UNIVERSITY OF NORTH BENGAL

Raja Rammohunpur, Dist. Darjeeling, Pin: 734013

FYUGP syllabus

B.Sc. 4-YEAR UNDER GRADUATE PROGRAM (FYUGP) WITH CHEMISTRY AS MAJOR SUBJECT UNDER THE NEW CURRICULUM AND CREDIT FRAMEWORK, 2022

First Semester & Second Semester

WITH EFFECT FROM THE 2023-2024 ACADEMIC SESSION

SEMESTER-I

COURSE TYPE - MAJOR

PAPER CODE	PAPER DESCRIPTION
UCHEMAJ11001	Organic Chemistry
Credit	Paper Type
4	TH+PLB
Paper Levels	Full Marks
100	75

COURSE TYPE - MINOR

PAPER CODE	PAPER DESCRIPTION
UCHEMIN11001	Introductory Chemistry
Credit	Paper Type
4	TH+PLB
Paper Levels	Full Marks
100	75

COURSE TYPE – SKILL ENHANCEMENT

PAPER CODE	PAPER DESCRIPTION
UCHESEC11001	Soil Chemistry
Credit	Paper Type
3	TH+PLB
Paper Levels	Full Marks
100	75

COURSE TYPE - MULTIDISCIPLINARY

PAPER CODE	PAPER DESCRIPTION
UCHEMDC11001	Chemistry in Action
Credit	**Paper Type**
3	TH
Paper Levels	**Full Marks**
100	75

UNIVERSITY OF NORTH BENGAL

CHEMISTRY

Semester- I

MAJOR COURSE

Paper Code: UCHEMAJ11001

Paper Description: ORGANIC CHEMISTRY

Paper Type: TH + PLB

Credits: Theory-03, Practical-01

Total Marks: 75 [Theory (ESE – 40); Practical (ESE – 20); CE – 10; Attendance – 05]

Theory: 45 Lectures [Each Lecture is one hour in duration]

ORGANIC CHEMISTRY

UNIT I: Basics of Organic Chemistry

Organic Compounds: Classification and Nomenclature, Hybridization.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation; Organic acids and bases: their relative strength.

Homolytic and Heterolytic fission; Electrophiles and Nucleophiles; Types, shape, and the relative stability of Carbocations, Carbanions, and Free radicals.

Introduction to types of organic reactions and their mechanism: Addition, Elimination, and Substitution reactions. **(12 Lectures)**

UNIT II: Chemistry of Hydrocarbons

A. Carbon-Carbon sigma bonds:

Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation-relative reactivity and selectivity.

B. Carbon-Carbon pi bonds:

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions, Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions, their mechanisms (Markownikov/ *Anti* Markownikov addition), hydroboration-oxidation, ozonolysis, catalytic reduction, *syn* and *anti*-hydroxylation(oxidation), addition reactions in conjugated dienes; Allylic and benzylic bromination and mechanism, e.g., propene, 1-butene, toluene, ethylbenzene.

Reactions of alkynes: Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes, and Reduction reactions.

C. Cycloalkanes:

Types of cycloalkanes and their relative stability, Baeyer strain theory. **(21 Lectures)**

UNIT III: Aromatic Hydrocarbons

Hückel's rule, aromatic character of arenes, cyclic carbocations/ carbanions, and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation, and Friedel-Craft's alkylation/ acylation with their mechanism. Directing effects of the groups. **(12 Lectures)**

Reference Books:

- Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. *Organic Chemistry*, Volume 1, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed., Cengage Learning India Edition, 2013.
- Claiden, J.; Warren, S. & Greeves, N. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.

- Carruthers, W. *Some Modern Methods of Organic Synthesis*, 4th Ed., Cambridge University Press, 2004.
- Loudon, M. *Organic Chemistry*, Oxford University Press, 2002.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, 6th Ed., Harlow, 1961.

ORGANIC CHEMISTRY PRACTICAL

End Semester Examination (ESE):

At the end of the semester, a practical examination will be conducted as per the following guidelines:

Marks distribution

Experiment	15 marks
Practical record notebook	03 marks
Viva-voce	02 marks

PRACTICAL 30 HOURS

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents:

   (a) Water; (b) Alcohol; (c) Alcohol-Water
3. Determination of the melting points of organic compounds.
4. Effect of impurities on the melting point-mixed melting point of two unknown organic compounds.
5. Chromatography **(any two)**

(a) Separation of a mixture of two amino acids by ascending and horizontal paper chromatography

(b) Separation of a mixture of two sugars by ascending paper chromatography

(c) Separation of a mixture of o- and p-nitrophenol or o-and p-aminophenol by thin-layer chromatography (TLC)

Reference Books:

- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education, 2009.
- Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G. & Tatchell, A.R. *Practical Organic*

Chemistry, 5th Ed., Pearson, 2012.

- Vogel, A. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Pearson India, 2003.

MINOR COURSE

Paper Code: UCHEMIN11001

Paper Description: INTRODUCTORY CHEMISTRY

Paper Type: TH + PLB

Credits: Theory-03, Practical-01

Total Marks: 75 [Theory (ESE – 40); Practical (ESE – 20); CE – 10; Attendance – 05]

Theory: 45 Lectures [Each Lecture is one hour in duration]

INTRODUCTORY CHEMISTRY

UNIT I: Basics of Organic Chemistry

Organic Compounds: Classification and Nomenclature, Hybridization. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation; Organic acids and bases: their relative strength. Huckel's rule of aromaticity.

Homolytic and Heterolytic fission; Electrophiles and Nucleophiles; Types, shape, and the relative stability of Carbocations, Carbanions, and Free radicals.

Introduction to types of organic reactions and their mechanism: Addition, Elimination (formation of alkenes and alkynes), and Substitution reactions. **(15 Lectures)**

UNIT II: Atomic Structure

Bohr's theory, its limitations, and the atomic spectrum of hydrogen atoms. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, the significance of ψ and ψ^2. Quantum numbers and their significance.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number. **(15 Lectures)**

UNIT III: Gaseous State

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, the relation between mean free path and coefficient of viscosity, calculation of σ from η.

The behavior of real gases: Deviations from ideal behavior, compressibility factor, *Z*, and its variation with pressure for different gases. Causes of deviation from ideal behavior, Van der Waals equation of state, its derivation and application in explaining real gas behavior and calculation of Boyle temperature. Isotherms of real gases and theircomparison with van der Waals isotherms, continuity of states, critical state, the relation between critical constants and van der Waals constants, and the law of corresponding states.

(15 Lectures)

Reference Books:

- Claiden, J.; Warren, S. & Greeves, N. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
- Carruthers, W. *Some Modern Methods of Organic Synthesis*, 4th Ed., Cambridge University Press, 2004.
- Loudon, M. *Organic Chemistry*, Oxford University Press, 2002.
- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry*, Oxford, 1970.
- Day, M.C. and Selbin, J. *Theoretical Inorganic Chemistry*, ACS Publications, 1962.
- Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry*, 10th Ed., Oxford University Press , 2014.
- Ball, D. W. *Physical Chemistry*, Thomson Press, India, 2007.
- Castellan, G. W. *Physical Chemistry*, 4th Ed., Narosa, 2004.

PRACTICAL

End Semester Examination (ESE):

At the end of the semester, a practical examination will be conducted as per the following guidelines:

Marks distribution

Experiment	15 marks
Practical record notebook	03 marks
Viva-voce	02 marks

Unit I — 10 HOURS

1. Purification of organic compounds by crystallization using the following solvents:

   (a) Water, (b) Alcohol

2. Determination of the melting points of organic compounds.

Reference Books:

- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education, 2009.
- Vogel, A. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Pearson India, 2003.

Unit II — 20 HOURS

1. Qualitative analysis of **water-soluble** mixtures - **three ionic species** (two cations and one anion or one cation and two anions) out of the following:

   Cations: Pb^{2+}, Cu^{2+}, Fe^{3+}, Ni^{2+}, Ba^{2+}, NH_4^+

   Anions: SO_4^{2-}, NO_3^-, Cl^-

   Cations are to be confirmed by special tests /spot tests wherever feasible

   (**Group analysis not to be performed**)

Reference Books:

- Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis*, 6th Ed., Pearson, 2009.
- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.

SKILL ENHANCEMENT COURSE

Paper Code: UCHESEC11001

Paper Description: SOIL CHEMISTRY

Paper Type: TH + PLB

Credits: Theory-02, Practical-01

Total Marks: 75 [Theory (ESE – 40); Practical (ESE – 20); CE – 10; Attendance – 05]

Theory: 30 Lectures [Each Lecture is one hour in duration]

SOIL CHEMISTRY

UNIT I: Physical Properties of Soil

Brief introduction about soil and its formation; texture; structure; density and weight relationship, pore space and porosity, color and components [organic and inorganic].

(8 Lectures)

UNIT II: Soil Micronutrients

Carbon cycle, Nitrogen cycle, and Terrestrial phosphorous cycle.

Sulfur cycle, the role of sulfur in the environment, forms of sulfur in nature, mineralization of organic sulfur, and oxidation of inorganic sulfur compounds.

(8 Lectures)

UNIT III: Basic Chemistry of Soil

Chemical composition, ion exchange, organic components [fulvic acids and humic acid]

Sources of acidity, effects of acid rain, toxicities in acid soils, the influence of pH, determination of soil pH, nutrient availability with pH, pH preferences of plants, soil buffer capacity, and management of pH. **(12 Lectures)**

UNIT IV: Soil Compost

Preparation, examples of compost soil. Composting to increase soil fertility.

(2 Lectures)

Reference Books:

- Foth, H.D. *Fundamentals of Soil Science*, 8th Ed.,Wiley, 2016.
- McLaren, A.D. & Skujins, J. *Soil Biochemistry*, Vol.2, Marcel Dekker, INC, New York, 1971.
- Paul, E.A. & Clark, F.E. *Soil Microbiology and Biochemistry*, 2nd Ed., Academic Press, 1996.

SOIL CHEMISTRY PRACTICAL 30 HOURS

1. Determination of pH of different types of soil.
2. Preparation of Compost.
3. Field visit to any nearby Composting unit and Project Report submission.

Reference Books:

- White, R.E. *Principles and Practice of Soil Science*, 4th Ed., Wiley, 2005.
- Rachelle, S. *Compost*, 8th Ed., Flame Tree Publishing, 2009.

MULTIDISCIPLINARY COURSE

Paper Code: UCHEMDC11001

Paper Description: CHEMISTRY IN ACTION

Paper Type: TH

Credits: Theory-03

Total Marks: 75 [Theory (ESE – 60); CE – 10; Attendance – 05]

Theory: 45 Lectures [Each Lecture is one hour in duration]

CHEMISTRY IN ACTION

UNIT I: Needs of Chemistry

Historical perspective of Chemistry. Importance of Chemistry in daily life. **(3 Lectures)**

UNIT II: Chemistry in Agriculture

Fertilizers, Organic manure, Pesticides, Insecticides, and Fungicides. **(4 Lectures)**

UNIT III: Chemistry in Food Industry

Food color, preservatives, artificial flavor, artificial sweeteners, salt, sugar, and spices, and their needs in our bodies, identification of adulterated food.

(8 Lectures)

UNIT IV: Chemistry in Pharmaceutical Industry

Medicinal drugs: Antipyretics, Antibiotics, Antacids. Antifungal agents, Antiseptics, Antimalarial Agents, and Antidiabetic agents. Chemicals used in First Aid and basic idea about surgical materials.

(8 Lectures)

UNIT V: Chemistry in the Soap Industry

Bathing soaps, Laundry soaps, Detergents, Floor cleaners, Dishwashers. The primary difference between soaps and detergents.

(5 Lectures)

UNIT VI: Chemistry in Transport

Coal, Petrol, Diesel, LPG, CNG, etc. **(5 Lectures)**

UNIT VII: Chemistry in the Cosmetic Industry

Talcum powder, Skincare and Baby care products, Creams and Lotions, Deodorants and Perfumes, Sunscreen, Nail polish, Nail enamel, etc. **(6 Lectures)**

UNIT VIII: Narcotic Drugs

Influence of Addictive Drugs in Society. An idea about harmful drugs like Cocaine, Brown sugar, Heroin, Angel dust, etc.

(6 Lectures)

Reference Books:

- Stocchi, E. *Industrial Chemistry*, Vol I, Ellis Horwood Ltd., UK, 1990.
- Kent, J.A. *Riegel's Handbook of Industrial Chemistry*, 9th Ed., CBS Publisher, New Delhi, 1997.
- Manahan, S.E. *Environmental Chemistry*, 7th Ed., CRC Press, 2010.
- Timberlake, K. & Timberlake, W. *Basic Chemistry*, 5th Ed., Pearson, 2019.
- Myers, R. *The Basics of Chemistry*, Atlantic Publishers, 2003.

SEMESTER-II

COURSE TYPE - MAJOR

PAPER CODE	PAPER DESCRIPTION
UCHEMAJ12002	Inorganic Chemistry
Credit	Paper Type
4	TH+PLB
Paper Levels	Full Marks
100	75

COURSE TYPE - MINOR

PAPER CODE	PAPER DESCRIPTION
UCHEMIN11001	Introductory Chemistry
Credit	Paper Type
4	TH+PLB
Paper Levels	Full Marks
100	75

COURSE TYPE – SKILL ENHANCEMENT

PAPER CODE	PAPER DESCRIPTION
UCHESEC12002	Pharmaceutical Chemistry
Credit	Paper Type
3	TH+PLB
Paper Levels	Full Marks
100	75

COURSE TYPE - MULTIDISCIPLINARY

PAPER CODE	PAPER DESCRIPTION
UCHEMDC12002	Polymer Chemistry
Credit	**Paper Type**
3	TH
Paper Levels	**Full Marks**
100	75

UNIVERSITY OF NORTH BENGAL

CHEMISTRY

Semester-II

MAJOR COURSE

Paper Code: UCHEMAJ12002

Paper Description: INORGANIC CHEMISTRY

Paper Type: TH + PLB

Credits: Theory-03, Practical-01

Total Marks: 75 [Theory (ESE – 40); Practical (ESE – 20); CE – 10; Attendance – 05]

Theory: 45 Lectures [Each Lecture is one hour in duration]

INORGANIC CHEMISTRY

UNIT I: Atomic Structure

Bohr's theory, its limitations, and the atomic spectrum of hydrogen atoms. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, the significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atoms. Radial and angular distribution curves. Shapes of *s*, *p*, *d*, and *f* orbitals.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number. **(14 Lectures)**

UNIT II: Periodicity of Elements

s, *p*, *d*, *f* block elements, the long form of the periodic table. A detailed discussion of the following properties of the elements, with reference to *s* and *p*-block.

(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective

nuclear charge in the periodic table.

(b) Atomic radii (van der Waals)

(c) Ionic and crystal radii.

(d) Covalent radii (octahedral and tetrahedral)

(e) Ionization enthalpy, Successive ionization enthalpies, and factors affecting ionization energy.Applications of ionization enthalpy.

(f) Electron gain enthalpy, trends of electron gain enthalpy.

(g)Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, and group electronegativity. **(16 Lectures)**

UNIT III: Chemical Bonding

(i) *Ionic bond:* General characteristics, types of ions, size effects, radius ratio rule, and limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle, and its application, Solvation energy.

(ii) *Covalent bond:* Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals, Bent's rule. Molecular orbital theory. Molecular orbital diagrams of diatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions (the idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach), and bond lengths.

Fajan's ule of Ionic distortion and its application. **(15 Lectures)**

Reference Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970
- Day, M.C. and Selbin, J. *Theoretical Inorganic Chemistry*, ACS Publications, 1962.
- Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning India Edition, 2002.
- Huheey, J.E.; Keiter, E.A. & Keiter, R.L. *Inorganic Chemistry*, 4th Ed., Harper Collins College Publishers, 1993.
- Shriver and Atkins' *Inorganic Chemistry*, 5th Ed., Oxford University Press, 2009.

- Cotton, F.A.; Wilkinson, G.; Murillo, C.A. & Bachmann , M. *Advanced Inorganic Chemistry*, 6th Ed., Wiley-Interscience, New York, 1999.

INORGANIC CHEMISTRY PRACTICAL 30 HOURS

1. Qualitative analysis of **water-soluble** mixtures - **four ionic species** (two cations and two anions) out of the following:

   Cations : Pb^{2+}, Cu^{2+}, Fe^{3+}, Al^{3+}, Ni^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Na^{+}, K^{+}, NH_4^{+}

   Anions: S^{2-}, SO_4^{2-}, NO_2^{-}, NO_3^{-}, Cl^{-}, Br^{-}, I^{-}

   Cations are to be confirmed by special tests /spot tests wherever feasible

   (**Group analysis not to be performed**)

Reference Books:

- Mendham, J., A. I. *Vogel's Quantitative Chemical Analysis*, 6th Ed., Pearson, 2009.
- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.

MINOR COURSE

Paper Code: UCHEMIN11001

Paper Description: INTRODUCTORY CHEMISTRY

Paper Type: TH + PLB

Credits: Theory-03, Practical-01

Total Marks: 75 [Theory (ESE – 40); Practical (ESE – 20); CE – 10; Attendance – 05]

Theory: 45 Lectures [Each Lecture is one hour in duration]

INTRODUCTORY CHEMISTRY

UNIT I: Basics of Organic Chemistry

Organic Compounds: Classification and Nomenclature, Hybridization. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation; Organic acids and bases: their relative strength. Huckel's rule of aromaticity.

Homolytic and Heterolytic fission; Electrophiles and Nucleophiles; Types, shape, and the relative stability of Carbocations, Carbanions, and Free radicals.

Introduction to types of organic reactions and their mechanism: Addition, Elimination (formation of alkenes and alkynes), and Substitution reactions. **(15 Lectures)**

UNIT II: Atomic Structure

Bohr's theory, its limitations, and the atomic spectrum of hydrogen atoms. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, the significance of ψ and ψ^2. Quantum numbers and their significance.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number. **(15 Lectures)**

UNIT III: Gaseous State

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, the relation between mean free path and coefficient of viscosity, calculation of σ from η.

The behavior of real gases: Deviations from ideal gas behavior, compressibility factor, *Z*, and itsvariation with pressure for different gases. Causes of deviation from ideal behavior, Van der Waals equation of state, its derivation and application in explaining real gas behavior and calculation of Boyle temperature. Isotherms of real gases and theircomparison with van der Waals isotherms, continuity of states, critical state, the relation between critical constants and van der Waals constants, and the law of corresponding states.

(15 Lectures)

Reference Books:

- Claiden, J.; Warren, S. & Greeves, N. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
- Carruthers, W. *Some Modern Methods of Organic Synthesis*, 4th Ed., Cambridge University Press, 2004.
- Loudon, M. *Organic Chemistry*, Oxford University Press, 2002.
- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970.
- Day, M.C. and Selbin, J. *Theoretical Inorganic Chemistry*, ACS Publications, 1962.
- Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry*, 10th Ed., Oxford University Press , 2014.
- Ball, D. W. *Physical Chemistry*, Thomson Press, India, 2007.
- Castellan, G. W. *Physical Chemistry*, 4th Ed., Narosa, 2004.

PRACTICAL

End Semester Examination (ESE):

At the end of the semester, a practical examination will be conducted as per the following guidelines:

Marks distribution

Experiment	15 marks
Practical record notebook	03 marks
Viva-voce	02 marks

Unit I — 10 HOURS

1. Purification of organic compounds by crystallization using the following solvents:

   (a) Water, (b) Alcohol

3. Determination of the melting points of organic compounds.

Reference Books:

- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education, 2009.
- Vogel, A. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Pearson India, 2003.

Unit II — 20 HOURS

1. Qualitative analysis of **water-soluble** mixtures - **three ionic species** (two cations and one anion or one cation and two anions) out of the following:

   Cations: Pb^{2+}, Cu^{2+}, Fe^{3+}, Ni^{2+}, Ba^{2+}, NH_4^+

   Anions: SO_4^{2-}, NO_3^-, Cl^-

   Cations are to be confirmed by special tests /spot tests wherever feasible

   (**Group analysis not to be performed**)

Reference Books:

- Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis*, 6th Ed., Pearson, 2009.
- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.

SKILL ENHANCEMENT COURSE

Paper Code: UCHESEC12002

Paper Description: PHARMACEUTICAL CHEMISTRY

Paper Type: TH + PLB

Credits: Theory-02, Practical-01

Total Marks: 75 [Theory (ESE – 40); Practical (ESE – 20); CE – 10; Attendance – 05]

Theory: 30 Lectures [Each Lecture is one hour in duration]

PHARMACEUTICAL CHEMISTRY

UNIT I: Introduction

Drug and medicine, classification of drugs, importance and working principle of drugs, Drug targets, binding with the targets, protein, and nucleic acid as drug targets.

(6 Lectures)

UNIT II: Drug Development

Screening of natural products, isolation and purification, structure determination, structure-activity relationship [The binding role of hydroxyl, amino groups, aromatic rings, and double bonds]; synthetic analogs [Variation of substituents, an extension of structure, chain extension/contractions, ring expansion/ contractions, isosteres, simplification/ rigidification of the structure].

(12 Lectures)

UNIT III: Synthesis and Applications of the Representative Classes of Drugs

Analgesic [paracetamol, aspirin], Antipyretic [Ketoprofen, Naproxen, Ibuprofen], Antidiabetic [Metformin, Acarbose, Chlorpropamide], Antihypertensive [captopril, atenolol], Antibacterial [Sulfonamides, Penicillins, Cephalosporins, Chloramphenicol], Antimalarial [Chloroquine, Piperaquine], Antiulcer [Pantoprazole, Cimetidine, Famotidine] Antiviral agents [HIV and flu-related drugs], Cardiovascular (Glyceryl trinitrate), Anti-leprosy (Dapsone), Central Nervous System agents (Phenobarbital, Diazepam, L-DOPA, Rivastigmine, Donepezil), Anticancer and Antidepressant.

(20 Lectures)

UNIT IV: Vitamins and natural products

Structure and biological importance of vitamins.

Medicinal values of curcumin (haldi), azadirachtin (neem), tulsi, and aloe vera.

(7 Lectures)

Reference Books:

- Patrick, G. L. *Introduction to Medicinal Chemistry, Oxford University* Press, UK, 2013.
- Wermuth, C. G.; Aldous, D.; Raboisson, P.; Rognan, D. *The Practice of Medicinal Chemistry*, 4th Ed. Academic Press.
- Singh, H. & Kapoor, V.K. *Medicinal and Pharmaceutical Chemistry,* Vallabh Prakashan, Pitampura, New Delhi, 2012.
- Foye, W.O., Lemke, T.L. & William, D.A. *Principles of Medicinal Chemistry*, 4th Ed., B.I. Waverly Pvt. Ltd. New Delhi.

PHARMACEUTICAL CHEMISTRY PRACTICAL 30 HOURS

A. Practical (<u>any two</u>)

1. Preparation of Aspirin and its analysis.
2. Preparation of magnesium bisilicate (Antacid).
3. Preparation of methylsalicylate (oil of wintergreen).
4. Any other preparation as desired.

B. Field visit and submission of the Report

Reference Books:

- Beckett, A.H. & Stenlake, J.B. *Practical Pharmaceutical Chemistry*, Part 1, 4th Ed., CBS Publishers, 2005.
- Jenkins, G.L.; Knevel, A.M. & Digangi, F.E. *Quantitative Pharmaceutical Chemistry*, 6th Ed. CBS Publication, 2008.

MULTIDISCIPLINARY COURSE

Paper Code: UCHEMDC12002

Paper Description: INTRODUCTION TO POLYMERS

Paper Type: TH

Credits: Theory-03

Total Marks: 75 [Theory (ESE – 60); CE – 10; Attendance – 05]

Theory: 45 Lectures [Each Lecture is one hour in duration]

INTRODUCTION TO POLYMERS

UNIT I: History of Polymeric Materials

Different schemes of classification of polymers with definitions and examples, Polymer nomenclature, Molecular forces and chemical bonding in polymers, and Texture of Polymers. Classifications including di-, tri-, and amphiphilic polymers. Recycling and chasing arrows.

(12 Lectures)

UNIT II: General applications of polymeric materials

Polymers in construction, automobile, transports, electronics, optics, medicines and medical consumables, textiles, sports, etc. **(08 lectures)**

UNIT III: Functionality of monomers

Addition and Condensation polymerization.

The extent of reaction and degree of polymerization. **(08 lectures)**

UNIT IV: Structure, Properties, and Application of the Polymers

Poly-olefins, polystyrene, styrene copolymers, poly(vinyl chloride) and poly(vinylacetate), acrylic polymers, fluoropolymers, polyamides, and related polymers.

Phenol formaldehyde resins (Bakelite, Novalac). Polyurethanes, silicone polymers, polydienes.

(12 Lectures)

UNIT V: Polymers and pollution

Issues related to polymer pollution, microplastic, polymer wastage, and recycling. **(5 lectures)**

Reference Books:

- Seymour, R.B. & Carraher, C.E., *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc. New York, 1981.
- Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.
- Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
- Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.
- Lenz, R.W. *Organic Chemistry of Synthetic High Polymers,* Interscience Publishers, New York, 1967.

End Semester Examination (ESE)

End Semester Examination (ESE) of 40 Marks:

At the end of the semester, an examination will be conducted, and the question pattern will be as follows:

Marks distribution:

Serial No.	Questions to be answered	Out of	Marks for each question	Total Marks
1	5	8	2	5 x 2 = 10
2	4	6	5	4 x 5 = 20
3	1	2	10	1 x 10 = 10

End Semester Examination (ESE) of 60 Marks:

At the end of the semester, an examination will be conducted, and the question pattern will be as follows:

Marks distribution:

Serial No.	**Questions to be answered**	**Out of**	**Marks for each question**	**Total Marks**
1	5	8	2	5 x 2 = 10
2	6	9	5	6 x 5 = 30
3	2	4	10	2 x 10 = 20