug discovery development, design and delivery systems, gene therapy and drug resistance.

**Unit II**

**Classification:** Drugs based on structure or pharmacological basis with examples, synthesis of important drugs such as α - methyl dopa, chloramphenicol, griseofulvin, cephelosphorins and nystatin. Molecular modelling, conformational analysis, qualitative and quantitative structure activity relationships.

**Unit III**

**General introduction to antibiotics:** Mechanism of action of lactam antibiotics and non lactam anti biotics, antiviral agents, chemistry, stereochemistry, biosynthesis and degradation of penicillins - An account of semisynthetic penicillins - acid resistant, penicillinase resistant and broad spectrum semisynthetic penicillins.

**Unit IV**

**Elucidation of enzyme structure:** Mechanism, kinetic, spectroscopic, isotopic and stereochemical studies. Chemical models and mimics for enzymes, design, synthesis and evaluation of enzyme inhibitors.

**Unit V**

**Interactions of enzymes:** DNA-protein interaction and DNA-drug interaction. Introduction to rational approach to drug design, physical and chemical factors associated with biological activities, mechanism of drug action.

**Text Books:**

TB1.I. Wilson, Giswald and F. Doerge, Text Book of Organic Medicinal and Pharmaceutical Chemistry, J.B. Lippincott Company, Philadelphia, 1971.
TB2.A. Burger, Medicinal Chemistry, Wiley Interscience, New York, Vol. I and II, 1970.

**Reference Books:**

RB1. A. Gringauz, Introduction to Medicinal Chemistry, How Drugs Act and Why?, John Wiley and Sons, 1997.
RB2.G. L. Patrick, Introduction to Medicinal Chemistry, Oxford Univeristy Press, 2001.

## Course outcomes (COs):

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1 | Gain comprehensive knowledge of various drug delivery systems, including controlled, sustained, and targeted delivery mechanisms. |
| CO2 | Understand the principles and chemistry behind drug release kinetics, polymeric systems, and biodegradable materials used in drug delivery. |
| CO3 | Develop skills in designing and formulating different drug delivery systems such as liposomes, nanoparticles, hydrogels, and transdermal patches. |
| CO4 | Learn to optimize drug formulations based on factors like drug stability, bioavailability, and therapeutic index. |
| CO5 | Understand the impact of drug delivery systems on the pharmacokinetics (absorption, distribution, metabolism, and excretion) and pharmacodynamics of therapeutic agents. |
| CO6 | Evaluate the relationship between drug delivery routes and their efficacy, safety, and patient compliance. |

| | | | | | |
|---|---|---|---|---|---|
| **Course code** | : **MCHE108** | | | | |
| **Course Name** | : **Stereochemistry and reaction Mechanism** | | | | |
| **Semester /Year** | : **I/ I** | **L** | **T** | **P** | **C** |
| | | 3 | 0 | 0 | 3 |

**Course Objective:** The course on Stereochemistry and Reaction Mechanism aims to equip students with a deep understanding of the three-dimensional structure of molecules and the mechanisms of organic reactions.

**Course contents**

**Unit 1:**

Optical isomerism, configuration, Cahn-Ingold-Prelog rule for designation of configuration. Stereochemistry of carbon compounds with no chiral atom, Biphenyls, Allenes,. Geometrical isomerism & stereochemistry of olefins.

**Unit-II**

Stereoisomerism of rings, stability of rings, ease of ring formation, Actual shape of six membered rings & its relation to properties & reactivity.

**Unit-III**

Mechanisms involving Aromatic eletrophilic reaction, Aromatic nucleophilic reactions, free radical reactions and elimination mechanism.

**Unit-IV**

Study of Name Reactions such as: Fries Rearrangement Beckmann rearrangement, Hofmann rearrangement & Hoffmann's degradation, Curtius reaction, Schmidt Reaction, Claisen's Condensation, Wittig Reaction, Oppenauer oxidation, Meerwein Pondroff Valery Reduction, Birch Reduction, Clemmensen reduction, Reimer-Tiemann Reaction, Wolf Kishner's Reduction, Michael's Condensation, Pinacol-Pinacolone Rearrangement, Aldol Condensation, Cannizaro's Reaction.

**BOOKS SUGGESTED**

1. E.L. Eliel Stereochemistry of carbon compounds, Tata McGra Hill Publishing Company New Delhi 1975.
2. 2. Jerry March, Advance organic Chemistry 4th ed.. A Wiley-Interscience Publication, 1999.

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1 | Explain key concepts of stereochemistry, including chirality, enantiomers, and diastereomers, and accurately represent molecular structures using various projection methods. |
| CO2 | Predict the stereochemical outcomes of organic reactions, considering factors such as steric hindrance, electronic effects, and reaction conditions. |
| CO3 | Analyze and describe reaction mechanisms, identifying intermediates, transition states, and the influence of nucleophiles, electrophiles, and leaving groups. |
| CO4 | Apply stereochemical and mechanistic principles to solve complex organic chemistry problems, both theoretically and in practical scenarios. |
| CO5 | Integrate knowledge of stereochemistry and reaction mechanisms to understand and predict the behavior of organic molecules in biological and synthetic processes. |
| CO6 | Critically evaluate and synthesize research findings in stereochemistry and reaction mechanisms, applying advanced concepts to propose innovative solutions and predict outcomes in complex organic reactions. |

| | | | | | |
|---|---|---|---|---|---|
| **Course code** | : **MCHE109** | | | | |
| **Course Name** | : **Computer and Biostatistics** | | | | |
| **Semester /Year** | : **I/ I** | | | | |
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**Course Objective:**
The objective of this course is to gain knowledge about use of computers and biostatistics in different field of biological and chemical sciences.

**Course contents:**

**Computers**

**Unit 1:** History of computer Simple model of computer and its working, input-output devices, computer languages and their hierarchy (low level and high level),Introduction of microcomputers, concept of operating system, computer networking, concept of OSI layers, Introduction of software(MS-Word, MS-Excel & Power point etc.)

**Unit 2:** Introduction of C++ Programming Difference between C and C++, concept of OOP'S, basic data types and operators, sample programs, conditional statements(IF-ELSE ,NESTED IF),concept of looping(for, while and dowhile),Introduction to arrays(single and double), classs and objects, function & function overloading, constructor and destructor, file handling.

**Unit 3:** Internet and its working,Uniform resource locator(URL),World wide web,HTTP,Internet explorer,PDB,NRL-3D,BLAST &FASTA,Special software to align sequences,general DNA sequence data base,protein structure data base,genome project database,human mapping data base.

**Biostatistics**

**Unit 4:** Introduction and scope of Biostatistics Presentation of data: classification of data, Methods of collection of data, frequency distribution, graphical representation of data by histogram, frequency polygon, frequency curve and cumulative frequency curve. Central tendency and measures of dispersion, mean, median, mode and their properties, partition value, standard deviation and coefficient of variation, simple correlation coefficient and regression coefficient, regression lines, tests of significance: t-test, z-test, chi-square tests, F-test, heterogeneity and independence of attributes.

**Unit 5:**
Testing of hypothesis Types of errors, power of test, test of significance based on normal distribution T-test for mean of population, difference of means of two normal population, chi square test of goodness of fit, independent test ,test of variance of normal population F-test for variance ration, correlation and regression ,latest square methods and its application, significance of coefficient of correlation, rank correlation curve fitting and sign test.

**Text books:**
TB1. Information technology-D.P.Curtin, Tata McGraw Hill,New Delhi.



Vishal kumar

TB2. Guide to Medical Informatics, The Internet & Telemedicine-E Coiera, Arnold Publishers, USA

**Course outcomes (COs):**

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1 | Demonstrate proficiency in basic computer operations, including the use of software tools for data management, analysis, and presentation. |
| CO2 | Apply statistical methods to analyze biological data, understanding the principles of descriptive and inferential statistics. |
| CO3 | Utilize statistical software to perform data analysis, including hypothesis testing, regression analysis, and analysis of variance (ANOVA). |
| CO4 | Interpret and present statistical results in a clear and scientifically rigorous manner, both in written and graphical formats. |
| CO5 | Integrate biostatistical concepts and computer skills to design and analyze experiments, surveys, and studies in the biological sciences. |
| CO6 | Evaluate and critically assess the statistical methods used in biological research, ensuring the appropriate application of techniques and the validity of conclusions drawn from data analysis. |

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|---|---|---|---|---|---|
| Course code | : MCHE110 | | | | |
| Course Name | : Research publication and ethics | | | | |
| Semester /Year | : I/ I | L | T | P | C |
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**Course Objectives:** Its objectives to provide knowledge about quality and ethics publication with concept of plagiarism.

**UNIT-I: Meaning &Functions of Research**



Shalini Manav

Vikal Kumar

Philosophy: Definition, introduction of concept, branches of Philosophy, Introduction of Metaphysics, Epistemology, Ethics/ Moral, Political and Aesthetics Philosophy Moral philosophy, nature of moral judgments and reactions.

**UNIT –II: Research Problem and Research Design**

Ethics: Definition with respect to science and research, Intellectual honesty and research integrity

Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP), Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data

**UNIT- III: Interpretation and Report Writing**

Publication ethics: Definition, introduction and importance, Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc., Conflicts of interest, Publication misconduct: Definition, concept, Introduction about authorship and contributorship, Violation of Publication Ethics, Identification of publication, complaints and appeals

**UNIT-IV: Statistical Techniques and Tools -I**

Introduction about Journals & Publishers, Predatory publishers and journals, Quality of Journals & Publication, Introduction about Scopus/SCI, eSCI/Web of Science Indexing (Scopus.com) etc., Software tool to identify predatory publications developed by SPPU Plagiarism tools , Journal finder/ Journal suggestion tools viz. JANE, Elsevier Journal finder, Springer Journal Suggester, etc.

**Suggested readings:**

1. Dutta, Sumanta, Research and Publication Ethics, Bharti Publications.
2. Yadav S.K., Research and Publication Ethics, Anne Publications.

Course Outcome **Course outcomes (COs):**

**Upon successful completion of the course a student will be able to**

| | |
|---|---|
| CO1. | Recognize the basics of philosophy of science with research ethics. |
| CO2. | Familiarize with important issues in research ethics, integrity & scientific misconduct. |

| | |
|---|---|
| CO3. | Analyze the best practices for publications, publication ethics and identify the predatory |
| CO4. | Analyzing, journal, publishers etc. Applying, remembering, understanding the detailed and complete study related to the use plagiarism software tools, citation databases and research metrics. |
| CO5. | **Evaluating,** analyzing, applying, remembering, and understanding the properties of mechanisms of Research Publication and Ethics. |
| CO6. | **Constructing (Creating),** Evaluating, Analyzing, demonstrating, remembering, and understanding the Research Publication and Ethics. |