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VEER NARMAD SOUTH GUJARAT UNIVERSITY

University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India

વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી

યુનિવર્સિટી કેમ્પસ, ઉદ્ધના-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.

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## -: પરિપત્ર :-

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન રસાયણશાસ્ત્ર વિષય ચલાવતી સ્નાતક કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૦-૨૧ અમલમાં આવનાર S.Y.B.Sc. Semester – III & IV ના સિલેબસ અંગે રસાયણશાસ્ત્ર વિષયની અભ્યાસસમિતિની તા.૩૦/૧૨/૨૦૧૯ નાં ઠરાવ ક્રમાંક: ૨ અન્વયે નીચે મુજબ ભલામણ કરેલ છે. જે ભલામણ વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલએ તેની તા.૩૦/૬/૨૦૨૦ ની સભાના ઠરાવ ક્રમાંક:૨૮ અન્વયે સ્વીકારી મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્દુપરાંત તેનો અમલ કરવો.

રસાયણશાસ્ત્ર વિષયની અભ્યાસસમિતિની તા.૩૦/૧૨/૨૦૧૯ નાં ઠરાવ ક્રમાંક: ૨

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ-૨૦૨૦-૨૧ થી અમલમાં આવનાર S.Y.B.Sc. Semester-III & IV નો અભ્યાસક્રમ સર્વાનુમતે મંજૂર કરી તે મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૩૦/૦૬/૨૦૨૦ ની સભાનાં ઠરાવ ક્રમાંક: ૨૮

:: આથી ઠરાવવામાં આવે છે કે, રસાયણશાસ્ત્ર વિષયની અભ્યાસસમિતિએ તેની તા.૩૦/૧૨/૨૦૧૯ ની સભાના ઠરાવ ક્રમાંક : ૨ અન્વયે ભલામણ કરેલ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિજ્ઞાન વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ મંજૂર કરેલ શૈક્ષણિક વર્ષ-૨૦૨૦-૨૧ થી અમલમાં આવનાર S.Y.B.Sc. Semester-III & IV નો અભ્યાસક્રમ મંજૂર કરવામાં આવે છે.

બિડાણ: ઉપર મુજબ

ક્રમાંક : એકે./પરિપત્ર/૫૮૦૬/૨૦૨૦

તા. ૧૫-૦૭-૨૦૨૦

R. B. R. M.  
16-07-20

ઈ.ચા. કુલસચિવ

પ્રતિ,

- ૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન રસાયણશાસ્ત્ર વિષય ચલાવતી સ્નાતક કોલેજોનાં આચાર્યશ્રીઓ.
- ૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
- ૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારૂ.

Veer Narmad South Gujarat University, Surat  
Proposed Syllabus for S.Y.B. Sc.; Semester-III

(Effective from 2020-21)

Chemistry Paper-IV [Organic Chemistry]

50 Marks [External]

Total =30 Hrs.

20 Marks [Internal]

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Unit-I

[A] Organic Nitrogen compounds: [6Hrs.]

(i) Preparation and physical properties and chemical reactions of Nitriles, Isonitriles, Carbamates, Semicarbazides and their application in organic synthesis.

(ii) Structure and nomenclature of amines, Preparation of aryl amines, physical properties and chemical reactions. Gabriel-phthalimide reaction, Bromamide reaction.

[B] Carboxylic acid and its derivatives: [4Hrs.]

Structure and nomenclature of acid chloride, ester, amides of monocarboxylic acid; Method of formation of monocarboxylic acid derivatives and chemical reactions.

Unit-II

[A] Heterocyclic compounds: [5Hrs.]

(i) Classification and nomenclature :

(ii) Synthesis, Chemical properties and reactions of pyridine.

(iii) Skraup's synthesis and Friedlander synthesis of quinoline. Electrophilic substitution reactions, Nucleophilic substitution reactions, Oxidation reaction, Reduction reactions.

(iv) Synthesis, Reactivity and importance of Imidazole and Benzimidazole.

[B] Polycyclic aromatic Hydrocarbons: [5Hrs.]

(i) Classification and nomenclature :

(ii) Linear orthofused polycyclic hydrocarbons: Occurrence, synthesis of Tetracene, Pentacene and Hexacene.

(iii) Non-linear orthofused polycyclic hydrocarbons: Occurrence, synthesis of 1,2-benzanthracene, 1,2,5,6-di benzanthracene.

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(iv) Ortho-perifused polycyclic hydrocarbons: Occurance, synthesis of Pyrene, Perylene and Coronene.

### Unit-III

#### [A] Diazonium salts:

[6Hrs.]

(i) Mechanism of diazotisation and method of preparation of diazonium salts.

(ii) Nomenclature of diazonium salts.

(iii) Reactions of diazonium salts., Replacement reactions in which nitrogen atom is eliminated and reactions in which nitrogen atoms are retained

Application of diazonium salts. In the synthesis of aromatic compounds.

(iv) Laws of coupling , coupling agents, Definition of diazoamino and aminoazo compounds.

(v) Synthesis and uses of : Methyl orange, Methyl red, Congo red and Eriochrome Black-T.

#### [B] Use of reagents:

[4Hrs.]

Synthesis and applications of following reagents.

- (i) Anhydrous aluminium chloride
- (ii) N-bromo succinimide
- (iii) Selenium dioxide
- (iv) Lithium aluminium hydride.

#### 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, Merrut
- (4) Reaction and reagents In Organic synthesis by O.P. Agrawal Goel pub. House, Merrut.
- (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.

*Upadhyay*

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]

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**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,  $\beta$ -elimination, E1-mechanism, E2-mechanism, Stereo chemistry of elimination reactions, Elimination v/s substitution,

$\alpha$ -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

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(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  $\lambda_{\max}$  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, Merrut
- (4) Reaction and reagents In Organic synthesis by O.P. Agrawal Goel pub. House, Merrut.
- (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.

*M. Anand*

**Veer Narmad South Gujarat University, Surat**  
**Proposed Syllabus for S.Y.B. Sc. Semester-III**  
**(Effective from 2020-21)**

**Chemistry Paper-III [Inorganic Chemistry]**

**50 Marks [External]**

**Total =30 Hrs.**

**20 Marks [Internal]**

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**[A] Chemistry of Elements of first transition elements : [5 Hrs.]**

Characteristics properties of d-block elements, properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states.

**[B] Electronic configuration of atom; L-S coupling: [5 Hrs.]**

Introduction, L-S coupling, J-J coupling (introduction), Term symbol, Determination of microstate of  $P^2$ ,  $P^3$  system, Term symbol of C, N, O, Ni,  $Ni^{2+}$ , Fe,  $Fe^{2+}$ ,  $Fe^{3+}$ , Cr,  $Cr^{3+}$ ,  $Co^{2+}$ , V,  $V^{3+}$  and  $Cl^-$ .

**UNIT-II**

**[A] Purification of water [5 Hrs.]**

Classification and composition of water ( tap water, mineral water, portable water, distilled water ). Different methods of purification of water for potable and industrial purposes, Soft and hard water. Desalination of sea water by reverse osmosis and electro dialysis.

**[B] Paper chromatography : [5 Hrs.]**

Principles of chromatography, Classification of chromatography according to mobile phase and stationary phase. Types of paper chromatography, one dimensional, two dimensional and radial paper chromatography,  $R_f$  value, Use of paper chromatography in inorganic analysis (I, IIA, IIIB, IV, and halides).

**UNIT-III**

**Quantum Mechanics [10Hrs.]**

**[A] Derivation of the time independent Schrodinger equation, Wave function and probability function, Well behaved wave function, Particle in one –dimensional box and its importance.**

**[B] Operators (definition and derivation), Linear operators, Commutator operators, Vector operators, Laplacian operators, Hamiltonian operators, Hermitian operators. Derivation of Hamiltonian equation, Hamiltonian operators for H atom  $H_2^+$ ,  $He^{2+}$  and Li.**

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### 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, 3<sup>rd</sup> addition, Pearson publication.
21. General and Inorganic chemistry (part-I & II) by R. Sarkar, Books and Allied (P) ltd.

*Chandra*

**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]**

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**[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, protic non aqueous solvents (liquid ammonia, anhydrous sulphuric acid), aprotic solvents (liquid SO<sub>2</sub>).

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### 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).
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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.
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19. Industrial Chemistry by B. K. Sharma
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21. General and Inorganic chemistry (part-I & II) by R. Sarkar, Books and Allied (P) ltd.

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**Veer Narmad South Gujarat University, Surat**

**Proposed Syllabus for S.Y.B. Sc. Semester-III**

**( Effective from 2020-21)**

**Chemistry Paper-V [Physical Chemistry]**

**50 Marks [External]**

**Total =30 Hrs.**

**20 Marks [Internal]**

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**Unit-I**

**[A] THEORIES OF REACTION RATE**

**[4Hrs.]**

Derivation of Arrhenius equation. Collision theory of reaction rate, Energy of activation including determination, Effect of catalysis on energy activation.

Numerical problems

**[B] PHOTOCHEMISTRY**

**[6Hrs.]**

Introduction of photochemistry, Basics of electromagnetic radiations, Photons, Thermal and photochemical laws

(a) Grothus Draper's law

(b) Lambert Beer's law

(c) Einstein's law of photochemical equivalence . Quantum yield or efficiency.

Experimental determination of Quantum yields. Reasons of low and high quantum yield. Numerical problems

Primary and secondary photochemical reactions. Factors affecting quantum yield. (i.e. temperature, light intensity and inert gases).

Isomeric changes, Polymerisation, Photosensitization, Photo physical process

[Fluorescence, Phosphorescence]. Hemilunescence. Factor affecting Fluorescence, Phosphorescence.

**Unit-II**

**ELECTROLYTES OR ELECTROCHEMISTRY**

**[10Hrs.]**

Ions in solution, formation of ion in solution metallic conductance, Electrolytic conductance, Electrolysis migration of ions, Transport number of ions and its determination by moving boundary method.

Kohlraush law of ionic conductance. Application of Kohlraush law to

(a) Determination of degree of dissociation of weak electrolyte.

(b) Determination of equivalent conductivity of weak electrolyte at infinite dilution

(c) Determination of solubility and solubility product of sparingly soluble salts.

(d) Determination of ionic product of water.

Numerical problems

### Unit-III

#### MOLECULAR SPECTROSCOPY

[10Hrs.]

Electromagnetic radiation with wave length and energy. Radio frequency, Microwave, IR, UV-visible region,

Pure rotational spectra, Vibrational and Vibrational-Rotational spectra. Raman spectra,

Rotational spectra, calculation of bond length. Vibrational rotational spectra, Hook's law, Vibrational energy level.

Numerical Problems.

References:

1. Physical chemistry by Gurdeep Raj.
2. Physical chemistry by K.L.Kapoor vol.-I to IV [Pub. Macmilan]
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.]

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**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]**

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**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 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 Gibbs Hemholtz equation.

Derivation of  $G=G_0+RT\ln p$ . Hemholtz equation, Relation of  $\Delta G$  and equilibrium constant  $K_p$   
(Vant Hoff isotherm and isochore

Derivation of Clapeyron and Clapeyron-Claiius equation.

*Manish*

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

### 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)  $\text{BaCl}_2$  v/s  $\text{K}_2\text{CrO}_4$
  - (ii)  $\text{NaCl}$  v/s  $\text{AgNO}_3$

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 by Glasston & 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-III**

**(Effective from 2020-21)**

**Industrial Chemistry**

**Generic Elective Course**

**50 Marks [External]**

**Total =30 Hrs**

**20 Marks [Internal]**

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**Unit-I**

**[10Hrs.]**

[A] Synthetic fibers with flowsheet diagram:

(1) Tetrafluoroethylene, Teflon (2) Nylon-6,10 (3) DMT, Ethyleneglycol, Terylene

[B] Synthetic rubbers with flow sheet diagram:

(1) Isoprene, Polyisoprene (2) Silicone Rubber (3) Polyurethane rubber

[C] Plastics and Resins with flow sheet diagram:

(1) Urea formaldehyde resin, Bakelite (2) Vinylchloride, PVC (3) Vinylalcohol, Polyvinyl alcohol (4) Melamine and melamine resin (5) Bisphenol-A, Epoxy resin (6) Propylene, Polypropylene

**Unit-II**

**[10Hrs.]**

[A] Detergents:

(1) Propylene tetramer (2) ABS (3) LAS

[B] Explosives:

(1) RDX (2) Nitrocellulose (3) Glyceryl trinitrate (4) Trinitro phenol (5) TNT (6) Ammitol

**Unit-III**

**[10Hrs.]**

[A] Synthetic drugs:

(1) Novacaine (2) Novalgin (3) Paludrine (4) Paracetamol (5) Sulphathiazole (6) Benadryl

( Diphenyl hydramine)

[B] Synthetic dyes:

(1) 3-phenyl, 7-methoxy coumarine (2) Blankophore-B (3) Eriochrome Black-T

(4) Eosin (5) Alizarine (6) Indanthrene khaki-GG

[C] Acetylene: (1) Wulff Process (2) Sachsse Process

**Veer Narmad South Gujarat University, Surat**  
**Proposed Syllabus for S.Y.B. Sc.; Semester-IV**  
**(Effective from 2020-21)**

**Industrial Chemistry**  
**Generic Elective Course**

**50 Marks [External]**

**Total =30 Hrs.**

**20 Marks [Internal]**

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**Unit-I**

**[10Hrs.]**

[A] Inorganic Chemicals:

(1) Red Phosphorus (2) Sodium hexametaphosphate

(3)  $PCl_5$  (4) Phosphoric acid

[B] Industrial Preparation and uses of:

(1) Potassium permanganate (2) Bleaching powder by Bachmann's method

**Unit-II**

**[10Hrs.]**

[A] Fertilizers:

Definition and classification of fertilizers, Direct and indirect fertilizers, Natural and synthetic fertilizer, Symptoms of deficiency of some elements like N, K, and P.

Industrial Preparation of: Ammonium sulphate

Hazardous effect of used of fertilizers and its preventive measures, Mixed fertilizers, Complex fertilizers, Fertilizers grades, Fertilizers ratio, Fertilizers condition, Fertilizers filter.

**Unit-III**

**[10Hrs.]**

[A] Glasses: Classification, properties and uses of glasses

[B] Non Ferrous alloys : Monel metal, Duralumin, Wood metal, Babbit metal, Phosphorus bronze, Brass, German silver

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Veer Narmad South Gujarat University, Surat

Proposed Syllabus for S.Y.B. Sc.; Semester-III  
(Effective from 2020-21)

Chemistry Practicals

60 Marks [External]

Uni.Exam 2 days

30 Marks [Internal]

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Gravimetric Estimation of

- |   |   |
|---|---|
| (1) $\text{Fe}^{2+}$ as $\text{Fe}_2\text{O}_3$ | ( Given solution of $\text{Fe-NH}_4\text{-SO}_4 + \text{H}_2\text{SO}_4$ )  |
| (2) $\text{Ba}^{2+}$ as $\text{BaSO}_4$         | (Given solution of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O} + \text{HCl}$ ) |
| (3) $\text{Ni}^{2+}$ as $\text{Ni (DMG)}_2$     | (Given solution of $\text{NiCl}_2 \cdot 6\text{H}_2\text{O} + \text{HCl}$ ) |

VOLUMETRIC EXERCISE (Any three)

- (1) To determine the amount of Nickel by EDTA.
- (2) To determine the amount of Copper by EDTA.
- (3) To determine the amount of Zinc by EDTA.
- (4) Determination of total hardness of water by EDTA.

ORGANIC SPOTTING [ Minimum 8 organic substances ]

ACID : Salicylic acid, Cinnamic acid, Phenyl acetic acid, Sulphanilic acid.

PHENOL:  $\alpha$ -Naphthol,  $\beta$ -Naphthol, o-Nitrophenol

BASE: o-Nitroaniline, m-Nitroaniline, p-Nitroaniline, p-Toludine, p-Chloroaniline,

Diphenyl amine, Dimethylaniline, Diethylaniline

NEUTRAL:

ALDEHYDE: Glucose, Benzaldehyde

KETONE: Methyl ethyl ketone, Acetophenone

ESTER: Ethylacetate, Butylacetate

ALCOHOL: Ethanol, Butanol

HYDROCARBON: Anthracene, Naphthalene, Diphenyl

NITRO HYDROCARBON: m-Dinitrobenzene, Nitrobenzene

HALOGENATED HYDROCARBON: Chlorobenzene, Bromobenzene, p-Dichlorobenzene

AMIDE: Benzamide, Thiourea

ANILIDE: Acetanilide



## PHYSICAL PRACTICALS:

1. pH metry: To determine the normality of weak acid pH-metrically using strong base.  
[  $\text{CH}_3\text{COOH} \rightarrow \text{NaOH}$  ]

2 Conductometric Titration:

(i) To determine the normality of strong acid conductometrically using strong base [  $\text{HCl} \rightarrow \text{NaOH}$  ]

3 Conductometric Titration:

To determine the solubility of  $\text{PbSO}_4$ .

4 Viscosity :

To determine the viscosity of the liquids and the % of unknown mixture 'C'.

5. Chemical kinetics- Ester hydrolysis:

To study the hydrolysis of methyl acetate at two different concentration in 0.5N HCl. [ mono molecular reaction ]

6 . Partition co-efficient

# Minimum 3 experiments should be performed in a semester.

# **At least one electrical instrumental exercise should be performed per Semester.**

*Pranav*

Veer Narmad South Gujarat University, Surat

Proposed Syllabus for S.Y.B. Sc.; Semester-IV  
Chemistry Practicals

60 Marks [External]

Uni.Exam 2 days

30 Marks [Internal]

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INORGANIC QUALITATIVE ANALYSIS: [ Minimum 8 inorganic mixtures ]

LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS:

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

$\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

BROMIDES:  $\text{Sr}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

IODIDES:  $\text{K}^{+}$

NITRITES:  $\text{Na}^{+}$ ,  $\text{K}^{+}$

NITRATES:  $\text{Bi}^{+3}$ ,  $\text{Pb}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Sr}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

SULPHITES:  $\text{Na}^{+}$

SULPHIDE:  $\text{Zn}^{+2}$ ,  $\text{Sb}^{+3}$

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

$\text{NH}_4^{+}$

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

$\text{Mg}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

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

$\text{Sr}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

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. & 250 ml.

*(Signature)*

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 mix acid in  $\text{HAc} + \text{HCl}$  pH-metrically using strong base.
2. Conductometric Titration:
  - (i) To determine the normality of given mixture ( $\text{HAc} + \text{HCl}$ ) 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  $\text{H}_2\text{SO}_4$  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 in a semester.

# **Atleast one electrical instrumental exercise should be performed per semester.**

*Upanish*

# Veer Narmad South Gujarat University, Surat

## Syllabus for S.Y.B. Sc. Semester-III

(Effective from 2020-21)

### Chemistry Paper-III [Inorganic Chemistry]

50 Marks [External]

Total =30 Hrs.

20 Marks [Internal]

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[A] Chemistry of Elements of first transition elements : [5 Hrs.]

Characteristics properties of d-block elements, properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states.

[B] Electronic configuration of atom; L-S coupling: [5 Hrs.]

Introduction, L-S coupling, J-J coupling (introduction), Term symbol, Determination of microstate of  $P^2$ ,  $P^3$  system, Term symbol of C, N, O, Ni,  $Ni^{2+}$ , Fe,  $Fe^{2+}$ ,  $Fe^{3+}$ , Cr,  $Cr^{3+}$ ,  $Co^{2+}$ ,  $V$ ,  $V^{3+}$  and  $Cl^-$ .

#### UNIT-II

[A] Purification of water [5 Hrs.]

Classification and composition of water ( tap water, mineral water, portable water, distilled water ). Different methods of purification of water for potable and industrial purposes, Soft and hard water. Desalination of sea water by reverse osmosis and electro dialysis.

[B] Paper chromatography : [5 Hrs.]

Principles of chromatography, Classification of chromatography according to mobile phase and stationary phase. Types of paper chromatography, one dimensional, two dimensional and radial paper chromatography,  $R_f$  value, Use of paper chromatography in inorganic analysis (I, IIA, IIIB, IV, and halides).

#### UNIT-III

Quantum Mechanics [10Hrs.]

[A] Derivation of the time independent Schrodinger equation, Wave function and probability function, Well behaved wave function, Particle in one –dimensional box and its importance.

[B] Operators (definition and derivation), Linear operators, Commutator operators, Vector operators, Laplacian operators, Hamiltonian operators, Hermitian operators. Derivation of Hamiltonian equation, Hamiltonian operators for H atom  $H_2^+$ ,  $He^{2+}$  and Li.

## **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, 3<sup>rd</sup> 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**

**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]**

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**[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 SO<sub>2</sub>).

## **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, 3<sup>rd</sup> 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**

**Syllabus for S.Y.B. Sc.; Semester-III**

**(Effective from 2020-21)**

**Chemistry Paper-IV [Organic Chemistry]**

**50 Marks [External]**

**Total =30 Hrs.**

**20 Marks [Internal]**

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**Unit-I**

**[A] Organic Nitrogen compounds: [6Hrs.]**

(i) Preparation and physical properties and chemical reactions of Nitriles, Isonitriles, Carbamates, Semicarbazides and their application in organic synthesis.

(ii) Structure and nomenclature of amines, Preparation of aryl amines, physical properties and chemical reactions. Gabriel-phthalimide reaction, Bromamide reaction.

**[B] Carboxylic acid and its derivatives: [4Hrs.]**

Structure and nomenclature of acid chloride, ester, amides of monocarboxylic acid; Method of formation of monocarboxylic acid derivatives and chemical reactions.

**Unit-II**

**[A] Heterocyclic compounds: [5Hrs.]**

(i) Classification and nomenclature :

(ii) Synthesis, Chemical properties and reactions of pyridine.

(iii) Skraup's synthesis and Friedlander synthesis of quinoline. Electrophilic substitution reactions, Nucleophilic substitution reactions, Oxidation reaction, Reduction reactions.

(iv) Synthesis, Reactivity and importance of Imidazole and Benzimidazole.

**[B] Polycyclic aromatic Hydrocarbons: [5Hrs.]**

(i) Classification and nomenclature :

(ii) Linear orthofused polycyclic hydrocarbons: Occurrence, synthesis of Tetracene, Pentacene and Hexacene.

(iii) Non-linear orthofused polycyclic hydrocarbons: Occurrence, synthesis of 1,2-benzanthracene, 1,2,5,6-di benzanthracene.



(iv) Ortho-perifused polycyclic hydrocarbons: Occurance, synthesis of of Pyrene, Perylene and Coronene.

### Unit-III

#### [A] Diazonium salts:

[6Hrs.]

(i) Mechanism of diazotisation and method of preparation of diazonium salts.

(ii) Nomenclature of diazonium salts.

(iii) Reactions of diazonium salts., Replacement reactions in which nitrogen atom is eliminated and reactions in which nitrogen atoms are retained

Application of diazonium salts. In the synthesis of aromatic compounds.

(iv) Laws of coupling , coupling agents, Definition of diazoamino and aminoazo compounds.

(v) Synthesis and uses of : Methyl orang, Methyl red, congo red and Erichrome Black-T.

#### [B] Use of reagents:

[4Hrs.]

Synthesis and applications of following reagents.

- (i) Anhydrous aluminium chloride
- (ii) N-bromo succinimide
- (iii) Selenium dioxide
- (iv) Lithium aluminium hydride.

#### Reference books:

- (1) Organic Chemistry by R.T.Morison 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, Merrut
- (4) Reaction and reagents In Organic synthesis by O.P.Agrawal Goel pub. House, Merrut.
- (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. Pretice Hall.

**Veer Narmad South Gujarat University, Surat**

**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]**

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**Unit-I**

**[A] NAME REACTIONS: [7Hrs.]**

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

- (1) Fridle 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,  $\beta$ -elimination, E1-mechanism, E2-mechanism, Stereo chemistry of elimination reactions, Elimination v/s substitution,

$\alpha$ -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  $\lambda_{\text{max}}$  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, Merrut
- (4) Reaction and reagents In Organic synthesis by O.P. Agrawal Goel pub. House, Merrut.
- (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**

**Syllabus for S.Y.B. Sc. Semester-III**

**( Effective from 2020-21)**

**Chemistry Paper-V [Physical Chemistry]**

**50 Marks [External]**

**Total =30 Hrs.**

**20 Marks [Internal]**

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**Unit-I**

**[A] THEORIES OF REACTION RATE**

**[4Hrs.]**

Derivation of Arrhenius equation. Collision theory of reaction rate, Energy of activation including determination, Effect of catalysis on energy activation.

Numerical problems

**[B] PHOTOCHEMISTRY**

**[6Hrs.]**

Introduction of photochemistry, Basics of electromagnetic radiations, Photons, Thermal and photochemical laws

- (a) Grothus Draper's law
- (b) Lambert Beer's law
- (c) Einstein's law of photochemical equivalence . Quantum yield or efficiency. Experimental determination of Quantum yields. Reasons of low and high quantum yield. Numerical problems  
Primary and secondary photochemical reactions. Factors affecting quantum yield. (i.e. temperature, light intensity and inert gases).  
Isomeric changes, Polymerisation, Photosensitization, Photo physical process [Fluorescence, Phosphorescence]. Hemilunescence. Factor affecting Fluorescence, Phosphorescence.

**Unit-II**

**ELECTROLYTES OR ELECTROCHEMISTRY**

**[10Hrs.]**

Ions in solution, formation of ion in solution metallic conductance, Electrolytic conductance, Electrolysis migration of ions, Transport number of ions and its determination by moving boundary method.

Kohlraush law of ionic conductance. Application of Kohlraush law to

- (a) Determination of degree of dissociation of weak electrolyte.
- (b) Determination of equivalent conductivity of weak electrolyte at infinite dilution
- (c) Determination of solubility and solubility product of sparingly soluble salts.
- (d) Determination of ionic product of water.

Numerical problems

### Unit-III

#### MOLECULAR SPECTROSCOPY

[10Hrs.]

Electromagnetic radiation with wave length and energy. Radio frequency, Microwave, IR, UV-visible region,

Pure rotational spectra, Vibrational and Vibrational-Rotational spectra. Raman spectra,

Rotational spectra, calculation of bond length. Vibrational rotational spectra, Hook's law, Vibrational energy level.

Numerical Problems.

References:

1. Physical chemistry by Gurdeep Raj.
2. Physical chemistry by K.L.Kapoor vol.-I to IV [Pub. Macmilan]
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**

**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]**

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**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  $\Delta G$  and equilibrium constant  $K_p$  (Van't Hoff isotherm and isochore)

Derivation of Clapeyron and Clapeyron-Claius equation.

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

### 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)  $\text{BaCl}_2$  v/s  $\text{K}_2\text{CrO}_4$
  - (ii)  $\text{NaCl}$  v/s  $\text{AgNO}_3$

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.
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**Veer Narmad South Gujarat University, Surat**

**Syllabus for S.Y.B. Sc.; Semester-III**

**(Effective from 2020-21)**

**Industrial Chemistry**

**Generic Elective Course**

**50 Marks [External]**

**Total =30 Hrs**

**20 Marks [Internal]**

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**Unit-I**

**[10Hrs.]**

[A] Synthetic fibers with flowsheet diagram:

(1) Tetrafluoroethylene, Teflon (2) Nylon-6,10 (3) DMT, Ethyleneglycol, Terylene

[B] Synthetic rubbers with flow sheet diagram:

(1) Isoprene, Polyisoprene (2) Silicone Rubber (3) Polyurethane rubber

[C] Plastics and Resins with flow sheet diagram:

(1) Urea formaldehyde resin, Bakelite (2) Vinylchloride, PVC (3) Vinylalcohol, Polyvinyl alcohol (4) Melamine and melamine resin (5) Bisphenol-A, Epoxy resin (6) Propylene, Polypropylene

**Unit-II**

**[10Hrs.]**

[A] Detergents:

(1) Propylene tetramer (2) ABS (3) LAS

[B] Explosives:

(1) RDX (2) Nitrocellulose (3) Glyceryl trinitrate (4) Trinitro phenol (5) TNT (6) Ammitol

**Unit-III**

**[10Hrs.]**

[A] Synthetic drugs:

(1) Novacaine (2) Novalgin (3) Paludrine (4) Paracetamol (5) Sulphathiazole (6) Benadryl  
( Diphenyl hydramine)

[B] Synthetic dyes:

(1) 3-phenyl, 7-methoxy coumarine (2) Blankophore-B (3) Eriochrome Black-T

(4) Eosin (5) Alizarine (6) Indanthrene khaki-GG

[C] Acetylene: (1) Wulff Process (2) Sachsse Process



**Veer Narmad South Gujarat University, Surat**

**Syllabus for S.Y.B. Sc.; Semester-IV**

**(Effective from 2020-21)**

**Industrial Chemistry**

**Generic Elective Course**

**50 Marks [External]**

**Total =30 Hrs.**

**20 Marks [Internal]**

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**Unit-I**

**[10Hrs.]**

[A] Inorganic Chemicals:

- (1) Red Phosphorus (2) Sodium hexametaphosphate  
(3)  $\text{PCl}_5$  (4) Phosphoric acid

[B] Industrial Preparation and uses of:

- (1) Potassium permanganate (2) Bleaching powder by Bachmann's method

**Unit-II**

**[10Hrs.]**

[A] Fertilizers:

Definition and classification of fertilizers, Direct and indirect fertilizers, Natural and synthetic fertilizer, Symptoms of deficiency of some elements like N, K, and P.

Industrial Preparation of: Ammonium sulphate

Hazardous effect of used of fertilizers and its preventive measures, Mixed fertilizers, Complex fertilizers, Fertilizers grades, Fertilizers ratio, Fertilizers condition, Fertilizers filter.

**Unit-III**

**[10Hrs.]**

[A] Glasses: Classification, properties and uses of glasses

[B] Non Ferrous alloys : Monel metal, Duralumin, Wood metal, Babbit metal, Phosphorus bronze, Brass, German silver

# Veer Narmad South Gujarat University, Surat

## Syllabus for S.Y.B. Sc.; Semester-III (Effective from 2020-21) Chemistry Practicals

**60 Marks [External]**

**Uni.Exam 2 days**

**30 Marks [Internal]**

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Gravimetric Estimation of

- |   |   |
|---|---|
| (1) $\text{Fe}^{2+}$ as $\text{Fe}_2\text{O}_3$ | ( Given solution of $\text{Fe-NH}_4\text{-SO}_4 + \text{H}_2\text{SO}_4$ )  |
| (2) $\text{Ba}^{2+}$ as $\text{BaSO}_4$         | (Given solution of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O} + \text{HCl}$ ) |
| (3) $\text{Ni}^{2+}$ as $\text{Ni (DMG)}_2$     | (Given solution of $\text{NiCl}_2 \cdot 6\text{H}_2\text{O} + \text{HCl}$ ) |

VOLUMETRIC EXERCISE (Any three)

- (1) To determine the amount of Nickel by EDTA.
- (2) To determine the amount of Copper by EDTA.
- (3) To determine the amount of Zinc by EDTA.
- (4) Determination of total hardness of water by EDTA.

ORGANIC SPOTTING [ Minimum 8 organic substances ]

ACID : Salicylic acid, Cinnamic acid, Phenyl acetic acid, Sulphanilic acid.

PHENOL:  $\alpha$ -Naphthol,  $\beta$ -Naphthol, o-Nitrophenol

BASE: o-Nitroaniline, m-Nitroaniline, p-Nitroaniline, p-Toludine, p-Chloroaniline,

Diphenyl amine, Dimethylaniline, Diethylaniline

NEUTRAL:

ALDEHYDE: Glucose, Benzaldehyde

KETONE: Methyl ethyl ketone, Acetophenone

ESTER: Ethylacetate, Butylacetate

ALCOHOL: Ethanol, Butanol

HYDROCARBON: Anthracene, Naphthalene, Diphenyl

NITRO HYDROCARBON: m-Dinitrobenzene, Nitrobenzene

HALOGENATED HYDROCARBON: Chlorobenzene, Bromobenzene, p-Dichlorobenzene

AMIDE: Benzamide, Thiourea

ANILIDE: Acetanilide

## PHYSICAL PRACTICALS:

1. pH metry: To determine the normality of weak acid pH-metrically using strong base.  
[  $\text{CH}_3\text{COOH} \rightarrow \text{NaOH}$  ]

2 Conductometric Titration:

(i) To determine the normality of strong acid conductometrically using strong base [  $\text{HCl} \rightarrow \text{NaOH}$  ]

3 Conductometric Titration:

To determine the solubility of  $\text{PbSO}_4$ .

4 Viscosity :

To determine the viscosity of the liquids and the % of unknown mixture 'C'.

5. Chemical kinetics- Ester hydrolysis:

To study the hydrolysis of methyl acetate at two different concentration in 0.5N HCl. [ mono molecular reaction ]

6 . Partition co-efficient

# Minimum 3 experiments should be performed in a semester.

# **At least one electrical instrumental exercise should be performed per Semester.**

# Veer Narmad South Gujarat University, Surat

## Syllabus for S.Y.B. Sc.; Semester-IV Chemistry Practicals

**60 Marks [External]**

**Uni.Exam 2 days**

**30 Marks [Internal]**

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INORGANIC QUALITATIVE ANALYSIS: [ Minimum 8 inorganic mixtures ]

LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS:

CHLORIDES:  $\text{Bi}^{+3}$ ,  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ ,  $\text{Fe}^{+3}$ ,  $\text{Mn}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Ca}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Sr}^{+2}$ ,  
 $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

BROMIDES:  $\text{Sr}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

IODIDES:  $\text{K}^{+}$

NITRITES:  $\text{Na}^{+}$ ,  $\text{K}^{+}$

NITRATES:  $\text{Bi}^{+3}$ ,  $\text{Pb}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Sr}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

SULPHITES:  $\text{Na}^{+}$

SULPHIDE:  $\text{Zn}^{+2}$ ,  $\text{Sb}^{+3}$

SULPHATES:  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ ,  $\text{Fe}^{+2}$ ,  $\text{Al}^{+3}$ ,  $\text{Mn}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Zn}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  
 $\text{NH}_4^{+}$

CARBONATES:  $\text{Pb}^{+2}$ ,  $\text{Bi}^{+3}$ ,  $\text{Cu}^{+2}$ ,  $\text{Zn}^{+2}$ ,  $\text{Mn}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Ca}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Sr}^{+2}$ ,  
 $\text{Mg}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

PHOSPHATES:  $\text{Cu}^{+2}$ ,  $\text{Al}^{+3}$ ,  $\text{Fe}^{+3}$ ,  $\text{Zn}^{+2}$ ,  $\text{Mn}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Ca}^{+2}$ ,  $\text{Ba}^{+2}$ ,  
 $\text{Sr}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{NH}_4^{+}$

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. & 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 mix acid in  $\text{H}\bar{\text{A}}\text{c} + \text{HCl}$  pH-metrically using strong base.
- 2 Conductometric Titration:
  - (i) 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  $\text{H}_2\text{SO}_4$  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 in a semester.

**# Atleast one electrical instrumental exercise should be performed per semester.**