

Krantiguru Shyamji Krishna Verma

Kachchh University

Mundra Road

BHUJ: 370 001



SYLLABUS (NEP)

B. Sc. Semester V: (FIVE)

CHEMISTRY

(With Research /Without Research)

**Curriculum as per UGC Guideline
Framed according to National Education Policy (NEP)-2020**

With effect from June-2025 (and thereafter)

Credit Framework and course code for Third Year (SEM-V) Chemistry Programme.

Year	Semester	Course Code	Paper Title	Credits	Marks		Total	
					CA	UA		
Third Year	V	MJCH-501 (Theory)	Inorganic Chemistry	3	35	40	75	
		MJCH-502P (Practical)	Inorganic Chemistry - PRACTICAL	1	15	10	25	
		MJCH-503 (Theory)	Organic Chemistry	3	35	40	75	
		MJCH-504P (Practical)	Organic Chemistry - PRACTICAL	1	15	10	25	
		MJCH-505 (Theory)	Physical Chemistry	3	35	40	75	
		MJCH-506P (Practical)	Physical Chemistry - PRACTICAL	1	15	10	25	
		Total Credits			12			300
		MNCH-507 (Theory)	Bio-organic Chemistry-II	3	35	40	75	
		MNCH-508P (Practical)	Bio-organic Chemistry-II- PRACTICAL	1	15	10	25	
		MNCH-509 (Theory)	Industrial Chemistry	3	35	40	75	
		MNCH-510P (Practical)	Industrial Chemistry - PRACTICAL	1	15	10	25	
		Total Credits			8			200



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

KACHCHH UNIVERSITY: BHUJ

**THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY**

PAPER NAME: Inorganic/Organic/Physical /Bioorganic-II/Industrial Chemistry

PAPER CODE NO: MJCH-501/503/505, MNCH-507/509

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 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/Chemical reaction 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
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY
PAPER NAME: INORGANIC CHEMISTRY
PAPER CODE NO: MJCH-501

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Inorganic Chemistry, like Quantum Chemistry, Chemical Bonding and Coordination chemistry. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	QUANTUM CHEMISTRY	15 Hours
	Setting up of Operators for observables, Time – dependant Schrodinger wave equation, Elimination of Time part, Stationary states, Important theorems concerning Hermitian operators, Particle in a three-dimensional box, Separation of variables, Eigen functions and Eigen values, Symmetry and degeneracy. Rigid rotator problem, Application to rotation spectra of diatomic molecules, Schrodinger equation in spherical polar co-ordinates for hydrogen atom, Separation of variables, solution of ϕ and Φ equation, Total energy of Hydrogen atom as per the variation method and the secular equation.	
UNIT-II	CHEMICAL BONDING:	15 Hours
	Molecular orbital treatment for square planar, tetrahedral and Octahedral complexes, Molecular orbital treatment of polyatomic molecules CH ₄ , H ₂ O and NH ₃ . MO treatment for complexes such as [PtCl ₄] ²⁻ , [NiF ₄] ²⁻ , [IrF ₆] ⁴⁻ , [Fe(CN) ₆] ⁴⁻ , [FeF ₆] ³⁻ , [V(CN) ₆] ³⁻ . Simple Huckel theory.	
UNIT-III	COORDINATION CHEMISTRY:	15 Hours
	Thermodynamic stability, factors affecting stability of complex, Kinetic stability: lability and inertness, interpretation of lability and inertness of transition metal complex, substitution reaction and mechanism in octahedral complex, evidence of dissociative (SN1) mechanism, acid hydrolysis and base hydrolysis of octahedral complex substitution reaction in square planar complex, factors affecting rate of substitution reaction in square planar complex, Trans effect, applications of trans effect, theories of trans effect.	



REFERENCE BOOKS

1. Introductory Quantum Chemistry: A K Chandra, 5th ed, Mc Graw Hill (1998)
2. Quantum mechanics in Chemistry: Melvin W Hanne
3. Chemical Bonding: An Introduction: A K Raval, K C Patel, & R D Patel
4. Principle of Inorganic Chemistry: Puri, Sharma & Kalia, 33rd ed., Vishal publication.
5. Coordination Chemistry by Ajay Kumar, 2nd edi., Aaryush Educations
6. Theoretical Inorganic Chemistry: Dey & Selbin
7. Electron and Chemical Bonding: Harry B Grey
8. Valency and Molecular structure: E Cartmell and G W Fowels .3rd Ed, ELBS, Bucker Worth (1970)
9. Advanced Inorganic Chemistry: F A Cotton, and Wilkinson.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY
PAPER NAME: INORGANIC CHEMISTRY PRACTICAL
PAPER CODE NO: MJCH-502P
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:

- Identify unknown cations and anions through systematic qualitative analysis.
- Practical skills in the field and laboratory experiments in Qualitative analysis.
- The course will provide ability to student to analysis of any inorganic salt mixture.

➤ **INORGANIC QUALITATIVE ANALYSIS:**

Analysis of inorganic mixture containing six radicals only (Either 3+3 or 2+4 or 4+2). Minimum of **10 (TEN)** mixtures to be done and reported in journal. Arsenic element not to be given in any form. No negative marking for wrong detection of Sodium ion. Examples of some mixtures: (i) $\text{FeCl}_3 + \text{KNO}_2 + \text{NaNO}_3$ (ii) $\text{CuCl}_2 + \text{KI} + \text{CdCO}_3$

➤ **JOURNAL**

➤ **VIVA**

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

Duration of Practical: 3Hrs.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY
PAPER NAME: ORGANIC CHEMISTRY
PAPER CODE NO: MJCH-503

Course Outcomes (COs):		
Upon successful completion of these papers students will learn about organic chemistry concepts like stereochemistry, name reaction, rearrangement, reagent and heterocyclic compounds. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	STEREO CHEMISTRY	15 Hours
	Introduction, Types of Isomerism, Stereoisomerism, Optical Isomerism, Enantiomers, Diastereomers, meso compounds, Racemic mixture, D-L system, R-S system, E-Z system, Conformational analysis of Ethane, Butane, <i>c</i> -Hexane, Mono methyl <i>c</i> -Hexane, Dimethyl <i>c</i> -Hexanes, Stereochemistry of Oximes, Molecular asymmetry of Di phenyls and Allenes. Stereo selective and stereo specific reactions: Stereo chemistry of addition of halogens to sym-alkenes. Syn and anti-addition, Concept of pro-stereoisomerism and Chiral synthesis: Cram's Rule, Prelog's Rule and assignment of configuration.	
UNIT-II		15 Hours
	(A) NUCLEOPHILIC REACTION (ALIPHATIC)	7 Hours
	Definition, types of reactions, Discussion about SN-1 and SN-2 reaction (definition, mechanism, evidences, stereochemistry, graph etc), Factors affecting the course and mode of SN reactions (Nature / structure of Substrate, nature of Nucleophile, Nature of leaving group, nature of solvent), Neighbouring group participation, SN-i reaction, Walden inversion.	
	(B) ELIMINATION REACTION	4 Hours
	Definition, classification, discussion about E-1, E-2 and E-1CB mechanism, Carbonium ion rearrangement, Orientation of double bond in elimination reactions.	
	(C) NUCLEOPHILIC AROMATIC SUBSTITUTION	4 Hours
	Definition, Bimolecular displacement and its mechanism, Reactivity, Orientation, Electron withdrawal by resonance, Evidence for two step mechanism. Benzyne Mechanism including structure of Benzyne and evidences.	
UNIT-III		15 Hours
	(A) HETEROCYCLIC COMPOUNDS	6 Hours
	Structure and aromaticity of Pyrrole, Furan and Thiophene, Electrophilic substitution reactions, Reactivity and Orientation, Structure of an aromatic characteristics of Pyridine, SE and SN reactions of Pyridine, Basicity of Pyridine, Synthesis and reactions of	



	Quinoline and Isoquinoline, Synthesis of Pyrimidine, Uracil, Thymine, Cytosine.		
	(B) NAME REACTIONS / REARRANGEMENTS/REAGENT		9 Hours
	Principle, Mechanism and synthetic applications of these reactions:		
	1. Arndt Eistert reaction 2. Baeyer-villiger oxidation 3. Dakin Reaction 4. Diels-Alder reaction 5. Hofmann reaction 6. Reimer-Tiemann 7. Wolff-Kishner reaction 8. Claisen Rearrangement	9. Fries Migration 10. Pinacol-pinacolone rearrangement 11. Lithium aluminium hydride (LiAlH ₄) 12. Triphenyl phosphine	

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. Organic Chemistry: Cram, Hammond and Hendrickson.
5. Organic Chemistry by L. G. Wade Jr.
6. Basic course in Organic Chemistry: Ramesh Luhana. Maglam Publ. New Delhi.
7. Simple Organic Chemistry: Ramesh Luhana Rughwani & Dr.Dinesh Kundariya. Maglam Publ. New Delhi.
8. Name reactions and Mechanism: Rustogi, S K Agarwal
9. Organic Chemistry: O P Agarwal / Chatwal
10. Stereochemistry: Configuration and Mechanism: P. S. Kalsi; Wiley Eastern Ltd.



KACHCHH UNIVERSITY: BHUJ

THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)

CHEMISTRY

PAPER NAME: ORGANIC CHEMISTRY PRACTICALS

PAPER CODE NO: MJCH-504P

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 SEPARATION AND ORGANIC SPOTTING:**

Binary Organic Mixture: Separation of two components from the mixture. Water soluble compound included. Identification of both of the components by Lassaign test, Physical & Chemical methods, determination of MP/BP etc. of the mixture. Minimum of 10 (TEN) mixtures to be done and reported in journal.

Chemical compounds:

Water insoluble Solids: Benzoic acid, Cinnamic acid, Salicylic acid, Phthalic acid, α -Naphthol, β -Naphthol, α -Naphthyl amine, p-Toluidine, meta and para- Nitro anilines, Diphenyl amine, m-Dinitrobenzene, Acetanilide, Naphthalene, Anthracene etc.

Water soluble solids: Succinic acid, Oxalic acid, Tartaric acid, Citric acid, Urea, Thiourea, Acetamide etc.

Liquids: Low BP: Acetone, Benzene, Chloroform, Ethyl acetate, Methyl acetate, Ethanol, Methanol, CTC etc.

High BP: Nitrobenzene, Aniline, Chloro benzene, Bromo benzene etc.

Few examples of Mixtures:

Solids: (1) Benzoic acid + Naphthalene (Type: Acid + Neutral) (2) Salicylic acid + α -Naphthol (Acid + Phenol) (3) Succinic acid + m-Dinitrobenzene (Water soluble acid + insoluble neutral) etc

Liquid Mix: L + L: Benzene + Aniline, Acetone + Nitrobenzene etc

S + L: Benzoic acid + Acetone, Succinic acid + Ethyl acetate etc

➤ **JOURNAL**

➤ **VIVA**

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Duration of Practical: 3Hrs.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY
PAPER NAME: PHYSICAL CHEMISTRY
PAPER CODE NO: MJCH-505

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Physical Chemistry, like Chemistry of thermodynamics, chemical kinetics, electrochemistry, Photochemistry, Phase rule This study will be helpful in further study, competitive exam and industries.		
UNIT-I		15 Hours
	(A) THERMODYNAMICS	8 Hours
	Zeroth law of TD, Thermometric equation, Trouton's law, Colligative properties, Elevation in boiling point, Depression in freezing point, Van't Hoff's Isotherm, Van't Hoff's Isochore, Third law of TD, Chemical potential, Derivation of Law of mass action using Chemical potential.	
	(B) CHEMICAL KINETICS	7 Hours
	Collision theory, Arrhenius equation, Temp. dependence of reaction rate and Arrhenius equation, Activated Complex Theory, Salt effect, Primary and secondary salt effects, simultaneous reactions: consecutive reactions, parallel reactions, reversible reactions, Chain reactions.	
UNIT-II	ELECTROCHEMISTRY	15 Hours
	Weston cell, concentration cells, Types of concentration cells, Derivation of equation of emf of each concentration cell, Derivation of equation of emf of concentration cell with transference and without transference, LJP and derivation of equation of emf of LJP. Application of emf measurement in determination of solubility and solubility product of sparingly soluble salt, ionic product of water, Valency of cations, transference number, degree of hydrolysis of a salt, Decomposition potential, its experimental determination, Application of decomposition potential.	
UNIT-III		15 Hours
	(A) PHOTOCHEMISTRY	7 Hours
	Laws of photochemistry, Grothuss-Draper law, Stark-Einstein law, Quantum yield, High quantum yield, Low quantum yield, Experimental determination of quantum yield, Types of photochemical reactions, Fluorescence and Phosphorescence, Chemiluminescence, Photosensitization, Flash Photolysis.	
	(B) PHASE RULE	8 Hours
	Introduction, Phase, Component, Degree of freedom, Derivation of phase rule, One component system: Water system, Sulphur system, condensed phase rule equation, study of two components systems:	



	Pb/Ag system, Zn/Cd system, solubility of partially miscible liquids: Phenol – water, Triethylamine-water and Nicotine-water systems.	
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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
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY

PAPER NAME: PHYSICAL CHEMISTRY PRACTICAL
PAPER CODE NO: MJCH-506P

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

Course Outcomes (COs):

On completion of this course, the students will be able to perform/do independently:

- Examine the rate & order of the reaction from experimental & graphical data.
- Determine relative strengths of acids.
- Determine Half-life time, Energy of activation and Temperature coefficient.
- To acquire skills in the operation of pH meter, Potentiometer and conductometric titrimetry.

➤ **PHYSICO CHEMICAL EXERCISE**

One exercise be given from the following to the candidate at the examination:

(a) Chemical Kinetics:

- (1) To study reaction between
 - (a) $K_2S_2O_8$ and KI ($a = b$)
 - (b) $HBrO_3$ and KI ($a = b; a \neq b$)
 - (c) H_2O_2 and HI ($a = b; a \neq b$)
- (2) To determine the energy of activation and temperature coefficient of hydrolysis of Methyl acetate or Ethyl acetate

(b) Conductometry:

- (1) To titrate the mix of strong acid + weak acid against strong base
- (2) To titrate the mix of strong base + weak base vs strong acid

(c) pH metry:

- (1) To titrate strong acid against strong base
- (2) To titrate a mixture of strong acid + weak acid against strong base

(d) Potentiometry:

- (1) To titrate strong acid against strong base
- (2) To titrate Fe^{+2} against $K_2C_2O_7$

➤ **JOURNAL**

➤ **VIVA**

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Duration of Practical: 3Hrs.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY
PAPER NAME: BIO-ORGANIC CHEMISTRY-II
PAPER CODE NO: MNCH-507

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Natural product chemistry like Carbohydrates, Terpenoids, and Alkaloids. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	CARBOHYDRATES	15 Hours
	Disaccharides: Introduction of Disaccharides, Chemical reactions and structures of Maltose, Cellobiose, Lactose and Sucrose. Polysaccharides: Introduction of Polysaccharides, Chemical reactions and structures of Starch, Cellulose. Applications of Disaccharides and Polysaccharides.	
UNIT-II	ISOPRENOIDS (TERPENOIDS)	15 Hours
	Classification, Isolation, general methods of determining structure of isoprenoids, Isoprene rules, Chemistry of Citral, α -Terpineol, Limonene, Menthol and Camphor with their synthesis, study of reactions of β - carotene (No synthesis)	
UNIT-III	ALKALOIDS	15 Hours
	Classification, Definition, Isolation, General methods of determining structure, Structure of Coniine, Nicotine, Piperine, Papaverine and Atropine including their synthesis.	

REFERENCE BOOKS

1. Organic Chemistry: R T Morrison and R N Boyd, 6th or 7th Edition, Prentice Hall, New Delhi
2. Organic Chemistry: I L Finar AR, Vol. II, 5th Ed.
3. A Text book of Organic Chemistry: P L SONI, Sultan Chand and sons, New Delhi
4. Organic Chemistry: Cram, Hammond and Hendrickson.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY

PAPER NAME: BIO-ORGANIC CHEMISTRY-II -PRACTICAL
PAPER CODE NO: MNCH-508P

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:

- Practical skills in the field and laboratory synthesis & characterization.
- Study of various organic reaction like bromination, nitration, oxidation etc.
- Preparation of various organic molecules/reagents/dyes etc.

➤ **ORGANIC PREPARATION:**

Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.

- a) p-Bromo acetanilide from Acetanilide (Bromination)
- b) Tri Bromo aniline from Aniline (Bromination)
- c) Tribromo phenol from Phenol (Bromination)
- d) p-Nitro acetanilide from Acetanilide (Nitration)
- e) m-Dinitrobenzene from Nitrobenzene (Nitration)
- f) Benzoic acid from Benzaldehyde (Oxidation)
- g) Preparation of carboxylic acid by alkaline hydrolysis of ester/amide.
- h) Preparation of methyl orange.
- i) Osazone from glucose/fructose
- j) Oxidation of alcohol/aldehydes/hydrocarbons to carboxylic acid.
- k) Preparation of chalcone.

➤ **JOURNAL**

➤ **VIVA**

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

Duration of Practical: 3Hrs.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY
PAPER NAME: INDUSTRIAL CHEMISTRY
PAPER CODE NO: MNCH-509

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of Industrial chemistry like Morden approach to chemical industry, ceramic, cement, nano materials, environment chemistry. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	MORDEN APPROACH TO CHEMICAL INDUSTRY	15 Hours
	Introduction, Basic requirements of chemical industries, chemical production, raw materials, unit process and unit operations, quality control, quality assurance, process control, research and development, pollution control, human resource, safety measures, classification of chemical reactions, batch and continues process, conversion, selectivity and yield, copy right act, patent act and trademarks.	
UNIT-II		15 Hours
	(A) CERAMIC	5 Hours
	What are ceramics, Classification of Ceramic products, General Properties of ceramics, Basic raw materials, manufacture process in brief,	
	(B) CEMENT	5 Marks
	Introduction and type of cement, Raw materials and manufacturing process (1) Dry process (2) Wet process, Setting of cement (1) Hydrolysis (2) Hydration, Properties of cement, Uses of cement.	
	(B) NANO MATERIALS	5 Marks
	Introduction and definition of nanomaterials & nanotechnology, history of nanomaterials, causes of interest in nanomaterials, properties and types, syntheses of nanomaterials, applications	
UNIT-III	ENVIRONMENT CHEMISTRY	15 Hours
	Environment – definition and introduction, Segments of environment (i) Atmosphere (ii) Hydrosphere (iii) Lithosphere (iv) Biosphere, Air Pollution: Major sources of air pollution, Control of Air pollution, Green House Effect, Photochemical smog, CFC and ozone depletion, Acid rain, Sources and effects of NOX and SOX, Water pollution: Classification of water pollution (i) Physical pollution (ii) Chemical pollution (iii) Biological pollution (iv) Physiological pollution Sources of water pollution (i) Sewage and domestic waste (ii) Industrial effluents (iii) Agricultural discharges (iv) Fertilizers (v) Toxic metals (vi) Siltation (vii) Thermal pollutions (viii) Radioactive materials Water Pollution Control Dissolved Oxygen (D.O.) determination Chemical Oxygen Demand (C.O.D.) determination Biological Oxygen Demand (B.O.D.) determination	



REFERENCE BOOKS

1. Industrial Chemistry by B. K. Sharma, GOEL Publishing House.
2. Nanostructures and Nanomaterials: Synthesis, Properties and Applications: G. Cao, ICP, London, 2004.
3. Environmental Chemistry by A.K. De
4. Environmental Chemistry by Sharma & Kaur
5. Environmental Solution of Analysis by S.M. Khopkar



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY
PAPER NAME: INDUSTRIAL CHEMISTRY-PRACTICAL
PAPER CODE NO: MNCH-510P
Marks: External Evaluation: 10, Internal Evaluation: 15. Total Marks 25

Course Outcomes (COs):

On completion of this course, the students will be able to perform/do independently:

- Practical skills in the field of Industrial chemistry.
- The course will provide ability to student to analysis Industrial product.
- Improve knowledge about titrimetric method.

➤ **INDUSTRIAL PRODUCT ANALYSIS:**

- a) To determine Calcium oxide in cement by rapid EDTA titration method.
- b) To estimate Hypo (Commercial sodium thiosulphate) using potassium dichromate by volumetric method
- c) To determine sodium carbonate in soda ash.
- d) To determine amount of bleach/bleaching powder in sample by thiosulphate in titrimetric method
- e) To estimate tartaric acid/citric acid by direct titration method.
- f) To estimate aspirin/methyl salicylate/lactic acid by residual titration method.
- g) To determine ascorbic acid (Vitamin C) by iodometric titration.

➤ **JOURNAL**

➤ **VIVA**

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

Duration of Practical: 3Hrs.

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
THIRD YEAR B.Sc.: NEP: SEMESTER: V (FIVE)
CHEMISTRY
PAPER NAME: SKILL BASED PRACTICAL-III
PAPER CODE NO: SEC CHE-501P

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:

- Understand and analysis of pharmaceutical product.
- To find out the purity of chemical like H₂O₂, Boric acid.
- Students will be able to preparation of different synthetic and herbal cosmetic product, also able to use of software for chemical structure drawing.

➤ **Pharmaceutical analysis**

- 1) To carry out the assay of aspirin.
- 2) To carry out the assay of Ibuprofen tablet
- 3) To carry out the assay of Metronidazole
- 4) To carry out the assay of Chlorpheniramine Maleate
- 5) To carry out the assay of atropine.
- 6) To determine the percentage purity of given H₂O₂ sample.
- 7) To determine the percentage purity of the given sample of boric acid.

➤ **Preparation of Cosmetics**

- 1) Preparation of talcum powder.
- 2) Preparation of synthetic and herbal shampoo.
- 3) Preparation of face cream and herbal face cream.
- 4) Preparation of herbal face scrub and anti-wrinkle cream.
- 5) Preparation of herbal tooth powder and paste.
- 6) Preparation of Synthetic Hair dye and Herbal Hair dye.
- 7) Preparation of multipurpose herbal cream.

➤ **Exercise related to chemistry structure drawing software.**

➤ **JOURNAL**

➤ **VIVA**

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



UNIVERSITY PRACTICAL EXAM PATTERN-SEC

There will be a Four Exercise 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

BHUI: 370 001



SYLLABUS (NEP)

B. Sc. Semester VI: (SIX)

CHEMISTRY

(With Research /Without Research)

Curriculum as per UGC Guideline
Framed according to National Education Policy (NEP)-2020

With effect from June-2025 (and thereafter)



Credit Framework and course code for Third Year (SEM-VI) Chemistry Programme.

Year	Semester	Course Code	Paper Title	Credits	Marks		Total	
					CA	UA		
Third Year	VI	MJCH-601 (Theory)	Spectroscopy Chemistry	3	35	40	75	
		MJCH-602P (Practical)	Spectroscopy Chemistry - PRACTICAL	1	15	10	25	
		MJCH-603 (Theory)	Analytical Chemistry	3	35	40	75	
		MJCH-604P (Practical)	Analytical Chemistry - PRACTICAL	1	15	10	25	
		MJCH-605 (Theory)	Structural Chemistry	3	35	40	75	
		MJCH-606P (Practical)	Structural Chemistry-PRACTICAL	1	15	10	25	
		Total Credits			12			300
		MNCH-607 (Theory)	Applied Chemistry	3	35	40	75	
		MNCH-608P (Practical)	Applied Chemistry - PRACTICAL	1	15	10	25	
		IN CHE-609 (Internship)	Internship in Chemistry (Major specific subject)	4	40	60	100	
		Total Credits			8			200



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

KACHCHH UNIVERSITY: BHUJ

THIRD YEAR B.Sc.: NEP: SEMESTER: VI SIX)

CHEMISTRY

PAPER NAME: Spectroscopy/Analytical/Structural/Applied Chemistry

PAPER CODE NO: MJCH-601/603/605, MNCH-607

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/Chemical reaction 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
THIRD YEAR B.Sc.: NEP: SEMESTER: VI (SIX)
CHEMISTRY
PAPER NAME: SPECTROSCOPY CHEMISTRY
PAPER CODE NO: MJCH-601

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of spectroscopy Chemistry, like IR, NMR and Mass Spectroscopy. This study will be helpful in structural identification, further study, competitive exam and industries.		
UNIT-I		15 Hours
	(A) IR SPECTROSCOPY	8 Hours
	Introduction, Basic principle, theory of IR, selection rules, Various types of vibrations, Instrumentation, Sample preparation, Group frequencies and its applications to Aliphatic and aromatic Hydrocarbons, alcohols phenols, carbonyl compounds, carboxylic acids and its derivatives, ethers, halogen compounds and compounds containing C-N, C-S, C-X linkages, Applications in Structural determination including H-bond, tautomers and geometrical isomers, Finger print region, Examples.	
	(B) MASS SPECTROSCOPY	7 Hours
	Introduction, Basic principle, Instrumentation, General fragmentation modes, Important features for the mass spectra of alkanes (without problems)	
UNIT-II		15 Hours
	(A) NMR SPECTROSCOPY	10 Hours
	Introduction, Principle, Equivalent and non-equivalent protons with illustrations, enantiotropic and diastereotopic protons, Position of the signal: Shielding and deshielding of protons, Internal standard, Chemical shift and factors affecting it, Magnetic anisotropic effect with examples, Relative intensity of signals, Peak area and number of protons, Splitting of the signals, Spin-spin coupling, Theory of splitting (formation of doublet, triplet, quartet), coupling constant, Geminal and Vicinal coupling, Deuterium labelling, Application including determination of Aromatic Character, H-bond, Carbocation, Examples (Problems related to determination of structure of organic molecules from PMR spectral data).	
	(B) RAMAN SPECTROSCOPY	5 Hours
	Instrumentation, Applications, Comparison of IR with Raman spectra.	
UNIT-III	PROBLEMS (COMBINED EXAMPLES)	15 Hours
	Problems based on the combined applications of UV, IR and NMR spectroscopy must be asked	



REFERENCE BOOKS

1. Applications of Absorption Spectroscopy of Organic Compounds: J R Dyer
2. Organic Chemistry: VIth Ed, Morrison and Boyd
3. Spectro photometric Identification of Organic Compounds: R M Silverstein,
4. G C Bassler & T C Morrill: 4th Ed. John Wiley & Sons
5. Spectroscopy of Organic Compounds: P S Kalsi: 6th Ed, New Age International
6. Organic Spectroscopy: William Kemp, 2nd Ed, ELBS
7. Elementary Organic Absorption Spectroscopy: Y R Sharma & O P Vig. S.Chand & company, New Delhi
8. Basic Principles of Spectroscopy: R Chang pages: 149-167, 182-185
9. Physical methods in Inorganic Chemistry: R S Drago.
10. Fundamentals of Molecular spectroscopy: C N Banwell.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: VI (SIX)
CHEMISTRY

PAPER NAME: SPECTOSCOPY CHEMISTRY PRACTICAL
PAPER CODE NO: MJCH-602P

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 quantity of given inorganic salt based on the quantitative analysis.
- Practical skills in the field and laboratory experiments in quantitative analysis.
- The course will provide ability to student to analysis of any inorganic volumetric analysis.

(A) Inorganic Gravimetric

Gravimetric determination of the metal after removing one impurity metal

- (1) $\text{BaCl}_2 + \text{FeCl}_3 + \text{HCl}$ (Estimation of Ba as BaSO_4 , after removal of Iron)
- (2) $\text{MnCl}_2 + \text{CuCl}_2 + \text{HCl}$ (Estimation of Mn as $\text{Mn}_2\text{P}_2\text{O}_7$, after removing Copper)
- (3) $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 + \text{CuSO}_4 + \text{H}_2\text{SO}_4$ (Estimation of Iron as Fe_2O_3)
- (4) $\text{Al}_2(\text{SO}_4)_3 + \text{CuSO}_4 + \text{H}_2\text{SO}_4$ (Estimation of Al as Al_2O_3 , after removing Copper)
- (5) Analysis of Brass (Cu Volumetrically and Zn gravimetrically)
- (6) Analysis of German Silver (Cu volumetrically and Ni as Gravimetrically)

(B) Inorganic Volumetric analysis

- (1) Estimation of Fe^{+3} by EDTA
- (2) Determination of Bi^{+3} by EDTA
- (3) %age purity of H_2O_2 by Iodometric method
- (4) Estimation of Cl^- by silver nitrate (Mohr's method)
- (5) Estimation of Zn^{+2} & Cd^{+2} in a mixture by EDTA
- (6) Estimation of Ca^{+2} & Mg^{+2} in a mixture by EDTA

➤ **JOURNAL**

➤ **VIVA**

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

Duration of Practical: 3Hrs.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: VI (SIX)
CHEMISTRY
PAPER NAME: ANALYTICAL CHEMISTRY
PAPER CODE NO: MJCH-603

Course Outcomes (COs):		
Upon success full completion of these paper students will learn about Analytical chemistry concept like chromatography, redox titration, potentiometry, complexometric titration and precipitation titration. This study will helpful in further study, competitive exam and industries.		
UNIT-I		15 Hours
	(A) CHROMATOGRAPHY	8 Marks
	Adsorption chromatography, Paper chromatography, Thin Layer chromatography, Gas chromatography, Instrumentation and evaluation of data, High performance liquid chromatography (HPLC-Principle, Instrumentation and applications)	
	(B) ION EXCHANGE RESIN	7 Marks
	Ion exchange equilibrium, Types of ion exchange resins, Ion exchange capacity, Applications of Ion exchange resins.	
UNIT-II		15 Hours
	(A) REDOX TITRATION	8 Hours
	Theory of redox titration, volumetric analysis involving (i) Potassium Permanganate, (ii) Potassium dichromate and (iii) Iodine, study of redox titration by electrochemical potential method (only), calculation of potential at various point on the titration curve, Redox indicators, potential requirements of redox titrations, multicomponent titrations, Iodometry and Iodimetry.	
	(B) POTENTIOMETRY	7 Hours
	Scope of potentiometric titrations, precipitation and neutralization titrations, graphical methods including Gran's plot for selecting end point, differential titrations, dead stop titrations, Ion selective electrodes & its types, principle of pH meter.	
UNIT-III		15 Hours
	(A) COMPLEXOMETRIC TITRATION	8 Hours
	Theory of Complexometric titrations: principle, effects of complexing agents and their advantages, step-wise EDTA Complex formation by disodium salt of EDTA and effect of pH, end point determination by visual and instrumental methods, indicators for EDTA titration, metal ion indicators, types of EDTA titrations– direct, back, displacement and indirect determinations, masking and demasking reagents, applications of EDTA titration - determination of hardness of water.	
	(B) PRECIPITATION TITRATION	7 Hours
	Titration curve for precipitation reaction, end point detection, Mohr's method, Volhard's method and Fajan's method.	



REFERENCE BOOKS

1. Instrumental Methods of Chemical Analysis: B K Sharma: Goel Publishing House, Merrut.
2. Quantitative Analysis: Day and Underwood.
3. Fundamentals of Analytical Chemistry: Skoog and West.
4. Analytical Chemistry: IVth Ed. Gary D Christian.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: VI (SIX)
CHEMISTRY
PAPER NAME: ANALYTICAL CHEMISTRY PRACTICALS
PAPER CODE NO: MJCH-604P
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:

- Volumetric organic estimations based on functional group characteristics.
- Determine/ estimate the amount of molecular weight of organic acid by titrimetric method.

➤ **Organic Estimation:**

- (1) To find out Mol. Wt of Organic acid by titrimetry method
- (2) To find out basicity of organic acid by titrimetry method
- (3) To find out the %age purity of the sample of organic acid
- (4) To find out the amount of Acetone in the given solution by iodine method
- (5) To find out amount of Ethyl acetate by hydrolysis method
- (6) To find out saponification value of an oil.
- (7) To find out %age purity of Ethyl acetate by hydrolysis method

➤ **JOURNAL**

➤ **VIVA**

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

Duration of Practical: 3Hrs.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: VI (SIX)
CHEMISTRY
PAPER NAME: STRUCTURAL CHEMISTRY
PAPER CODE NO: MJCH-605

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of symmetry, term symbol, electronic spectra and UV spectroscopy. This study will be helpful in further study, competitive exam and industries.		
UNIT-I	SYMMETRY	15 Hours
	Symmetry Operations and Symmetry elements (C_n , σ , S_n , i), Multiplication Table C_{2v} , C_{2h} and C_{3v} point groups, Classification of Schoenflies Point groups: C_1 , C_s , C_i , C_n , C_{nh} , C_{nv} , D_n , D_{nh} , D_{nd} , T_d and O_h , Matrix representation of C_n , σ , S_n , i , E Symmetry and Dipole moment, Symmetry and Optical activity.	
UNIT-II		15 Hours
	(A) TERM SYMBOLS	8 Hours
	Russel Saunders Coupling and determination of Term symbols in Ground state, Pigeon Hole diagram of p^2 and d^2 , Hund's rules, Hole formalism, Calculation of number of microstates.	
	(B) ELECTRONIC SPECTRA OF METAL COMPLEXES	7 Hours
	Electronic Spectra of Transition metal complexes, Selection rules, Laporte Orbital Selection rules, Spin selection rule, Orgel combined energy level diagram (d^1-d^9 , $d^2 - d^8$ only) and their spectra, Spectra of d^5 , Jahn Teller distortions, Spectro chemical series, Vibronic coupling.	
UNIT-III	UV-VISIBLE SPECTROSCOPY	15 Hours
	Introduction to spectroscopy, Various electronic transitions, Origin of UV-Vis band, Form of spectrum, Chromophore, Auxochrome, Bathochromic shift, Hypsochromic shift, Hyperchromic shift, Hypochromic shift, UV spectra of Alkene and conjugated diene, Solvent effect on UV-Vis spectra of Alkenes, carbonyl compounds, Theoretical calculation of λ_{max} in Ethanol solvent for enes, enones, aromatic carbonyl (benzoyl) compounds applying Woodward-Fischer empirical rules, UV-Vis spectra of Polynuclear hydrocarbons, Application in geometrical isomerism.	



REFERENCE BOOKS

1. Physical Chemistry by Daniels and Alberty, 4th Ed, pages 434-446
2. Chemical Applications of Group theory by F A Cotton, 2nd Ed, pages 14-32, 33-38, 45-52, 62-73.
3. Introductory Quantum Chemistry: A K Chandra, 3rd Ed, page 252-273
4. Chemical Bonding: An Introduction: A K Raval, KC Patel, & R D Patel: 2nd Ed, Pages 149-189.
5. Concise Inorganic Chemistry: J D Lee, 4th Ed, pages 938 to 950
6. Concise Inorganic Chemistry: J D Lee, 4th Ed, pages 951 to 967
7. Spectroscopy of Organic Compounds: P S Kalsi: 6th Ed, New Age International.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: VI (SIX)
CHEMISTRY

PAPER NAME: STRUCTURAL CHEMISTRY-PRACTICAL
PAPER CODE NO: MJCH-606P

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:

- The course will provide ability to student to study Lambert-Beer law.
- Determine heat of solution of an organic acid.
- Practical skills in the field and laboratory experiments in physical chemistry

➤ **PHYSICO CHEMICAL EXERCISE**

One exercise be given from the following to the candidate at the examination

(a) Colorimetry:

(1) To study Beer's law and to determine the concentration of (i) Cu^{+2} (ii) CrO_4^{-2} (iii) Fe^{+3} in unknown solution.

(b) Distribution law:

- (1) To study the distribution of Ammonia between Water and Chloroform
- (2) To study the distribution of Ammonia between Water and Carbon tetra chloride

(c) Thermo chemistry:

(1) To determine the heat of solution of an organic acid (Benzoic acid, Salicylic acid, Succinic acid)

➤ **JOURNAL**

➤ **VIVA**

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

Duration of Practical: 3Hrs.



KACHCHH UNIVERSITY: BHUJ
THIRD YEAR B.Sc.: NEP: SEMESTER: VI (SIX)
CHEMISTRY
PAPER NAME: APPLIED CHEMISTRY
PAPER CODE NO: MNCH-607

Course Outcomes (COs):		
Upon successful completion of these papers' students will learn about concepts of solvent extraction, acid-base titration, colorimetry & spectrophotometry, flame photometry, bio-inorganic chemistry and synthetic drugs. This study will be helpful in further study, competitive exam and industries.		
UNIT-I		15 Hours
	(A) SOLVENT EXTRACTION	5 Hours
	Distribution coefficient, Distribution ratio, Solvent extraction of metals, Extraction process, Separation efficiency, Choice of solvent.	
	(B) ACID BASE TITRATIONS	10 Hours
	Theory of acid-base titration, end point determination, titration of strong acid with strong base, titration of weak base with strong acid, titration of weak acid with strong base, titrations of polyprotic acids and acid mixtures, titration of salts, differential alkali titration. Non-aqueous titrations: classification of solvents with examples - (i) Protic, aprotic and amphiprotic, (ii) Acidic, basic and neutral (iii) Aqueous and non-aqueous (iv) Polar and nonpolar. Theory of titration of adrenaline.	
UNIT-II		15 Hours
	(A) COLORIMETRY AND SPECTROPHOTOMETRY	7 Hours
	Laws of absorption, Spectrophotometric instrument, Light sources, Optical system, Wavelength selector, Light sensitive devices, Accuracy and error of spectrophotometry, Analysis of mixtures.	
	(B) FLAME PHOTOMETRY AND AAS	8 Hours
	Flame emission spectroscopy, and atomic absorption spectroscopy, Principle and comparison, inductively coupled plasma emission spectroscopy, Burners (Total consumption burner and pre mix burners)	
UNIT-III		15 Hours
	(A) BIO INORGANIC CHEMISTRY	7 Hours
	Role of Myoglobin and Hemoglobin in biological system, cooperative effect. Metallo enzymes, Inhabitation and poisoning of enzymes, Role of alkali and alkaline earth metal ions in biological systems, Sodium pump, Calcium pump, biological junction and toxicity of some elements, biological fixation of nitrogen.	
	(B) SYNTHETIC DRUGS	8 Hours
	Chemotherapy, Synthesis and use of (1) Sulphathiazole (2) Sulphadiazine (3) Benzocaine (4) Paracetamol (5) Para amino salicylic acid (PAS) (6) Phenacetin (7) Antipyrine (8) Tolbutamide (9) Chloramine-T (10) n-Hexyl resorcinol.	



REFERENCE BOOKS

1. A text book of Pharmaceutical Chemistry-II: Dr. A V Kasture & Dr. S G Woodcare: Nirali Prakashan.
2. Organic Pharmaceutical Chemistry: Harkishan Singh & V K Kapoor: Vallabh Prakashan, Delhi



KACHCHH UNIVERSITY: BHUJ

THIRD YEAR B.Sc.: NEP: SEMESTER: VI (SIX)

CHEMISTRY

PAPER NAME: APPLIED CHEMISTRY PRACTICAL

PAPER CODE NO: MNCH-608P

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

Course Outcomes (COs):

On completion of this course, the students will be able to perform/do independently:

- Students should understand the fundamental concepts behind chromatographic separation technique.
- They should be able to differentiate between various chromatographic techniques.
- They should be aware of the diverse applications of chromatography in fields of chemistry.

➤ **Chromatography**

- a) Separation of 1st groups ions.
- b) Separation of 2nd groups ions.
- c) Separation of Dyes by ascending paper chromatography.
- d) Separation of Dyes by thin layer chromatography (TLC).
- e) Separation of Amino acids by ascending paper chromatography.
- f) Separation of Amino acids by thin layer chromatography (TLC).
- g) Separation of Amino acids by circular paper chromatography

➤ **JOURNAL**

➤ **VIVA**

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

Duration of Practical: 3Hrs.

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
THIRD YEAR B.Sc.: NEP: SEMESTER: VI (SIX)
CHEMISTRY
PAPER NAME: INTERNSHIP IN MAJOR SPECIFIC COURSE
PAPER CODE NO: IN CHE-609
Credit: 4

Title	Credit
Includes Dissertation/Project work/ Internship (other than self-institute)/ Review work/other relevant	Total credit: 04

The credit weightage for Internship/Apprenticeship/OJT is suggested to be 30 hrs. per credit if they have only practical exposure or lab-based activities. Accordingly, the students must dedicate required number of hours for the same. The guidelines offer scope for providing hands on learning with classroom experience. In case of field visit or experiential learning, 1 credit is equivalent to 40-45 Hours.

Both HEIs & Industries can decide mutually for the duration of classroom lecture and industry visit.

Credit allocation:

		For earning 4 credit
Lab based activities or practical exposure	30hrs/ credit	120 hrs for paper
Field visit or experimental learning	40-45 hrs/credit	160-180 hrs per paper
Please refer 3.4.2 & 3.4.3 of SOP page no.		

Evaluation:

- **Marking system will be 60% and 40% for Supervisor and faculty respectively. 60% of the marking should be given by the external supervisor while 40% internal assessment will be based on viva and report submission.**
- **Report** of the training will be must for proper documentation.
- **Certificate** from SKP will be required on successful completion.

General Rules:

- The Internship or skill earning can be from any organization/industry/Govt. body/NGO/any other institute/ SKP (Skill Knowledge Provider) etc.
- For Industry or other institute internship please refer 3.4.3 of SoP.
- The concerned can issue a certificate or letter for work completion after successful completion of OJT/Internship/Apprenticeship activities by students.

