Krantiguru Shyamji Krishna Verma

Kachchh University Mundra Road

BHUJ: 370 015

SYLLABUS (CBCS)

B. Sc. Semester III: (THREE)

CHEMISTRY

With effect from June 2024

Credit Framework and course code for Second Year (SEM-III) Chemistry Programme.

Year	Semester	Course Code	Paper Title	Credits	Marks		Total
					CA	UA	
Second Year	III	MAJ CHE-301 (Theory)	Bio-organic Chemistry	3	35	40	75
		MAJ CHE-302-P (Practical)	Bio-organic Chemistry - PRACTICAL	1	15	10	25
		MAJ CHE-303 (Theory)	Organic Chemistry	3	35	40	75
		MAJ CHE-304-P (Practical)	Organic Chemistry - PRACTICAL	1	15	10	25
		MAJ CHE-305 (Theory)	Inorganic Chemistry	3	35	40	75
		MAJ CHE-306-P (Practical)	Inorganic Chemistry - PRACTICAL	1	15	10	25
		Total Credits		**12**			**300**
		MDC CHE-307 (Theory)	Bio-organic Chemistry	3	35	40	75
		MDC CHE-308-P (Practical)	Bio-organic Chemistry - PRACTICAL	1	15	10	25
		Total Credits		**4**			**100**

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

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: Bio-organic/Organic/Inorganic Chemistry

PAPER CODE NO: MAJ CHE -301/303/305, MDC CHE- 307

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 *with internal option)*	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

SECONND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: BIO-ORGANIC CHEMISTRY

PAPER CODE NO: MAJ CHE-301

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Basic Chemistry, like Carbohydrates, Amino acids, Proteins, Lipids. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	**CARBOHYDRATES**	**15 Hours**
	Definition, Classification, Nomenclature of parent and derivatives, Reactions with open chain structure of Glucose and Fructose: Oxidation (using Bromine water, Tollens' reagent, Fehling's reagent, HIO_4 and conc. HNO_3), Reduction of Glucose and Fructose, Acetylation of Glucose and Fructose, Epimer and Epimerization, Osazone formation with mechanism and importance, Killiani-Fischer synthesis, Ruff degradation, Open chain structure of Glucose, Cyclic structure of Glucose and conformations	
UNIT-II		**15 Hours**
	(A) AMINO ACIDS:	**7 Hrs**
	Definition, structural formula of all 20 α- amino acids, Synthesis of Amino acids (Amination, Strecker's method, Gabriel's method, Azalactone method), Zwitter ion, Iso electric point, Reaction with Ninhydrin.	
	(B) PROTEINS:	**8 Hrs**
	Peptides and proteins, Nomenclature of peptide molecules, Geometry of peptide linkage, Synthesis of di and tri peptides by Bergmann – Zarvas method, Determination of structure of polypeptides / Proteins: Nitrogen terminal method: Use of DNFB, Edman method, Carbon terminal method, Partial hydrolysis, Primary, secondary and tertiary structures of Proteins, Biological importance of proteins.	
UNIT-III	**LIPIDS :**	**15 Hours**
	Definition, Chemical composition of oils, fats and waxes, Name and structures of few fatty acids found in oil, fat and waxes, Hardening of oil, Drying oil, Soap and Saponification, Detergents: Preparation of ABS and LAS, Mechanism of Cleaning, Bio hard and bio soft detergents, Biological role of Lipids. Acid value, Saponification value and Iodine value of oil.	

REFERENCE BOOKS:

1. Organic Chemistry : R T Morrison and R N Boyd , 6th or 7th Edition , Prentice Hall, New Delhi
2. A Text book of Organic Chemistry : P L SONI, Sultan Chand and sons, New Delhi
3. College Organic Chemistry : Singh, Upadhyay, Rao, , Himalaya Publishing house,
4. College Organic Chemistry for SYBSc : Singh, Upahyay, Rao and Lalwani : Himalaya Publishing house
5. Organic Chemistry: Cram, Hammond and Hendrickson.
6. Simple Organic Chemistry: Ramesh Luhana Rughwani & Dr.Dinesh Kundariya. Maglam Publ. New Delhi.

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: BIO-ORGANIC CHEMISTRY PRACTICAL

PAPER CODE NO: MAJ CHE-302-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:

- To find out the amount of organic compounds by volumetric analysis.
- Practical skills in the field and laboratory experiments in quantitative analysis.
- Also determine some specific sample (food analysis) some test.
- The course will provide ability to student to analysis some commercial organic & food sample.

➢ ORGANIC ESTIMATION:

To find out the amount of Aniline, Phenol, Glucose, Amide, Carboxylic acid in the given solution by volumetric analysis.

➢ FOOD ANALYSIS

1. To measure out saponification value of given oil sample.
2. To measure out iodine value of given oil sample.
3. To measure out acid value of given sample of oil.
4. To determine the amount of calcium in milk with EDTA.
5. To determine the amount of total carbohydrate in sample of beverages.

➢ JOURNAL:

➢ VIVA:

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

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: ORGANIC CHEMISTRY

PAPER CODE NO: MAJ CHE-303

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of organic Chemistry, like detailed study of acid-base properties of organic substances, PNAC: (polynuclear aromatic compounds), electrophilic aromatic substitution, organic nitrogen compounds. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	**ACID – BASE PROPERTIES OF ORGANIC SUBSTANCES:**	**15 Hours**
	Introduction: Acid – base theory of Arrhenius, of Lowry – Bronsted and of Lewis, Mode of expression of strength of acid and base (pka , pkb values), Acidic character of saturated aliphatic mono and di carboxylic acids, Aromatic acids, Phenols, Basicity of Aliphatic and Aromatic Amines and other compounds like Alcohols, Aldehydes, Ketones, Amides, Imides, Nitro and Cyano compounds. The factors to be covered must include Inductive effect, Resonance, Hybridization, H-Bond and Steric hindrance.	
UNIT-II	**PNAC: (POLYNUCLEAR AROMATIC COMPOUNDS):**	**15 Hours**
	Introduction, Definition, Study of Naphthalene, Anthracene and Phenanthrene, Their aromatic character, Structural features, Synthesis of parent and derivatives by Haworth ring closure method, Chemical properties (Addition, oxidation, Electrophilic substitution with mechanism)	
UNIT-III		**15 Hours**
	(A) ELECTROPHILIC AROMATIC SUBSTITUTION	**8 Hours**
	Disubstituent in Benzene, Determination of orientation, Relative reactivity, Classification of substituents, Mechanism of disubstitution, (Theory of Orientation and reactivity), Orientation in disubstituted benzenes (only guidelines, no mechanism), Synthetic application and Conversions.	
	(B) ORGANIC NITROGEN COMPOUNDS	**7 Hours**
	Preparation and physical properties and chemical reactions of Nitriles, Isonitriles, Carbamates, Semi carbazides and their application in organic synthesis. Structure and nomenclature of amines, Preparation of aryl amines, physical properties and chemical reactions, Gabriel-phthalimide reaction, Bromamide reaction.	

REFERENCE BOOKS:

1. Organic Chemistry : R T Morrison and R N Boyd , 6th or 7th Edition , Prentice Hall, New Delhi
2. A Text book of Organic Chemistry : P L SONI, Sultan Chand and sons, New Delhi
3. College Organic Chemistry : Singh, Upadhyay, Rao, , Himalaya Publishing house,
4. College Organic Chemistry for SYBSc : Singh, Upahyay, Rao and Lalwani : Himalaya Publishing house
5. Organic Chemistry : Cram, Hammond and Hendrickson.
6. Organic Chemistry by L. G. Wade Jr.
7. Basic course in Organic Chemistry : Ramesh Luhana . Maglam Publ. New Delhi.
8. Simple Organic Chemistry : Ramesh Luhana Rughwani & Dr.Dinesh Kundariya. Maglam Publ. New Delhi.

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: ORGANIC CHEMISTRY PRACTICALS

PAPER CODE NO: MAJ CHE-304-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.

➢ ORGANIC SPOTTING:

Qualitative analysis of bifunctional Organic compounds such as:

1) Salycilic acid, p-Nitro benzoic acid, Anthranilic acid, p-Chloro benzoic acid

2) Resorcinol, o- Nitrophenol, p-nitophenol

3) o-Nitro aniline, p-Nitroaniline, p-Toluidine, p-Chloroaniline, p- Bromoaniline,

4) Ethyl Salicylate, Salicylaldehyde, Actophenone, p-Dichlorobenzene, p-Nitro toluene, Benzamide etc.

Other organic compound not included may also be considered.

➢ JOURNAL

➢ VIVA

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

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: INORGANIC CHEMISTRY

PAPER CODE NO: MAJ CHE-305

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Basic Chemistry, like Wave mechanics, molecular orbital theory, non-aqueous solvents, valence bond theory, crystal field theory. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	**WAVE MECHANICS**	**15 Hours**
	Wave postulates of quantum mechanics, wave function and its interpretation. Operators (linear Hermitian, their addition subtraction and multiplication). Commutators, setting up of operators for different observables (physical quantities) like position x-component of momentum (Px), momentum (P), Kinetic energy(T), x-component of Kinetic energy (Tx), Potential Energy (V), Total energy(E,H), Hamiltonian operator, Setting up of Hamiltonian Operator for different atoms upto carbon, Eigen function and Eigen value, Mean expectation value, Schrodinger wave equation and particle in a one dimensional box, electron in a ring.	
UNIT-II		**15 Hours**
	(A) MOLECULAR ORBITAL THEORY	**8 Hours**
	Basic principles, LCAO, formation of sigma and pie bonding, antibonding, nonbonding molecular orbitals, bond order and its significance, configuration of some heteronuclear molecules and their MO formation- BeH2, CH4 and BH3. MO diagrams of complex molecules $[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-}$, $[Ni(CN_6]^{2-}$ and $[Ni(CO)_4]$.	
	(B) NON AQUEOUS SOLVENTS	**7 Hours**
	Classification, common properties, of ionic solvents, - dielectric constant, dipole moment, viscosity, electrical conductivity, proton affinity, melting and boiling points, Chemical prop of non aq. solvents liq. Ammonia, liq. SO_2, liq. HF – Acid base reactions, solvated complex formation reactions, solvolytic reaction, precipitation reaction, oxidation reduction reaction, differentiating and leveling solvents.	
UNIT-III	**CHEMICAL BONDING**	**15 Hours**
	(A) VALENCE BOND THEORY	**8 Hours**
	Hybridization of orbitals, structure of complexes $[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-}$, $[MnCl_4]^{2-}$, $[Ni(CN)_4]^{-2}$ based on hybridization theory, limitations of VB Theory.	
	(B) CRYSTAL FIELD THEORY	**7 Hours**
	Crystal field splitting due to octahedral, tetrahedral, square planar fields created by ligands. Spin free and spin paired conditions. CFSE	

	(crystal field stabilization energy), magnetic properties of complexes. Absorption spectra of complexes, thermodynamic properties due to crystal field like Lattice energy, heat of hydration, ionic radii of M^{2+}, ions of the first transition series, Jahn Teller Effect	

REFERENCE BOOKS:

1. Introductory Quantum Chemistry: A K Chandra, 5th Edition, Mc Graw Hill (1998).
2. Basic Inorganic Chemistry: F. Allert, Cotton, G. Wilkinson, P.L Gans, 3rd Edition, John Willey, New York, 1995.
3. Valency and Molecular structures – E. Cartmell and G.W.A Fowels. 3rd Edition, ELBS, Bucter worth ,1970.
4. A New Concise Inorganic Chemistry, J.D Lee, 4th Edition ,1991 ELBS and D.van Nostrand company Ltd.
5. Principles of Inorganic Chemistry by Puri, Sharma and pathania, 29th Edition.

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: INORGANIC CHEMISTRY PRACTICAL

PAPER CODE NO: MAJ CHE-306-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 mixture with cations and anions.
- Practical skills in the field and laboratory experiments in qualitative analysis.
- The course will provide ability to student to identify any inorganic salt mixture.

➢ INORGANIC MIXTURE: (Four radicals) (Any Ten)

(01)	$ZnS + (NH_4)_2CO_3$	(02)	$ZnS + NiCO_3$	(03)	$ZnS + MgCO_3$
(04)	$ZnS + MnCO_3$	(05)	$ZnCO_3 + Al_2(SO_4)_3$	(06)	$MgCO_3 + Al_2(SO_4)_3$
(07)	$(NH_4)_2CO_3 + K_2SO_4$	(08)	$CaCO_3 + NaHSO_4$	(09)	$K_2SO_4 + Na_2SO_4 + (NH_4)_2SO_4$
(10)	$KCl + MgCl_2 + NaCl$	(11)	$FeSO_4 + Al_2(SO_4)_3 + (NH_4)_2SO_4$	(12)	$KCl + SrBr_2$
(13)	$KBr + NaBr + NH_4Br$	(14)	$BaCl_2 + SrBr_2$	(15)	$KBr + NH4Cl$
(16)	$MgCl_2 + KI$	(17)	$SrBr_2 + KI$	(18)	$(NH4)_2SO_4 + MgCl_2$
(19)	$CuSO_4 + KBr$	(20)	$SrCO_3 + KCl$	(21)	$BaCO_3 + NH_4Cl$
(22)	$CrCl_3 + (NH_4)_2SO_4$	(23)	$K_2SO_4 + K_2CO_3 + KCl$	(24)	$Pb(NO_3)_2 + KNO_2$
(25)	$KBr + KCl + KI$	(26)	$NaNO_2 + Sr(NO_3)_2$	(27)	$KNO_2 + NH_4NO_3$
(28)	$K_2CrO_4 + (NH_4)_2SO_4$	(29)	$K_2CrO_4 + NH_4Cl$	(30)	$MnCl_2 + ZnSO_4$
(31)	$NaNO_3 + KBr$	(32)	$Sr(NO_3)_2 + CaCl_2$	(33)	$BaCl_2 + Sr(NO_3)_2$
(34)	$Ca(NO_3)_2 + MgSO_4$	(35)	$NH_4Cl + KCl + MgCl_2$	(36)	$K_2SO_4 + NH_4Br$

➢ JOURNAL

➢ VIVA

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

KACHCHH UNIVERSITY: BHUJ

SECONND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: BIO-ORGANIC CHEMISTRY

PAPER CODE NO: MDC CHE-307

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Basic Chemistry, like Carbohydrates, amino acids, proteins , lipids .This study will be helpful in further study, competitive exam and industries.		
UNIT-I	**CARBOHYDRATES**	**15 Hours**
	Definition, Classification, Nomenclature of parent and derivatives, Reactions with open chain structure of Glucose and Fructose: Oxidation (using Bromine water, Tollens' reagent, Fehling's reagent, HIO4 and conc. HNO3), Reduction of Glucose and Fructose, Acetylation of Glucose and Fructose, Epimer and Epimerization, Osazone formation with mechanism and importance, Killiani-Fischer synthesis, Ruff degradation, Open chain structure of Glucose, Cyclic structure of Glucose and conformations	
UNIT-II		**15 Hours**
	(A) AMINO ACIDS:	**7 Hrs**
	Definition, structural formula of all 20 α- amino acids, Synthesis of Amino acids (Amination, Strecker's method, Gabriel's method, Azalactone method), Zwitter ion,Iso electric point, Reaction with Ninhydrin.	
	(B) PROTEINS:	**8 Hrs**
	Peptides and proteins, Nomenclature of peptide molecules, Geometry of peptide linkage, Synthesis of di and tri peptides by Bergmann – Zarvas method, Determination of structure of polypeptides / Proteins: Nitrogen terminal method: Use of DNFB, Edman method, Carbon terminal method, Partial hydrolysis, Primary, secondary and tertiary structures of Proteins, Biological importance of proteins.	
UNIT-III	**LIPIDS:**	**15 Hours**
	Definition, Chemical composition of oils, fats and waxes, Name and structures of few fatty acids found in oil, fat and waxes, Hardening of oil, Drying oil, Soap and Saponification, Detergents: Preparation of ABS and LAS, Mechanism of Cleaning, Bio hard and bio soft detergents, Biological role of Lipids. Acid value, Saponification value and Iodine value of oil.	

REFERENCE BOOKS:

1. Organic Chemistry : R T Morrison and R N Boyd , 6th or 7th Edition , Prentice Hall, New Delhi
2. A Text book of Organic Chemistry : P L SONI, Sultan Chand and sons, New Delhi
3. College Organic Chemistry : Singh, Upadhyay, Rao, , Himalaya Publishing house,
4. College Organic Chemistry for SYBSc : Singh, Upahyay, Rao and Lalwani : Himalaya Publishing house
5. Organic Chemistry: Cram, Hammond and Hendrickson.
6. Simple Organic Chemistry: Ramesh Luhana Rughwani & Dr.Dinesh Kundariya. Maglam Publ. New Delhi.

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: BASIC CHEMISTRY-I-PRACTICAL

PAPER CODE NO: MDC CHE-308-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:

- To find out the amount of organic compounds by volumetric analysis.
- Practical skills in the field and laboratory experiments in quantitative analysis.
- Also determine some specific sample (food analysis) some test.
- The course will provide ability to student to analysis some commercial organic & food sample.

➢ ORGANIC ESTIMATION:

To find out the amount of Aniline, Phenol, Glucose, Amide, Carboxylic acid in the given solution by volumetric analysis.

➢ FOOD ANALYSIS

6. To measure out saponification value of given oil sample.
7. To measure out iodine value of given oil sample.
8. To measure out acid value of given sample of oil.
9. To determine the amount of calcium in milk with EDTA.
10. To determine the amount of total carbohydrate in sample of beverages.

➢ JOURNAL:

➢ VIVA

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

UNIVERSITY PRACTICAL EXAM PATTERN

There will be a Three Exercise in each practical, as under, total of **20 Marks.**
(1) Practical exercise (15 marks) (2) Viva (3 marks) (3) Practical Journal (2 marks)

Duration of Exam: 3 Hrs.

Examiner will submit marks out of 10 to university.

Passing standard: **4 Marks out of 10 Marks.**

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: III (THREE)

CHEMISTRY

PAPER NAME: SKILL BASED PRACTICAL-I

PAPER CODE NO: SEC CHE-301-P

Marks: External Evaluation: 25, Internal Evaluation: 25. Total Marks 50

Course Outcomes (COs):

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

- To find out the adulteration present in milk & milk product.
- Students will be able to detect common adulteration present in oil, honey, sugar etc.

➢ To detect the purity of milk and milk products

1. Detection of water in milk.
2. Detection of detergent in milk.
3. Detection of starch in milk and milk products.
4. Detection of potatoes in milk products.
5. Detection of Added Urea/Ammonium Salts in Milk.
6. Detection of Preservatives added to Milk
   - Formalin, Hydrogen peroxide, Boric Acid and Borate, Benzoic and Sodium benzoate, Salicylic Acid, Mercuric chloride

➢ To detect the purity of oil / Honey/ Sugar/ Jaggery/ Hing/ Chilli powder.

1. Detection of other oil in coconut oil.
2. Detection of TOCP (Tri-ortho-cresyl-phosphate) in oil.
3. Detection of sugar solution in honey.
4. Detection of chalk powder in Sugar/ Jaggery.
5. Detection of foreign resin in Hing.
6. Detection of soap stone in Hing.
7. Detection of starch in Hing.
8. Detection of artificial color in chilli powder.
9. Detection of cassia bark in cinnamon.
10. Detection of lead chromate in turmeric whole.
11. Detection of artificial color in turmeric powder.
12. Detection of exhausted tea/ Iron filings in tea leaves.
13. Differentiation of common salt and iodised salt.

➢ **JOURNAL:**

Journals are to be signed regularly by the concerned teacher and finally certified before the College Internal test. If student does not bring the certified journal at the exam, he/she will not be allowed for the exam.

➢ **VIVA**

REFERENCE BOOKS:

1. FSSAI- Manual of Methods of Analysis of Foods Oils & Fats, 2016
2. FSSAI DART Manual

UNIVERSITY PRACTICAL EXAM PATTERN-SEC

There will be Four Exercises in each practical, as under, total of **25 Marks.**

(1) Exercise-I (10 marks) (2) Exercise-II (10 marks) (3) Viva (3 marks) (4) Practical Journal (2 marks)

Duration of Exam: 4 Hrs.

Passing standard: **10 Marks out of 25 Marks.**

Krantiguru Shyamji Krishna Verma

Kachchh University Mundra Road

BHUJ: 370 015

SYLLABUS (CBCS)

B. Sc. Semester IV: (FOUR)

CHEMISTRY

With effect from June 2024

Credit Framework and course code for Second Year (SEM-IV) Chemistry Programme.

Year	Semester	Course Code	Paper Title	Credits	Marks		Total
					CA	UA	
Second Year	IV	MAJ CHE-401 (Theory)	APPLIED CHEMISTRY	3	35	40	75
		MAJ CHE-402-P (Practical)	APPLIED CHEMISTRY - PRACTICAL	1	15	10	25
		MAJ CHE-403 (Theory)	PHYSICAL CHEMISTRY	3	35	40	75
		MAJ CHE-404-P (Practical)	PHYSICAL CHEMISTRY - PRACTICAL	1	15	10	25
		MAJ CHE-405 (Theory)	ANALYTICAL CHEMISTRY	3	35	40	75
		MAJ CHE-406-P (Practical)	ANALYTICAL CHEMISTRY PRACTICAL	1	15	10	25
		Total Credits		**12**			**100**
		MIN CHE-407 (Theory)	APPLIED CHEMISTRY	3	35	40	75
		MIN CHE-408-P (Practical)	APPLIED CHEMISTRY - PRACTICAL	1	15	10	25
		Total Credits		**4**			**100**

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

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: IV (FOUR)

CHEMISTRY

PAPER NAME: Applied Chemistry / Physical Chemistry / Analytical Chemistry

PAPER CODE NO: MAJ CHE-401/403/405, MIN CHE-407

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 *with internal option)*	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 mark, 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
SECOND YEAR B. Sc.: CBCS: SEMESTER: IV (FOUR)
CHEMISTRY
PAPER NAME: APPLIED CHEMISTRY
PAPER CODE NO: MAJ CHE-401

Course Outcomes (COs):		
Upon successful completion of these papers, students will learn about concepts of Chemistry, like fertilizers of chemistry, synthetic dyes, glass, pesticides, synthetic perfumes. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	**FERTILIZERS:**	**15 Hours**
	Plant nutrients, Nutrient function, Micro nutrients, Fertilizer types, need for fertilizer, Essential requirements, Fertility of soil, PH value of the soil, Classification of fertilizer, Straight and mixed fertilizers, source of fertilizers, Nitrogenous fertilizers, Phosphate fertilizers, Potassium fertilizers, Mixed fertilizers, Pollution caused by fertilizers, effect of fertilizers.	
UNIT-II	**(A) SYNTHETIC DYES:**	**8 Hours**
	Introduction, Uses of dyes, Structural features of dyes, Chromophore and Auxochrome, Classifications of fibers and dyes, Mordant and Vat dyes, Acid and Basic dyes, Synthesis of Alizarin, Malachite green, Congored, Eosine and Indigo.	
	(B) GLASS:	**7 Hours**
	Glass and its general properties, Manufacture of Glass, Variety of glasses and their applications.	
UNIT-III	**(A) PESTICIDES:**	**7 Hours**
	General, Definition, Classification, Synthesis of DDT, BHC, Aldrin and Malathion	
	(B) SYNTHETIC PERFUMES:	**8 Hours**
	Introduction, Esters, Alcohols, Ketones, Nitromusk, Aldehyde, Diphenyl Compound, Production of natural Perfumes, Natural and artificial flavours.	

REFERENCE BOOKS:

1. Industrial Chemistry: B.K. Sharma Goel Publication
2. Synthetic Organic Chemistry: O P Agarwal.
3. Basic course in Organic Chemistry: Ramesh Luhana Rughwani: Mangalam Publication. New Delhi

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: IV (FOUR)

CHEMISTRY

PAPER NAME: APPLIED CHEMISTRY PRACTICAL

PAPER CODE NO: MAJ CHE-402-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 amount of each component in a mixture.
- Practical skills in the field and laboratory experiments in volumetric analysis.
- Learn method to carry out analysis of commercial sample.
- Learn synthesis of some dyes.
- Synthesis of dyes useful for commercial preparation too.

➢ Water Analysis:

1. To determine amount of chlorides in given water sample.
2. To determine total hardness of water into given water sample.
3. To determine amount of alkalinity of water into given water sample.
4. To measure out amount of sulphates into given sample.
5. Estimation of amount of acidity of water into given water sample
6. Estimation of the amount of dissolved oxygen into given water sample

➢ Synthesis of Dyes (any two):

Nitroso dimethyl Aniline, Butter yellow, Fast Green O dye. (Dinitro resorcinol), Fast Red A, Methyl orange dye, Methyl Red, Mordant Yellow dye, Naphthol blue black dye, Benzoparpurine, Orange I, Orange II, Yellow 4-G, Malachite green, Alizarine, Congored, Eosine and Indigo etc.

➢ **JOURNAL**

➢ **VIVA**

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

KACHCHH UNIVERSITY: BHUJ
SECOND YEAR B. Sc.: CBCS: SEMESTER: IV (FOUR)
CHEMISTRY
PAPER NAME: PHYSICAL CHEMISTRY
PAPER CODE NO: MAJ CHE-403

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Physical Chemistry, like Chemistry of thermodynamics, electrochemistry, colloids, catalysis This study will be helpful in further study, competitive exam and industries.		
UNIT-I	**THERMODYNAMICS:**	**15 Hours**
	Spontaneous Process, Carnot cycle, Efficiency of heat engine, Entropy, Derivation of entropy from carnot cycle, Entropy change for an ideal gas, Entropy change at constant pressure and constant volume, Physical Significance of entropy, Free energy function (G) & Work function(A), Variation of free energy with temperature and pressure, Gibbs-Helmholtz equation, The Clapeyron equation, Clausius –Clapeyron Equation, application of Clausius –Clapeyron Equation, numerical.	
UNIT-II	**ELECTRO CHEMISTRY:**	**15 Hours**
	Migration of ions, Transport Number and its determination by Hittrof's method and Moving Boundary method, Conductometric Titration, concept of Electrochemical cell, Reversible and irreversible cell, Reversible electrodes, Metal Metal ion electrodes, Gas electrodes, Metal-insouble Metal salt electrode, oxidation-reduction electrode, Reference electrodes (SHE, calomel electrode, Quinhydrone electrode), Glass electrode, Relation between EMF and free energy, Single electrode potential, Nernst equation (derivation), numerical.	
UNIT-III	**(A) COLLOIDS:**	**8 Hours**
	Colloidal state, Preparation, Purification, Optical and kinetic properties of colloids, Electrical properties of colloids, Gels & Emulsions, Applications of Colloids, Determination of Molecular weight of Polymers by Osmotic Pressure and Viscosity methods.	
	(B) CATALYSIS:	**7 Hours**
	Criteria and Types of Catalysis, Promoters, Catalytic poisoning, Autocatalysis, Negative Catalysis, Enzyme catalyzed reactions.	

REFERENCE BOOKS:

1. Principles of Physical Chemistry: B.R Puri, L.R Sharma, M.S Pathania. 48th Edition.
2. Elements of Physical Chemistry: Glasstone and Lewis, 3rd Edition, Macmillan & Co.
3. Essentials of Physical Chemistry: Arun Bhal, B.S. Bhal, G.D. Tuli, S.Chand 28th Edition
4. Advanced Physical Chemistry : Gurdeep Raj, Goel Publication
5. Textbook of Physical Chemistry : P.L. Soni, O.P. Dharmendra, U. N. Dash, Sultan Chand and son.
6. Physical Chemistry : P.W. Atkins, 5th edition. Oxford University Press, 1984. Physical Chemistry : Lavine.

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: IV (FOUR)

CHEMISTRY

PAPER NAME: PHYSICAL CHEMISTRY PRACTICAL

PAPER CODE NO: MAJ CHE-404-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:

- Quantitatively analyze unknown concentration of different acid and base by conductometer.
- Determination of degree of adsorption of an acid & viscosity of liquids.
- Practical skills in the field and laboratory experiments in quantitative analysis.
- The course will provide ability to student to determine concentration by conductometer and also adsorption effect on charcoal and physical properties of viscosity.

➢ **PHYSICAL EXCERSISES:**

CONDUCTOMETRY:

1. Determination of the strength of HCl by titrating it against standard solution of NaOH.
2. Determination of strength of HCl and Acetic acid in a given mixture of acids by titrating against 0.1 N NaOH.
3. Determination of strength of NaOH and NH_4OH in a given mixture of base by titrating against 0.1 N HCl.
4. Determination of solubility and solubility product of sparingly soluble salt conductometrically.
5. Determination of dissociation constant of weak acid by conductivity method.

ADSORPTION:

1. Determination of degree of adsorption of an oxalic acid on activated Charcoal.
2. Determination of degree of adsorption of an acetic acid on activated Charcoal

VISCOSITY:

1. To determine relative and absolute viscosity of pure liquid A, B, C, D by ostwald's viscometer.
2. To prepare 2.5%, 5%, 10% aqueous solution of glycerine, find the viscosity of these solutions as well as concentration of unknown solution using ostwald's viscometer.

➢ **JOURNAL**

➢ **VIVA**

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: IV (FOUR)
CHEMISTRY
PAPER NAME: ANALYTICAL CHEMISTRY
PAPER CODE NO: MAJ CHE-405

Course Outcomes (COs):		
Upon successful completion of these papers, students will learn about concepts of Chemistry, like Types of analytical methods, Basic concepts of SI units, Laboratory operation, Error in chemical analysis. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	**TYPES OF ANALYTICAL METHODS:**	**15 Hours**
	Introduction, Branches of Chemistry, Analytical Chemistry, Importance of Analytical Chemistry, Classification of Analytical methods, Advantages and limitations of Chemical methods and Instrumental methods, Literature of Analytical Chemistry including Chemical abstract, Names of few reference books and Journals on Analytical Chemistry.	
UNIT-II	**(A) BASIC CONCEPTS:**	**5 Hours**
	System international units or SI Units, Definitions of the Seven Base Units (Mass, Length, Time, Temperature, Amount of substance, Electrical current and Luminous intensity), Derived units, Conversion between units.	
	(B) LABORATORY OPERATIONS:	**10 Hours**
	Single pan analytical balance: (operation and theory of the balance, construction details, errors in weighing, care of an analytical balance). Description and use of common laboratory apparatus: Volumetric flasks, burettes, pipettes, meniscus readers, weighing bottles, different types of funnels chromatographic columns, chromatographic jars, desiccators, drying ovens, filter crucibles, rubber policeman. Calibration and use of volumetric glass ware.	
UNIT-III	**ERRORS IN CHEMICAL ANALYSIS:**	**15 Hours**
	Significant figures, Accuracy, Precision, Types of errors and minimization of errors, The Gaussian distribution, mean and standard deviation, confidence intervals, rejection of result, Statistical test of data (Q. test, students t-test and F-test), Correlation coefficient.	

REFERENCE BOOKS:

1. Analytical chemistry : D.A Skoog, D.M West, F.J Holler, 5th Ed, Saunder's college, Publishers, London,1990
2. Instrumental Methods of Chemical Analysis: B K Sharma: Goel Publishing House, Merrut
3. Quantitative Analysis : Day and Underwood
4. Analytical Chemistry : IV th Ed. Gary D Christian

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: IV (FOUR)

CHEMISTRY

PAPER NAME: ANALYTICAL CHEMISTRY PRACTICAL

PAPER CODE NO: MAJ CHE-406-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 amount of each component in a mixture & complexometric titration.
- Practical skills in the field and laboratory experiments in volumetric analysis.
- Learn method to carry out analysis of commercial sample.

➢ VOLUMETRIC ANALYSIS:

1. Determination of amount of Zinc ion by EDTA.
2. Determination of amount of Ni ion by EDTA method.
3. Determination of Nitrite (KNO_2) by Oxidation method using $KMnO_4$.
4. Determination of the amount of Ca and Mg from given mix. Of $CaCl_2$ $2H_2O$ and $MgCl_2$ $2H_2O$ using EDTA solution.
5. Determination of amount of Bi^{+3} in the given solution $Bi(NO_3)_3$ $5H_2O$ by EDTA method.

➢ Potentiometry:

1. To determine Molarity of strong / weak acid by titrating against 0.1 M NaOH solution
2. The Dissociation Constant of weak monobasic acids like HAC, Formic acid, Benzoic acid by titrating against 0.1 M NaOH solution.
3. To determine Molarity of each acid present in a Mixture of strong acid and weak acid.

➢ JOURNAL

➢ VIVA

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: IV (FOUR)
CHEMISTRY
PAPER NAME: APPLIED CHEMISTRY
PAPER CODE NO: MIN CHE-407

Course Outcomes (COs):		
Upon successful completion of these papers, students will learn about concepts of Chemistry, like fertilizers of chemistry, synthetic dyes, glass, pesticides, synthetic perfumes. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	**FERTILIZERS:**	**15 Hours**
	Plant nutrients, Nutrient function, Micro nutrients, Fertilizer types, need for fertilizer, Essential requirements, Fertility of soil, PH value of the soil, Classification of fertilizer, Straight and mixed fertilizers, source of fertilizers, Nitrogenous fertilizers, Phosphate fertilizers, Potassium fertilizers, Mixed fertilizers, Pollution caused by fertilizers, effect of fertilizers.	
UNIT-II	**(A) SYNTHETIC DYES:**	**8 Hours**
	Introduction, Uses of dyes, Structural features of dyes, Chromophore and Auxochrome, Classifications of fibers and dyes, Mordant and Vat dyes, Acid and Basic dyes, Synthesis of Alizarin, Malachite green, Congored, Eosine and Indigo.	
	(B) GLASS:	**7 Hours**
	Glass and its general properties, Manufacture of Glass, Variety of glasses and their applications.	
UNIT-III	**(A) PESTICIDES:**	**7 Hours**
	General, Definition, Classification, Synthesis of DDT, BHC, Aldrin and Malathion	
	(B) SYNTHETIC PERFUMES:	**8 Hours**
	Introduction, Esters, Alcohols, Ketones, Nitromusk, Aldehyde, Diphenyl Compound, Production of natural Perfumes, Natural and artificial flavours.	

REFERENCE BOOKS:

1. Industrial Chemistry: B.K. Sharma Goel Publication
2. Synthetic Organic Chemistry: O P Agarwal.
3. Basic course in Organic Chemistry: Ramesh Luhana Rughwani : Mangalam Publication. New Delhi

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: IV (FOUR)

CHEMISTRY

PAPER NAME: APPLIED CHEMISTRY PRACTICAL

PAPER CODE NO: MIN CHE-407 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 amount of each component in a mixture.
- Practical skills in the field and laboratory experiments in volumetric analysis.
- Learn method to carry out analysis of commercial sample.
- Learn synthesis of some dyes.
- Synthesis of dyes useful for commercial preparation too.

➢ Water Analysis:

1. To determine amount of chlorides in given water sample.
2. To determine total hardness of water into given water sample.
3. To determine amount of alkalinity of water into given water sample.
4. To measure out amount of sulphates into given sample.
5. Estimation of amount of acidity of water into given water sample
6. Estimation of the amount of dissolved oxygen into given water sample

➢ Synthesis of Dyes (any two) :

Nitroso dimethyl Aniline, Butter yellow, Fast Green O dye. (Dinitro resorcinol), Fast Red A, Methyl orange dye, Methyl Red, Mordant Yellow dye, Naphthol blue black dye, Benzoparpurine, Orange I, Orange II, Yellow 4-G, Malachite green, Alizarine, Congored, Eosine and Indigo etc.

➢ **JOURNAL**

➢ **VIVA**

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

UNIVERSITY PRACTICAL EXAM PATTERN

There will be a Three Exercise in each practical, as under, total of **20 Marks.**
(1) Practical exercise (15 marks) (2) Viva (3 marks) (3) Practical Journal (2 marks)

Duration of Exam: 3 Hrs.

Examiner will submit marks out of 10 to university.

Passing standard: **4 Marks out of 10 Marks.**

KACHCHH UNIVERSITY: BHUJ

SECOND YEAR B.Sc.: CBCS: SEMESTER: IV (FOUR)

CHEMISTRY

PAPER NAME: SKILL BASED PRACTICAL-II

PAPER CODE NO: SEC CHE-401-P

Marks: External Evaluation: 25, Internal Evaluation: 25. Total Marks 50

Course Outcomes (COs):

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

- To find out the analysis of oil & fats.
- Students will be able to knowledge about gravimetric analysis and pH metry analysis.

➢ Gravimetric Analysis:

Pure aq. Solution of the concerned metallic ion is to be given.

1. Iron as Ferric Oxide, Salt: $FeSO_4$ **OR** Ferrous Ammonium Sulphate
2. Ni as $Ni(DMG)_2$, Salt: $NiCl_2$ **OR** $NiSO_4$
3. Ba as $BaSO_4$, Salt: $BaCl_2$
4. Mn as $Mn_2P_2O_7$, Salt: $MnCl_2$ **OR** $MnSO_4$

➢ Practical: Analysis of Oils and Fats

1. Determination of Refractive Index
2. Determination of Moisture Content
3. Determination of Melting Point of Fat
4. Determination of Saponification Value
5. Determination of Unsaponifiable Matter
6. Determination of Acid Value
7. Determination of Iodine Value
8. Determination of Reichert Meissl and Polenske Value
9. Test for Sesame Oil (Baudouins Test)
10. Test for Cottonseed Oil (Halphens Test)
11. Test for presence of Rice Bran Oil
12. Test for presence of Linseed oil (Hexabromide Test)
13. Polybromide test for Mustard Oil
14. Detection of Rancidity
15. Detection of Cottonseed oil
16. Detection of Castor oil

➢ pH Metry

1. Concept of pH,
2. pH scale,
3. Determination of pH of various samples like Soil, Water, Milk, Cold drinks.

➢ JOURNAL:

Journals are to be signed regularly by the concerned teacher and finally certified before the College Internal test. If student does not bring the certified journal at the exam, he/she will not be allowed for the exam.

➢ VIVA

REFERENCE BOOKS:

1. FSSAI- Manual of Methods of Analysis of Foods Oils & Fats, 2016
2. FSSAI DART Manual

UNIVERSITY PRACTICAL EXAM PATTERN-SEC

There will be Four Exercises in each practical, as under, total of **25 Marks.**

(1) Exercise-I (10 marks) (2) Exercise-II (10 marks) (3) Viva (3 marks) (4) Practical Journal (2 marks)

Duration of Exam: 4 Hrs.

Passing standard: **10 Marks out of 25 Marks.**