પરિપત્ર

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટીની સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે સાયન્સ વિદ્યાશાખા હેઠળનો NEP-૨૦૨૦ અંતર્ગતનો કેમેસ્ટ્રી વિષયનો (બી.એસ.સી. વિથ ઓનર્સ) નો સેમેસ્ટર-૧ (શિક્ષણ વિભાગની SOP પ્રામાણેની પેપર સ્ટાઈલ સાથે), સેમેસ્ટર-૨ નો અભ્યાસક્રમ આ સાથે સામેલ છે.

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

23/12/2023

ખાસ ફરજ પરના અધિકારી

(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/ એકેડેમિક/૨૧૪૬/૨૦૨૩-૨૦૨૪

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી,

સરકારી પોલીટેકનિક કેમ્પસ,

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી રોડ,

ખડીયા, જૂનાગઢ-૩૬૨૨૬૩

તા.૨૩/૧૨/૨૦૨૩

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 ZOOLOGY STUDIES

FACULTY OF SCIENCE

SYLLABUS FOR

BACHELOR OF SCIENCE (HONOURS) PROGRAMME

(SEMESTER-II)

EFFECTIVE FROM JUNE, 2023

INDEX

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

Faculty: Science Semester: 1 & 2

Sr. No	Level UG/PG	Course Group Major/Minor/MDC /SEC /SEC/DSE	Course (Paper) Title	Paper No.	Credit	Teaching Hours	Practical hours	CCE(Formative)	SEE (Summative)	Total Marks	Page
	Semester-1										
1	UG	Major	Chemistry	MAJCHEM 111	4	45	30	50	50	100	8
2	UG	Major	Chemistry	MAJCHEM 112	4	45	30	50	50	100	12
3	UG	Minor	Chemistry	MINCHEM 111	4	45	30	50	50	100	16
4	UG	MDC/IDC	Chemistry	MDCCHEM 111	4	45	30	50	50	100	22
5	UG	SEC	Chemistry	SECCHEM 111	2	-	30	25	25	50	28
	Semester-II										
1	UG	Major	Chemistry	MAJCHEM 121	4	45	30	50	50	100	31
2	UG	Major	Chemistry	MAJCHEM 122	4	45	30	50	50	100	35
3	UG	Minor	Chemistry	MINCHEM 121	4	45	30	50	50	100	40
4	UG	MDC/IDC	Chemistry	MDCCHEM 121	4	45	30	50	50	100	46
5	UG	SEC	Chemistry	SECCHEM 121	2	-	30	25	25	50	52

Credit Structure

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.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

B. Sc. Semester – II

MAJCHEM121(Foundation in Chemistry)

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

Course objectives and Learning Outcomes

This course will generate basic foundation in learner for the scientific reasoning for the physical and chemical behaviours of organic and inorganic chemicals. and extending it up to the chemical kinetics and reaction mechanisms.

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

- Periodicity in the physical and chemical properties of s-block elements, some diagonal relationship between I and II group elements and preparation properties and uses of some special Heavy chemicals.
- Formation, structure and chemical reactivities like addition and elimination of unsaturated aliphatic hydrocarbons. They will also understand some useful common electrophilic and nucleophilic addition reactions of alkenes and alkynes.
- Preparations, usual and unusual properties alicyclic compounds. Justify their behaviour. Understand basic concept of Baeyer Strain theory and its limitations.
- Types of electrolytes, their behaviour (strong/weak, acids/bases) in solution, buffering action of electrolyte, various types of salts and degree of hydrolysis, pH and various analytical numerical calculation.
- Basic principles involved in Qualitative analysis of simple inorganic salt. This includes principles involved in dry test of positive and negative radicals.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

B. Sc. Semester – II

MAJCHEM121(Foundation in Chemistry)

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

Syllabus-Theory component

UNIT – I

Chapter-1 Chemistry of s-block elements [15 Hours]

- General introduction.
- Electronic configuration, Atomic and ionic radii, Ionization potential.
- Physical and Chemical properties *[Reactivity towards air, water, halogen and hydrogen],*
- Special characteristics such as metallic character, polarizing power, hydration energy, Flame coloration,
- Inert pair effect, relative stability of different oxidation state,
- complex formation tendency of s-block elements,
- diagonal relationship of (1) lithium with magnesium (2) beryllium with aluminum, anomalous behavior of Li, Be, uses.
- Preparation, Physical properties and uses of Na_2CO_3, $NaHCO_3$, NaCl, NaOH, CaO, $CaCO_3$, $Ca(OH)_2$ and Plaster of Paris.

UNIT – II

Chapter-2 Aliphatic Hydrocarbons-II [15 Hours]

- Hydrocarbons containing Carbon-Carbon π bonds
- Formation of alkene by Elimination reactions, dehydration of alcohol, dehydrohalogenation of alkyl halide, dehalogenation of vicinal and germinal dihalides,
- Mechanism of elimination reactions: E_1, E_2 and E_1^{cb}
- Saytzeff's rule and Hofmann eliminations
- Electrophilic addition reaction and its mechanism *(Markownikov/ Anti Markownikov rule).*
- Reactions of alkenes: Oxymercuration-demercuration, Hydroboration oxidation, Ozonolysis, Reduction (catalytic), Syn and anti-hydroxylation (oxidation), 1, 2- and 1,4 - addition reactions in conjugated dienes, Diels Alder reaction.

- Formation of alkynes: Dehydrohalogenation of vicinal and geminal dihalides, Dehalogenation of tetrahalides
- Reactions of alkynes: Acidity, electrophilic addition reactions like halogenation, hydrohalogenation, hydration, hydroboration, addition of carbene and catalytic hydrogenation. Nucleophilic addition rection with hydrogen cyanide and alcohols.
- Alkylation of terminal alkynes.

UNIT – III

Chapter-3 Ionic Equilibrium [15 Hours]

- Types of electrolytes, degree of dissociation and factors affecting degree of dissociation,
- Ionic product of water, dissociation constants of weak acids and bases,
- Common ion effect and calculation of concentrations of OH^- ions ($NH_4Cl + NH_4OH$) and H^+ ions (H_2S+HCl),
- Solubility and solubility products of sparingly soluble salts,
- Applications of solubility product principle (solubility, whether precipitate out, salt out, and inorganic qualitative analysis)
- Hydrolysis of salts: Definition of hydrolysis of salts, Salts of strong acids and bases,
- Relation among Kh, Ka, or Kb and Kw,
- Degree of hydrolysis and pH of the solution of salts of weak acids and strong bases, salts of weak bases and strong acids and salts of weak bases and weak acids.
- Buffer solutions: Definition and types of buffer solutions, Buffer action, Derivation of Henderson Hasselbalch equation,
- Numericals

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

B. Sc. Semester – II

MAJCHEM121(Chemistry Practical)

Course Objectives and Learning Outcome

The course will provide ability to student to analyze special ions using titrimetric methods.

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

- Prepare standard solutions of acids and bases.
- Determine purity of some commercially available acids.
- Carry out Quantitative analysis of some cations.
- Standardize a given solution of acid or base.
- Carry out quantitative analysis of $Ca^{+2}/Mg^{+2}/Zn^{+2}$ using complexometric titration method.

Syllabus

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

Performance **[15 Marks]**

1. Inorganic volumetric analysis

(Standard solution should be given)

1) Quantitative estimation of Cu^{2+} in a given $CuCl_2.2H2O$ solution using 0.01M EDTA solution.
2) Quantitative estimation of Ni^{2+} in a given $NiSO_4.7H_2O$ solution using 0.01M EDTA solution.
3) Quantitative estimation of Zn^{2+} in a given $ZnCl_2$ solution using 0.01M EDTA solution.
4) Determination of total Ca^{+2}/Mg^{+2} of water by EDTA.
5) Determination of acetic acid in a commercial vinegar using 0.1M NaOH solution.
6) Determination of alkali in antacid using 0.1M HCl solution.
7) Quantitative estimation of Fe^{2+} by dichromate method (Internal indicator method).

Viva **[10 Marks]**

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

B. Sc. Semester – II

MAJCHEM122(Foundation in Chemistry)

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

Course Objectives and Learning Outcome

This course will generate a foundation in learner for scientific reasoning for the physical and chemical behaviours of organic and inorganic chemicals and extending their reasoning up to molecular dynamics and related properties

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

- Periodicity in the physical and chemical properties of p-block elements,
- Structure, bonding, properties and uses of boron compounds
- Study of oxides of nitrogen
- Basic principles of inorganic qualitative analysis including the chemical reaction behind particular identification tests.
- Preparations and properties of alicyclic compounds. Justify their stabilities through basic concept of Baeyer Strain theory.
- Molecular dynamics and change in stability due to various interactions.
- Concept of conformations, their nomenclature and stability of conformations of some acyclic molecules
- Concept of aromaticity and application of Huckel's rule to certain cyclic systems.
- Chemical reactions 0f benzene and its mechanisms.
- States of matter and solid state.
- Crystalline structure and lattice
- Types of unit cells crystal systems
- Laws of crystallography, miller and Weiss indices, Bragg's law
- Numerical based on dimensions from formula of compounds

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

B. Sc. Semester – II

MAJCHEM122(Foundation in Chemistry)

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

Syllabus-Theory component

UNIT – I [15 Hours]

Chapter-1 Chemistry of p block elements [07 hours]

- Introduction of Oxides
- Properties of oxides, Classification of oxides based on their chemical behavior and based on their oxygen content,
- Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses;

  Borax, Boric acid, Boron nitrides, Borohydrides (diborane), Boron halide and Aluminum halide acidity comparison,
- Oxides of nitrogen (N_2O, NO, N_2O_3, NO_2, N_2O_4, N_2O_5).

Chapter-2 Basic Principles of Qualitative Analysis [08 Hours]

- Introduction
- Preparation of Original Solution (OS)
- Concept of classification of cations (IP and Ksp) and role of Group reagents
- Common ion effect
- Numericals on IP and Ksp
- Explanation with chemical equations for the following

A. Dry test for positive radicals

(a) Charcoal test

(b) Cobalt nitrate test

(c) Borax bead test

(d) Flame test.

B. Dry test for negative radicals (including use of various reagent papers and its chemistry with reactions)

UNIT – II [15 Hours]

Chapter-3 Alicyclic compounds and conformations [07 Hours]

- Introduction and classification of ring systems (Based on number of rings, size, number of carbon atom common between the two rings).
- IUPAC nomenclature of cycloalkanes (including simple spiro compounds, fused ring and bridged ring systems-bicyclic only)
- Method of preparation of small ring cycloalkanes:
  Intra-molecular Wurtz' reaction, Simmons-Smith, Diels-Alder reaction.
- Chemical Properties of Cycloalkanes: Substitution Reactions, Addition Reactions,
- Baeyer's Strain Theory and its limitations (puckering).
- Definition of conformations, Dihedral angle and Tortional angle
- General factors affecting stability of conformations of acyclic molecules.
- Factors affecting energy of conformations of ethane, propane and butane with relative energy level diagram.
- Klyne prelog terminology for designation of various conformations of butane.

Chapter-4 Aromatic Hydrocarbons [08 Hours]

- Aromaticity: Criteria for aromatic, non-aromatic and antiaromatic compounds, applications of Huckel's rule to simple annulene, cyclic carbocation/anion.
- Electrophilic aromatic substitution reactions of benzene with mechanisms,
- Theory of effect of substituents on reactivity and orientation (with resonating structures for activating and deactivating groups).
- Electrophilic aromatic substitution reactions with mechanisms: Halogenation, nitration, sulphonation, Friedel Crafts alkylation, Friedel-Crafts acylation.

UNIT – III

Chapter-4 Solid State [15 Hours]

- Introduction,
- Crystalline and Amorphous solid,
- Forms of Crystalline Solids (Molecular, Ionic, Metallic and Network solid)
- Crystal Lattice & it's Characteristics
- Primitive & Centered Cubic unit cells (SCP, BCC FCC, ECC)
- Calculation of No of atoms per unit cell
- Crystal systems & Bravais lattices,
- Close pack Structures (1D, 2D & 3D)
- Octahedral & Tetrahedral Voids & it's position
- Laws of crystallography: (1) Law of Symmetry, (2) Law of constancy of interfacial angles and (3) law of rational indices,
- Miller and Weiss indices
- Derivation of Bragg's law,
- X–Ray diffraction methods: Rotating Crystal Method and Powder Method.
- Structures of NaCl and KCl by Crystallography
- Density of unit cell,
- Numerical based on Formula of compounds, Bragg's law, Miller indices and Density.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

B. Sc. Semester – II

MAJCHEM122(Chemistry Practical)

Course Objectives and Learning Outcome

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

The course will provide ability to student to identify any pure inorganic salts.

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

- Qualitatively analyse unknown inorganic salt with a cation and an anion.

Syllabus

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

Performance 15 Marks

1. Qualitative analysis of inorganic salts

(Minimum 12 salts containing two radicals)

Inorganic salts containing anion (chloride, bromide iodide, nitrate, nitrite, sulphate, sulphite, sulphide, carbonate, phosphate (soluble & insoluble), oxide, chromate, and dichromate).

Viva **10 Marks**

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
B. Sc. Semester – II
MINCHEM121(Foundation in Chemistry)
Course Objectives and Learning Outcome

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

This course will generate a basic foundation in learner for the scientific reasoning for the physical and chemical behaviours of inorganic and organic chemicals and extending their scientific reasoning up to crystalline structure perspective of solids.

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

- Periodicity in the physical and chemical properties of s-block and p-block elements, some diagonal relationship between I and II group elements and preparation properties and uses of some special Heavy chemicals.
- Chemistry of p-block elements with special reference to B and Al elements.
- Basic principles involved in Qualitative analysis of simple inorganic salt. This includes principles involved in dry test of positive and negative radicals.
- Formation, structure and chemical reactivities like addition and elimination reactions.
- Reactions of unsaturated aliphatic hydrocarbons.
- Classification of rings systems, their preparation and unusual properties.
- Concept of aromaticity and applications to Huckel rule.
- Reactions of benzene and orientation in its substitution reactions.
- Preparations, usual and unusual properties alicyclic compounds. Justify their behaviour. Understand basic concept of Baeyer Strain theory and its limitations.
- Types of electrolytes, their behaviour (strong/weak, acids/bases) in solution, buffering action of electrolyte, various types of salts and degree of hydrolysis, acidic and basic salts.
- States of matter and solid state. Crystalline structure and lattice
- Types of unit cells crystal systems
- Calculation of number of atoms per unit cell.
- Crystal systems and Bravais lattices.
- Schottky and Frenkel defects
- Numerical based on dimensions from formula of compounds

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

B. Sc. Semester – II

MINCHEM121(Foundation in Chemistry)

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

Syllabus-Theory component

UNIT – I

Chapter-1 Chemistry of s-block elements [07 Hours]

- General introduction
- Electronic configuration, Atomic and ionic radii, Ionization potential
- Physical properties
- Special characteristics such as metallic character, Flame coloration.
- Inert pair effect, relative stability of different oxidation state.
- Diagonal relationship of (1) lithium with magnesium (2) beryllium with aluminum.
- Preparation, Physical properties and uses of Na_2CO_3, $NaHCO_3$, NaOH.

Chapter-2 Chemistry of p block elements [04 hours]

- Introduction of Oxides
- Properties of oxides, Classification of oxides based on their chemical behavior and based on their oxygen content.
- Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses;

  Borax, Boric acid, Borohydrides (diborane) and Aluminum halide.

Chapter-3 Basic Principles of Qualitative Analysis [04 Hours]

- Introduction
- Preparation of Original Solution (OS)
- Concept of classification of cations (IP and Ksp) and role of Group reagents
- Explanation with chemical equations for the following

A. Dry test for positive radicals

(1) Charcoal test, (2) Cobalt nitrate test & (3) Flame test.

B. Dry test for negative radicals (including use of various reagent papers)

UNIT – II

Chapter-4 Aliphatic Hydrocarbons-II [07 Hours]

- Hydrocarbons containing Carbon-Carbon π bonds
- Formation of alkene by Elimination reactions, dehydration of alcohol, dehydrohalogenation of alkyl halide, dehalogenation of vicinal and germinal dihalides,
- Introduction to mechanism of elimination reactions: E_1, E_2.
- Types of eliminations products (Saytzeff and Hofmann)
- Types of addition products *(Markownikov/ Anti Markownikov).*
- Reactions of alkynes: Acidity, electrophilic addition reactions like halogenation, hydrohalogenation and hydration. Nucleophilic addition reaction with hydrogen cyanide and alcohol.

Chapter-5 Alicyclic compounds [04 Hours]

- Introduction and classification of ring systems (Based on number of rings, size, number of carbon atom common between the two rings).
- IUPAC nomenclature of cycloalkanes (including simple spiro compounds, fused ring and bridged ring systems-bicyclic only)
- Method of preparation of small ring cycloalkanes:
  Intra-molecular Wurtz' reaction, Diels-Alder reaction.
- Chemical Properties of Cycloalkanes: Substitution Reactions, Addition Reactions,
- Baeyer's Strain Theory and its limitations (puckering).

Chapter-6 Aromatic Hydrocarbons [04 Hours]

- Aromaticity: Criteria for aromatic, non-aromatic and antiaromatic compounds, applications of Huckel's rule to simple annulene, cyclic carbocation/anion.
- Electrophilic aromatic substitution reactions of benzene with general mechanisms.
- Theory of effect of substituents on reactivity and orientation (with resonating structures for activating and deactivating groups).

UNIT – III

Chapter-7 Ionic Equilibrium [07 Hours]

- Types of electrolytes, degree of dissociation and factors affecting degree of dissociation,
- Ionic product of water, dissociation constants of weak acids and bases,
- Common ion effect and calculation of concentrations of OH^- ions ($NH_4Cl + NH_4OH$) and H^+ ions (H_2S+HCl),
- Solubility and solubility products of sparingly soluble salts,
- Applications of solubility product principle (solubility, whether precipitate out, salt out, and inorganic qualitative analysis)
- Hydrolysis of salts: Definition of hydrolysis of salts, Salts of strong acids and bases,

Chapter-8 Solid State [08 Hours]

- Introduction,
- Crystalline and Amorphous solid,
- Forms of Crystalline Solids (Molecular, Ionic, Metallic and Network solid)
- Crystal Lattice & it's Characteristics
- Primitive & Centered Cubic unit cells (SCP, BCC FCC, ECC)
- Calculation of No of atoms per unit cell
- Crystal systems & Bravais lattices,
- Close pack Structures (1D, 2D & 3D)
- Octahedral & Tetrahedral Voids & it's position
- Schottky and Frenkel defects.
- Laws of crystallography: (1) Law of Symmetry, (2) Law of constancy of interfacial angles.
- Density of unit cell,
- Numerical based on Formula of compounds and Density.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

B. Sc. Semester – II

MINCHEM121 (Chemistry Practicals)

Course Objectives and Learning Outcome

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

The course will provide ability to student to identify any pure inorganic salt also equips learner with ability to analyze special ions using titrimetric methods.

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

- Qualitatively analyse unknown inorganic salt with a cation and an anion.
- Prepare standard solutions of acids and bases.
- Determine purity of some commercially available acids.
- Carry out Quantitative analysis of some cations.
- Standardize a given solution of acid or base.
- Carry out quantitative analysis of $Ca^{+2}/Mg^{+2}/Zn^{+2}$ using complexometric titration method.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
B. Sc. Semester – II
MINCHEM121 (Chemistry Practical)
Syllabus

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

Performance -15 Marks

1. Qualitative analysis of inorganic salts

(Minimum 12 salts-containing two radicals)

Inorganic salts containing anion (chloride, bromide iodide, nitrate, nitrite, sulphate, sulphite, sulphide, carbonate, phosphate (soluble & insoluble), oxide, chromate, and dichromate).

2. Inorganic volumetric analysis

(Standard solution should be given)

1) Quantitative estimation of Cu^{2+} in a given $CuCl_2.2H2O$ solution using 0.01M EDTA solution.
2) Quantitative estimation of Ni^{2+} in a given $NiSO_4.7H_2O$ solution using 0.01M EDTA solution.
3) Quantitative estimation of Zn^{2+} in a given $ZnCl_2$ solution using 0.01M EDTA solution.
4) Determination of total Ca^{+2}/Mg^{+2} of water by EDTA.
5) Determination of acetic acid in a commercial vinegar using 0.1M NaOH solution.
6) Determination of alkali in antacid using 0.1M HCl solution.
7) Quantitative estimation of Fe^{2+} by dichromate method (Internal indicator method).

Viva **[10 Marks]**

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
B.Sc. Semester–II
MDCCHEM121(Foundation in Chemistry)
Course Objectives and Learning Outcome

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

This course will introduce the learner for scientific reasoning about the physical and chemical behaviours of organic and inorganic chemicals and extending their reasoning up to 3D perspective of the molecules.

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

- Periodicity in the physical and chemical properties of sand p-block elements, some diagonal relationship between them and preparation properties and uses of some special Heavy chemicals.
- Basic principles involved in Qualitative analysis of simple inorganic salt. This includes principles involved in dry test of positive and negative radicals.
- Aromaticity and application of Huckel's rule
- Substitution reactions of benzene and general mechanism.
- Effect of substitution-on-Substitution reactions of benzene
- Introduction to Analytical chemistry and its interdisciplinary nature, Concept of sampling, accuracy and precision, methods for minimizing errors
- standard deviation, Significant figures,
- Analysis of water, Definition of pure water
- purification methods
- Determination of pH, acidity and alkalinity, dissolved oxygen and TDS of a water sample
- Composition of soil
- Concept of pH and pH measurement, Determination of pH of soil
- Determination of calcium, magnesium, Chelation and Chelating agents
- Examples and uses of Indicators
- Introduction and Classification and characteristics of polymers
- Preparation of polymers, Applications in various fields
- Introduction, Nomenclature, Classification sources and deficiency dieses of Vitamins,
- Chemical structures and Names of Vitamin-A1, B1, C, D, E, H, K1
- Introduction, to Crystalline and Amorphous solid states of matter
- Forms, Crystal Lattice Characteristics, unit cells (SCP, BCC FCC, ECC), No of atoms per unit cell, Octahedral & Tetrahedral Voids
- Crystal systems & Bravais lattice, Schottky and Frenkel defects, Close pack Structures (1D, 2D & 3D)

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

B.Sc. Semester–II

MDCCHEM121(Foundation in Chemistry)

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

Syllabus-Theory component

UNIT– I

Chapter-1 Chemistry of s-block elements [07 Hours]

- General introduction
- Electronic configuration, Atomic and ionic radii, Ionization potential
- Physical properties
- Special characteristics such as metallic character, Flame coloration.
- Inert pair effect, relative stability of different oxidation state.
- Diagonal relationship of (1) lithium with magnesium (2) beryllium with aluminum.
- Preparation, Physical properties and uses of Na_2CO_3, $NaHCO_3$, NaOH.

Chapter-2 Chemistry of p-block elements [04 hours]

- Introduction of Oxides
- Properties of oxides, Classification of oxides based on their chemical behavior and based on their oxygen content.
- Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses; Borax, Boric acid, Borohydrides (diborane) and Aluminum halide.

Chapter-3 Basic Principles of Qualitative Analysis [04 Hours]

- Introduction
- Preparation of Original Solution (OS)
- Concept of classification of cations (IP and Ksp) and role of Group reagents
- Explanation with chemical equations for the following

A. Dry test for positive radicals

(1) Charcoal test, (2) Cobalt nitrate test& (3) Flame test.

B. Dry test for negative radicals (including use of various reagent papers)

UNIT– II

Chapter-4 Aromatic Hydrocarbons [05 Hours]

- Aromaticity: Criteria for aromatic, non-aromatic and antiaromatic compounds, applications of Huckel's rule to simple annulene, cyclic carbocation/anion.
- Electrophilic aromatic substitution reactions of benzene with general mechanisms.
- Effect of substituents on reactivity of benzene and orientation (General reasons for o/p or m directing effect.).

Chapter-5 Basic Analytical Chemistry [06 Hours]

- Introduction to Analytical chemistry and its interdisciplinary nature
- Concept of sampling
- Importance and difference between accuracy and precision
- Types of errors in analytical measurements and methods for minimizing errors
- Relative and standard deviation, Significant figures,
- Analysis of water: Definition of pure water
- Source responsible for contaminating of water
- Water sampling methods and water purification methods
- Determination of pH, acidity and alkalinity of a water sample
- Determination of dissolved oxygen and TDS of a water sample

Chapter-6 Soil Analysis [04 Hours]

- Composition of soil
- Concept of pH and pH measurement, Determination of pH of soil
- Determination of calcium and magnesium as calcium carbonate by complexometric
- Chelation and Chelating agents
- Examples and uses of Indicators

UNIT – III

Chapter-7 Polymers [04 Hours]

- Introduction and Classification
- Characteristics
- Preparation of polymers: Nylon-6, Nylon-66, Terylene/Dacron and PHBV
- Applications of polymers in Electronics, Automobile components, Aerospace, Medical, etc.

Chapter-8 Vitamins [04 Hours]

- Introduction and Nomenclature
- Classification
- Sources and Deficiency diseases
- Structures and Names of Vitamin-A_1, B_1, C, D, E, H, K_1

Chapter-9 Solid State [07 Hours]

- Introduction,
- Crystalline and Amorphous solid,
- Forms of Crystalline Solids (Molecular, Ionic, Metallic and Network solid)
- Crystal Lattice & it's Characteristics
- Primitive & Centered Cubic unit cells (SCP, BCC FCC, ECC)
- Calculation of No of atoms per unit cell
- Crystal systems & Bravais lattices
- Schottky and Frenkel defects
- Close pack Structures (1D, 2D & 3D)
- Octahedral & Tetrahedral Voids & it's position

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
B.Sc. Semester–II
MDCCHEM121 Chemistry Practical)
Course Objectives and Learning Outcome

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

The course will provide ability to student to identify any pure inorganic salt also equips learner with ability to analyse special ions using titrimetric methods.

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

- Qualitatively analyse unknown inorganic salt with a cation and an anion.
- Prepare standard solutions of acids and bases.
- Determine purity of some commercially available acids.
- Carry out Quantitative analysis of some cations.
- Standardize a given solution of acid or base.
- Carry out quantitative analysis of $Ca^{+2}/Mg^{+2}/Zn^{+2}$ using complexometric titration method.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
B. Sc. Semester – II
MDCCHEM121(Chemistry Practical)
Syllabus

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

Performance 15 Marks

1. Qualitative analysis of inorganic salts

(Minimum 12 salts-containing two radicals)

Inorganic salts containing anion (chloride, bromide iodide, nitrate, nitrite, sulphate, sulphite, sulphide, carbonate, phosphate (soluble & insoluble), oxide, chromate, and dichromate).

2. Inorganic volumetric analysis

(Standard solution should be given)

1) Quantitative estimation of Cu^{2+} in a given $CuCl_2.2H2O$ solution using 0.01M EDTA solution.
2) Quantitative estimation of Ni^{2+} in a given $NiSO_4.7H_2O$ solution using 0.01M EDTA solution.
3) Quantitative estimation of Zn^{2+} in a given $ZnCl_2$ solution using 0.01M EDTA solution.
4) Determination of total Ca^{+2}/Mg^{+2} of water by EDTA.
5) Determination of acetic acid in a commercial vinegar using 0.1M NaOH solution.
6) Determination of alkali in antacid using 0.1M HCl solution.
7) Quantitative estimation of Fe^{2+} by dichromate method (Internal indicator method).

Viva **[10 Marks]**

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
B. Sc. Semester – I
SECCHEM121(Laboratory Analytical Techniques)

Course Objectives and Learning Outcome

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

The course will provide its learners a practical exposure to various analytical techniques like Redox titrations, pH measurement of live samples using various methods, water analysis, and analysis of some real minerals and oils.

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

- Determine the normality, molarity and gms/liter of each component in a mixture of components like of $H_2C_2O_4.2H_2O$ and H_2SO_4 / $H_2C_2O_4.2H_2O$ and $K_2C_2O_4.H_2O/KMnO_4$ and $FeSO_4.7H_2O$ /$FeSO_4$ $(NH_4)_2SO_4.6H_2O$ and $K_2Cr_2O_7$ using redox titrimetric methods.
- Determine pH of various real food or other samples using different handy methods.
- Carry out analysis of drinking water of samples across the region
- Learn method to carry out analysis of minerals/ores, oil.

Practical examination mark distribution:

a) Redox titration of a sample containing mixture **[20 marks]**

b) Analysis/Testing of real sample/Explanation/Demonstration of practical assignment work undertaken. **[15 marks]**

c) Continuous internal assessment may also include active participation in activities and demonstration of innovative handy analytical skills/Assignment. **[15 marks]**

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
B. Sc. Semester – II
SECCHEM121(Laboratory Analytical Techniques)
Syllabus

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

1-Redox titration

- To determine the normality, molarity and g/lit of each component in a mixture of $H_2C_2O_4.2H_2O$ and H_2SO_4 using 0.1N NaOH and 0.1 N $KMnO_4$ solution.
- To determine the normality, molarity and g/lit of each component in a mixture of $H_2C_2O_4.2H_2O$ and $K_2C_2O_4.H_2O$ using 0.1N NaOH and 0.1 N $KMnO_4$ solution
- To determine the normality, molarity and g/lit of $KMnO_4$ and $FeSO_4.7H_2O$ solution using 0.1 N $H_2C_2O_4.2H_2O$ solution.
- To determine the normality, molarity and g/lit of $FeSO_4$ $(NH_4)_2SO_4.6H_2O$ and $K_2Cr_2O_7$ solutions using 0.1 N $KMnO_4$ solution.

2-pH

- Concept of pH,
- pH scale,
- Determination of pH of various samples like
  - Farming soil, colleges soil…
  - water
  - Fruit
  - Milk
  - Cold drinks by pH strip, indicator [Without instrument]

3. Water analysis:

- Concept of Hardness-Total Hardness, Temporary and permanent hardness.
- Removal of Temporary hardness by boiling and filtration.
- Estimation of hardness by complexometric titration with EDTA.
- Measurement of TDS.
- Handy measurement of pH of water using various methods.

4. Analysis of real samples using titrimetric methods.

- Dolomite-Estimation of Ca^{+2}/Mg^{+2}
- Oil-Saponification value

Reference books

1. UGC Inorganic Chemistry - H. C. Khera (Pragati Prakashan)
2. Inorganic Chemistry - J. N. Gurtu & H. C. Khera
3. Principles of Inorganic chemistry- B. R. Puri, L. R. Sharma and K. C. Kalia; Vallabh publications, Delhi.
4. Concise Inorganic Chemistry - J. D. Lee
5. Basic Inorganic Chemistry – Gurdeep & Chatwal.
6. Advanced Inorganic Chemistry - Raymond Chang
7. Advanced Inorganic Chemistry- Cotton and Wilkinson
8. Undergraduate Organic Chemistry, Vol-1, Jagdamba Singh, L. D.S. Yadav, Pragati Prakashan, 8th edition-2013
9. Organic Reaction Mechanism, including Reaction Intermediates, V. K. Ahluwalia
10. Organic Chemistry, Vol-1, by Sultanat, Ane's Student Edition, Ane Book Pvt Ltd.
11. Organic Chemistry by Morrison and Boyd.
12. Organic Chemistry by Clayden.
13. Stereochemistry, conformation and mechanism by P.S. Kalsi New Age International publications ISBN:978-9393159947
14. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand & Co.
15. Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
16. Physical Chemistry, B. K. Sharma, Goel Publication House. Meerut.
17. Chemical Kinetics, G. R. Chatwal and Harish Mishra, Goel Publication House.
18. A text book of Physical Chemistry by Samuel Glasstone
19. Elements of Physical Chemistry by Samuel Glasstone and D lew
20. Analytical Chemistry Manual by Dr. H. S. Joshi (ISBN-978-93-90855-07-0).
21. How and why in Chemistry Practical by Dr. A. R. Parikh Himanshu Book co. ISBN978- 81-950054-0-6
22. March's Advanced Organic Chemistry Reactions, Mechanism and Structure by Michael B Smith and Jerry March.
23. Vogel's Qualitative inorganic analysis
24. A Text book of practical organic chemistry; including qualitative organic analysis.
25. Analytical Chemistry Manual by Dr. H. S. Joshi (ISBN-978-93-90855-07-0).
26. How and why in Chemistry Practical by Dr. A. R. Parikh Himanshu Book co. ISBN(78-81-950054-0-6

Bhakta Kavi Narsinh Mehta University, Junagadh

Effective from June - 2023

Subject: All 3-Credit course (NEP-2020)

MAJCHEM111,112,121,122, MINCHEM111,121, MDC111,121

(THEORY EXAM)

PAPER STYLE

Total mark: 50 **Time: 2:00 hours**

All the questions are compulsory.

Q. 1 (a) Answer the following question. **[UNIT-I]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**

OR

Q. 1 (a) Answer the following question. **[UNIT-I]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**

Q. 2 (a) Answer the following question. **[UNIT-2]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**

OR

Q. 2 (a) Answer the following question. **[UNIT-2]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**

Q. 3 (a) Answer the following question. **[UNIT-3]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**

OR

Q. 3 (a) Answer the following question. **[UNIT-3]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**

Q. 4 (a) Answer the following question. **[UNIT 1 and 2]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**

OR

Q. 4 (a) Answer the following question. **[UNIT 1 and 2]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**

Q. 5 (a) Answer the following question. **[UNIT 2 and 3]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**

OR

Q. 5 (a) Answer the following question. **[UNIT 2 and 3]** **(5)**

(*May be bifurcated into 2/3 etc marks***)**

(b) Answer the following question **(5)**