પરિપત્ર:

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે સાયન્સ વિદ્યાશાખા હેઠળનો NEP-૨૦૨૦ અંતર્ગતનો કેમેસ્ટ્રી વિષય (બી.એસ.સી કેમેસ્ટ્રી વિથ ઓનર્સ) સેમેસ્ટર-૧ના અભ્યાસક્રમમાં રિવાઈઝ્ડ પેપર સ્ટાઈલ (SOP, શિક્ષણ વિભાગ, ગુજરાત સરકાર ની ગાઈડલાઈન્સ પ્રમાણે) જેની સાથેનો ૨૦૨૩-૨૪નો અભ્યાસક્રમ આ સાથે સામેલ છે. જે આપને વિદિત થાય.

માનનીય કુલપતિશ્રીની મંજુરી અનુસાર સદર અભ્યાસક્રમ શૈક્ષણિક વર્ષ જુન,૨૦૨૩ થી અમલવારી કરવાની રહે છે. સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજો ધ્વારા તેની અમલવારી કરવા જણાવવામાં આવે છે.

Bhakta Kavi Narsinh Mehta University Junagadh.

16/10/2024

ખાસ ફરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/ એકેડેમિક/૧૩૯૦/૨૦૨૪
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી,
સરકારી પોલીટેકનિક કેમ્પસ,
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી રોડ,
ખડીયા, જૂનાગઢ-૩૬૨૨૬૩
તા.૧૬/૧૦/૨૦૨૪

પ્રતિ,

- ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમો ચલાવતી તમામ કોલેજોના આચાર્યશ્રીઓ તરફ....

નકલ સાદર રવાનાઃ-

- માન.કુલપતિશ્રી/કુલસચિવશ્રીનાં અંગત સચિવશ્રી.
- પરીક્ષા નિયામકશ્રી, ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી, જુનાગઢ

નકલ રવાના જાણ તથા યોગ્ય કાર્યવાહી અર્થેઃ

- સીસ્ટમ મેનેજરશ્રી, આઇ.ટી.સેલ વિભાગ (વેબસાઇટ ઉપર પ્રસિદ્ધ થવા અર્થે.)

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
JUNAGADH

BOARD OF CHEMISTRY STUDIES

FACULTY OF SCIENCE

SYLLABUS FOR

B.Sc. (CHEMISTRY) (HONOURS)

PROGRAMME

(SEMESTER- I)

EFFECTIVE FROM JUNE, 2023

INDEX

Subject: Chemistry-MAJOR/MINOR, MDC/IDC & SEC

Faculty: Science

Credit Structure

Sr. No	Level UG/PG	Course Group Major/Minor /MDC /SEC	Course (Paper) Title	Paper No.	Credit	Teaching Hours	Practical hours	CCE (Formative)	SEE (Summative)	Total Marks
1	UG	Major	Chemistry	MAJCHEM 111	03	45	-	25	50	100
				MAJCHEM 111 (Practical)	01	-	30	25	-	
2	UG	Major	Chemistry	MAJCHEM 112	03	45	-	25	50	100
				MAJCHEM 112 (Practical)	01	-	30	25	-	
3	UG	Minor	Chemistry	MINCHEM 111	03	45	-	25	50	100
				MINCHEM 111 (Practical)	01	-	30	25	-	
4	UG	MDC/IDC	Chemistry	MDCCHEM 111	03	45	-	25	50	100
				MDCCHEM 111 (Practical)	01	-	30	25	-	
5	UG	SEC	Chemistry	SECCHEM 111	02	-	30	25	25	50

DSC: Discipline Specific Course [**Major (Core), Minor (Elective**)]
MDC: Multi-Disciplinary Course, **IDC**: Inter Disciplinary Course
SEC: Skill Enhancement Course

Important Instructions:

- One Theory credit equals 15 lecture hours per semester.
- One practical work credit equal 30 hours per week.
- Four credit course equals 45 hours of theory teaching per semester and 30 hours of practical experiences per semester.
- Theory component syllabus (Major/Minor/MDC) for any Semester consists of three units each.
- Lecture hours are distributed equally amongst all three units (15 for each)
- Total marks for each Chemistry course (Major/Minor/MDC) are 100.
- Out of this, 50% of marks will be evaluated under CEE and 50% of marks will be evaluated under SEE.
- The SEE-Semester End Exam (External exam) question paper will be drawn of 50 marks by assigning equal weightage to all the Theory component units.
- Within CEE of 50 marks, Evaluation of 25 marks will from the theory component of the course paper and 25 marks will be from the practical component of the course. (**Note: The practical component of 25 marks will be evaluated under CEE only**).
- The minimum passing standard for both the exams is exclusively 36 %. i.e.; Total of 18 marks out of 50 under CEE and 18 marks out of 50 under SEE.
- Common list of Reference books for all papers is given at the end of the syllabus.
- Theory Question paper style is also given at the end of the syllabus.

UG Certificate:

Students who opt to exit after completion of the first year (two Semesters) and have secured 40 credits will be awarded a UG certificate if, in addition, they complete one vocational course (internship/ of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

Learning outcome descriptors of Programme
B. Sc. Chemistry (Honours) Graduate attributes

The student graduating with the programme of B. Sc. (Honours) Chemistry should be able to demonstrate the acquisition of:

- **Comprehensive knowledge** of chemistry and coherent understanding of its concepts explained through its main branches like inorganic chemistry, organic chemistry, physical chemistry and analytical chemistry in a multidisciplinary context of natural and other branches of Physical sciences. Know its linkages with related fields of study like pharmaceuticals, heavy chemicals, material science, polymer and other applied chemistry. Also know the current and emerging developments associated with the main stream of branches and its allied fields of learning.
- **Practical, professional, and procedural knowledge** required for carrying out a job in Handling chemicals, synthesis or analysis of chemical for a company or for undertaking self-employment initiatives, and knowledge and mindset required for entrepreneurship involving enterprise creation, improved product development, or a new mode of organization.
- **Skills** in industrial production methods and protocols, standard laboratory protocols, apparatus, equipment and instruments with sufficient knowledge of its operational procedures.
- **Capacity to learn** the most sophisticated instruments, analyses the generated data using the acquired theoretical knowledge of various analytical techniques.
- **Ability to further apply**/extrapolate theoretical and practical skills in chemistry and allied field to find the solutions of complex problems solving for the industry or as an entrepreneur or to solve societal problems.
- **Critical thinking** in identifying ideas/data from various sources and drawing conclusions using validated evidences.
- **Creativity** in solving simple problems related to chemistry problems by applying imaginative and lateral thinking from multiple perspectives.
- **Communicative skills** in terms of reading, understanding and delivering own thoughts through respectful language or in a technical, systematic acceptable way of communication.
- **Analytical reasoning** capability in evaluating data from a variety of sources through evidence-based validation.
- **Research related skills** in terms of solving problem in chemistry through acceptable research methodologies, problem formulation in chemistry, designing study project with clear aim and objectives of the project and reporting it sustaining the ethical values.
- **Coordinating/collaborating with others** for common cause and work efficiently as a member of research/work group.
- **Leadership readiness quality** during group project work preparations and execution or any other team work by sharing, motivating and working closely to achieve the clear objectives of the work.

- **Digital and technological skills and learning how to learn skills f**or the independent task completion or problem solution using appropriate resources available ICT tools, open access

platforms, software for data analysis or to work independently, acquire organizational skills and time management to achieve self-defined goals.

- **Multicultural competence** by interacting respectfully with diverse group of people, show inclusive spirit during completion of common group task and also by empathy for less advantaged, differently abled or people with learning disabilities.
- **Autonomy, responsibility and accountability** while completing the task assignment by applying knowledge and executing it in a demonstrative way considering safety, security, accountability and simultaneously maintaining ethical values.
- **Value inculcation** by maintaining ethical and moral standards in work and reporting of data, show environmental concerns and prepare sustainable projects and participate in sustainable development programs and follow ethical practices.

Learning outcome descriptors of Programme
B. Sc. Chemistry Certificate holder attributes

The student having with the certificate in B. Sc Chemistry should be able to demonstrate the acquisition of:

- **Foundation knowledge** of chemistry and coherent understanding of its concepts explained through its main branches like inorganic chemistry, organic chemistry, physical chemistry and analytical chemistry in a multidisciplinary context. Know its application in fields of production of materials, analysis and handling of chemicals.
- **Practical, professional, and procedural knowledge** in carrying out some primary volumetric exercises, in identifying various chemicals, (including organic and inorganic chemicals through appropriate tests), apparatus, laboratory equipment, glass wares and chemicals. Should be able to effectively handle chemicals in terms of sampling, weighing, preparation of laboratory reagents, solutions for titrimetric or other analysis, methods of systematic storage of chemicals using knowledge from MSDS (Material safety and data sheet) or other sources as and when required.
- **Primary Skills** associated with laboratory set up and handling for small analytical laboratory or academic units or chemical production units. This also includes skills associated with handling of LPG burners and use of fume hood for volatile liquids etc. Primary exposure to analytical laboratory or production unit protocol and its execution (Achieved through vocational training / internship).
- **Emergency response skill** to handle any laboratory accident including fire, gas or chemical hazard by acting logically and provide appropriate first aid including CPR. Specialized skill for helping effectively during any natural or other disaster.
- **Creativity** in solving simple problems related to chemistry laboratory or production unit by applying imaginative and lateral thinking from multiple perspectives.
- **Analytical reasoning** capability in understanding laboratory protocols, evaluating data from a variety of sources through evidence-based validation.
- **Primary communicative skills** in terms of reading, understanding various protocols, expressing difficulties faced in executing work or concerns and delivering own thoughts through respectful language or in a technical, systematic acceptable way of communication.

  Ability and employability in various primary chemistry laboratories as assistant to chemist/helper in advanced laboratories, production units, or entrepreneur for self-employment

MAJCHEM111(Introductory Chemistry)

4 CREDITS (3 hrs theory + 2 hrs practical = 5 Hours/Week) 100 MARKS

Course Objectives and learning outcome-Theory component

This course will provide a basic introduction to understand the important aspects of branches of Chemistry. It is designed to understand the physical properties and chemical reactivities at the atomic level. It will enable student understand stoichiometric calculations of compounds and carry out some problem solving qualitative and quantitative analytical operations, understand, identify and evaluate chemical and physical phenomenon.

On completion of the course, the students will be able to understand:

- Atomic structure using wave particle dual nature of electron and Schrodinger's wave equation, its acceptable solutions and possible value of quantum numbers for multi electron atoms.
- Classification of elements into periodic table, periodicity in their various properties, anomalous behaviors of some elements and calculation of some of their physical parameters.
- IUPAC nomenclature of organic compounds (Acyclic-1993)
- Various electron displacement effects in organic molecules.
- Bond fission and Curley arrow rules for electron transfer.
- Types of organic reactions
- Modes of concentration and calculation of solutions.
- Phenomenon of adsorption, its mechanism, types and applications
- Types of catalysts, its characteristic, theory of catalysis

Syllabus-Theory component

UNIT – I

Chapter-1 Atomic structure and Periodic properties [15 hours]

- Introduction to development of the structure of atom.
- Basic concept of Wave particle duality of electron, De-Broglie's equation, Heisenberg's uncertainty principle,
- Example based on de-Broglie's equation, Heisenberg's uncertainty principle,
- Difference between Orbit & Orbital, Schrödinger's wave equation, significance of ψ and ψ^2

and Quantum numbers.

- Aufbau rule, Pauli's Principle, and Hund's rule for electronic configuration, stability of half-filled and completely filled orbitals.
- Study of modern periodic table, electronic configuration in periodic table, Periodicity in atomic properties and its causes, Magic number,
- Explanation of general trends of periodic properties:(1) atomic radii (covalent, metallic and van der Walls radii), (2) Ionic radii, Calculation of Ionic radii by Pauling method, (3) Ionization potential, (4) electron gain enthalpy, (5) electronegativity, Calculation of Electronegativity by Mullikan and Pauling method, Ionic radii
- Periodic Trends in Chemical Properties, (a) Periodicity of Valence or Oxidation States, (b) Anomalous Properties of Second Period Elements, Periodic Trends and Chemical Reactivity,

UNIT – II

Chapter-2 Basic Organic Chemistry [15 hours]

- IUPAC Nomenclature of organic compounds (Acyclic, cyclic) *(minimum 50 examples should be done)*
- Electronic displacements in organic molecules: (1) Inductive effect, (2) Electromeric effect, (3) Mesomeric effect and (4) Hyperconjugation.
- Applications of Inductive effect to (1) bond length, (2) dipole-moment, (3) reactivity of alkyl halides, (4) relative strength of acid, (5) basicity of amines.
- Homolytic and heterolytic fission, curly arrow rules
- Reaction Intermediates: (1) Carbocation, (2) Carbanion, (3) Free radical, (4) Carbenes and (5) Benzynes *(Formation by cleavage type, structure, relative stabilities, generation)*
- Types of organic reagents: Nucleophiles and Electrophiles
- Types of organic reactions: (1) Substitution, (2) Addition, (3) Elimination
  (4) Rearrangement.

UNIT – III [15 hours]

Chapter-3 Modes of Concentration [With Numerical] [05 hours]

- Primary and secondary standards for preparation of solutions and their Characteristics
- Preparation of Standard Solutions
- Equivalent weight of acid and base, Equivalent weight of acid salt, Equivalent weight of an ion.
- Molarity, Normality, Molality (All with numericals)
- Strength of solutions, % concentration w/v, Volume Fraction, Weight Fraction, ppm etc.

Chapter-4 Adsorption **[05 hours]**

- Introduction
- Mechanism of Adsorption
- Types of Adsorptions (physical and chemical)
- Characteristics and factors affecting on adsorption
- Adsorption isotherm and Freundlich equation with limitations,
- Langmuir theory of adsorption: assumptions, derivation, modification in equation at very low and high pressure.
- Applications of adsorption.

Chapter-5 Catalysis **[05 hours]**

- Introduction,
- Types of catalysis (homogeneous and heterogeneous)
- Characteristics of catalysis,
- Definitions with examples: Auto-catalysis, Negative catalysis (Inhibitor), Promoters and Catalytic poisoning
- Activation energy and catalysis,
- Theories of catalysis: (1) Intermediate compound formation and (2) Adsorption theory
- Active centers, Enzyme catalysis and its characteristics.

MAJCHEM111(Chemistry Practical)

(Course Objectives and learning outcome)

The course will provide analytical ability to quantitatively analyse concentration of various acids and bases.

On completion of the course, the students will be able to understand and evaluate:

- Concentration in various acids and bases using titrimetric analytical methods using appropriate indicators.

Syllabus

(2 Hours/Week) **25 MARKS**

1. Volumetric analysis-Acid Base Titration [Performance-15 Marks]

1) To prepare a solution by dissolving 'x' g $NaHCO_3$/Na_2CO_3 in 100 ml solution and determine its concentration in terms of normality and molarity using 0.1 N HCl solution.

2) To determine the normality, molarity and g/lit of NaOH and HCl using 0.1 N Na_2CO_3 solution.

3) To determine the normality, molarity and g/lit of each component in a given mixture of $NaHCO_3$ and Na_2CO_3 using 0.1N HCl solution.

Viva **[10 Marks]**

MAJCHEM112(Introductory Chemistry)
4 CREDITS (3 hrs theory + 2 hrs practical = 5 Hours/Week) 100 MARKS

Course Objectives and learning outcome-Theory component

This course will provide a broad introduction to concepts of linkages between atoms to form bonds. Introduction and chemistry of organic compounds like alkanes and alkyl halides, isomerism in organic compound and its basis of classification into various types including stereoisomerism. They will also learn about some special states of matter.

On completion of the course, the students will be able to understand:

- Detailed VBT, MOT with LCAO concept, energy level diagram of molecular orbitals and ions, H-bonding and its applications.
- Various theories to explain shapes of various molecules.
- Calculation of available electron pairs with the central atom in some molecules.
- Chemistry of alkanes including reactivity and selectivity in its characteristic reaction
- Isomerism in organic compounds and its mode of classification
- Identify and Perceive similarity and difference between molecules using the concepts of superimposable and mirror image (symmetry), Differentiate enantiomers and diastereomers and understand their Nomenclature.
- General reactions of alkyl halides. Mechanism for Nucleophilic substitution reaction of alkyl halides (S_N1/ S_N2)
- Classification, preparation and properties of Colloids and its importance.

Syllabus - Theory component

UNIT – I

Chapter-1 Chemical bonding [15 hours]

- Basics of Ionic bond, Covalent bond, Co-ordinate covalent bond and H- bond
- Valence bond theory and its limitations
- Concept of hybridization: sp (C_2H_2, $BeCl_2$), sp^2 (BF_3, C_2H_4), sp^3 (CH_4), sp^3d (PCl_5) & sp^3d^2 (SF_6), bond parameters and strength of bond
- Hybridization of elements involving π-bonds (SO_2, SO_3, XeO_3),
- Sidgwick Powell rule and VSEPR theory,
- Calculation of total electron pairs, loan pairs, bond pairs in CH_4, NH_3, H_2O, $SnCl_2$, SO_4^{-2}, I_3^-, CO_3^{-2} (with Structure), resonance structures in NO_2^-, CO_3^{-2} and O_3 molecules
- Basic concept of MO theory
- Bonding and anti-bonding molecular orbital, gerade and ungerade molecular orbital, σ - molecular orbital and σ*- molecular orbital, π- molecular orbital and π*- molecular orbital,

- Conditions for effective combinations of atomic orbitals.
- Energy level diagrams of B_2, C_2, N_2, O_2, F_2, CO, and NO with calculation of bond order and magnetic moment,
- Comparison of MO theory and VB theory,
- Intermolecular forces; H-bonds, Types and applications of H-bond.

UNIT – II [15 hours]

Chapter-2 Aliphatic Hydrocarbons-I and alkyl halides [08 hours]

- Alkanes: Formation of alkanes by Wurtz reaction, Wurtz-Fittig reaction.
- Free radical substitutions reactions
- Preparation of alkyl halides
- Relative reactivity and selectivity in Halogenation.
- Reactions of alkyl halides: Nucleophilic substitution reaction mechanism (SN^1& SN^2) for alkyl halides

Chapter-3 Introduction to Stereochemistry [7 hours]

- Homomers and Isomers, Concept of isomerism. Constitutional isomers, Chirality and Stereoisomers
- Modern classification of stereoisomers based on superimposability and energy criterion *(Configurational enantiomers, Configurational diastereomers, Conformational enantiomers, Conformational diastereomers),* Difference between enantiomers and diastereomers
- Fisher, Sawhorse and Newman projection formulae and their interconversion *(two asymmetric carbon only)*
- R/S nomenclature for acyclic compounds containing one and two chiral carbons *(using CIP rules).*
- Concept of Geometrical isomerism: Cis–trans, Syn-anti, E/Z notations *(using CIP rules)*

UNIT – III

Chapter-4 The Colloidal State [15 Marks]

- Introduction
- Classification of Colloids based on (1) Physical state of dispersed phase & Dispersion medium (2) Nature of interaction between dispersed phase & Dispersion medium (3) Type of particles of the dispersed phase
- Preparation of colloidal solutions; (1) Chemical methods, (2) Electrical disintegration or Bredig's Arc method, (3) Peptization

- Purification of colloidal solutions; (1) Dialysis, (2) Electro-dialysis, (3) Ultrafiltration
- General properties of colloidal systems

  Tyndall effect, Colour, Brownian movement, Charge on colloidal particles, Electrophoresis/Electro-osmosis, Coagulation or Precipitation, Protection of colloids

- Emulsions & its types, Emulsifiers,
- Gels: Elastic and Non-elastic gels
- Importance and applications of colloids

MAJCHEM112 (Chemistry Practical)

(Course Objectives and learning outcome)

The course will provide analytical ability to qualitatively analyze mono-functional organic compound using various physical and chemical methods.

On completion of the course, the students will be able to understand and evaluate:

- Physical properties of mono functional organic compounds such as carboxylic acids, esters, amides, ketones, alcohols, phenols, aldehydes, halogenated hydrocarbon, aromatic hydrocarbons, Nitro compounds, amines, anilides etc.

Syllabus

(2 Hours/Week) **25 MARKS**

Organic qualitative analysis **[Performance-15 Marks]**

Identification of Aromatic Hydrocarbons or Compounds containing a functional group (other than multiple bond) using Physical and Chemical tests.

[Minimum 12 compounds covering all the chemical nature must be given]

Examples:

Carboxylic acids: Aliphatic acids like oxalic and succinic acid,

Aromatic acids: Benzoic acid, cinnamic acid and pthalic acid

Phenols: α-naphthol, β-naphthol, Resorcinol

Bases: Aniline, methylaniline, dimethylamine etc

Neutral: Acetone, Ethyl methyl ketone, Ethyl acetate, naphthalene, anthracene, nitrobenzene, benzamide, urea, thiourea, chloroform, acetanilide, benzanilide, carbon tetra chloride, chloroform, chlorobenzene, bromobenzene.

Viva **[10 Marks]**

MINCHEM111(Introductory Chemistry)

4 CREDITS (3 hrs theory + 2 hrs practical = 5 Hours/Week) 100 MARKS

Course Objectives and learning outcome

This course will provide a basic introduction to understand the branches of Chemistry which deals with the physical properties and chemical reactivity's of chemicals at the atomic level. It will enable student understand stoichiometric calculations of compounds and carry out some problem solving qualitative and quantitative analytical operations, understand, identify and evaluate chemical and physical phenomenon.

On completion of the course, the students will be able to understand:

- Atomic structure using wave particle dual nature of electron
- Classification of elements into periodic table, periodicity in their various properties, anomalous behaviors of some elements and calculation of some of their physical parameters.
- Various types of force of attraction that holds two atoms together, various advanced theories with its limitations to explain bonding in molecules.
- Detailed VBT, MOT with LCAO concept, energy level diagram of molecular orbitals and ions, H-bonding and its applications.
- Various theories to explain shapes of various molecules.
- Calculation of available electron pairs with the central atom in some molecules.
- IUPAC nomenclature of organic compounds (Acyclic-1993)
- Various electron displacement effects in organic molecules.
- Bond fission and Curley arrow rules for electron transfer.
- Types of organic reactions
- Chemistry of alkanes including reactivity and selectivity in its characteristic reaction
- General reactions of alkyl halides. Mechanism for Nucleophilic substitution reaction of alkyl halides (S_N1/ S_N2) and stereochemistry.
- Modes of concentration
- Phenomenon of adsorption
- Types of Catalysis and its theories
- Classification, preparation, properties and applications of colloidal state.

Syllabus-Theory component

UNIT – I

Chapter-1 Atomic structure and Periodic properties [7 hours]

- Introduction to evaluation of atomic theory
- Basic concept of Wave particle duality of electron, De-Broglie's equation, Heisenberg's uncertainty principle,
- Example based on de-Broglie's equation, Heisenberg's uncertainty principle,

- Difference between Orbit & Orbital, Quantum numbers,
- Aufbau rule, Pauli's Principle, and Hund's rule for electronic configuration, stability of half-filled and completely filled orbitals.
- Study of modern periodic table, electronic configuration in periodic table, Periodicity in atomic properties and its causes, Magic number

Chapter-2 Chemical bonding [8 hours]

- Basics of Ionic bond, Covalent bond, Co-ordinate covalent bond and H- bond
- Valence bond theory and its limitations
- Concept of hybridization: sp (C_2H_2, $BeCl_2$), sp^2 (BF_3, C_2H_4), sp^3 (CH_4), sp^3d (PCl_5) & sp^3d^2 (SF_6)
- Sidgwick Powell rule and VSEPR theory,
- Calculation of total electron pairs, loan pairs, bond pairs in CH_4, NH_3, H_2O
- Basic concept of MO theory
- Bonding and anti-bonding molecular orbital, gerade and ungerade molecular orbital, σ - molecular orbital and σ*- molecular orbital, π- molecular orbital and π*- molecular orbital,
- Energy level diagrams of B_2, C_2, N_2, O_2 with calculation of bond order and magnetic moment,
- Comparison of MO theory and VB theory,

UNIT – II

Chapter-3 Basic Organic Chemistry [07 hours]

- IUPAC Nomenclature of organic compounds (Acyclic, cyclic) *(minimum 30 examples should be done)*
- Electronic displacements in organic molecules: (1) Inductive effect, (2) Electromeric effect, (3) Mesomeric effect and (4) Hyperconjugation.
- Homolytic and heterolytic fission, curly arrow rules
- Reaction Intermediates: (1) Carbocation, (2) Carbanion, (3) Free radical
- Types of organic reagents: Nucleophiles and Electrophiles
- Types of organic reactions: (1) Substitution, (2) Addition, (3) Elimination (4) Rearrangement.

Chapter-4 Aliphatic Hydrocarbons-I and alkyl halides [04 hours]

- Alkanes: Formation of alkanes by Wurtz reaction, Wurtz-Fittig reaction.
- Free radical substitutions reactions

- Preparation of alkyl halides
- Only Introduction of two types (SN^1& SN^2) of mechanism and difference between SN^1& SN^2.

Chapter-5 Introduction to Stereochemistry [04 hours]

- Homomers and Isomers, Concept of isomerism. Constitutional isomers, Chirality and Stereoisomers
- Modern classification of stereoisomers based on superimposability and energy criterion *(Configurational enantiomers, Configurational diastereomers, Conformational enantiomers, Conformational diastereomers),* Difference between enantiomers and diastereomers

UNIT – III [15 hours]

Chapter-6 Modes of Concentration [03 hours]

- Primary and secondary standards for preparation of solutions and their Characteristics
- Preparation of Standard Solutions
- Equivalent weight of acid and base, Equivalent weight of acid salt, Equivalent weight of an ion.
- Molarity, Normality, Molality, %w/v, %v/v & ppm.

Chapter-7 Adsorption [03 hours]

- Introduction
- Mechanism of Adsorption
- Types of Adsorptions (physical and chemical)
- Characteristics and factors affecting on adsorption
- Adsorption isotherm and Freundlich equation with limitations.
- Applications of adsorption.

Chapter-8 Catalysis [03 hours]

- Introduction,
- Types of catalysis (homogeneous and heterogeneous)
- Characteristics of catalysis,
- Definitions with examples: Auto-catalysis, Negative catalysis (Inhibitor), Promoters and Catalytic poisoning

Chapter-9 The Colloidal State [06 hours]

- Introduction
- Classification of Colloids based on (1) Physical state of dispersed phase & Dispersion medium (2) Nature of interaction between dispersed phase & Dispersion medium.
- Preparation of colloidal solutions; (1) Chemical methods, (2) Peptization
- Purification of colloidal solutions; (1) Dialysis, (2) Electro-dialysis, (3) Ultrafiltration
- General properties of colloidal systems
    - Tyndall effect
    - Brownian movement
- Protection of colloids
- Importance and applications of colloids

MINCHEM111(Chemistry Practical)

Course Objectives and learning outcome

The course will provide analytical ability to qualitatively analyse mono-functional organic compound using various characteristics physical and chemical methods. It also generates quantitative aspects in student to determine strength of certain acids and base.

On completion of the course, the students will be able to understand and evaluate:

- Physical properties of mono functional organic compounds such as carboxylic acids, esters, amides, ketones, alcohols, phenols, aldehydes, halogenated hydrocarbon, aromatic hydrocarbons, Nitro compounds, amines, anilides etc.
- Concentration in various acids and bases using titrimetric analytical methods using appropriate indicators.

Syllabus

2 Hours per week **25 Marks**
[Performance-15 Marks]

1. Organic qualitative analysis

Identification of simple Aromatic Hydrocarbons or Compounds containing a functional group using preliminary characteristics and some Physical and Chemical tests.

[Minimum 8 compounds covering all the chemical nature must be given]

Examples:

Carboxylic acids: Aliphatic acids like oxalic and succinic acid,

Aromatic acids: Benzoic acid, cinnamic acid and pthalic acid

Phenols: Phenol, α-naphthol, β-naphthol

Bases: Aniline

Neutral: Acetone, Ethyl methyl ketone, Ethyl acetate, naphthalene, anthracene, nitrobenzene, urea, thiourea, chloroform, acetanilide, benzanilide, carbon tetra chloride, chloroform, chlorobenzene, bromobenzene.

2. Volumetric Analysis-Acid Base Titration

1) To prepare a solution by dissolving 'x' g $NaHCO_3$ /Na_2CO_3 in 100 ml solution and determine its concentration in terms of normality and molarity using 0.1 N HCl solution.

2) To determine the normality, molarity and g/lit of NaOH and HCl using 0.1 N Na_2CO_3 solution.

3) To determine the normality, molarity and g/lit of each component in a given mixture of $NaHCO_3$ and Na_2CO_3 using 0.1N HCl solution.

Viva **[10 Marks]**

MDCCHEM111(Introductory Chemistry)

4 CREDITS (3 hrs theory + 2 hrs practical = 5 Hours/Week) 100 MARKS

Course Objectives and learning outcome

This course will provide a basic introduction to understand the branches of Chemistry and its concepts. The physical properties and chemical reactivity's of chemicals at the atomic level. It will enable student understand stoichiometric calculations of compounds and carry out some problem solving qualitative and quantitative analytical operations, understand, identify and evaluate chemistry of chemical and physical phenomenon.

On completion of the course, the students will be able to understand:

- Atomic structure using wave particle dual nature of electron
- Classification of elements into periodic table, periodicity in their various properties, anomalous behaviors of some elements and calculation of some of their physical parameters.
- Various types of force of attraction that holds two atoms together, various advanced theories with its limitations to explain bonding in molecules.
- VBT, MOT with LCAO concept, energy level diagram of molecular orbitals and ions, H-bonding and its applications.
- Various theories to explain shapes of various molecules.
- Calculation of available electron pairs with the central atom in some molecules.
- IUPAC nomenclature of organic compounds (Acyclic-1993)
- Various electron displacement effects in organic molecules.
- Bond fission and Curley arrow rules for electron transfer.
- Types of organic reactions
- Chemistry of alkanes including reactivity and selectivity in its characteristic reaction
- General reactions of alkyl halides. Concepts of types of Mechanism for Nucleophilic substitution reaction of alkyl halides
- Basic concepts of organic stereochemistry.
- Modes of concentration measurement.
- Phenomenon of adsorption
- Types of Catalysis and its theories
- Chemistry of various types of storage cells
- Classification, preparation, properties and applications of colloidal state.

Syllabus-Theory component

UNIT– I

Chapter-1 Atomic structure and Periodic properties [7 hours]

- Introduction to evaluation of atomic theory
- Basic concept of Wave particle duality of electron, De-Broglie's equation, Heisenberg's

uncertainty principle,

- Example based on de-Broglie's equation, Heisenberg's uncertainty principle,
- Difference between Orbit & Orbital, Quantum numbers,
- Aufbau rule, Pauli's Principle, and Hund's rule for electronic configuration, stability of half-filled and completely filled orbitals.
- Study of modern periodic table, electronic configuration in periodic table, Periodicity in atomic properties and its causes, Magic number

Chapter-2 Chemical bonding [8 hours]

- Basics of Ionic bond, Covalent bond, Co-ordinate covalent bond and H- bond
- Valence bond theory and its limitations
- Concept of hybridization: sp (C_2H_2, $BeCl_2$), sp^2 (BF_3, C_2H_4), sp^3 (CH_4), sp^3d (PCl_5) & sp^3d^2 (SF_6)
- Sidgwick Powell rule and VSEPR theory,
- Calculation of total electron pairs, loan pairs, bond pairs in CH_4, NH_3, H_2O
- Basic concept of MO theory
- Bonding and anti-bonding molecular orbital, gerade and ungerade molecular orbital, σ - molecular orbital and σ*- molecular orbital, π- molecular orbital and π*- molecular orbital,
- Energy level diagrams of B_2, C_2, N_2, $O_2$with calculation of bond order and magnetic moment,
- Comparison of MO theory and VB theory,

UNIT – II

Chapter-3 Basic Organic Chemistry [07 hours]

- IUPAC Nomenclature of organic compounds (Acyclic, cyclic) *(minimum 30 examples should be done)*
- Electronic displacements in organic molecules: (1) Inductive effect, (2) Electromeric effect, (3) Mesomeric effect and (4) Hyperconjugation.
- Homolytic and heterolytic fission, curly arrow rules
- Reaction Intermediates: (1) Carbocation, (2) Carbanion, (3) Free radical
- Types of organic reagents: Nucleophiles and Electrophiles
- Types of organic reactions: (1) Substitution, (2) Addition, (3) Elimination
  (4) Rearrangement.

Chapter-4 Aliphatic Hydrocarbons-I and alkyl halides [04 hours]

- Alkanes: Formation of alkanes by Wurtz reaction, Wurtz-Fittig reaction.

- Free radical substitutions reactions
- Preparation of alkyl halides
- Only Introduction of two types (SN^1& SN^2) of mechanism and difference between SN^1& SN^2.

Chapter-5 Introduction to Stereochemistry [04 hours]

- Homomers and Isomers, Concept of isomerism. Constitutional isomers, Chirality and Stereoisomers
- Modern classification of stereoisomers based on superimposability and energy criterion *(Configurational enantiomers, Configurational diastereomers, Conformational enantiomers, Conformational diastereomers),* Difference between enantiomers and diastereomers

UNIT – III

Chapter-6 Modes of Concentration [03 hours]

- Primary and secondary standards for preparation of solutions and their Characteristics
- Preparation of Standard Solutions
- Equivalent weight of acid and base, Equivalent weight of acid salt, Equivalent weight of an ion.
- Molarity, Normality, Molality, %w/v, %v/v & ppm.

Chapter-7 Adsorption and Catalysis [02 hours]

- Introduction and Mechanism of Adsorption
- Types of Adsorptions (physical and chemical)
- Introduction to Catalysis and Types of catalysis (homogeneous and heterogeneous)
- PSA Oxygen generator

Chapter-8 Chemistry of Storage-cells [04 hours]

- Oxidation, Reduction and Electron Transfer Reactions
- Types of Redox Reactions and Introduction of Electrochemical Series
- Primary and secondary Batteries
- Components and roles
- Characteristics
- Working of Li-ion battery and Pb-acid battery
- Working of Fuel cell, Solar cell and Polymer cell

Chapter-9 The Colloidal State [06 hours]

- Introduction
- Classification of Colloids based on (1) Physical state of dispersed phase & Dispersion medium (2) Nature of interaction between dispersed phase & Dispersion medium.
- Preparation of colloidal solutions; (1) Chemical methods, (2) Peptization
- Purification of colloidal solutions; (1) Dialysis, (2) Electro-dialysis, (3) Ultrafiltration
- General properties of colloidal systems
    - Tyndall effect
    - Brownian movement
- Protection of colloids
- Importance and applications of colloid

MDCCHEM111 (Chemistry Practical)

Course Objectives and learning outcome

(2 Hours/Week) **25 MARKS**

The course will provide analytical ability to qualitatively analyze mono-functional organic compound using various characteristics physical and chemical methods. It also generates quantitative aspects in student to determine strength of certain acids and base.
On completion of the course, the students will be able to understand and evaluate:

- Physical properties of mono functional organic compounds such as carboxylic acids, esters, amides, ketones, alcohols, phenols, aldehydes, halogenated hydrocarbon, aromatic hydrocarbons, Nitro compounds, amines, anilides etc.
- Concentration in various acids and bases using titrimetric analytical methods using appropriate indicators.

Syllabus

(2 Hours/Week) **25 MARKS**

Performance15 Marks

1. Organic qualitative analysis

Identification of simple Aromatic Hydrocarbons or Compounds containing a functional group using preliminary characteristics and some Physical and Chemical tests.

[Minimum 8 compounds covering all the chemical nature must be given]

Examples:

Carboxylic acids: Aliphatic acids like oxalic and succinic acid,

Aromatic acids: Benzoic acid, cinnamic acid and pthalic acid

Phenols: Phenol, α-naphthol, β-naphthol

Bases: Aniline

Neutral: Acetone, Ethyl methyl ketone, Ethyl acetate, naphthalene, anthracene, nitrobenzene, urea, thiourea, chloroform, acetanilide, benzanilide, carbon tetra chloride, chloroform, chlorobenzene, bromobenzene.

2. Volumetric Analysis-Acid Base Titration

1) To prepare a solution by dissolving ‘x’ g $NaHCO_3$ /Na_2CO_3 in 100 ml solution and

determine its concentration in terms of normality and molarity using 0.1 N HCl solution.

2) To determine the normality, molarity and g/lit of NaOH and HCl using 0.1 N Na_2CO_3 solution.

3) To determine the normality, molarity and g/lit of each component in a given mixture of $NaHCO_3$ and Na_2CO_3 using 0.1N HCl solution.

Viva **[10 Marks]**

SECCHEM111(Laboratory skills and safety)
Course Objectives and learning outcome

2 CREDITS (4 Hours/Week) 50 MARKS

The course will provide its learners a primary practical exposure to the chemistry laboratory skills in terms of handling of chemicals, primary analytical techniques, various types of hazards and its safety measures including first aid and disaster management.

On completion of the course the student should be able to:

- Identify various laboratory glass apparatus and handle it properly.
- Use chainomatic balance as well as electronic weighing machine to weigh smaller samples.
- Use, handle and maintain miscellaneous apparatus including electric heating devices.
- Classify various chemicals w.r.t. requirements for safe storage.
- Prepare laboratory reagents, calculate and weigh chemicals for solution preparation and titrations.
- Carry out simple quantitative exercises like acid base titration.
- Carry out qualitative exercises like crystallization, m.p, determination, TLC for identification of two component, and lassaigne Test for elements analysis in organic compounds.
- Learn about fire hazards and its response techniques.
- Learn about MSDS and use it effectively to demonstrate laboratory skills and avoid chemical hazards.
- Learn about detection and handling of LPG gas leakages.
- Know about gas hazards and develop handling skills.
- Provide First Aid including CPR in case of any medical emergency.
- Serve as a skilled person/volunteer during any natural or man-made disaster in the laboratory or elsewhere.

Practical examination mark distribution:

a) Acid base titration of an unknown sample/Gravimetric analysis. **[20 marks]**

b) viva/Demonstration of practical skills related to identification and handling of equipment, chemicals handling and storage, safety protocol, CPR, First aid, etc. / Explanation of practical assignment work undertaken. **[15 marks]**

c) Continuous internal assessment may also include active participation in activities and demonstration of skill achievement **[15 marks]**

Syllabus

2 CREDITS (4 Hours/Week) **50 MARKS**

1. LABORATORY INTRODUCTION:

A. Introduction of Lab Apparatus

Glass apparatus - Beaker, Test tube, boiling tube, funnel, separating funnel, filtration flask, round bottom flask, flat bottom flask, condenser, watch glass etc. measuring conical or condenser, petri dish, desiccator.

Volumetric Apparatus - Measuring cylinder, burette, pipette, volumetric flask

Weight and Measurement – Weighing of chemicals for preparation of solutions using chainomatic balance, analytical balance, single-pan electronic balance etc.

Miscellaneous apparatus- Buchner funnel, effective handing of Bunsen burner, burette stand, retort clamp, China clay dish/evaporating basin, wire gauze, filter pumps, crucible, clay pipe triangle, pestle and mortar, spirit lamp, spatulas, thermometer, pH meter/pH paper etc**.** and laboratory centrifuge**.**

Apparatus for heating: Bunsen burner, water bath, oil bath, hot plate, sand bath, hot air oven, heating mantle etc**.**

B. Chemical handling and storage

- Classification of Inorganic compounds based on negative ion
- Classification of organic compounds based on chemical nature
- Storage requirement of different chemicals [Low Temperature, sun light, Fume wood]

2. Laboratory Skills:

Quantitative aspects

- Solution Preparation: Preparation of solutions, indicators and reagents (concentration of solutions: percentage, molarity, normality, molality (in ppm) calculation of masses and volumes for preparation of solutions solids, liquids.)
- Simple acid-base titration.

Qualitative aspects

- Purification and Crystallization of organic compounds using appropriate solvents.

- Determination of boiling point and melting point of organic compounds
- Chromatographic separation of components. TLC-preparation and identification of number components.
- Detection of nitrogen, Sulphur and halogen in given sample using Lassigne test.

3. Laboratory Safety: (Precautions, Demonstrations and Drill**)**

Fire Hazards: Causes of fires, classification of fires, fire prevention protocols for different types of fires, fire Extinguishers and its drill. (in coordination with expert of fire department or NGS)

Chemical Hazards: Classification and handling of hazardous chemicals, storage of chemicals, transfer from large containers. Use of MSDS for efficient handling of chemicals (Assignment/Project report preparation for some specific chemicals may be given to students)

Gas Hazards:
Safe usage of LPG in the laboratory,
Detection and handling of Gas Leakage, Precautions and first aid related to gas hazards.

4. Medical emergency and First Aid including CPR-(Demonstrations/ Drill and training): Through collaboration/coordination with various Health care service providers, GOs/NGOs like Indian Red Cross Society etc.

Natural or Man-made Disaster and its response management (Demonstrations/ Drill and training). Through collaboration/coordination with various GOs District disaster management cell/NGOs like Indian Red Cross Society etc.

Bhakta Kavi Narsinh Mehta University
Syllabus of Bachelor of Science (B.Sc) as per NEP
Syllabus of Sem-1
Effective from June, 2023
Subject: Chemistry

(THEORY EXAM)
PAPER STYLE

EXTERNAL ASSESSMENT BY UNIVERSITY			50 Marks
Que. No.	**Particulars**	**Unit**	**Marks**
Que-1	**(a) Answer the following question.** **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**	**1**	**05** **05**
	OR		
	(a) Answer the following question. **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**		**05** **05**
Que-2	**(a) Answer the following question.** **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**	**2**	**05** **05**
	OR		
	(a) Answer the following question. **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**		**05** **05**
Que-3	**(a) Answer the following question.** **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**	**3**	**05** **05**
	OR		
	(a) Answer the following question. **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**		**05** **05**
Que-4	**(a) Answer the following question.** **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**	**1 & 2**	**05** **05**
	OR		
	(a) Answer the following question. **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**		**05** **05**
Que-5	**(a) Answer the following question.** **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**	**2 & 3**	**05** **05**
	OR		
	(a) Answer the following question. **(***May be bifurcated into 2/3 etc marks***)** **(b) Answer the following question**		**05** **05**