

Krantiguru Shyamji Krishna Verma

Kachchh University

Mundra Road

BHUJ: 370 001



SYLLABUS (CBCS)

B. Sc. Semester I: (ONE)

CHEMISTRY

With effect from June 2023

NATURE AND EXTENT OF BACHELOR'S DEGREE PROGRAMME IN CHEMISTRY (HONOURS)

A bachelor's degree in Chemistry with Research or without Research is a 4-year degree course which is divided into 8 semesters.

Sr. No.	Type of Award	Stage of Exit	Mandatory Credits to be secured for the Award
1	Certificate in the Discipline	After successful completion of 1st Year	Certificate With Exit 4 Credit course (44+4)
2	Diploma in the Discipline	After successful completion of 1st and 2nd Years	Diploma With Exit 4 Credit course (88+4)
3	B.Sc. in Chemistry	After successful completion of 1st, 2nd and 3rd Years	Bachelor degree (132)
4	B.Sc. (Honours with Research/without Research) in Chemistry	After successful completion of 1st, 2nd, 3rd and 4th Years	Bachelor + Honors degree (176) Bachelor + Research degree (176)

A student pursuing 4 years undergraduate programme with research in a specific discipline shall be awarded an appropriate Degree in that discipline on completion of 8th Semester if he/she secures required Credits. Similarly, for certificate, diploma and degree, a student needs to fulfil the associated credits. An illustration of credits requirements in relation to the type of award is illustrated as above.

Bachelor's Degree (Honours) is a well-recognized, structured, and specialized graduate level qualification in tertiary, collegiate education. The contents of this degree are determined in terms of knowledge, understanding, qualification, skills, and values that a student intends to acquire to look for professional avenues or move to higher education at the postgraduate level.

Bachelor's Degree (Honours) programmes attract entrants from the secondary level or equivalent, often with subject knowledge that may or may not be directly relevant to the field of study/profession. Thus, B.Sc. (Honours) Course in Chemistry aims to prepare students to qualify for joining a profession or to provide development opportunities in particular employment settings.

AIMS:

- To develop the curriculum for fostering subjective-learning.
- To shape students as a responsible and sensible citizen.
- To provide updated subject matter theoretically and practically which can enhance

student's core competency and learning.

- To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
- To enable the graduate, prepare for national as well as international competitive examinations, especially UGC-CSIR NET/SET/JAM/GATE etc. and Public Services Examination.

COURSE INTRODUCTION

The redesigned curriculum of B.Sc. in Chemistry offers essential knowledge and technical skills to study chemical science in a holistic manner. Students would be exposed to different areas of chemical science using a unique combination of core, elective and vocational papers with significant inter-disciplinary components. Students would be taught using modern methods and technologies to understand Organic, Inorganic, Physical, Analytical, Applied chemistry etc.

The entire programme of B.Sc. Chemistry will include classroom theories and laboratory component. The programme will also have Industrial visit/study tours, outstations and projects as part of their curriculum, Candidates who have curiosity in chemical science and laboratory research career can take up B.Sc Chemistry programme.

PROGRAMME OUTCOMES (POs):

Transformed curriculum shall develop educated outcome-oriented candidature, to develop into responsible citizen for nation-building and transforming the country towards the future with their knowledge gained in the field of Chemical science.

Programme specific objectives (PSOs): B.Sc. in Chemistry

- This course will enable students to learn avenues in Chemistry.
- The entire course syllabus can help students to get ready for competitive exams.
- Students will be able to know about basic chemical science knowledge.
- Certificate and diploma courses are framed to generate self- entrepreneurship and self- employability, if multi exit option is opted.
- Students will increase the ability of critical thinking, reasoning and curiosity, development of scientific attitude, problem solving, improve practical skills, enhance communication skill, social interaction, and increase awareness in chemical science.
- The training provided to the students will make them competent enough for doing jobs in Govt. and private sectors of academia, research and industry at entry level.

EVALUATION METHODS:

Academic performance in various courses *i.e.* **Major, Minor, IDC/MDC, AEC, VAC** and **SEC** are to be considered as parameters for assessing the achievement of students in the subject. A number of appropriate assessment methods of chemistry will be used to determine the extent to which students demonstrate desired learning outcomes.

A student shall be evaluated through Comprehensive Continuous Assessment (CCA)/ (Internal Evaluation) as well as the End of Semester examination (External Evaluation). The weight-age of CCA shall be shall be 50%, whereas the weight-age of the Semester end examination shall be shall be 50%. CCA will include tests/online –offline exams/seminars/assignments/ submissions/student attendance and active participations.

The End of Semester examination (External Evaluation) shall have an assessment based upon following perspective with respect to all the courses:

- a. Evaluation with respect to Knowledge,
- b. Evaluation with respect to Understanding,
- c. Evaluation with respect to Skill,
- d. Evaluation with respect to Application and
- e. Higher Order Thinking Skills.

This is compulsory to record laboratory work in the Journal. Certified journal has to be produced while appearing at the time of Practical examination.

Credit Framework and course code for First Year (SEM-I) Chemistry Programme.

Year	Semester	Course Code	Paper Title	Credits	Marks		Total	
					CA	UA		
First Year	I	MAJ CHE-101 (Theory)	BASIC CHEMISTRY-I	3	35	40	75	
		MAJ CHE-102-P (Practical)	BASIC CHEMISTRY-I-PRACTICAL	1	15	10	25	
		MAJ CHE-103 (Theory)	GENERAL CHEMISTRY-I	3	35	40	75	
		MAJ CHE-104-P (Practical)	GENERAL CHEMISTRY-I-PRACTICAL	1	15	10	25	
		Total Credits			8			200
		MIN CHE-105 (Theory)	BASIC CHEMISTRY-I	3	35	40	75	
		MIN CHE-106-P (Practical)	BASIC CHEMISTRY-I-PRACTICAL	1	15	10	25	
		Total Credits			4			100
		MDC CHE-107 (Theory)	BASIC CHEMISTRY-I	3	35	40	75	
		MDC CHE-108-P (Practical)	BASIC CHEMISTRY-I-PRACTICAL	1	15	10	25	
		Total Credits			4			100

Structure of the Question Paper (Theory) for the University Exam

KACHCHH UNIVERSITY: BHUJ

FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)

CHEMISTRY

PAPER NAME: BASIC CHEMISTRY-I/ GENERAL CHEMISTRY-I

PAPER CODE NO: MAJ/MIN/MDC CHE-101/103/105/107

Total Marks: 40, Passing standard: 16 Marks

PATTERN OF QUESTION PAPER

FOR SEMESTER-END EXAMS

Questions	Section	Marks
Question-1 (Unit-I)	(Descriptive - Essay type - Short notes <i>with internal option</i>)	10 marks
Question-2 (Unit-II)	--do--	10 marks
Question-3 (Unit-III)	--do--	10 marks
Question – 4 (Unit-I, II & III)	Total 12 short questions of 1 marks, each unit will have 4 questions. students will attempt any 10 out of 12	10 Marks

- *Question 4 may include one line answers/ two line answers/ definitions/ reasoning/ derivations of equations/ derivations of sums/ drawing small figures/ matching the figures/ fill in the blanks/ multiple choice question/ one word answer/ match the pairs etc.*
- *Industrial Visit/ Project work/ Tour/ other activity (Given by teacher or as a part of Syllabus) will be mandatory for all the students.*
- *The language of the question papers shall be English.*

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-I
PAPER CODE NO: MAJ CHE-101

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Basic Chemistry, like atomic structure and periodic properties, chemistry of alkane, alkene and alkynes, study of solvent, modes of concentration, acid-base theory, P^H , buffer solution and indicator This study will be helpful in further study, competitive exam and industries.		
UNIT-I	INORGANIC CHEMISTRY	15 Hours
	ATOMIC STRUCTURE AND PERIODIC PROPERTIES	
	Basic concept of dual nature of electron: de-Broglie's equation, Heisenberg's Uncertainty principle & its significance, Schrodinger's wave equation, significance of ψ and ψ^2 , Quantum numbers their significance, Aufbau Principle, Pauli's Exclusion Principle and Hund's Rule for electron configuration. Stability of half-filled and complete filled orbitals, periodic table, electronic configuration in periodic table. Periodicity in atomic properties and its causes, magic numbers, explanation of general trends of periodic properties: atomic radii, and ionic radii ionization potential, electronegative and electron affinity.	
UNIT-II	ORGANIC CHEMISTRY	15 Hours
	ALKANES, ALKENES & ALKYNES	
	*Structure, Nomenclature, Preparation. (Reduction of R-X, Wurtz reaction, Grignard reaction, Decarboxylation of acid, Kolbe's electrolytic process), Chemical reactions (Halogenation– Chlorination of Methane - free radical mechanism) of Alkanes *Structure and nomenclature of Alkenes, Preparations (Dehydration, Dehalogenation, Dehydrohalogenation) and Chemical reactions (with H_2 , X_2 , HX , $HOCl$, H_2SO_4 – Markovnikov and anti Markovnikov reactions with Mechanism), oxidation reaction with $KMnO_4$ (Bayer's test) Ozonolysis. Reactions of terminal Acetylenes, i.e Acetylide formation. Reaction with H_2SO_4 , Hg^{+2} . * In case of Alkynes, the reactions given by alkenes need not to be repeated.	
UNIT-III	PHYSICAL CHEMISTRY	15 Hours
	(A) STRENGTH OF SOLUTION	8 Hours
	Solute, solvent, solution, Types of solution, Preparation of Standard solution: equivalent weight of Acid and Base, Eq wt of acid salt, Eq	

	Wt of an ion, Oxidizing and reducing agents. % w/w, w/v, v/v; Mole fraction, Molality, Molarity, Normality (their definition, mathematical expressions and numerical problems)	
	(B) AQUEOUS SYSTEMS	7 Hours
	Arrhenius, Lowry-Bronsted and Lewis's concept of acid-base. Relative strength of acid-base, pH of solution, pH scale, buffer solution, buffer capacity, buffer index, buffer type and their uses, calculations of pH of buffer mixture, Hydrolysis of salt, relation between K_h , K_w , K_a , K_b . Acid base indicators theory, Acid base titration and choice of suitable indicator.	

KACHCHH UNIVERSITY: BHUJ

FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)

CHEMISTRY

PAPER NAME: BASIC CHEMISTRY-I-PRACTICAL

PAPER CODE NO: MAJ CHE-102-P

Marks: External Evaluation: 10, Internal Evaluation: 15. Total Marks 25

Course Outcomes (COs):

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

- Qualitatively analyze unknown inorganic salt with a cation and an anion.
- Practical skills in the field and laboratory experiments in qualitative analysis.
- The course will provide ability to student to identify any pure inorganic salt

Q.1 Inorganic Qualitative analysis:

Give water soluble or insoluble salt for analysis. 10 Single salts to be analysed.

- (01) Bromide (Br^{-1}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}, \text{Sr}^{+2}$
- (02) Chloride (Cl^{-1}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}, \text{Cu}^{+2}, \text{Cd}^{+2}, \text{Mg}^{+2}, \text{Ba}^{+2}, \text{Sr}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}, \text{Co}^{+2}$.
- (03) Iodide (I^{-1}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (04) Chromate (CrO_4^{-2}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (05) Dichromate ($\text{Cr}_2\text{O}_7^{-2}$): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (06) Nitrate (NO_3^{-1}): $\text{Pb}^{+2}, \text{Cu}^{+2}, \text{Co}^{+2}, \text{Ni}^{+2}, \text{Ba}^{+2}, \text{Sr}^{+2}, \text{Na}^{+1}$
- (07) Carbonate (CO_3^{-2}): $\text{Cu}^{+2}, \text{Cd}^{+2}, \text{Bi}^{+2}, \text{Zn}^{+2}, \text{Ni}^{+2}, \text{Mn}^{+2}, \text{Ca}^{+2}, \text{Ba}^{+2}, \text{Sr}^{+2}, \text{Mg}^{+2}, \text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (08) Phosphate (PO_4^{-3}): $\text{Cu}^{+2}, \text{Fe}^{+2}, \text{Al}^{+3}, \text{Zn}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}, \text{Co}^{+2}, \text{Ba}^{+2}, \text{Ca}^{+2}, \text{Sr}^{+2}, \text{Mg}^{+2}, \text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (09) Sulphate (SO_4^{-2}): $\text{Cu}^{+2}, \text{Al}^{+3}, \text{Zn}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}, \text{Fe}^{+2}, \text{Mg}^{+2}, \text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$.
- (10) Sulfide (S^{-2}): $\text{Zn}^{+2}, \text{Cd}^{+2}, \text{Sb}^{+2}$

Q.2 Three short questions related to practical's only

Q.3 Certified journal

Note: Student shall not be allowed to appear in the examination if he does not produce certified journals.

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-I-PRACTICAL
PAPER CODE NO: MAJ CHE-102-P
Total Marks: 10; Passing standard: 04 Marks

(A) Inorganic Qualitative Analysis:

- (a) Preliminary Observations
- (b) Dry Tests for Cation
- (c) Dry Tests for Anion
- (d) Wet test for Cation / Group tests
- (e) Analysis of group / Phosphate scheme to get correct cation
- (f) Confirmative tests for cation
- (g) Wet tests for Anion to get correct ion
- (h) CT for anion
- (i) Result, Chemical formula and name of compound found
- (j) Chemical equations: Cation + Anion

(B) Short Answers:

(C) Certified Journal:

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KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)
CHEMISTRY
PAPER NAME: GENERAL CHEMISTRY-I
PAPER CODE NO: MAJ CHE-103

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Basic Chemistry, like detailed study of VBT, MOT with LCAO concept, concept of hybridization, determination of molecular weight, various electron displacement effects in organic molecules, thermodynamics, ionic equilibrium, This study will be helpful in further study, competitive exam and industries.		
UNIT-I	INORGANIC CHEMISTRY	15 Hours
	CHEMICAL BONDING	
	Definition of chemical bonds (covalent, co-ordinate covalent, ionic, metallic, H-bond, Vander Waals force of attraction), Valence bond theory & limitation, Concept of hybridization: sp (BeCl ₂), sp ² (BF ₃), sp ³ (SiH ₄), sp ³ d (PCl ₅) and sp ³ d ² (SF ₆), Hybridization of elements involving π-bonds (SO ₂ , SO ₃ , XeO ₃), MOT; LCAO method, Bonding molecular orbital, Non-bonding molecular orbital, anti-bonding molecular orbital, gerade and ungerade molecular orbital, bond order, magnetic properties and molecular orbital energy level diagram of homo & hetero diatomic molecule e.g. F ₂ , F ₂ ⁺ , O ₂ , O ₂ ⁺¹ , O ₂ ⁻¹ , CO, CN, NO. Stereochemistry of inorganic molecules: Sidgwick Powell rule and VSEPR theory. Structure of molecules: SnCl ₂ , SO ₄ ⁻² , CO ₃ ⁻² .	
UNIT-II	ORGANIC CHEMISTRY	15 Hours
	(A) MOLECULAR FORMULA	8 Hours
	Estimation of Carbon, Hydrogen (Liebig Method), Oxygen, Nitrogen (Kjeldahl's simple method, no use of Boric acid), Halogens, Sulfur, Phosphorous (Carius method), Principle and calculation, Numerical problems to find out percentage; (No diagram of any method.) Determination of Molecular weight: Silver salt method, Chloroplatinate method and Volumetric method. Numerical problems Determination of Empirical formula and of organic molecules from %age composition, to find out percentage composition from molecular formula.	
	(B) VARIOUS ELECTRONIC EFFECTS	7 Hours
	Inductive effect, Resonance, Electrometric effect, Hyper conjugation, : Definitions and conditions with few examples, Fission of Covalent bond, Types of reagents and reactive intermediates, structure and formation of Alkyl and other free radicals, Carbo cations, Carb anions, comparison and stability.	

UNIT-III	PHYSICAL CHEMISTRY	15 Hours
	(A) THERMODYNAMICS	8 Hours
	Thermodynamic terms and basic concepts, intensive and extensive property, thermodynamic processes, state of a system, nature of heat of work, pressure-volume work, isothermal reversible expansion work of an ideal gas, internal energy, first law of thermodynamics, enthalpy of system, Heat capacity C_p , C_v and their relations, Joule Thomson effect, adiabatic expansion of an ideal gas, definition of zeroth law.	
	(B) IONIC EQUILIBRIUM	7 Hours
	Electrolytic conductance, specific conductance, molar conductance and their relations, cell constant, Variation in molar conductance with dilution, Ionic mobility, Kohlrausch law and application, Calculation of molar and ionic conductance, relation between ionic and molar conductance, Ostwald's law of dilution and its limitations, Debye-Huckel theory of strong electrolyte, numerical	

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)
CHEMISTRY

PAPER NAME: GENERAL CHEMISTRY-I-PRACTICAL

PAPER CODE NO: MAJ CHE-104-P

Marks: External Evaluation: 10, Internal Evaluation: 15. Total Marks 25

Course Outcomes (COs):

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

- Determine the normality, molarity and gms/liter of each component in a solution.
- Practical skills in the field and laboratory experiments in volumetric analysis.
- Standardize a given solution of acid or base.
- Prepare standard solutions of acid or base.
- Learn method to carry out analysis of water.

Q.1 VOLUMETRIC EXERCISE:

Single step titrations: One of the two standard solutions to be prepared by students. The following exercise may be set.

Aim: for example; Prepare 0.08 N, 100 ml solution of Succinic acid and use it to find out the strength of given solution of xN NaOH in terms of Normality, gm/lit and Molarity.

- 1) 0.05 N to 0.1 N Succinic acid Vs x N NaOH / KOH
- 2) 0.05 N to 0.1 N Oxalic acid Vs x N KOH / NaOH
- 3) 0.01 M EDTA Vs $\text{CaCl}_2 \cdot 2 \text{H}_2\text{O}$ / Hardness of water.
- 4) 0.01 M EDTA Vs x M $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$
- 5) 0.01 M EDTA Vs x M ZnCl_2
- 6) 0.05 – 0.1 N Oxalic acid / Pot oxalate / Sodium Oxalate Vs x N KMnO_4
- 7) 0.05 – 0.1 $\text{Na}_2\text{S}_2\text{O}_3$ Vs x N I_2 solution
- 8) 0.05 – 0.1 N $\text{Na}_2\text{S}_2\text{O}_3$ Vs x N CuSO_4
- 9) 0.05 – 0.1 N KMnO_4 Vs xN Ferrous Ammonium Sulphate or $\text{FeSO}_4 \cdot 7 \text{H}_2\text{O}$
- 10) 0.05 / 0.1 N $\text{K}_2\text{Cr}_2\text{O}_7$ Vs x N $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ or FAS using internal indicator.

Q.2 Viva

Q.3 Certified journal

Note: Student shall not be allowed to appear in the examination if he does not produce certified journals.

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)
CHEMISTRY
PAPER NAME: GENERAL CHEMISTRY-I-PRACTICAL
PAPER CODE NO: MAJ CHE-104-P
Total Marks: 10; Passing standard: 04 Marks

(A) Single step Volumetric Analysis

One Standard solution to be prepared by students

- (a) Calculation of weight and preparation of solution: **1 Marks**
- (b) Correct Reading: **5 Marks**
- (c) Calculation: **3 Marks** (One mark each for Normality, Gm/lit, Molarity)
- (d) Equation: **1 Marks**

(B) Viva

(C) Certified Journal

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KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-I
PAPER CODE NO: MIN CHE-105

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Basic Chemistry, like Atomic structure and periodic properties, chemistry of alkane, alkene and alkynes, study of solvent, modes of concentration, acid-base theory, P^H , buffer solution and indicator This study will be helpful in further study, competitive exam and industries.		
UNIT-I	INORGANIC CHEMISTRY	15 Hours
	ATOMIC STRUCTURE AND PERIODIC PROPERTIES	
	Basic concept of dual nature of electron: de-Broglie's equation, Heisenberg's Uncertainty principle & its significance, Schrodinger's wave equation, significance of ψ and ψ^2 , Quantum numbers their significance, Aufbau Principle, Pauli's Exclusion Principle and Hund's Rule for electron configuration. Stability of half-filled and complete filled orbitals, periodic table, electronic configuration in periodic table. Periodicity in atomic properties and its causes, magic numbers, explanation of general trends of periodic properties: atomic radii, and ionic radii ionization potential, electronegative and electron affinity.	
UNIT-II	ORGANIC CHEMISTRY	15 Hours
	ALKANES, ALKENES & ALKYNES	
	*Structure, Nomenclature, Preparation. (Reduction of R-X, Wurtz reaction, Grignard reaction, Decarboxylation of acid, Kolbe's electrolytic process), Chemical reactions (Halogenation– Chlorination of Methane - free radical mechanism) of Alkanes *Structure and nomenclature of Alkenes, Preparations (Dehydration, Dehalogenation, Dehydrohalogenation) and Chemical reactions (with H_2 , X_2 , HX , $HOCl$, H_2SO_4 – Markovnikov and anti Markovnikov reactions with Mechanism), oxidation reaction with $KMnO_4$ (Bayer's test) Ozonolysis. Reactions of terminal Acetylenes, i.e Acetylide formation. Reaction with H_2SO_4 , Hg^{+2} . * In case of Alkynes, the reactions given by alkenes need not to be repeated.	
UNIT-III	PHYSICAL CHEMISTRY	15 Hours
	(A) STRENGTH OF SOLUTION	8 Hours
	Solute, solvent, solution, Types of solution, Preparation of Standard solution: equivalent weight of Acid and Base, Eq wt of acid salt, Eq	

	Wt of an ion, Oxidizing and reducing agents. % w/w, w/v, v/v; Mole fraction, Molality, Molarity, Normality (their definition, mathematical expressions and numerical problems)	
	(B) AQUEOUS SYSTEMS	7 Hours
	Arrhenius, Lowry-Bronsted and Lewis's concept of acid-base. Relative strength of acid-base, pH of solution, pH scale, buffer solution, buffer capacity, buffer index, buffer type and their uses, calculations of pH of buffer mixture, Hydrolysis of salt, relation between K_h , K_w , K_a , K_b . Acid base indicators theory, Acid base titration and choice of suitable indicator.	

KACHCHH UNIVERSITY: BHUJ

FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)

CHEMISTRY

PAPER NAME: BASIC CHEMISTRY-I-PRACTICAL

PAPER CODE NO: MIN CHE-106-P

Marks: External Evaluation: 10, Internal Evaluation: 15. Total Marks 25

Course Outcomes (COs):

After the completion of the course the students will be able to:

- Qualitatively analyze unknown inorganic salt with a cation and an anion.
- Practical skills in the field and laboratory experiments in qualitative analysis.
- The course will provide ability to student to identify any pure inorganic salt

Q.1 Inorganic Qualitative analysis:

Give water soluble or insoluble salt for analysis. 10 Single salts to be analysed.

- (01) Bromide (Br^{-1}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}, \text{Sr}^{+2}$
- (02) Chloride (Cl^{-1}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}, \text{Cu}^{+2}, \text{Cd}^{+2}, \text{Mg}^{+2}, \text{Ba}^{+2}, \text{Sr}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}, \text{Co}^{+2}$.
- (03) Iodide (I^{-1}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (04) Chromate (CrO_4^{-2}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (05) Dichromate ($\text{Cr}_2\text{O}_7^{-2}$): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (06) Nitrate (NO_3^{-1}): $\text{Pb}^{+2}, \text{Cu}^{+2}, \text{Co}^{+2}, \text{Ni}^{+2}, \text{Ba}^{+2}, \text{Sr}^{+2}, \text{Na}^{+1}$
- (07) Carbonate (CO_3^{-2}): $\text{Cu}^{+2}, \text{Cd}^{+2}, \text{Bi}^{+2}, \text{Zn}^{+2}, \text{Ni}^{+2}, \text{Mn}^{+2}, \text{Ca}^{+2}, \text{Ba}^{+2}, \text{Sr}^{+2}, \text{Mg}^{+2}, \text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (08) Phosphate (PO_4^{-3}): $\text{Cu}^{+2}, \text{Fe}^{+2}, \text{Al}^{+3}, \text{Zn}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}, \text{Co}^{+2}, \text{Ba}^{+2}, \text{Ca}^{+2}, \text{Sr}^{+2}, \text{Mg}^{+2}, \text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (09) Sulphate (SO_4^{-2}): $\text{Cu}^{+2}, \text{Al}^{+3}, \text{Zn}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}, \text{Fe}^{+2}, \text{Mg}^{+2}, \text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$.
- (10) Sulfide (S^{-2}): $\text{Zn}^{+2}, \text{Cd}^{+2}, \text{Sb}^{+2}$

Q.2 Three short questions related to practical's only

Q.3 Certified journal

Note: Student shall not be allowed to appear in the examination if he does not produce certified journals.

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-I-PRACTICAL
PAPER CODE NO: MIN CHE-106-P
Total Marks: 10; Passing standard: 04 Marks

(A) Inorganic Qualitative Analysis:

- (a) Preliminary Observations
- (b) Dry Tests for Cation
- (c) Dry Tests for Anion
- (d) Wet test for Cation / Group tests
- (e) Analysis of group / Phosphate scheme to get correct cation
- (f) Confirmative tests for cation
- (g) Wet tests for Anion to get correct ion
- (h) CT for anion
- (i) Result, Chemical formula and name of compound found
- (j) Chemical equations : Cation + Anion

(B) Short Answers:

(C) Certified Journal:

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KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-I
PAPER CODE NO: MDC CHE-107

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Basic Chemistry, like Atomic structure and periodic properties, chemistry of alkane, alkene and alkynes, study of solvent, modes of concentration, acid-base theory, P^H , buffer solution and indicator This study will be helpful in further study, competitive exam and industries.		
UNIT-I	INORGANIC CHEMISTRY	15 Hours
	ATOMIC STRUCTURE AND PERIODIC PROPERTIES	
	Basic concept of dual nature of electron: de-Broglie's equation, Heisenberg's Uncertainty principle & its significance, Schrodinger's wave equation, significance of ψ and ψ^2 , Quantum numbers their significance, Aufbau Principle, Pauli's Exclusion Principle and Hund's Rule for electron configuration. Stability of half-filled and complete filled orbitals, periodic table, electronic configuration in periodic table. Periodicity in atomic properties and its causes, magic numbers, explanation of general trends of periodic properties: atomic radii, and ionic radii ionization potential, electronegative and electron affinity.	
UNIT-II	ORGANIC CHEMISTRY	15 Hours
	ALKANES, ALKENES & ALKYNES	
	*Structure, Nomenclature, Preparation. (Reduction of R-X, Wurtz reaction, Grignard reaction, Decarboxylation of acid, Kolbe's electrolytic process), Chemical reactions (Halogenation– Chlorination of Methane - free radical mechanism) of Alkanes *Structure and nomenclature of Alkenes, Preparations (Dehydration, Dehalogenation, Dehydrohalogenation) and Chemical reactions (with H_2 , X_2 , HX , $HOCl$, H_2SO_4 – Markovnikov and anti Markovnikov reactions with Mechanism), oxidation reaction with $KMnO_4$ (Bayer's test) Ozonolysis. Reactions of terminal Acetylenes, i.e Acetylde formation. Reaction with H_2SO_4 , Hg^{+2} . * In case of Alkynes, the reactions given by alkenes need not to be repeated.	
UNIT-III	PHYSICAL CHEMISTRY	15 Hours
	(A) STRENGTH OF SOLUTION	8 Hours
	Solute, solvent, solution, Types of solution, Preparation of Standard solution: equivalent weight of Acid and Base, Eq wt of acid salt, Eq	

	Wt of an ion, Oxidizing and reducing agents. % w/w, w/v, v/v; Mole fraction, Molality, Molarity, Normality (their definition, mathematical expressions and numerical problems)	
	(B) AQUEOUS SYSTEMS	7 Hours
	Arrhenius, Lowry-Bronsted and Lewis's concept of acid-base. Relative strength of acid-base, pH of solution, pH scale, buffer solution, buffer capacity, buffer index, buffer type and their uses, calculations of pH of buffer mixture, Hydrolysis of salt, relation between K_h , K_w , K_a , K_b . Acid base indicators theory, Acid base titration and choice of suitable indicator.	

KACHCHH UNIVERSITY: BHUJ

FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)

CHEMISTRY

PAPER NAME: BASIC CHEMISTRY-I-PRACTICAL

PAPER CODE NO: MDC CHE-108-P

Marks: External Evaluation: 10, Internal Evaluation: 15. Total Marks 25

Course Outcomes (COs):

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

- Qualitatively analyze unknown inorganic salt with a cation and an anion.
- Practical skills in the field and laboratory experiments in qualitative analysis.
- The course will provide ability to student to identify any pure inorganic salt

Q.1 Inorganic Qualitative analysis:

Give water soluble or insoluble salt for analysis. 10 Single salts to be analysed.

- (01) Bromide (Br^{-1}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}, \text{Sr}^{+2}$
- (02) Chloride (Cl^{-1}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}, \text{Cu}^{+2}, \text{Cd}^{+2}, \text{Mg}^{+2}, \text{Ba}^{+2}, \text{Sr}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}, \text{Co}^{+2}$.
- (03) Iodide (I^{-1}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (04) Chromate (CrO_4^{-2}): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (05) Dichromate ($\text{Cr}_2\text{O}_7^{-2}$): $\text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (06) Nitrate (NO_3^{-1}): $\text{Pb}^{+2}, \text{Cu}^{+2}, \text{Co}^{+2}, \text{Ni}^{+2}, \text{Ba}^{+2}, \text{Sr}^{+2}, \text{Na}^{+1}$
- (07) Carbonate (CO_3^{-2}): $\text{Cu}^{+2}, \text{Cd}^{+2}, \text{Bi}^{+2}, \text{Zn}^{+2}, \text{Ni}^{+2}, \text{Mn}^{+2}, \text{Ca}^{+2}, \text{Ba}^{+2}, \text{Sr}^{+2}, \text{Mg}^{+2}, \text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (08) Phosphate (PO_4^{-3}): $\text{Cu}^{+2}, \text{Fe}^{+2}, \text{Al}^{+3}, \text{Zn}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}, \text{Co}^{+2}, \text{Ba}^{+2}, \text{Ca}^{+2}, \text{Sr}^{+2}, \text{Mg}^{+2}, \text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$
- (09) Sulphate (SO_4^{-2}): $\text{Cu}^{+2}, \text{Al}^{+3}, \text{Zn}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}, \text{Fe}^{+2}, \text{Mg}^{+2}, \text{Na}^{+1}, \text{K}^{+1}, \text{NH}_4^{+1}$.
- (10) Sulfide (S^{-2}): $\text{Zn}^{+2}, \text{Cd}^{+2}, \text{Sb}^{+2}$

Q.2 Three short questions related to practical's only

Q.3 Certified journal

Note: Student shall not be allowed to appear in the examination if he does not produce certified journals.

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: I (ONE)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-I-PRACTICAL
PAPER CODE NO: MDC CHE-108-P
Total Marks: 10; Passing standard: 04 Marks

(A) Inorganic Qualitative Analysis:

- (a) Preliminary Observations
- (b) Dry Tests for Cation
- (c) Dry Tests for Anion
- (d) Wet test for Cation / Group tests
- (e) Analysis of group / Phosphate scheme to get correct cation
- (f) Confirmative tests for cation
- (g) Wet tests for Anion to get correct ion
- (h) CT for anion
- (i) Result, Chemical formula and name of compound found
- (j) Chemical equations : Cation + Anion

(B) Short Answers:

(C) Certified Journal:

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REFERENCE BOOKS:

(A) Physical Chemistry:

1. Physical chemistry: P.W. Atkins,
2. Elements of Physical Chemistry Samuel Glasstone .
3. Principles of Phys. Chem: B.R.Puri, L.R.Sharma and Pathania, 41st edition.
4. A text book of Physical Chemistry: P L Soni , O P Dharmarha& UN Dash
5. Physical Chemistry: D R Pandit, A R Rao & Padke
6. Essential of Physical Chemistry: Arun Bahl, B. S. Bahl, G. D. Tuli, S. Chand Publication

(B) Inorganic Chemistry:

1. Concise Inorganic Chemistry: J.D.Lee, Chapman and Hall, 5th ed., 1996.
2. Basic Inorganic Chemistry: F A Cotton & G Wilkinson
3. Valence and Molecular Structure: Cartmell&Fowels
4. Atomic Structure and Chemical Bonding : Manas Chanda
5. Principles of Inorganic Chemistry: B R Puri, L R Sharma & K C Kalia
6. Inorganic Chemistry - P. L. Soni.

(C) Organic Chemistry:

1. Text Book of Organic Chemistry: P L Soni & H M Chawla: Sultan Chand & sons, New Delhi.
2. Organic Chemistry: R T Morrison and R N Boyd, 6th Ed, Prentice Hall.
3. A Textbook of Organic Chemistry: R K Bansal, 3rd Ed, 2002, New Age International, New Delhi.
4. Advanced Organic Chemistry: Arun Bahl & B S Bahl, 2004.
5. Reaction Mechanism in Organic Chemistry: S M Mukherji & S P Singh, S.Chand& Co. Ltd, New Dehli.
6. Advanced Organic Chemistry: Jerry March.
7. A text book of Organic Chemistry : K S Tewari , N K Vishnoi& S N Mehrotra
8. Reaction mechanisms and reagents in organic Chemistry: Gurdeep Chatwal
9. Basic course in Organic Chemistry : Ramesh Luhana

Krantiguru Shyamji Krishna Verma

Kachchh University

Mundra Road

BHUJ: 370 001



SYLLABUS (CBCS)

B. Sc. Semester II: (TWO)

CHEMISTRY

With effect from June 2023

NATURE AND EXTENT OF BACHELOR'S DEGREE PROGRAMME IN CHEMISTRY (HONOURS)

A bachelor's degree in Chemistry with Research or without Research is a 4 year degree course which is divided into 8 semesters.

Sr. No.	Type of Award	Stage of Exit	Mandatory Credits to be secured for the Award
1	Certificate in the Discipline	After successful completion of 1st Year	Certificate With Exit 4 Credit course (44+4)
2	Diploma in the Discipline	After successful completion of 1st and 2nd Years	Diploma With Exit 4 Credit course (88+4)
3	B.Sc. in Chemistry	After successful completion of 1st, 2nd and 3rd Years	Bachelor degree (132)
4	B.Sc. (Honours with Research/without Research) in Chemistry	After successful completion of 1st, 2nd, 3rd and 4th Years	Bachelor + Honors degree (176) Bachelor + Research degree (176)

A student pursuing 4 years undergraduate programme with research in a specific discipline shall be awarded an appropriate Degree in that discipline on completion of 8th Semester if he/she secures required Credits. Similarly, for certificate, diploma and degree, a student needs to fulfil the associated credits. An illustration of credits requirements in relation to the type of award is illustrated as above.

Bachelor's Degree (Honours) is a well-recognized, structured, and specialized graduate level qualification in tertiary, collegiate education. The contents of this degree are determined in terms of knowledge, understanding, qualification, skills, and values that a student intends to acquire to look for professional avenues or move to higher education at the postgraduate level.

Bachelor's Degree (Honours) programmes attract entrants from the secondary level or equivalent, often with subject knowledge that may or may not be directly relevant to the field of study/profession. Thus, B.Sc. (Honours) Course in Chemistry aims to prepare students to qualify for joining a profession or to provide development opportunities in particular employment settings.

AIMS:

- To develop the curriculum for fostering subjective-learning.
- To shape students as a responsible and sensible citizen.
- To provide updated subject matter theoretically and practically which can enhance

student's core competency and learning.

- To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
- To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET/SET/JAM/GATE etc. and Public Services Examination.

COURSE INTRODUCTION

The redesigned curriculum of B.Sc. in Chemistry offers essential knowledge and technical skills to study chemical science in a holistic manner. Students would be exposed to different areas of chemical science using a unique combination of core, elective and vocational papers with significant inter-disciplinary components. Students would be taught using modern methods and technologies to understand Organic, Inorganic, Physical, Analytical, Applied chemistry etc.

The entire programme of B.Sc. Chemistry will include classroom theories and laboratory component. The programme will also have Industrial visit/study tours, outstations and projects as part of their curriculum, Candidates who have curiosity in chemical science and laboratory research career can take up B.Sc Chemistry programme.

PROGRAMME OUTCOMES (POs):

Transformed curriculum shall develop educated outcome-oriented candidature, to develop into responsible citizen for nation-building and transforming the country towards the future with their knowledge gained in the field of Chemical science.

Programme specific objectives (PSOs): B.Sc. in Chemistry

- This course will enable students to learn avenues in Chemistry.
- The entire course syllabus can help students to get ready for competitive exams.
- Students will be able to know about basic chemical science knowledge.
- Certificate and diploma courses are framed to generate self- entrepreneurship and self- employability, if multi exit option is opted.
- Students will increase the ability of critical thinking, reasoning and curiosity, development of scientific attitude, problem solving, improve practical skills, enhance communication skill, social interaction, and increase awareness in chemical science.
- The training provided to the students will make them competent enough for doing jobs in Govt. and private sectors of academia, research and industry at entry level.

EVALUATION METHODS:

Academic performance in various courses *i.e.* **Major, Minor, IDC/MDC, AEC, VAC** and **SEC** are to be considered as parameters for assessing the achievement of students in the subject. A number of appropriate assessment methods of chemistry will be used to determine the extent to which students demonstrate desired learning outcomes.

A student shall be evaluated through Comprehensive Continuous Assessment (CCA)/ (Internal Evaluation) as well as the End of Semester examination (External Evaluation). The weight-age of CCA shall be around 50%, whereas the weight-age of the Semester end examination shall be around 50%. CCA will include tests/online –offline exams/seminars/assignments/ submissions/student attendance and active participations.

The End of Semester examination (External Evaluation) shall have an assessment based upon following perspective with respect to all the courses:

- a. Evaluation with respect to Knowledge,
- b. Evaluation with respect to Understanding,
- c. Evaluation with respect to Skill,
- d. Evaluation with respect to Application and
- e. Higher Order Thinking Skills.

This is compulsory to record laboratory work in the Journal. Certified journal has to be produced while appearing at the time of Practical examination.

Credit Framework and course code for First Year (SEM-II) Chemistry Programme.

Year	Semester	Course Code	Paper Title	Credits	Marks		Total	
					CA	UA		
First Year	II	MAJ CHE-201 (Theory)	BASIC CHEMISTRY-II	3	35	40	75	
		MAJ CHE-202-P (Practical)	BASIC CHEMISTRY-II-PRACTICAL	1	15	10	25	
		MAJ CHE-203 (Theory)	GENERAL CHEMISTRY-II	3	35	40	75	
		MAJ CHE-204-P (Practical)	GENERAL CHEMISTRY-II-PRACTICAL	1	15	10	25	
		Total Credits			8			200
		MIN CHE-205 (Theory)	BASIC CHEMISTRY-II	3	35	40	75	
		MIN CHE-206-P (Practical)	BASIC CHEMISTRY-II-PRACTICAL	1	15	10	25	
		Total Credits			4			100
		MDC CHE-207 (Theory)	BASIC CHEMISTRY-II	3	35	40	75	
		MDC CHE-208-P (Practical)	BASIC CHEMISTRY-II-PRACTICAL	1	15	10	25	
		Total Credits			4			100

Structure of the Question Paper (Theory) for the University Exam

KACHCHH UNIVERSITY: BHUJ

FIRST YEAR B.Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY

PAPER NAME: BASIC CHEMISTRY-II/ GENERAL CHEMISTRY-II

PAPER CODE NO: MAJ/MIN/MDC CHE-201/203/205/207

Total Marks: 40, Passing standard: 16 Marks

PATTERN OF QUESTION PAPER

FOR SEMESTER-END EXAMS

Questions	Section	Marks
Question-1 (Unit-I)	(Descriptive - Essay type - Short notes <i>with internal option</i>)	10 marks
Question-2 (Unit-II)	--do--	10 marks
Question-3 (Unit-III)	--do--	10 marks
Question – 4 (Unit-I, II & III)	Total 12 short questions of 1 marks, each unit will have 4 questions. students will attempt any 10 out of 12	10 Marks

- *Question 4 may include one line answers/ two line answers/ definitions/ reasoning/ derivations of equations/ derivations of sums/ drawing small figures/ matching the figures/ fill in the blanks/ multiple choice question/ one word answer/ match the pairs etc.*
- *Industrial Visit/ Project work/ Tour/ other activity (Given by teacher or as a part of Syllabus) will be mandatory for all the students.*
- *The language of the question papers shall be English.*

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B. Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-II
PAPER CODE NO: MAJ CHE-201

Course Outcomes (COs):		
Upon successful completion of these papers, students will learn about concepts of Chemistry, like Coordination chemistry, metallurgy, aromatic hydrocarbon, selected organic molecules, gaseous state, and adsorption. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	INORGANIC CHEMISTRY	15 Hours
	(A) COORDINATION CHEMISTRY	10 Hours
	Explanation of complex compound (Coordination compounds), Introduction to basic terminologies (primary and secondary coordination spheres, ligands and their types, Coordination number and geometry, chelation.), Nomenclature of coordination compounds, chelates, Classification of chelates, Uses of chelates, Werner theory, Stability of complex compounds,, Factors influencing stability (properties of metal ion and properties of ligand) Inner orbital complexes, outer orbital complexes, Biological importance of complexes.	
	(B) METALLURGY	05 Hours
	Extraction of Ag, Zn, Pt from their respective chief ore, electroplating.	
UNIT-II	ORGANIC CHEMISTRY	15 Hours
	(A) AROMATIC HYDROCARBONS	8 Hours
	Benzene, source of electrons, Electrophilic Substitution reactions of Benzene (Nitration, Sulfonation, Chlorination, Friedel – Crafts alkylation using alkyl halide, alcohol and alkene, Friedel – Crafts Acetylation) with mechanism with energy profile graph, Directive influence of substituents, Disubstitution in Benzene (No mechanism), Inter conversions of substituents, Conversions with two or three steps. For example: Convert Benzene into Resorcinol/m-Chloro nitro benzene/Acetanilide Benzoic acid/p-or m-Nitro benzaldehyde or Benzoic acid etc.	
	(B) SELECTED ORGANIC MOLECULES	7 Hours
	Preparations, Physical and Chemical Properties and uses of Ethyl Chloride, Chloroform, Carbon tetra Chloride, Chloro benzene, Ethanol, Phenol, HCHO, CH ₃ CHO, C ₆ H ₅ CHO, CH ₃ COCH ₃ (Halo form reaction, addition with HCN, NaHSO ₃ , R-Mg-X, Acetal formation, Reaction with Ammonia derivatives (NH ₂ -Z), Aldol condensation. Oxidation, reduction, and polymerization.	

UNIT-III	PHYSICAL CHEMISTRY	15 Hours
	(A) THE GASEOUS STATE	10 Hours
	Gas laws, kinetic molecular theory of gases, Deviation from ideal behaviour, cause of deviation, Van-der-Waal's equation and its application, method of limiting densities, critical state, Relation between critical constants and Van-der-Waal's constant, Law of corresponding states, Liquefaction of gases, Maxwell's distribution of molecular velocity, Collision number, mean free path.	
	(B) ADSORPTION	5 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.	

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY

PAPER NAME: BASIC CHEMISTRY-II-PRACTICAL
PAPER CODE NO: MAJ CHE-202-P

Marks: External Evaluation: 10, Internal Evaluation: 15. Total Marks 25

Course Outcomes (COs):

After the completion of the course the students will be able to:

- Determine the normality, molarity and gms/liter of each component in a mixture.
- Practical skills in the field and laboratory experiments in volumetric analysis.
- Standardize a given solution of acid or base.
- Learn method to carry out analysis of commercial acid/bas.

Q.1 Inorganic TWO STEP Volumetric Analysis:

Standard solution to be given to the students:

- (1) Use of 0.05 N–0.1 N Na_2CO_3 to determine the strength of given xN HCl and thence xN NaOH
- (2) Use of 0.05 N–0.1 N Oxalic acid to determine the strength of xN KMnO_4 and thence x N $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ / x N FAS. $6\text{H}_2\text{O}$
- (3) Use of 0.05 N–0.1 N KMnO_4 to determine the strength of given solutions of x N FAS. $6\text{H}_2\text{O}$ and thence x N $\text{K}_2\text{Cr}_2\text{O}_7$.
- (4) Determination of Acetic acid in Commercial Vinegar using 0.1 M NaOH. NaOH to be standardized using 0.1 N Succinic acid
- (5) To determine the strength of each component in a mixture of $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3$ using 0.1 N HCl.
- (6) To determine the strength of each component in a mix of Oxalic acid + H_2SO_4 using 0.02 M KMnO_4 and 0.1 M NaOH.
- (7) To determine the strength of each component in a mixture of $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O} + \text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ using 0.1 M NaOH and 0.02 M KMnO_4 solution.

Q.2 Three short questions related to practical's only

Q.3 Certified journal

Note: Student shall not be allowed to appear in the examination if he does not produce certified journals.

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-II-PRACTICAL
PAPER CODE NO: MAJ CHE-202-P
Total Marks: 10; Passing standard: 04 Marks

(A) TWO Step Volumetric Analysis:

Standard solution to be given to the candidates

Step: I (Reading + Calculation): 5 M

Step: II (Reading + Calculation): 5 M

Over all result in tabular form

(B) Short Answers:

(C) Certified Journal:

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B. Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY
PAPER NAME: GENERAL CHEMISTRY-II
PAPER CODE NO: MAJ CHE-203

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Chemistry, like Chemistry of S block element, carboxylic acid and acid chloride, amide, ester, anhydride derivatives, chemical equilibrium and chemical. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	INORGANIC CHEMISTRY	15 Hours
	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 ₂ CO ₃ , NaHCO ₃ , NaCl, NaOH, CaO, CaCO ₃ , Ca(OH) ₂ and Plaster of Paris.	
UNIT-II	ORGANIC CHEMISTRY	15 Hours
	(A) MONO CARBOXYLIC ACIDS & DICARBOXYLIC ACIDS	8 Hours
	Structure and Nomenclature, Preparation and Chemical Reactions of Formic acid, Acetic acid and Benzoic acid. Nomenclature of dibasic acids, Preparations and Chemical reactions of oxalic acid, Succinic acid and Phthalic acid	
	(B) ACIDS DERIVATIVES	7 Hours
	Formation of and chemical reactions of acid chloride, amide, ester, anhydride to be treated in brief, for both aliphatic and aromatic covering organic compounds Acetyl Chloride and Benzoyl Chloride, Acetamide and Benzamide, Ethyl acetate and Ethyl benzoate Succinic anhydride and Phthalic anhydride.	
UNIT-III	PHYSICAL CHEMISTRY	15 Hours
	(A) CHEMICAL EQUILIBRIUM	8 Hours
	Reversible reaction, Nature of chemical Equilibrium & its definition, Characteristics of chemical equilibrium, Law of mass action, Equilibrium constant, Equilibrium constant in terms of partial pressure, Relation between K _p & K _c , Units of Equilibrium constant, Thermodynamic Derivation of law of chemical	

	equilibrium, Temperature dependence of equilibrium constant, Heterogeneous Equilibria, Lechatelier's principle, Numerical	
	(B) CHEMICAL KINETICS	7 Hours
	Reaction Rate, Rate law, Order of reaction, Molecularity of Reaction, Pseudo order reaction, Integrated Rate equation for Zero order, First order and Second order (With equal conc.), Determination of Order of reaction, Numerical.	

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY

PAPER NAME: GENERAL CHEMISTRY-II-PRACTICAL

PAPER CODE NO: MAJ CHE-204-P

Marks: External Evaluation: 10, Internal Evaluation: 15. Total Marks 25

Course Outcomes (COs):

After the completion of the course the students will be able to:

- Qualitatively analyze unknown organic compound with a nature of substance, element, functional group and physical constant.
- Practical skills in the field and laboratory experiments in Organic qualitative analysis.
- The course will provide ability to student to identify any pure organic compound.

Q.1 Organic Spotting

Give compounds containing one Functional group:

Acids: Acetic acid, Oxalic acid, Succinic acid, Benzoic acid, Salicylic acid,

Phenol: Phenol, α - Naphthol, β - Naphthol

Base: Aniline, p-Toluidine.

Neutral: Liquids: Nitro benzene, Benzaldehyde, Ethyl acetate, Methyl acetate, Acetone, Methanol, Ethanol, Bromobenzene, Chloroform, Benzene.

Solids: Benzamide, Naphthalene, Urea, Thiourea, m-Dinitrobenzene, Acetanilide, Glucose

Q.2 Viva

Q.3 Certified journal

Note: Student shall not be allowed to appear in the examination if he does not produce certified journals.

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY
PAPER NAME: GENERAL CHEMISTRY-II-PRACTICAL
PAPER CODE NO: MAJ CHE-204-P
Total Marks: 10; Passing standard: 04 Marks

(A) Organic Spotting

- a) MP / BP
- b) Preliminary Observation
- c) Nature of substance
- d) Other tests (four)
- e) Lassigne's Test (tests one each for Nitrogen, Sulfur and Halogen)
- f) Functional group tests
- g) Confirmative tests
- h) Result with name and structure

(B) Viva

(C) Certified Journal

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B. Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-II
PAPER CODE NO: MIN CHE-205

Course Outcomes (COs):		
Upon successful completion of these papers, students will learn about concepts of Chemistry, like Coordination chemistry, metallurgy, aromatic hydrocarbon, selected organic molecules, gaseous state, and adsorption. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	INORGANIC CHEMISTRY	15 Hours
	(A) COORDINATION CHEMISTRY	10 Hours
	Explanation of complex compound (Coordination compounds), Introduction to basic terminologies (primary and secondary coordination spheres, ligands and their types, Coordination number and geometry, chelation.), Nomenclature of coordination compounds, chelates, Classification of chelates, Uses of chelates, Werner theory, Stability of complex compounds,, Factors influencing stability (properties of metal ion and properties of ligand) Inner orbital complexes, outer orbital complexes, Biological importance of complexes.	
	(B) METALLURGY	05 Hours
	Extraction of Ag, Zn, Pt from their respective chief ore, electroplating.	
UNIT-II	ORGANIC CHEMISTRY	15 Hours
	(A) AROMATIC HYDROCARBONS	8 Hours
	Benzene, source of electrons, Electrophilic Substitution reactions of Benzene (Nitration, Sulfonation, Chlorination, Friedel – Crafts alkylation using alkyl halide, alcohol and alkene, Friedel – Crafts Acetylation) with mechanism with energy profile graph, Directive influence of substituents, Disubstitution in Benzene (No mechanism), Inter conversions of substituents, Conversions with two or three steps. For example: Convert Benzene into Resorcinol/m-Chloro nitro benzene/Acetanilide Benzoic acid/p-or m-Nitro benzaldehyde or Benzoic acid etc.	
	(B) SELECTED ORGANIC MOLECULES	7 Hours
	Preparations, Physical and Chemical Properties and uses of Ethyl Chloride, Chloroform, Carbon tetra Chloride, Chloro benzene, Ethanol, Phenol, HCHO, CH ₃ CHO, C ₆ H ₅ CHO, CH ₃ COCH ₃ (Halo form reaction, addition with HCN, NaHSO ₃ , R-Mg-X, Acetal formation, Reaction with Ammonia derivatives (NH ₂ -Z), Aldol condensation. Oxidation, reduction, and polymerization.	

UNIT-III	PHYSICAL CHEMISTRY	15 Hours
	(A) THE GASEOUS STATE	10 Hours
	Gas laws, kinetic molecular theory of gases, Deviation from ideal behaviour, cause of deviation, Van-der-Waal's equation and its application, method of limiting densities, critical state, Relation between critical constants and Van-der-Waal's constant, Law of corresponding states, Liquefaction of gases, Maxwell's distribution of molecular velocity, Collision number, mean free path.	
	(B) ADSORPTION	5 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.	

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY

PAPER NAME: BASIC CHEMISTRY-II-PRACTICAL
PAPER CODE NO: MIN CHE-206-P

Marks: External Evaluation: 10, Internal Evaluation: 15. Total Marks 25

Course Outcomes (COs):

After the completion of the course the students will be able to:

- Determine the normality, molarity and gms/liter of each component in a mixture.
- Practical skills in the field and laboratory experiments in volumetric analysis.
- Standardize a given solution of acid or base.
- Learn method to carry out analysis of commercial acid/bas.

Q.1 Inorganic TWO STEP Volumetric Analysis:

Standard solution to be given to the students:

- (8) Use of 0.05 N–0.1 N Na_2CO_3 to determine the strength of given xN HCl and thence xN NaOH
- (9) Use of 0.05 N–0.1 N Oxalic acid to determine the strength of xN KMnO_4 and thence x N $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ / x N FAS. $6\text{H}_2\text{O}$
- (10) Use of 0.05 N–0.1 N KMnO_4 to determine the strength of given solutions of x N FAS. $6\text{H}_2\text{O}$ and thence x N $\text{K}_2\text{Cr}_2\text{O}_7$.
- (11) Determination of Acetic acid in Commercial Vinegar using 0.1 M NaOH. NaOH to be standardized using 0.1 N Succinic acid
- (12) To determine the strength of each component in a mixture of $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3$ using 0.1 N HCl.
- (13) To determine the strength of each component in a mix of Oxalic acid + H_2SO_4 using 0.02 M KMnO_4 and 0.1 M NaOH.
- (14) To determine the strength of each component in a mixture of $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O} + \text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ using 0.1 M NaOH and 0.02 M KMnO_4 solution.

Q.2 Three short questions related to practical's only

Q.3 Certified journal

Note: Student shall not be allowed to appear in the examination if he does not produce certified journals.

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-II-PRACTICAL
PAPER CODE NO: MIN CHE-206-P
Total Marks: 10; Passing standard: 04 Marks

(A) TWO Step Volumetric Analysis:

Standard solution to be given to the candidates

Step: I (Reading + Calculation): 5 M

Step: II (Reading + Calculation): 5 M

Over all result in tabular form

(B) Short Answers:

(C) Certified Journal:

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B. Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-II
PAPER CODE NO: MDC CHE-207

Course Outcomes (COs):		
Upon successful completion of these papers, students will learn about concepts of Chemistry, like Coordination chemistry, metallurgy, aromatic hydrocarbon, selected organic molecules, gaseous state, and adsorption. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	INORGANIC CHEMISTRY	15 Hours
	(A) COORDINATION CHEMISTRY	10 Hours
	Explanation of complex compound (Coordination compounds), Introduction to basic terminologies (primary and secondary coordination spheres, ligands and their types, Coordination number and geometry, chelation.), Nomenclature of coordination compounds, chelates, Classification of chelates, Uses of chelates, Werner theory, Stability of complex compounds,, Factors influencing stability (properties of metal ion and properties of ligand) Inner orbital complexes, outer orbital complexes, Biological importance of complexes.	
	(B) METALLURGY	05 Hours
	Extraction of Ag, Zn, Pt from their respective chief ore, electroplating.	
UNIT-II	ORGANIC CHEMISTRY	15 Hours
	(A) AROMATIC HYDROCARBONS	8 Hours
	Benzene, source of electrons, Electrophilic Substitution reactions of Benzene (Nitration, Sulfonation, Chlorination, Friedel – Crafts alkylation using alkyl halide, alcohol and alkene, Friedel – Crafts Acetylation) with mechanism with energy profile graph, Directive influence of substituents, Disubstitution in Benzene (No mechanism), Inter conversions of substituents, Conversions with two or three steps. For example: Convert Benzene into Resorcinol/m-Chloro nitro benzene/Acetanilide Benzoic acid/p-or m-Nitro benzaldehyde or Benzoic acid etc.	
	(B) SELECTED ORGANIC MOLECULES	7 Hours
	Preparations, Physical and Chemical Properties and uses of Ethyl Chloride, Chloroform, Carbon tetra Chloride, Chloro benzene, Ethanol, Phenol, HCHO, CH ₃ CHO, C ₆ H ₅ CHO, CH ₃ COCH ₃ (Halo form reaction, addition with HCN, NaHSO ₃ , R-Mg-X, Acetal formation, Reaction with Ammonia derivatives (NH ₂ -Z), Aldol condensation. Oxidation, reduction, and polymerization.	

UNIT-III	PHYSICAL CHEMISTRY	15 Hours
	(A) THE GASEOUS STATE	10 Hours
	Gas laws, kinetic molecular theory of gases, Deviation from ideal behaviour, cause of deviation, Van-der-Waal's equation and its application, method of limiting densities, critical state, Relation between critical constants and Van-der-Waal's constant, Law of corresponding states, Liquefaction of gases, Maxwell's distribution of molecular velocity, Collision number, mean free path.	
	(B) ADSORPTION	5 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.	

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY

PAPER NAME: BASIC CHEMISTRY-II-PRACTICAL
PAPER CODE NO: MDC CHE-208-P

Marks: External Evaluation: 10, Internal Evaluation: 15. Total Marks 25

Course Outcomes (COs):

After the completion of the course the students will be able to:

- Determine the normality, molarity and gms/liter of each component in a mixture.
- Practical skills in the field and laboratory experiments in volumetric analysis.
- Standardize a given solution of acid or base.
- Learn method to carry out analysis of commercial acid/bas.

Q.1 Inorganic TWO STEP Volumetric Analysis:

Standard solution to be given to the students:

- (15) Use of 0.05 N–0.1 N Na_2CO_3 to determine the strength of given xN HCl and thence xN NaOH
- (16) Use of 0.05 N–0.1 N Oxalic acid to determine the strength of xN KMnO_4 and thence x N $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ / x N FAS. $6\text{H}_2\text{O}$
- (17) Use of 0.05 N–0.1 N KMnO_4 to determine the strength of given solutions of x N FAS. $6\text{H}_2\text{O}$ and thence x N $\text{K}_2\text{Cr}_2\text{O}_7$.
- (18) Determination of Acetic acid in Commercial Vinegar using 0.1 M NaOH. NaOH to be standardized using 0.1 N Succinic acid
- (19) To determine the strength of each component in a mixture of $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3$ using 0.1 N HCl.
- (20) To determine the strength of each component in a mix of Oxalic acid + H_2SO_4 using 0.02 M KMnO_4 and 0.1 M NaOH.
- (21) To determine the strength of each component in a mixture of $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O} + \text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ using 0.1 M NaOH and 0.02 M KMnO_4 solution.

Q.2 Three short questions related to practical's only

Q.3 Certified journal

Note: Student shall not be allowed to appear in the examination if he does not produce certified journals.

KACHCHH UNIVERSITY: BHUJ
FIRST YEAR B.Sc.: CBCS: SEMESTER: II (TWO)
CHEMISTRY
PAPER NAME: BASIC CHEMISTRY-II-PRACTICAL
PAPER CODE NO: MDC CHE-208-P
Total Marks: 10; Passing standard: 04 Marks

(A) TWO Step Volumetric Analysis:

Standard solution to be given to the candidates

Step: I (Reading + Calculation): 5 M

Step: II (Reading + Calculation): 5 M

Over all result in tabular form

(B) Short Answers:

(C) Certified Journal:

REFERENCE BOOKS:

(A) Physical Chemistry:

1. Physical chemistry: P.W. Atkins,
2. Elements of Physical Chemistry Samuel Glasstone .
3. Principles of Phys. Chem: B.R.Puri, L.R.Sharma and Pathania, 41st edition.
4. A text book of Physical Chemistry: P L Soni , O P Dharmarha & UN Dash
5. Physical Chemistry: D R Pandit, A R Rao & Padke

(B) Inorganic Chemistry:

1. Concise Inorganic Chemistry: J. D. Lee, Chapman and Hall, 5th ed., 1996.
2. Basic Inorganic Chemistry: F A Cotton & G Wilkinson
3. Valence and Molecular Structure: Cartmell & Fowels
4. Atomic Structure and Chemical Bonding : Manas Chanda
5. Principles of Inorganic Chemistry: B R Puri, L R Sharma & K C Kalia

(C) Organic Chemistry:

1. Text Book of Organic Chemistry: P L Soni & H M Chawla : Sultan Chand & sons, New Delhi.
2. Organic Chemistry: R T Morrison and R N Boyd, 6th Ed, Prentice Hall.
3. A Text book of Organic Chemistry: R K Bansal, 3rd Ed, 2002, New Age International, New Delhi.
4. Advanced Organic Chemistry: Arun Bahl & B S Bahl, 2004.
5. Reaction Mechanism in Organic Chemistry: S M Mukherji & S P Singh, S.Chand & Co. Ltd, New Dehli.
6. Advanced Organic Chemistry: Jerry March.
7. Reaction mechanisms and reagents in organic Chemistry: Gurdeep Chatwal
8. Basic course in Organic Chemistry: Ramesh Luhana.
9. A text book of Organic Chemistry: K S Tewari, N K Vishnoi & S N Mehrotra.