

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

**PROPOSED SYLLABUS FOR S.Y.B. Sc. SEMESTER-IV
(EFFECTIVE FROM 2020-21)**

CHEMISTRY PAPER-III [INORGANIC CHEMISTRY]

50 MARKS [EXTERNAL]

TOTAL = 30 HRS.

20 MARKS [INTERNAL]

UNIT-I

[A] Chemistry of Lanthanide and Actinide Elements : [10Hrs.]

(a) Lanthanide and Actinide Elements, Electronic configuration, Sources. Occurrence, Extraction by solvent and ion exchange, Properties (Spectral and Magnetic).

(b) Lanthanide contraction, Use of Lanthanide compounds. Industrial use Uranium and Plutonium, Misch metal.

UNIT-II

[A] Hydrogen Bonding : [4 Hrs.]

Theory of hydrogen bonding, classification, importance of hydrogen bonding in ice, Effect of hydrogen bonding in various fields.

[B] Metal Complexes: [6 Hrs.]

Introduction, Werner's coordination theory, CFSE, Factors affecting on CFSE, Application of CFT (Magnetic properties, Spectral properties)

Nomenclature of complexes (Nomenclature rules, Examples of Common monodentate and multidentate ligands).

UNIT-III

[A] Ion-exchange chromatography: [6Hrs.]

Synthesis and Characterization of ion exchanger, Basic requirements of ion exchange resin. Types of ion-exchange resin. Technique of ion exchange, Application of ion exchange for Separation.

[B] Non aqueous solvents : [4Hrs.]

Introduction, classification of solvents, Properties characterising of solvents, protonic non aqueous solvents (liquid ammonia, anhydrous sulphuric acid), aprotic solvents (liquid SO₂).



Reference Books:

1. Introductory Quantum Chemistry by A. K. Chandra, Tata Mc. Graw Hill Delhi.
2. Atomic Structure and Chemical Bond by Manos Chandra, Tata Mc. Graw Hill Pub. Co. Ltd.
3. Theoretical Inorganic Chemistry by M. C. Day & J. Selbin Affiliated, East West Pub. Pvt. Ltd.
4. Coordination Compounds (Studies in Modern Chemistry) S. F. A. Kettle, Nelson.
5. Inorganic Chemistry by (Principles of Structure and Reactivity) James E. Huhely, Harper International (NY).
6. Inorganic Chemistry by R. B. Heslop and P. L. Robinson Elsevier Pub. Co. NY.
7. Physical Methods Inorganic Chemistry by R. S. Drago, W.B.S. Saunders Co. London, Reinhold Pub. Co. NY.
8. Basic Concepts of Analytical Chemistry by S. M. Khopkar, Wiely Estern Ltd. New Delhi.
9. Quantitative Analysis Day & Underwood Prentice Hall of India, Pvt. Ltd.
10. Instrumental Method of Analysis B. K. Sharma, Krishna Pub. House, Merrut.
11. Principles of Inorganic Chemistry (Puri, Sharma, Kalia).
12. Enviornmental Chemistry, By S. K. Banerji. Prentice Hall India Pvt. Ltd.
13. Progressive Inorganic Chemistry, Suratkar, Thatte, Pandit, Ideal Book Service, Poona.
14. Advanced Inorganic Chemistry Vol. I & II by Gurudeep Raj, Goel Pub. House, Meerut.
15. Quantum Chemistry Ir. N. Levine, Prentice Hall.
16. Advanced Inorganic Chemistry by Cotton & Wilkinson John Wihn Wiely.
17. Introduction to Chromatography Theory and Practice by V. K. Srivastava and K. K. Srivastava - S. Chand Pub.
18. Environmental Chemistry by. A. K. De.
19. Industrial Chemistry by B. K. Sharma
20. Inorganic chemistry by Gray L. Miessler, Donald A. Tarr, 3rd addition, Pearson publication.
21. General and Inorganic chemistry (part-I & II) by R. Sarkar, Books and Allied (P) ltd.



VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

PROPOSED SYLLABUS FOR S.Y.B.Sc. SEMESTER-IV
(EFFECTIVE FROM 2020-21)

CHEMISTRY PAPER-IV [ORGANIC CHEMISTRY]

50 MARKS [EXTERNAL]

TOTAL = 30 HRS.

20 MARKS [INTERNAL]

UNIT-I

[A] NAME REACTIONS: [7Hrs.]

General nature, Reaction mechanism and applications of the following reactions:

- (1) Friedle Craft reaction
- (2) Aldol condensation
- (3) Dickmann reaction
- (4) Michael reaction
- (5) Wolf-Kishner reduction
- (6) Mannich Reaction
- (7) Reimer Tiemann reaction
- (8) Wittig reaction

[B] Elimination reaction: [3Hrs.]

Introduction, β -elimination, E1-mechanism, E2-mechanism, Stereo chemistry of elimination reactions, Elimination v/s substitution,

α -elimination, Generation of carbenes and Ketenes.

UNIT-II

[A] Carbohydrates: [5Hrs.]

- (a) General introduction:
- (b) Disaccharides: Structure elucidation of maltose, lactose and sucrose
- (c) Methods of methylating sugar.

[B] Compounds containing reactive methylene group: [5Hrs.]

- (a) Malonic ester: Preparation from acetic acid and its synthetic applications (n-butyric acid, n-caproic acid, succinic acid, adipic acid, cinnamic acid and barbituric acid)
- (b) Acetoacetic ester (Ethyacetoacetate): Preparation and synthetic applications (butanone, 1,3 and 1,4-diketone, alicyclic compound.)
- (c) Keto-enol tautomerism: Factors affecting keto-enol tautomerism and its mechanism.



UNIT-III

[A] Organic Sulphur compounds:

[4Hrs.]

- (a) Aliphatic sulphur : Nomenclature, General methods of preparation and reactions of mercaptans, thioethers, sulfinic acid and sulfonic acids
- (b) Aromatic Sulfonic acid: Nomenclature, General methods of preparation and uses of sulfonic acids of toluene.

[B] Electromagnetic spectrum:

[6Hrs.]

UV and visible spectroscopy, Ultraviolet absorption spectroscopy, absorption laws, (Beer-Lambert law) terminology used in UV and visible spectra, Molar absorptivity, Types of electronic transitions, effect of conjugation, concept of chromophore and Auxochrome and hypsochromic shifts UV spectra of conjugated enes and enones, effect of solvent substitution on electronic transition. Problems based on calculation of λ_{max} for conjugated dienes and unsaturated carbonyl compounds and substituted benzene derivatives using relevant rule.

Reference books:

1. Organic Chemistry by R.T. Morrison and R.N. Boyd, Prentice Hall India.
2. Organic Chemistry vol-I & II by I.L. Finar.
3. Organic Chemistry vol-I & II by B.K. Sharma, Goel pub. House, Meerut
4. Reaction and reagents In Organic synthesis by O.P. Agrawal Goel pub. House, Meerut.
5. Organic Chemistry by S.H. Pine
6. Reaction Mechanism In Organic chemistry by S.M. Mukharji & S.P. Singh.
7. Organic Chemistry by L.G. Wade Jr. Prentice Hall.



VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
PROPOSED SYLLABUS FOR S.Y.B.Sc. SEMESTER-IV
(EFFECTIVE FROM 2020-21)

CHEMISTRY PAPER-V [PHYSICAL CHEMISTRY]

50 MARKS [EXTERNAL]

TOTAL = 30 HRS.

20 MARKS [INTERNAL]

UNIT-I

[A] PARTITION CO-EFFICIENT

[4Hrs.]

Explanation of Nernst distribution law and its conditions for the validity.

Complications arising in distribution law:

- (a) Association of solute in one of the phases.
- (b) Dissociation of solute in one of the phases.
- (c) Dissociation of solute in both the phases.

Derivation of distribution law from kinetic consideration

Explanation of solvent extraction process.

Numerical Problems

[B] ADSORPTION

[6Hrs.]

Adsorption and absorption, Heat of adsorption, Characteristics of adsorption, Physical adsorption and chemical adsorption.

Distinction between physical adsorption and chemical adsorption,

Freundlich's adsorption isotherm, Langmuir's adsorption

isotherm. Catalysis, General features of catalysis.

Heterogeneous catalysis, Adsorption theory of catalysis.

UNIT-II

THERMODYNAMICS :

[10Hrs.]

Free energy or work function [Gibbs free energy (G) and Helmholtz free energy (A)].
Derivation of Gibbs-Helmholtz equation.

Derivation of $G = G_0 + RT \ln p$. Helmholtz equation, Relation of ΔG and equilibrium constant K_p
(Van't Hoff isotherm and isochore)

Derivation of Clapeyron and Clausius-Clapeyron equation.

Application of Clausius-Clapeyron equation in the derivation of Molal elevation constant &
Molal depression constant. Numerical problems.



UNIT-III

[A] CONDUCTOMETRIC TITRATIONS:

[5Hrs.]

Principle, Types of conductometric titrations:

- (a) Strong acid v/s strong base
- (b) Strong acid v/s weak base
- (c) Weak acid v/s strong base
- (d) Weak acid v/s weak base
- (e) Mixture of Strong acid and weak acid v/s strong base
- (f) Precipitation titration of
 - (i) BaCl_2 v/s K_2CrO_4
 - (ii) NaCl v/s AgNO_3

Advantages of conductometric titrations over indicator method

[B] IONIC EQUILIBRIA

[5Hrs.]

Relation between degree of hydrolysis, Hydrolysis constant and pH of solutions of:

- (a) Salts of weak acid v/s strong base
- (b) Salts of strong acid v/s weak base
- (c) Salts of weak acid v/s weak base

Theories of acid-base indicators. Oswald and Quinonoid theories,

Choice of indicators, Indicator exponent and useful range of pH of an indicator.

Numerical Problems.

References:

1. Physical chemistry by Gurdeep Raj.
2. Physical chemistry by K.L.Kapoor vol.-I to IV [Pub. Macmillan]
3. Advanced Physical chemistry by D.N.Bajpai.
4. Text book of Physical chemistry by S.C. Khetepal & Yogeshwar Sharma. [Pub. R.Chand]
5. Physical chemistry by Puri & Sharma[S.Nagin & Co.]
6. A text book of Physical chemistry by A.S.Negi & Anand [New age International]
7. Physical chemistry by P.L.Soni & O.P.Dharmraj.
8. Physical chemistry by B.K.Sharma.
9. Essential of Physical chemistry by Bahl Tuli &Bahl.
10. Elemental Physical chemistry byGlasston & Lewis.
11. Physical chemistry by K.K.Sharma, L.K.Sharma [Vikas Publication House, New Delhi.]



VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

PROPOSED SYLLABUS FOR S.Y.B. SC. SEMESTER-IV (EFFECTIVE FROM 2020-21)

CHEMISTRY PRACTICALS

60 MARKS [EXTERNAL]

UNI. EXAM 2 DAYS

30 MARKS [INTERNAL]

INORGANIC QUALITATIVE ANALYSIS: [Minimum 8 inorganic mixtures]

LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS:

CHLORIDES: Bi^{+3} , Cu^{+2} , Cd^{+2} , Fe^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} ,

Na^{+} , K^{+} , NH_4^{+}

BROMIDES: Sr^{+2} , Na^{+} , K^{+} , NH_4^{+}

IODIDES: K^{+}

NITRITES: Na^{+} , K^{+}

NITRATES: Bi^{+3} , Pb^{+2} , Co^{+2} , Ni^{+2} , Ba^{+2} , Sr^{+2} , Na^{+} , K^{+} , NH_4^{+}

SULPHITES: Na^{+}

SULPHIDE: Zn^{+2} , Sb^{+3}

SULPHATES: Cu^{+2} , Cd^{+2} , Fe^{+2} , Al^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Zn^{+2} , Mg^{+2} , Na^{+} , K^{+} ,

NH_4^{+}

CARBONATES: Pb^{+2} , Bi^{+3} , Cu^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} ,

Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

PHOSPHATES: Cu^{+2} , Al^{+3} , Fe^{+3} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} ,

Sr^{+2} , Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

Inorganic qualitative analysis of mixture containing four radicals. The mixture may be soluble in water or dilute hydrochloric acid or concentrated hydrochloric acid excluding Arsenite, Arsenate, Chromates and Borate.

The following exercises should not be asked in the university examination.

1. Calibration of burette 50ml., Pipette 5ml, 10ml. & 25 ml., Measuring flasks 100 ml. and 250 ml.



ORGANIC ESTIMATIONS (Any 3 estimations should be done)

1. To determine the amount of acetamide in the given solution hydrolysis by NaOH.
2. To determine the amount of phenol/ Aniline in the given solution by bromination.
3. To determine the number of -COOH group of given carboxylic acid.
4. Percentage purity of L-ascorbic acid (Vitamin-c)

*Organic Preparation: (Minimum 3 should be done)

1. Anthraquinone from Anthracene
2. m-Dinitrobenzene from Benzene
3. p-Bromoacetanilide from Acetanilide
4. Naphthalene picrate from Naphthalene.

N.B. Preparation should be submitted with sample and justification (M.P. & C.T.)

[OR]

*Type of water insoluble organic solid mixture (Any four type)

PHYSICAL PRACTICALS:

1. pH metry:

To determine the normality of given mixture acid in ($\text{H}\bar{\text{A}}\text{c} + \text{HCl}$) pH-metrically using strong base.

2. Conductometric Titration:

To determine the normality of given mixture ($\text{H}\bar{\text{A}}\text{c} + \text{HCl}$) solution by conductometric titration with the given 0.1N NaOH solution.

3. Heat of solution:

To determine the heat of solution of organic acid (benzoic acid, phthalic acid) by finding the solubility of the acid at two different temperature

4. Surface Tension:

To determine the parachor of $-\text{CH}_2$ group of liquid: (Benzene, Toluene, Xylene)

5. Adsorption:

To study the adsorption of given organic acid (Acetic acid/ oxalic acid) on animal charcoal.

6. Relative strength:

To study the relative strength of two acids H_2SO_4 and HCl.

7. pH metry:

Determination of K_a of weak acid. To determination of ionisation constant of weak acid.

Minimum 3 experiments should be performed per semester.

Atleast one electrical instrumental exercise should be performed per semester.

