# RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS)

## LATUR – 413512

## DEPARTMENT OF CHEMISTRY


## Syllabus

## B.Sc. (Third Year) Chemistry

## (V & VI Semester)

## With Effect From 2018-2019

**Rajarshi shahu Mahavidyalaya, (Autonomous) Latur-413512**

**B.Sc. Third Year (Semester – V)**

**w.e.f. 2018-19**

| Paper | Course Code | Course Title | Periods Per Week | Total Periods | Marks | Credits |
|---|---|---|---|---|---|---|
| IX | U-CHE-557 | Physical and Inorganic Chemistry | 03 | 30+15=45 | 50 | 02 |
| X | U-CHE-558 | Organic and Inorganic Chemistry | 03 | 30+15=45 | 50 | 02 |
| VII | U-CHE-559 | Laboratory Course - VII | 03 | 45 | 50 | 02 |
| VIII | U-CHE-560 | Laboratory Course – VIII | 03 | 45 | 50 | 02 |
| | | **Total** | | | **200** | **08** |

**B.Sc. Third Year (Semester – VI)**

**w.e.f.2018-19**

| Paper | Course Code | Course Title | Periods Per Week | Total Periods | Marks | Credits |
|---|---|---|---|---|---|---|
| XI | U-CHE-657 | Physical and Inorganic Chemistry | 03 | 30+15=45 | 50 | 02 |
| XII | U-CHE-658 | Organic and Inorganic Chemistry | 03 | 30+15=45 | 50 | 02 |
| IX | U-CHE-659 | Laboratory Course - IX | 03 | 45 | 50 | 02 |
| X | U-CHE-660 | Laboratory Course – X | 03 | 45 | 50 | 02 |
| | | **Total** | | | **200** | **08** |

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**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur.**

**Faculty of Science**

**B.Sc. III Year (Semester - V)**

**Chemistry – IX**

**Paper Code : U-CHE-557**

**Section A**

**(Physical Chemistry & Inorganic Chemistry)**

**Marks: 50** **Periods: 45**

**Credit: 02** **Weeks: 06**

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**Learning Objective:**

1. To learn the basic concepts like planks quantum theory, photoelectric effect.

2.To understand the concepts of surface chemistry,types of adsorption, Freundlic adsorption isotherm etc.

3.To introduce the students about Molecular Spectroscopy

4.Learn about role, applications of bio inorganic chemistry

5. Know about properties of d-block elements (First transition series)

**Course Outcome:**

After successful completion of the course the students will :

1.Learn about the planks quantum theory, Compton effect, Heisenberg's uncertainity principle.

2.know the difference between different types of adsorption,and adsorption isotherm phenomenon.

3.Familiarize with principles of Molecular Spectroscopy and their applications.

4.Understand the functions of various biomolecules like hemoglobin,myoglobin etc.

5.Familiarize with firsr transition series and their properties.

## a. (Physical Chemistry)

**Unit - I Quantum Chemistry : 11 Periods**

1.1. Introduction: Origin of quantum mechanics, limitations of classical mechanics.

1.2 Black body radiation, Stefan – Boltzmann law.

1.3 Planck's quantum theory of radiation.

1.4 Photoelectric effect, explanation on the basis of quantum theory.

1.5 Compton effect.

1.6 De-Broglie hypothesis – Derivation of de-Broglie equation, explanation.

1.7 Davisson – Germer experiment.

1.8 Heisenberg's uncertainty principle, (Statement, explanation)

1.9 Schrodinger wave equation: Derivation in time independent form. Laplacian operator form. Physical significance of $\Psi$ and $\Psi^2$.

1.10 Postulates of quantum mechanics.

**Unit II – Surface chemistry 05 Periods**

2.1 Introduction – Adsorption, Mechanism of adsorption, factors affecting adsorption, difference between adsorption and absorption.

2.2 Types of adsorption – physical adsorption and chemical adsorption.

2.3 Adsorption of gases by solids.

2.4 Adsorption isotherm: Freundlich adsorption isotherm and Langmuir adsorption isotherm.

**Unit III – Molecular Spectroscopy 14 Periods**

3.1 Introduction – Electromagnetic radiation and its characteristics, Electromagnetic spectrum,

introduction to atomic and molecular spectroscopy.

3.2 Rotational Spectra – Principle, condition, classification of molecules, rotational spectra of

diatomic molecules – Rigid rotator (Model), effect of isotopic substitution, applications,

numaericals on bond length.

3.3 Vibrational Spectra – Principle, condition, simple harmonic oscillator (Model),

force

constant and bond energies, applications, numerical on force constant.

3.4 Raman spectra – Introduction, condition, concept of polarizability, quantum theory of

Raman scattering, applications.

3.5 Electronic Spectra – Concept of potential energy curve, Frank – Condon principle,

types of electronic transitions, applications.

## b. (Inorganic Chemistry)

**Unit – I : Bio Inorganic chemistry : 05 Periods**

Definition of Bio-Inorganic chemistry, Essential and Trace elements of Biological importance, Criteria for essential elements. Structure of Metalloporphyrin, Myoglobin and Haemoglobin. Role of myoglobin and haemoglobin in biological process $Na^+$ - $K^+$ pump. Haemoglobin as oxygen and $CO_2$ carrier. Nitrogen fixation : Natural and Artificial Nitrogen cycle.

**Unit – II : d-Block Elements : 10 Periods**

Definition, Elements of first, second and third transition series, Electronic configuration of first transition series. General characteristics of d-block elements, properties of d-block elements (First transition series) such as : Metallic character. Atomic and ionic radii, Melting and Boiling Points, Ionisation enthalpies Reactivity, Oxidation states, Standard electrode potentials, Reducing properties, Colour of ions, Magnetic properties, Catalytic properties and Complex forming tendency.

**B.Sc. III Year (Semester - V)**
**Chemistry – X**
**Paper Code : U-CHE-558**
**Section B**
**(Organic Chemistry & Inorganic Chemistry)**

**Marks: 50** **Periods: 45**
**Credit: 02** **Weeks: 06**

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**Learning Objective:**

1. To write the reactions for synthesis of Polynuclear hydrocarbons and heterocyclic compounds with mechanism

2. To know about synthetic dyes, drugs, pesticides and their preparations.

3.To understand the classification,Constitution and synthesis of Alkaloids and vitamins.

4.Learn the properties of Lanthanids and their uses.

5.Know about nature of radioactive radiations, Stability of the nucleus etc.

**Course Outcome:**

After successful completion of the course the students will :

1.Write the reactions for synthesis of naphthalene, anthracene, furan,pyridine etc.with their mechanism

2.Know about methyl orange, Crystal – violet, tolbutamide,paracetamol, sulphanilamide benzocaine and their preparation methods.

3.Can understand the classification,Constitution and synthesis of alkaloids and vitamins.

4.Learn the properties of lanthanids like oxidation states, ionic radii and lanthanide contraction and their uses.

5.Know about nature of radioactive radiations, Stability of the nucleus etc.

## a. (Organic Chemistry)

**Unit – I Polynuclear Hydrocarbons and Heterocyclic Compounds : 05 Periods**

**I) Polynuclear Hydrocarbons :** Introduction and Classification :

A) **Naphthalene :** Isolation from Coal tar.

i) Synthesis from : 1) 4 – phenylbut-1-ene, 2) Haworth's synthesis.

ii) Physical Properties :

iii) Chemical Properties : a) Reduction b) Electrophilic substitution reactions.

B) **Anthracene** : Isolation from Coal tar.

Synthesis from : 1) Naphthaquinone, 2) o-bromobenzyl bromide.

Physical Properties & Chemical properties:

a) Oxidation b) Diels–Alder reaction c) Electrophilic substitution reactions

**II) Heterocyclic Compounds :**

i) Introduction, classification and nomenclature of heterocyclic compounds.

ii) Molecular orbital and resonance structure of five membered and six membered rings.

iii) General electrophilic substitution reactions & their mechanism.

**A) Five membered Heterocyclics :**

**I) Furan : (Oxole)**

i) Synthesis from : 1) Mucic acid, 2) succinaldehyde.

ii) Physical properties.

iii) Chemical properties : a) Basic nature b) Reduction c) Diels – Alder reaction

d) Electrophilic substitution reactions – Nitration, Sulphonation, Halogenation, Friedel – Craft's acylation, Gattermann-Koch, reaction Gomberg reaction & reaction with n-butyl lithium.

**II) Pyrrole : (Azole) :**

i) Synthesis from : 1) Furan & 2) Acetylene.

ii) Physical properties.

iii) Chemical properties : a) Acidic character b) Reduction c) Oxidation

d) Ring expansion e) Electrophilic substitution reactions – Nitration, Sulphonation, Halogenation, Friedel – Craft's acylation, Gattermann reaction, Reimer- Tieman reaction and coupling reaction.

**III) Thiophene : (Thiole) :**

i) Synthesis from : 1) n-butane and 2) sodium succinate.

ii) Physical properties.

iii) Chemical properties – a) Reduction b) Electrophilic substitution reactions – Nitration Sulphonation, Halogenation, Friedel – Craft's acylation chloromethylation, Mercuration and reaction with n-butyl lithium.

**B) Six – membered Heterocyclics :**

**I) Pyridine : (Azine) :**

i) Synthesis from : 1) Acetylene, and 2) pentamethylene diamine hydrochloride.

ii) Physical properties.

iii) Chemical properties – a) Basic character b) reduction c) Oxidation

d) Electrophilic substitution reactions – Nitration & Sulphonation

e) Nucleophilic substitution reactions – Amination (mechanism).

**C) Condensed – Heterocyclics :**

**I) Indole (Benzopyrrole) :**

i) Synthesis by : 1) Fischer Indole synthesis and 2) Reissert Indole synthesis.

ii) Electrophilic substitution reactions.

**II) Quinoline (Benzopyridine)**

i) Synthesis by : 1) Skraup synthesis & 2) Friedlander synthesis.

ii) Electrophilic substitution reactions.

**10**

**Unit II – Synthetic dyes, drugs and pesticides : Periods**

**I) Synthetic dyes :**

i) Introduction

ii) Qualities of a good dye.

iii) Colour and chemical constitution (a) Witt's theory (b) Armstrong's theory.

iv) Synthesis and uses of the following :

| | |
|---|---|
| a) Methyl orange | b) Phenolphthalein |
| c) Congo-Red | d) Malachite – Green |
| e) Alizarin | f) Crystal – violet |
| g) Rosaniline | h) Diamond black – F |

**II) Synthetic drugs :**

i) Introduction

ii) Qualities of a good drug.

iii) Classification of drugs based on their therapeutic action.

a) Functional drugs: Anaesthetics, antipyretics, analgesics, antidiabetics, sedatives, hypnotics, tranquillizers & anti-inflammatory.

b) Chemotherapeutics : Antibiotics, Antibacterials, antimalarials, antituberculars, antiseptics, antifungals, antivirals and disinfectants.

iv) Synthesis and uses of the following :

a) Tolbutamide b) Paracetamol

c) Sulphanilamide d) Benzocaine

e) Isoniazide

**III) Pesticides :**

i) Introduction

ii) Classification

iii) Impact of pesticides on human health.

iv) Synthesis and uses of the following.

a) 2, 4, 5 – T b) Methoxylchlor

c) Malathion d) Carbaryl

**Unit III – Alkaloids and vitamins : 08 periods**

**I) Alkaloids :**

i) Introduction

ii) Occurrence and extraction.

iii) Classification & general properties.

iv) Determination of chemical constitution of alkaloids.

v) Constitution of the following alkaloids :

a) Nicotine : (Synthesis from : nicotinonitrile)

b) Piperine : (Synthesis from piperic acid)

**II) Vitamins :**

i) Introduction, Classification, Provitamins & Precursors.

ii) Source, overdose and deficiency diseases of the following vitamins :

a) Fat soluble vitamins : vitamin – A, D,E & K.

b) Water soluble vitamins : $B_1$, $B_2$, $B_3$, $B_6$, $B_{12}$ and vitamin – C.

## b (Inorganic Chemistry)

**Unit – I : f- Block Elements (Lanthanides) : 07 Periods**

Definition, position in periodic table, Electronic configuration, Oxidation states, Ionic radii and Lanthanide contraction, Its consequences, Colour of ions, Magnetic properties, Oxidation potential, Basic character of hydroxides, Chemical reactivity, Complexing ability, Important minerals of lanthanides, Separation of lanthanides by ion exchange method and solvent extraction method. Uses of lanthanides.

**Unit – II : Radioactivity – I : 08 Periods**

Definition, Nature of radioactive radiations, Stability of the nucleus, Factors affecting nuclear stability – Nuclear force, Nuclear size. Nuclear density, Packing fraction Mass defect Nuclear binding energy, Odd and Even number of nucleons, Problems based on packing fraction, Mass defect and Binding energy.

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**Faculty of Science**

**B.Sc. III Year (Semester - V)**

**Paper Code : U-CHE-559**

## Laboratory Course – VII

**Marks: 50** **Periods: 45**

**Credit: 02** **Weeks: 06**

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**Learning Objective:**

1.To acquire practical knowledge of using colorimeter

2.To learn for determination of the rate constant of the reaction, molecular weight and analyse the ores

**Course Outcome:**

1.Students can acquire practical knowledge of to handle colorimeter and perform experiments.

2.They can determine the rate constant of the reaction, molecular weight and analyse the ores like haematite, bauxite pyrolusite etc.

Note : At least eight experiments be completed (six from Section-A & two from Section–B)

### Section A : (Physical Chemistry)

**Instrumental :**

1) Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.
2) Determine the concentrations of KMnO4 and K2Cr2O7 in a mixture colourimetricaly.
3) To determine the specific refractivity's of the given liquids A and B and their mixture and hence determine the percentage composition their mixture C.
4) Determine the concentration of $Cu^{2+}$ ion in given solution, titrating it against std. EDTA solution by colorimetric measurements.
5) Determine the empirical formula of a complex between $Fe^{3+}$ and 5-Sulphosalicylic acid by Job's method colorimetrically.
6) Determine the equivalent conductance of a strong electrolyte at several concentration and hence verify the Onsager's equation.

**Non instrumental :**

1) To determine molecular weight of high polymer (Polyvinyl alcohol) by viscosity measurements.
2) To Separate of mixture of o- & p-nitro anilines on an alumina column.
3) Determine interfacial tension between immiscible liquids (benzene and water) by stalagmometer.
4) To study the kinetics of dissolution of magnesium metal in dil. HCl.
5) The study of energy of activation of second order reaction i.e. reaction between $K_2S_2O_8$ and KI (Unequal concentrations).
6) Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated
   charcoal

## Section B : (Inorganic Chemistry)

Analysis of Ores

a) Analyse the Haematite ore for iron content volumetrically.
b) Analyse the dolomite ore for calcium content by EDTA method.
c) Analyse the pyrolusite ore for manganese content by oxalic acid method.
d) Analyse the bauxite ore for aluminium content by oxinate method.

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur.**

**Faculty of Science**

**B.Sc. III Year (Sem V)**

**Paper Code : U-CHE-560**

**Laboratory Course – VIII**

**Marks: 50** **Periods: 45**

**Credit: 02** **Weeks: 06**

**Learning Objective:**

1.To gain thorough knowledge regarding organic preparations like diazotization, acetlyation, benzoylation etc.

2.To learn about analysis of alloys and determine its inorganic ion volumetrically,and gravimetrically.

Course Outcome:

1.Students can know the knowledge regarding organic preparations like diazotization, acetlyation, benzoylation etc.

2.Can do analysis of alloys and determine its inorganic ion volumetrically,and gravimetrically.

Note : At least eight experiments be completed (six from Section A & two from Section – B)

## Section A : (Organic Chemistry)

**1) Organic Preparations : (Any Six)**

(Weight of crude product, crude % yield, recrystallisation of crude product and its melting point expected)

a) Electrophilic Substitution :

I) Preparation of p-nitroacetanilide from acetanilide (Nitration)

II) Preparation of 2, 4, 6 – Tribromoaniline from aniline (Bromination)

b) Diazotisation :

I) Preparation of methylorange / methylred.

II) Preparation of o – chlorobenzoic acid from anthyanilic acid.

III) Preparation of p-iodonitrobenzene from p – nitroaniline.

c) Acetlyation :

I) Preparation of acetanilidc / glucose pentaacetate.

II) Preparation of – naphthyl acetate from - naphthol.

d) Hydrolysis :

I) Preparation of p-nitroaniline from p-nitroacetanilide.

II) Preparation of p-bromo aniline from p – bromoacetanilide.

e) Reduction :

I) Preparation of m-nitroaniline from m-dinitrobenzene.

f) Hofmann bromamide Reaction :

I) Preparation of anthranilic acid from phthalimide.

g) Benzoylation :

I) Preparation of benzanilide from aniline.

II) Preparation of napthylbenzoate from – naphthol.

h) Amide formation :

I) Preparation of benzamide from benzoicacid.

i) Oxidation : Preparation of benzoic acid from Toluene.

**Section – B (Inorganic Chemistry)**

Analysis of Alloys (Any Two)

a) Analyse the brass alloy for copper content volumetrically.

b) Analyse the Nickel coin (White) for Nickel Content gravimetrically.

c) Analyse the soldermetal for lead content gravimetrically.

d) Analyse the stainless steel for iron content volumetrically.

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**(Autonomous), Latur.**

**Faculty of Science**

**B.Sc. III Year (Semester - VI)**
**Chemistry –XI**
**Paper Code : U-CHE-657**
**Section A**
**(Physical Chemistry & Inorganic Chemistry)**

**Marks: 50** **Periods:45**
**Credit: 02** **Weeks: 06**

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**Learning Objective:**

1.To understand the concept of electrochemical cells, Nernst equation, application of EMF

measurement etc.

2.To learn about Gibbs free energy, Nerns't heat theorem, variation of chemical potential.

3.Familiarize with synthesis and characterization of nanomaterials.

4. Learn the properties of actinides, uses of actinides.

5.To understand nuclear reactions, Q – Value of the nuclear reactions.

**Course Outcome:**

After successful completion of the course the students will :

1.Understand the concept of electrochemical cells, Nernst equation, application of EMF measurement etc.

2.Learn about Gibbs free energy, Nerns't heat theorem, variation of chemical potential.

3.Familiarize with synthesis and characterization like X-PES, X-ray diffraction, SEM, TEM of nanomaterials.

4. Learn the properties of actinides like electronic configuration, oxidation states etc and uses of actinides.

5.Understand nuclear reactions like nuclear fission,nuclear fusion and Q – Value of the nuclear reactions.

**a. (Physical Chemistry)**

**Unit - I Electrochemistry – II : 13 Periods**

1.1 Introduction, concept of electrode potential – Nernst theory, single electrode potential, standard electrode potential.

1.2 Electrochemical cells – Electrolytic and Galvanic cells, reversible and irreversible cells, conventional representation of an electrochemical cells.

1.3 EMF of a cell, its measurement.

1.4 Reference electrodes – primary (SHE) and secondary (calomel)

1.5 Relation of emf with $G$, $H$ and $S$.

1.6 Nernst equation – For single electrode potential and emf of the cell (no

derivation).

1.7 Electrolyte concentration cells – concentration cell with transport and without transport, liquid junction potential.

1.8 Application of EMF measurement in determination of pH by using.

a) Quinhydrone electrode.

b) Glass electrode.

1.9 Potentiometric titrations.(Acid-Base, Redox & precipitation)

1.10 Numericals on standard emf of the cell, Nernst equation.

**Unit - II Thermodynamics – II : 10 Periods**

2.1 Gibbs free energy(G)–Definition, characteristics, significance, variation with T and P.

2.2 Helmholtz free energy (A) – Definition, characteristics, significance, variation with T and V. Relation between G and A.

2.3 Gibb's – Helmholtz equation (derivation)

2.4 The Nerns't heat theorem, third law of thermodynamics.

2.5 Partial molar properties, chemical potential, Gibb's – Duhem equation (Derivation), Variation of chemical potential with T and P.

2.6 Van't – Hoff's isotherm.

2.7 Van't - Hoff's reaction isochore, its integrated form.

2.8 Clausius – Clapeyron equation and its applications.

2.9 Thermodynamic derivation of law of mass action.

2.10 Numericals on Van't – Hoff's isotherm, Van't – Hoff's isochore & Clausius Clapeyron equation.

**Unit – III Introduction to nanotechnology : 07 Periods**

3.1 History, background & scope of nanotechnology.

3.2 Synthesis of nanomaterials : Chemical methods - such as chemical precipitation method, sol-gel method, chemical reduction method.

3.3 Characterization of nanomaterials by different methods such as: X-PES, X-ray diffraction, SEM, TEM.

**b. (Inorganic Chemistry)**

**Unit – I f-block elements (Actinides) : 07 Periods**

Definition, position in periodic table, occurrence of actinides, electronic configuration, oxidation states, general methods of preparation of transuranic elements, IUPAC nomenclature of supra heavy elements with atomic number greater than 100. Uses of Actinides Comparision between Lanthanides and Actinides.

**Unit – II Radiochemistry II : 08 Periods**

Nuclear models – Nuclear shell model, liquid drop model. Nuclear reactions a) based on nature of bombarding particles, b) based on transformation of nucleus. Nuclear fission reaction – principle of atomic bomb, Q – Value of the nuclear reaction, Nuclear fusion reaction – Principle of hydrogen bomb. Indias nuclear energy program.

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur.**
**Faculty of Science**
**B.Sc. III Year (Semmester - VI)**
**Chemistry - XII**
**Paper Code : U-CHE-658**
**Section B**
**(Organic Chemistry & Inorganic Chemistry)**

**Marks: 50** **Periods: 45**
**Credit: 02** **Weeks: 06**

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**Learning Objective:**

1. To understand different types of spectroscopy and their applications to organic compounds.

2. To learn the reactions of amino acids, peptides and proteins

3.To understand difeerent rearrangement reactions and reagents.

4. To familiarize the students with molecular orbital theory and non transition elements like silicates, zeolites and carbides.

**Course Ootcome:**

After successful completion of the course the students will :

1.Understand about U.V, I.R, NMR spectroscopy and their applications to organic compounds.

2.Write the reactions of amino acids, peptides and proteins with their mechanisms

3.Know about how to write different rearrangement reactions like Pinacol – Pinacolone Baeyer – Villiger, Wolf and Hofmann reactins and the uses of different reagents in synthesis.

4. Familiarize with molecular orbital theory and non transition elements like silicates, zeolites and carbides etc.

## a (Organic Chemistry)

**Unit – I Spectroscopy :** **14 Periods**

i) Introduction, Electromagnetic radiations & Electromagnetic spectrum.

ii) Characteristics of Electromagnetic radiations.

iii) Types of Spectroscopy, Advantages of spectroscopic methods.

**I) U.V. Spectroscopy :**

i) Introduction

ii) Absorption of U.V. radiations : Absorption laws.

iii) Principle of U.V. Spectroscopy

iv) Types of Electronic transitions

v) Terms used in U.V. spectroscopy.

a) Chromophore b) Auxochrome c) Bathochromic Shift or Effect

d) Hypsochromic Shift or Effect e) Hyperchromic Effect

f) Hypochromic Effect

vi) Effect of conjugation on position of U.V. and visible bands.

vii) Woodward – Fieser rules for calculating $_{max}$ of conjugated dienes, polyenes and enones.

viii) Spectral problems based on U.V.

**II) I.R. Spectroscopy :**

i) Introduction

ii) Principle of I.R. Spectroscopy

iii) Molecular Vibrations, Hooke's law

iv) Requirement for the absorption of I.R. radiations.

v) I.R. Spectrum : Functional group region and Finger print region.

vi) Factors affecting vibrational frequencies.

vii) Characteristic absorption frequencies of functional groups.

viii) Interpretation of I.R. spectra of following organic compounds :

a) Ethane b) Ethene c) Ethyne d) Benzene e) 1-Propanol

f) 2- Propanol g) ter-butyl alcohol h) Phenol i) Acetone

j) Acetophenone k) Acetaldehyde l) Benzaldehyde m) Benzoic acid

n)Methylbenzoate o) Phenyl cyanide p) Aniline

**III) NMR – Spectroscopy :**

i) Introduction

ii) Principle of NMR Spectroscopy.

iii) Magnetic and non-magnetic nuclei.

iv) PMR–Spectroscopy: Spinning nuclei, Magnetic moment, Magnetic field, precessional motion, Orientations of proton, nuclear resonance & absorption signals.

v) Equivalent and Non – equivalent protons.

vi) Number of PMR signals in the following compounds :

a) Acetone b) Cyclobutane c) Methanol d) Ethylbenzene

e)Ethylamine f) Mesitylene g) Diethylether h) Toluene

i) Allylalcohol j) Ethanol

vii) Shielding and Deshielding of protons. (Examples of acetylene and benzene)

viii) Chemical Shift & Measurement of Chemical Shift.

ix) TMS as a standard substance for recording chemical shift.

x) Spin – Spin Coupling : Splitting of PMR Signals.

xi) Coupling Constant : (J – Values) of first order coupling.

xii) Peak area & its significance.

xiii) Interpretation of PMR spectrum of following compounds :

a) Ethylbromide b) Ethylalcohol c) Acetaldehyde

d) Ethylacetate e) Ethylamine f) Toluene

g) Acetophenone h) Acetic acid i) Benzoic acid

j) 1,1,2-Tribromoethane

xiv) Problems pertaining to the structure elucidation of simple organic compounds using PMR – spectroscopic data. (supporting IR and UV data to be given)

**Unit – II : Amino acids, peptides and proteins : 08 Periods**

**I) Amino acids :**

i) Introduction and classification.

ii) Dipolar nature of amino acids ; Zwitter ion, Iso- electric point.

iii) Methods of preparation of Amino acids :

a) From -Haloacids b) By Strecker's synthesis

iv) Chemical Properties of - amino acids :

a) Reactions due to – $NH_2$ group.

b) Reactions due to – COOH group.

c) Reactions due to both – $NH_2$ and – COOH groups.

v) Reagents used for identification of amino acids.

**II) Peptides :**

i) Introduction, Classification and Nomenclature.

ii) N-Terminus and C – Terminus protecting agents.

iii) Synthesis of peptides from amino acids :

a) By protecting – $NH_2$ group.

b) By protecting – COOH group.

**III) Proteins :**

i) Introduction.

ii) Colour tests for protein identification.

iii) Classification on the basis of :

a) Molecular Structure b) Hydrolysis Products

iv) General characteristics of proteins.

v) Renaturation & Denaturation of proteins.

**Unit – III Rearrangements and Reagents : 08 Periods**

**I) Rearrangements :**

i) Introduction.

ii) Types of molecular rearrangements.

iii) Study of following rearrangements with mechanism.

a) Pinacol – Pinacolone b) Baeyer – Villiger c) Wolf d) Hofmann

f) Beckmann g) Benzilic acid

**II) Reagents :**

i) Introduction

ii) Synthetic applications of following reagents in organic synthesis.

a) Osmium tetra oxide ($OsO_4$) b) N – Bromo succinimide (NBS)

c) Lead Tetra acetate Pb $CH_3COO_4$ d) Lithium Aluminium hydride ($LiAlH_4$)

e) Selenium dioxide ($SeO_2$) f) Anhydrous Aluminum Chloride ($AlCl_3$) Alu

**b. (Inorganic Chemistry)**

**Unit – I : Molecular orbital theory 10 Periods**

Comparison of VBT and MOT of covalent bonding Atomic and molecular orbitals. Linear combination of atomic orbitals. Bonding and Antibonding molecular orbitals sigma and molecular orbitals. Energy level diagram of Homonuclear diatomic

molecules of $H_2$, $He_2$, $N_2$, $O_2$, $O_2^+$, $O_2^-$, $O_2^{2-}$ Bond order, Energy level diagram of hetero nuclear diatomic molecules of HCl, NO, CO.

**Unit-II: Chemistry of non transition elements** **05 periods**

a. Silicates, definition, unit of silicates, Classification on the basis of basic units and their characteristics.

b. Zeolites: Definition, preparation and classification and application, ultramarine

c) Carbides: Definition, classification, preparation, properties and structures of ionic or salt like carbides e,g. ( $CaC_2$), metallic carbides (TiC) & covalent carbides (SiC)

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur.**
**Faculty of Science**
**B.Sc. III Year (Semester - VI)**
**Paper Code :** U-CHE-660
**Laboratory Course – IX**

**Marks: 50** **Periods: 45**
**Credit: 02** **Weeks: 08**

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**Learning Objective:**

1. To acquire skill for handling instruments like potentiometer, PH-meter, polarimeter.

2. To find out the enthalpy of neutralization, energy of activation, amount of ion in given solution by EDTA titrations

**Course Outcome:**

1. Developed the skill for handling instruments like potentiometer, PH-meter,

polarimeter and determime dissociation constant, hydrolysis constant of solutions.

2.Can find out the enthalpy of neutralization, energy of activation, amount of ion in given solution by EDTA titrations

Note : At least eight experiments be completed (six from Section A & two from Section –B)

## Section A : (Physical Chemistry)

**Instrumental :**

i) Determination of dissociation constant of an organic acid ($CH_3COOH$) using various buffers ($CH_3COOH + CH_3COONa$) pH metrically.
ii) To determine the hydrolysis constant of an aniline hydrochloride by pH measurement.
iii) To study the inversion of cane sugar by polarimetrically.
iv) Determine the equivalent conductance of a strong electrolyte at several concentration and hence verify the Onsager's equation.
v) To prepare standard 0.2 M $Na2HPO_4$ and 0.1 M Citric acid solution, hence prepare four different buffer solutions using them. Determine the $pK_a$ value of these and unknown solutions potentiometrically.

**Non–instrumental :**

i) To determine the standard free energy change $\Delta G0$ and equilibrium constant for the reaction. $Cu + 2\ Ag+ = Cu+2 + 2\ Ag$
ii) To determine the molecular state of Benzoic Acid by distribution method .
iii) To Determine energy of activation of hydrolysis of an ester by acid / base.
iv) To determine the enthalpy of neutralization of strong acid by strong base.
v) Investigate the reaction between bromic acid hydroiodic acid.
vi) To find out the enthalpy of neutralization of weak acid / weak base against strong base / strong acid and determine the enthalpy of ionization of weak acid / weak base.

## Section B : (Inorganic Chemistry)

**EDTA titrations**:

a) Estimate the amount of Nickel in the given solution.

b) Estimate the amount of Aluminum in the given solution.

c) Estimate the amount of Magnesium in the given solution.

Estimate the amount of vanadium in the given solution.

**Rajarshi Shahu Mahavidyalaya (Autonomous), Latur.**
**Faculty of Science**
**B.Sc. III Year (Semester - VI)**
**Paper Code : U-CHE-659**
**Laboratory Course – X**

**Marks: 50** **Periods: 45**
**Credit: 02** **Weeks: 06**

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**Learning Objective:**

1. Develop experimental skills in Separation of organic binary mixture containing two solid components.

2. To estimate the amount of elements by EDTA,and Iodometric method.

**Course Outcome:**

1.Students can do Separation of organic binary mixture containing two solid components.

like Acid + Phenol, Phenol + Base, Base + Neutral etc.

2.Can estimate the amount of elements like Mg, Cl etc.by EDTA,and Iodometric method.

Note: At least eight experiments be completed (six from Section-A & two from Section–B)

## Section A : (Organic Chemistry)

**Organic Qualitative Analysis : (Six mixtures)**

[Separation of organic binary mixture containing two solid components, using $NaHCO_3$, NaOH and HCl & Analysis of one component with preparation of derivative]

At least one mixture from each of the following types should be taken:

a) Acid + Phenol b) Acid + Base c) Acid + Neutral

d) Phenol + Base e) Phenol + Neutral e) Base + Neutral

Following compounds are to be used for the preparation of binary mixtures:

A) Acids: Benzoic acid, Salicylic acid, Cinnamic acid, Phtalic acid and o/ m – chlorobenzoic acid.

B) Phenols: α- naphtol, β- naphthol o/m/p nitro- phenols.

C) Bases: o/m/ p- nitroanilines , p- Toluidine, diphenylamine, p – chloroaniline.

d) Neutrals: Acetanilide, naphthalene, anthrancene m- dinitrobenzene, benzophenone

**Section: - B Inorganic Chemistry: (Any two)**

a) Estimate the amount of available chlorine in bleaching powder by Iodometric method.

b) Estimate the amount of magnesium in Talcum Powder by EDTA method.

c) Determine the iodine value of given oil sample.

d) Estimate the amount of vitamin–C in Ascorbic acid tablets.

**Reference Books (Organic Chemistry)**

1. Organic Chemistry : S.M. Mukherji, S.P. Singh and R.P. Kapoor (Vol – II & III)
2. Organic Chemistry : Jagdamba Singh and L.D.S. Yadav (Vol. II & III)
3. A Text book of Organic Chemistry : Arun Bahl and B.S. Bahl.

4. A Text book of Organic Chemistry : K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra.
5. A Text book of Organic Chemistry : P.L. Soni and H.M. Chawla.
6. Principles of Organic Chemistry : M.K. Jain.
7. Natural Products : O.P. Agarwal (Vol. I & II)
8. Synthetic Organic Chemistry : Gurdeep R. Chatwal.
9. Spectroscopy of Organic Compounds : P.S. Kalsi.
10. Elementary Organic Absorption Spectroscopy : Y.R. Sharma.
11. Chemistry of Pesticides : K.H. Buchel (T.W.)
12. Elements of Toxicology : Kamlesh Pandey & J.P. Shukla.
13. Medicinal Chemistry : Burger.
14. Reactions, rearrangements and reagents : S.N. Sanyal.
15. Industrial chemistry : B.K. Sharma.
16. Synthetic dyes : G.R. Chatwal.
17. A Text book of synthetic drugs : O.D. Tyagi & M. Yadav.
18. Synthetic Organic Chemistry : Kamlesh Bansal.

**References : (Physical Chemistry)**

1. Physical Chemistry by G.M.Barrow (Tata Mc – Graw Hill publishing Co., Ltd.)
2. Elements of Physical Chemistry by S.Glasstone & D. Lewis (D.vannostrand co.inc.)
3. Physical Chemistry by W.J. Moor (Orient Longman)
4) Principles of Physical Chemistry by S.H. Maron and C.F. Prutton.
5) University General Chemistry by C.N.R. Rao (Mc-Millan).
6) Elements of Physical Chemistry by P.W. Atkins. (Oxford University Press.)
7) Physical Chemistry by R.A. Alberty (Willey Eastern Ltd.)
8) Physical Chemistry through problems by S.K. Dogra, D.Dogra (Wiley Eastern Ltd.)
9) Principles of Physical Chemistry by Puri, Sharam and Pathania (Vishal Publication Jallandher, Delhi).
10)Physical Chemistry by A.J. Mee. ELBS & Heinemann Educational Books Ltd.
11)Essentials Physical Chemistry by Arun Bhal, B.S. Bahl and G.D. Tuli (S. Chand).
12)Chemical Kinetics by K.J. Laidler (Tata Mc-Graw Hill Publishing Co. Ltd.)
13)Text Book Physical Chemistry by Soni – Dharmarha.
14)A Text Book Physical Chemistry by S. Glasstone, (Mac Millan)

15)Advanced Physical Chemistry by D.N. Bajpai. (S. Chand)

16)Advanced Physical Chemistry by Gurdeep Raj. (Goel publishing house, Meerut).

**References : (Inorganic Chemistry)**

1. Concise Inorganic Chemistry by J.D. Lee.
2. Advanced Inorganic Chemistry by F.A. Cotton and Wilkinson.
3. Inorganic Chemistry by A.G. Sharp.
4. Inorganic Chemistry by Miessler and Tarr.
5. Chemistry for degree students, B.Sc. TY by R.L. Madan.
6. Advanced Inorganic Chemistry by Gurudeep Raj and Chatwal Anand.
7. Principles of Inorganic Chemistry by Puri – Sharma and Kalia.
8. Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and P.L.Gaus.
9. Advanced Inorganic Chemistry Vol. – I, Vol. – II by Satyparakash, Tuli, Basu and Madan.
10. Inorganic Chemistry by Huhcey, Keiter and Keiter.

**References : (Practical's )**

1) Practical Organic Chemistry by A.I. Vogel.
2) Advanced Practical Organic Chemistry by O.P. Agarwal.
3) Advanced Practical Organic Chemistry by N.K. Vishnoi.
4) Handbook of Organic qualitative analysis by H.T. Clarke.
5) A Laboratory Hand book of Organic Qualitative Analysis by V.S. Kulkarni.
6) Advanced inorganic analysis by Agarwal, Keemtilal.
7) Experiments in chemistry by Dr.D.V. Jahagirdar
8) Advanced inorganic chemistry experiments by – Gurtu – Gurtu.
9) Advanced practical inorganic chemistry by – Gurudeep Raj.
10) Experiments in inorganic chemistry by – Gurtu and Kapoor.
11) Advanced practical chemistry by J.B. Yadhav.
12) Systematic experimental physical chemistry – S.W. Rajbhoj and T.K. Chondhekar.
13) Experimental physical chemistry by R.Daniel and others.
14) Experiments in physical chemistry by R.C. Das and Behere
15) Experiments in General Chemistry by C.N.R. Rao