

VANITA VISHRAM WOMEN'S UNIVERSITY
SCHOOL OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CHEMISTRY



VANITA VISHRAM
WOMEN'S UNIVERSITY
— SURAT —

BACHELOR OF SCIENCE (B.Sc.) HONOURS CHEMISTRY
PROGRAMME

under Learning Outcomes-based Curriculum Framework (LOCF)
for Under Graduate (UG) Education

SEMESTERS 2

Core Courses (CC), Ability Enhancement Compulsory Courses (AECC),
Generic Elective Courses (GE)

Syllabus applicable to the students seeking admission in the following programmes

B.A. /B.Com./B.B.A./B.Sc./B.C.A. under LOCF

w.e.f. the Academic Year 2021-2022

1. Preamble – VVWU

Vanita Vishram Women's University (VVWU) is the First-ever Women's University of Gujarat approved by the Government of Gujarat under the provisions of the Gujarat Private Universities Act, 2009. It is a University committed to achieve Women's Empowerment through Quality Education, Skill Development, and by providing employment opportunities to its girl students through its model curriculum, integration of technology in pedagogy and best-in-class infrastructure. The focus is on prioritizing practical component and experiential learning supported through academia-industry linkages, functional MoUs, skill development training, internships etc. It aims at providing opportunities to the girl students for holistic development and self-reliance.

VISION

Empowerment of women through quality education and skill development, so as to make them strong pillars of stability in the society.

MISSION

To provide Education & Professional Training to all women for their all-round development, so as to enable them to become economically independent and socially empowered citizens.

2. Introduction of the Programme

It is a three-year undergraduate course offered after completion of 10+2 schooling. The course aims to provide broad and balanced knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories. It will provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry, in related areas or multidisciplinary areas that can be helpful for self-employment / entrepreneurship. The course is designed to provide intellectual and laboratory skills according to the UGC module for CHOICE BASED CREDIT SYSTEM (CBCS) pertaining to B.Sc. Chemistry (Honours).

3. Programme Specific Objectives (PSOs)

- To provide knowledge of chemistry with board and balanced aspects
- Development of laboratory analysis skills.
- To develop critical thinking approaches for problem solving.
- To provide skill base training to hold out in the current competitive environment.
- Multidisciplinary approach for overall development.

4. Programme Specific Outcomes (PSOs)

- Identifying chemistry related problems, analysis and application of data using appropriate methodologies.
- Finding opportunity to apply subject-related skills for acquiring jobs and self-employment.
- Understanding new frontiers of knowledge in chemistry for professional development.
- Applying subject knowledge for solving societal problems related to application of chemistry in day to day life.
- Applying subject knowledge for sustainable environment friendly green initiatives.

BACHELOR OF SCIENCE (B.Sc.) CHEMISTRY HONOURS

SEMESTER 2 CORE COURSE PAPER 3 (CH11050)

Inorganic & Physical Chemistry-II

Course Objectives

- In attaining knowledge based on working based on electrolysis and its type.
- Learning of different thermodynamic properties.
- Knowing inner transition elements, their occurrence and their uses.
- Studying organic and inorganic reagents, its preparation and its application.

Course Outcomes

After completing the course, the students will be able to:

After completion the course, the learner shall be able to understand:

Basic concepts about electrolysis, thermodynamic properties, the nature of f-block elements, organic and inorganic reagents used in qualitative analysis.

COURSE CONTENTS

Unit-1 Electrolysis and Electrical Conductance (Theory)

Mechanism of electrolysis, Electrical units, Faraday's laws of Electrolysis, Faraday's first law, Faraday's second law, Importance of the first Law of electrolysis, Importance of the second Law of electrolysis, Conductance of Electrolytes, Specific conductance, Equivalent conductance, Molar conductance, Variation of Equivalent conductance with Concentration (or Dilution), Variation of Conductance with Temperature, Summary of Electrochemical Quantities, Strong electrolytes, Weak electrolytes, Measurement of Electrolytic conductance, Determination of the cell Constant, Numericals

Unit-2 Thermochemistry (Theory)

Units of energy changes, Enthalpy of a reaction, Exothermic and endothermic reactions, Thermochemical equations, Heat of reaction or enthalpy of reaction, Variation of heat (or enthalpy) of reaction with temperature, Different types of heat (enthalpy) of reaction, Heat of combustion, Heat of solution, Heat of neutralisation, Energy changes during transitions or phase changes, Heat of fusion, Heat of vaporisation, Heat of sublimation, Heat of transition, Hess's law of constant, Heat summation, Applications of Hess's law, Bond energy, Measurement of the heat of reaction, Numericals

Unit-3 Chemistry of Inner Transition elements (Theory)

Lanthanides-4f block elements: Electronic configuration, Oxidation States, Atomic and ionic radii of M^{+3} , Lanthanide contraction, Magnetic Properties, Physical Properties, Chemical reactivity, Formation of compound and complexes. Uses of lanthanide and compounds
Actinides-5f block elements: Transuranic elements, Position of elements in the periodic table, Occurrence, Electronic configuration, Actinide Contraction, Properties of Actinides.

Unit- 4 Uses of organic and Inorganic reagents in Inorganic Analysis (Theory)

Introduction, Advantages of using organic reagents, common properties of organic reagents, Advantages of organic reagents over inorganic reagents, Disadvantages of organic reagents, Important organic reagents: Oxime, DMG, α nitroso β naphthol, Cupferron, Aluminon, Rubeanic acid, Benzidine, Cupron, Magneson, Alizarin, Important inorganic reagents

Reference Books

- J.D. Lee, Concise inorganic Chemistry, 5th Edition, Wiley- Blackwell, New Jersey, 1999.
- F.A. Cotton, G. Wilkinson, C.A. Murillo, M. Bochman, Advanced Inorganic Chemistry, 6th edition, John Wiley & Sons. New York, 1999
- Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970
- S. Prakash, G.D. Tuli, Advanced inorganic Chemistry, S. Chand
- Physical Chemistry by Arun Bahl, B. S. Bahl and G. D. Tuli; Pub. S. Chand
- Text book of physical chemistry by P. L. Soni, O. P. Sharma; Pub. S. Chand
- Atkins P. and De Paula, J. Physical Chemistry Tenth Ed., OUP, 2014.

SEMESTER 2
CORE COURSE PAPER 4 (CH11070)

Organic Chemistry-II

Course Objectives

- Aromatic compounds and aromaticity, mechanism of aromatic reactions.
- Basic concepts of polynuclear hydrocarbons.
- Detailed concept of nucleophilic substitution reactions.
- Reactivity, stability and reactions of alcohols, phenols, ethers and epoxides.
- Preparation, physical properties and reactions of monocarboxylic acids and their derivatives.

Course Outcomes

After completing the course, the students will be able to:

- Gain detailed knowledge of aromatic compounds and their aromaticity, nucleophilic substitution reactions
- Understand about alcohols, phenols, ethers and epoxides, carboxylic acid and their derivatives.

COURSE CONTENTS

Unit-1 Hydrocarbons (Theory)

A) Aromatic Hydrocarbons

Aromaticity: Huckel'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 substituent groups.

B) Polynuclear Hydrocarbons: Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.

Unit-2 Nucleophilic substitution Reactions (Theory)

Nucleophilic substitution, Structure and stability of carbocations, The SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Unit-3 Alcohols, Phenols, Ethers and Epoxides (Theory)

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouveault-Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement. Phenols: Preparation and properties; Acidity and factors affecting it, Ring substitution reactions, Reimer-Tiemann and Kolbe's-Schmidt Reactions, Fries and Claisen rearrangements with mechanism. Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH₄

Unit-4 Carboxylic Acids and their Derivatives (Theory)

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids; Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group - Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann Bromamide degradation and Curtius rearrangement.

Reference Books

- Morrison, R. N. & Boyd, R. N. Organic Chemistry, 6th Edn., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- F. A. Carey, Organic Chemistry, Seventh Edition, Tata McGraw Hill (2008).
- J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd Ed., (2012), Oxford University Press.
- Organic Chemistry by Bahl & Bahl

- “Text book of Organic Chemistry” by P. L. Soni and H. M. Chawla, 26/E, 1995, Sultan Chand & Sons Publication, New Delhi.

SEMESTER 2
CORE COURSE PAPER 3 (CH11060)

Inorganic and Physical Chemistry Practical-II

Course Objectives

- To perform basic volumetric titrations
- To perform gravimetric analysis

Course Outcomes

After completing the course, the students will be able to:
Perform simple volumetric and gravimetric analysis.

COURSE CONTENTS

Practical to be performed:

1. **Inorganic Qualitative Analysis. (Inorganic qualitative analysis of single salt)**
2. **Physical Exercise:**
 - 1) Polarimetry: Determination of angle of rotation of Glucose using five different dilutions.
 - 2) Conductometric Titration: To determine the concentration of a weak acid (CH₃COOH) conductometrically using standard caustic soda solution.

Reference Books

- Quantitative analysis by R.A. Day and A.L. Underwood.
- Vogel's qualitative organic analysis.
- Elementary Practical Organic Chemistry Part-I Small Scale Preparations by A. I. Vogel.
- Practical Pharmaceutical Chemistry by A. H. Beckett, Volume I & II.
- Elementary Practical Organic Chemistry Part-III Quantitative Organic Analysis by A. I. Vogel.

SEMESTER 2
CORE COURSE PAPER 4 (CH11080)

Organic Chemistry Practical-II

Course Objectives

- To understand the preparation of solutions and perform standardisation processes.
- To understand estimations of various compounds.

Course Outcomes

After completing the course, the students will be able to:

- Gain detailed knowledge of solution preparation and standardisation.
- Conduct experiments and interpret results, while observing responsible and ethical scientific conduct.

CONTENTS

Experiments

- 1. Organic Qualitative Analysis. (Organic Qualitative Analysis of single substance)**
- 2. Estimations:**
 1. Estimation of Amide.
 2. Estimation of Aniline.

Reference Books

- Quantitative analysis by R.A. Day and A.L. Underwood.
- Vogel's qualitative organic analysis.
- Elementary Practical Organic Chemistry Part-I Small Scale Preparations by A. I. Vogel.
- Practical Pharmaceutical Chemistry by A. H. Beckett, Volume I & II.
- Elementary Practical Organic Chemistry Part-III Quantitative Organic Analysis by A. I. Vogel.