Krantiguru Shyamji Krishna Verma

Kachchh University

Mundra Road

BHUJ : 370 001

SYLLABUS

B. Sc. Semester III: (THREE)

CHEMISTRY

TWO Papers: Code No: CECH-303 (Inorganic Chemistry)

Code No: CECH-304 (Organic Chemistry)

With effect from June 2012

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KACHCHH UNIVERSITY : BHUJ
SEMESTER: III (THREE)
CHEMISTRY PAPER: III (wef June 2012)
Paper Code NO. : CECH-303 (INORGANIC CHEMISTRY)

UNIT : I : WAVE MECHANICS : [15]

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 : CHEMICAL BONDING:1

(A) VALENCE BOND THEORY : [8]

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]

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.

UNIT : III: CHEMICAL BONDING:2

(A) MOLECULAR ORBITAL THEORY: [8]

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- BeH_2, CH_4 and BH_3. MO diagrams of complex molecules $[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-}$, $[Ni(CN_6]^{2-}$ and $[Ni(CO)_4]$.

(B) CHEMISTRY OF f - BLOCK ELEMENTS : [7]

Lanthanide series : Properties of Lanthanides, electron configuration, oxidation states, Color , basic character, solubility of compounds, chemical reactivity, extraction and separation of lanthanides

Actinides series : Symbol and names of actinides, Transuranic elements, extraction of Thorium, Uranium, Plutonium, their compounds and uses.

UNIT : IV :

(A) NON AQUEOUS SOLVENTS : [5]

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.

(B) PHYSICO CHEMICAL PRINCIPLES : **[5]**

Manufacture of Ammonia - Effect of pressure, temperature and catalyst suggested mechanism
Manufacture of NaOH – Electrolysis of brine, porous diagram process and mercury cathode process

(C) SOLID STATE: **[5]**

Crystal structures, h,k,l notations, Miller's indices, Bragg's equation, X-rays study of NaCl and KCl crystals, X-ray method to determine Avogadro number .

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 and Sharma ,29th Edition
6) Environmental Chemistry by A.K. Dey.

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PATTERN OF QUESTION PAPER

FOR SEMESTER-END EXAMINATION

Total Marks : 60 , Duration : THREE Hours
Passing standard : 40% ie 24 Marks

1. Internal options are compulsory (i.e. Q.1 or Q.1; Q.2 or Q.2 etc. or attempt 2 or 3 out of given four or five)
2. There are four questions (Q. 1 to Q. 4) each carrying 15 marks

The structure of the questions is as under:

Questions	Section	Marks
Question – 1 Unit – I	A (Objective type) (no internal option)	5 marks
	B (Descriptive - Essay type - Short notes with internal option)	10 marks
Question – 2 Unit –II	A –do-	5 marks
	B –do-	10 marks
Question – 3 Unit – III	A –do-	5 marks
	B –do-	10 marks
Question – 4 Unit – IV	A –do-	5 marks
	B –do-	10 marks

Types of questions for section A are varied: like: one line answers/ two line answers/ definitions/ reasoning/ derivations of equations/ derivations of sums/ drawing small figures/ matching the figures etc.

KACHCHH UNIVERSITY : BHUJ
SEMESTER : III (THREE)
CHEMISTRY PAPER : 4 (wef June 2012)
Paper Code NO. : CECH -304 (ORGANIC CHEMISTRY)

UNIT : I

(A) ACID – BASE PROPERTIES OF ORGANIC SUBSTANCES : [9]

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.

(B) SYNTHETIC DYES : [6]

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.

UNIT : II

(A) ELECTROPHILIC AROMATIC SUBSTITUTION : [7]

Disubstituion 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) PNAC : (POLYNUCLEAR AROMATIC COMPOUNDS) : [8]

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

(A) ALICYLIC COMPOUNDS : [7]

Introduction, Definition, Structural features, Nomenclature (monocyclic, bicyclic compounds) , Preparation and properties of cyclo alkanes only , Baeyer's strain theory, Heat of combustion, Orbital picture of angle strain and stability of cyclo Propane and cyclo Butane.

(B) CARBOHYDRATES : [8]

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 : IV

(A) AMINO ACIDS : [7]

Definition , structural formula of all 20 **α-** amino acids, Synthesis of Amino acids (Ammination, Strecker's method, Gabriel's method, Azalactone method), Zwitter ion,Iso electric point, Reaction with Ninhydrin.

(B) PROTEINS : **[8]**

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.

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) Name reactions and Mechanism : Rustogi, S KAgarwal
(6) Organic Chemistry : Cram, Hammond and Hendrickson.
(7) Organic Chemistry : O P Agarwal / Chatwal

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PATTERN OF QUESTION PAPER

FOR SEMESTER-END EXAMINATION

Total Marks : 60 , Duration : THREE Hours
Passing standard : 40% ie 24 Marks

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2. There are four questions (Q. 1 to Q. 4) each carrying 15 marks

The structure of the questions is as under:

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Question – 2 Unit –II	A –do-	5 marks
	B –do-	10 marks
Question – 3 Unit – III	A –do-	5 marks
	B –do-	10 marks
Question – 4 Unit – IV	A –do-	5 marks
	B –do-	10 marks

Types of questions for section A are varied: like: one line answers/ two line answers/ definitions/ reasoning/ derivations of equations/ derivations of sums/ drawing small figures/ matching the figures etc.

KACHCHH UNIVERSITY : BHUJ

SEMESTER : III (THREE)

CHEMISTRY PRACTICALS (wef June 2012)

Marks : External Evaluation : 60 , Internal Evaluation : 40 . Total 100

One exercise from each part to be set for examination .

(A) INORGANIC MIXTURE : (Four radicals) . List of mixtures: [16]

(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)	$K_2SO_4 + NH_4Br$

(B) ORGANIC SPOTTING : [15]

15 substances to be identified and reported in journals.

Acids : Citric acid, Tartaric acid, Phthalic acid, Cinnamic acid, Benzoic acid, Salicylic acid , Anthranilic acid, p-Nitro benzoic acid.

Phenols : α-Naphthol, β- Naphthol, o-Nitro phenol, p-Nitro phenol

Base : p-Toluidine, Diphenyl amine, o-Nitro aniline, m- Nitro aniline and p-Nitro aniline

Neutral Liquids : Acetone, Benzaldehyde, Bromobenzene, Chloroform, Ethanol, Ethyl acetate, CTC, Chlorobenzene, Nitrobenzene

Neutral Solids : Naphthalene, Anthracene, Glucose, Acetanilide, Banzamide.

(C) GRAVIMETRIC ANALYSIS : [18]

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** $MnSO_4$

(D) VIVA : [5]

Viva will be asked during practical exam and will be related to the practicals.

(E) JOURNALS : [6]

Journals should be signed periodically and finely Certified.

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SYLLABUS

B. Sc. Semester IV : (FOUR)

CHEMISTRY

TWO Papers :

Code No : CECH-405 (Physical Chemistry)

Code No : CECH-406 (Analytical Chemistry)

With effect from June 2012

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KACHCHH UNIVERSITY : BHUJ
SEMESTER : IV (FOUR)
CHEMISTRY PAPER : 5 (wef June 2012)
Paper Code NO. : CECH- 405 (PHYSICAL CHEMISTRY)

UNIT-I : THERMODYNAMICS: **[15]**

Carnot cycle, Efficiency of heat engine, Entropy change for an ideal gas, Entropy change at constant pressure and constant volume, Physical Significance of entropy , Clausius –Clapeyron Equation.

UNIT :II

(A) ELECTRO CHEMISTRY: **[7]**

Transference Number and its determination by Hittrof's method and Moving Boundary method, Conduct metric Titration , Reversible Cells, Electrodes (Standard Hydrogen , Calomel, Quinhydrone), Nernst equation.

(B) NUCLEAR CHEMISTRY: **[8]**

Detection of Ionizing radiation by G.M. counter, Scintillation counter, Proportional counter, Acceleration of charged particles by Cyclotron, Linear Accelerators and Nuclear Fission.

UNIT : III

(A) CHEMICAL KINETICS: **[07]**

Third Order Reaction, Activated Complex Theory, Chain Reactions, Consecutive Reactions.

(B) CATALYSIS: **[08]**

Criteria and Types of Catalysis, Active Centers, Enzyme catalyzed reactions, Catalytic poisoning, Retardation reaction.

UNIT-IV:

(A) COLLOIDS : **[10]**

Colloidal state, Preparation, Purification, Electro optical and Electro kinetic properties of colloids, Gels & Emulsions , Determination of Molecular weight of Polymers by Donnan equilibrium , Osmotic Pressure and Viscosity methods.

(B) ADSORPTION: **[05]**

Adsorption and its types, Freundlich adsorption isotherm, Langmuir adsorption isotherm.

REFERENCE BOOKS :

(1) Principles of Physical Chemistry : B.R Puri, L.R Sharma, M.S Pathania. 41st Edition.
(2) Elements of Physical Chemistry : Glasstone and Lewis, 3rd Edition , Macmillan & Co.
(3) Physical Chemistry : Walter Moore , 4th Edition, Orient Longman.
(4) Physical Chemistry : G.M Barrow, 5th Edition,McGraw-Hill, New York, 1988.
(5) Physical Chemistry : Daniel & Alberty, 4th Edition
(6) Physical Chemistry : P.W. Atkins, 5th edition. Oxford University Press, 1984.
(7) Physical Chemistry : Lavine.
(8) Thermodynamics : Glasstone.
(9) Electro chemistry : Glasstone.

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PATTERN OF QUESTION PAPER FOR SEMESTER-END EXAMINATION

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	B –do-	10 marks

Types of questions for section A are varied: like: one line answers/ two line answers/ definitions/ reasoning/ derivations of equations/ derivations of sums/ drawing small figures/ matching the figures etc.

KACHCHH UNIVERSITY : BHUJ
SEMESTER : IV (FOUR)
CHEMISTRY PAPER : 6 (wef June 2012)
Paper Code No. : CECH- 406 (ANALYTICAL CHEMISTRY)

UNIT : I :

(A) INERT GAS COMPOUNDS : [5]

Hydrates of Noble gases, Clathrates of noble gases, uses of Clathrates, Bartlett's experiment, Fluorides, Oxofluorides, and Oxides of Xenon (preparation, properties & structure).

(B) METAL CARBIDES : [5]

Classification and application.

(C) FERTILIZERS: [5]

Industries in India, manufacture of Ammonical fertilizers, Ammonium salts, Urea, nitrates, phosphate and super phosphates, mixed fertilizers. Micronutrient and their role in fertilizers.

UNIT : II

(A) PHYSICAL PROPERTIES AND MOLECULAR STRUCTURE : [10]

Molar volume, surface tension and parachor, Viscosity. Molar refraction, optical rotation, polar and non-polar molecules, dielectric constant, dipole moment. Its measurement only by temperature method and its application. Dimagnetism and paramagnetism, Magnetic susceptibility, Magnetic moment and its determination by Gouy method.

(B) GLASS : [5]

Manufacture of Glass , Types of glass.

UNIT : III :

(A) DETECTION and ESTIMATION OF FUNCTIONAL GROUPS : [8]

$-NH_2$ (Aniline), -CHO (Glucose), –COOH (Benzoic acid) , Ester (Ethyl acetate) , $-CONH_2$ (Acetamide) $–NO_2$ (Nitrobenzene) .

(B) LIPIDS : [7]

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.

UNIT : IV

(A) UV – VISIBLE SPECTROSCOPY : [9]

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 λmax 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.

(B) PESTICIDES : [6]

General, Definition, Classification, Synthesis of DDT, BHC, Aldrin and Malathion

Reference Books :

(01) Volgel's Quantitative Inorganic analysis : G Svehla , 6th Edition, Orient Longman,

(02) Analytical chemistry : D.A Skoog, D.M West, F.J Holler, 5th Ed, Saunder's college,Publishers,London,1990.

(03) Synthetic Organic Chemistry : O P Agarwal.

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KACHCHH UNIVERSITY : BHUJ
SEMESTER : IV (FOUR)
CHEMISTRY PRACTICALS (wef June 2012)
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One exercise from each part to be set for examination .

(A) PHYSICAL CHEMISTRY : [18]

01 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

02 Adsorption :

1. Determination of degree of adsorption of a given organic acoid on activated Charcoal.

03 Distribution Law :

1. To study partition co-efficient of Benzoic acid between Water and Benzene
2. To study partition co-efficient of Acetic acid between Water and Chloroform

(B) VOLUMETRIC ANALYSIS : [15]

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 KMnO4
4. Hardness of water

(C) ORGANIC ESTIMATION : [16]

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

(D) VIVA : [5]

Viva will be asked during practical exam and will be strictly based on the practicals.

(E) JOURNALS : [6]

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