VIVEKANANDHA COLLEGE OF
ARTS AND SCIENCES FOR WOMEN
[Autonomous]
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*An ISO 9001 : 2008 Certified Institution*
*Affiliated to Periyar University, Approved by AICTE and*
*Re-Accredited with 'A' Grade by NAAC*
*Recognized under section 2(f) and 12(B) Under UGC Act, 1956*
Elayampalayam – 637 205. Tiruchengode, Namakkal Dt., Tamil Nadu

VIVEKANANDHA
EDUCATIONAL INSTITUTIONS

## 1.1 Curriculum Design and Development

# 1.1.2 Syllabus Revision

## M.Sc

**(2017-18)**

## PG AND RESEARCH DEPARTMENT OF CHEMISTRY

# CURRICULUM (2017-18)

| Subjects | Inst. Hour/Week | Credit | Exam Hours | Internal | External | Total Marks | Subjects | Inst. Hour/Week | Credit | Exam Hours | Internal | External | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **YEAR I** | | | | | | | | | | | | | |
| **Semester I** | | | | | | | **Semester II** | | | | | | |
| Organic Chemistry-I | 4 | 5 | 3 | 25 | 75 | 100 | Organic Chemistry-II | 5 | 5 | 3 | 25 | 75 | 100 |
| Inorganic Chemistry-I | 4 | 5 | 3 | 25 | 75 | 100 | Inorganic Chemistry-II | 5 | 5 | 3 | 25 | 75 | 100 |
| Physical Chemistry-I | 4 | 5 | 3 | 25 | 75 | 100 | Electrochemistry and Photochemistry | 5 | 4 | 3 | 25 | 75 | 100 |
| Nano chemistry | 4 | 4 | 3 | 25 | 75 | 100 | Organic Chemistry Practical-I | 5 | 4 | 6 | 40 | 60 | 100 |
| Organic Chemistry Practical-I | 4 | - | 6 | - | - | - | Inorganic Chemistry-Practical-I | 5 | 4 | 6 | 40 | 60 | 100 |
| Inorganic Chemistry-Practical-I | 5 | - | 6 | - | - | - | Physical Chemistry-Practical-I | 4 | 4 | 6 | 40 | 60 | 100 |
| Physical Chemistry-Practical-I | 4 | - | 6 | - | - | - | Library | 1 | - | - | - | - | - |
| Library | 1 | - | - | - | - | - | | - | - | - | - | - | - |
| **Total** | **30** | **19** | **12** | **100** | **300** | **400** | **Total** | **30** | **26** | **21** | **195** | **405** | **600** |
| | | | | | | | **I YEAR TOTAL** | | **45** | **33** | **295** | **705** | **1000** |
| **YEAR II** | | | | | | | | | | | | | |
| **Semester III** | | | | | | | **Semester IV** | | | | | | |
| Organic Chemistry-III | 5 | 5 | 3 | 25 | 75 | 100 | Physical Chemistry-III | 5 | 5 | 3 | 25 | 75 | 100 |
| Inorganic Chemistry-III | 5 | 5 | 3 | 25 | 75 | 100 | Environmental chemistry | 5 | 4 | 3 | 25 | 75 | 100 |
| Physical Chemistry-II | 5 | 5 | 3 | 25 | 75 | 100 | Organic Chemistry Practical-II | 5 | 4 | 6 | 40 | 60 | 100 |
| Applied polymer chemistry | 4 | 4 | 3 | 25 | 75 | 100 | Inorganic Chemistry-Practical-II | 5 | 4 | 6 | 40 | 60 | 100 |
| Organic Chemistry Practical-II | 5 | - | - | - | - | - | Library | 1 | - | - | - | - | - |
| Inorganic Chemistry-Practical-II | 5 | - | - | - | - | - | Project Work | 8 | 9 | 3 | 60 | 140 | 200 |
| Human Rights | 1 | 1 | 3 | 25 | 75 | 100 | | | | | | | |
| **Total** | **30** | **20** | **15** | **125** | **375** | **500** | **Total** | **30** | **26** | **21** | **190** | **410** | **600** |
| | | | | | | | **II YEAR TOTAL** | | **46** | **36** | **315** | **785** | **1100** |
| **TOTAL CREDIT FOR THE COURSE** | | | | | | | | | **91** | **69** | **610** | **1490** | **2100** |

**VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN**

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NO ADDITION

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS**

| | |
|---|---|
| **SEMESTER –I** | **TOTAL HRS: 75** |
| **14PICH01** | **CREDIT: 5** |

## ORGANIC CHEMISTRY –I

### UNIT-I: Basic Concepts and Mechanistic Studies (15)

Electronic effects: Inductive effect- field effect-resonance- hyperconjucation effect on the dissociation of organic acid and bases- stability of carbocations and carbenes. Kinetic and nonkinetic methods of study of reaction mechanisms - Kinetic methods primary and secondary kinetic isotopic effects, non-kinetic methods - study of reaction mechanism — study of intermediates, isotopic labeling, stereo chemical studies and cross over experiments. Hammond's postulate, Microscopic reversibility, Kinetic and thermodynamic control, Linear free energy relationship — Hammett equation —Taft equation- limitations and its applications.

### UNIT-II: Substitution reactions-I (15)

Aliphatic nucleophilic substitution reactions- $S_N1$, $S_N2$, $S_Ni$ mechanisms. Factors affecting nucleophilic substitution reaction – nature of the substrate, solvent, nucleophile and leaving group. Neighbouring group participation, Ambident nucleophiles and ambient substrates. Stereochemistry of nucleophilic substitution reactions. Substitution at vinyl carbon allylic carbon and bridge head carbon. Typical substitution reactions such as Von Braun reaction, Claisen condensation and hydrolysis of esters.

Aliphatic electrophilic substitution reactions- $S_E1$ and $S_E2$ reactions - mechanisms and reactivity - typical reactions involving migration of double bond - keto-enol tautomerism - halogenations of carbonyl compounds - Stork Enamine reactions - decarboxylation of aliphatic acids - Friedel Crafts acylation of olefinic carbon.

### UNIT-III : Aromaticity (15)

Concept of aromaticity- aromatic character of benzene and heterocyclic compounds-benzene, pyrrole and pyridine. Effect of aromaticity on bond length, resonance energy and induced ring currents. Huckels rule- concept of homoaromaticity and antiaromaticity. Nonbenzenoid aromatic compounds- cyclopropenium cation, cyclopentadienyl anion, ferrocene, diazocyclopentadiene, sydnones, azulene, tropolone ion, tropylium ion and annulenes- their structures and aromaticity.

**UNIT-IV: Stereochemistry** **(15)**

Homotopic, enantiotopic, diastereotopic H atoms, groups in organic molecules. Fischer, Newman and Sawhorse projections and their interconvertion. Optical activity in the absence of chiral carbon – biphenyls, allenes and spiranes – R and S notations. Chirality due to helical shape, trans cyclooctene. E – Z isomerism of olefins containing one double bond and more than one double bond. Stereospecific and stereoselective synthesis with suitable examples, asymmetric synthesis – Crams rule.

**UNIT-V: Heterocyclic Compounds** **(15)**

Synthesis and properties of indole, imidazole, oxazole and thiazole- synthesis, properties and structural elucidation of flavones, isoflavones and Xanthocyanins- synthesis of pyrimidines- synthesis and structural elucidation of purines (uric acid and caffeine)

**TEXT BOOKS**


1. Jerry March, Advanced organic chemistry - Reactions mechanism and structure, McGraw Hill Kogakusha Ltd., (1977).
2. I.L. Finar, Organic chemistry, Vol. I and Vol. II. Pearson Education (P) Ltd (2011).
3. P. S. Kalsi, Stereochemistry- Conformation and Mechanism, 6th Edition, New Age International Publishers (2005).
4. Jerry March, Advanced organic chemistry - Reactions mechanism and structure, McGraw Hill Kogakusha Ltd., (1977).


**REFERENCE BOOKS**


1. Lowry and Richardson, Mechanism and theory in organic chemistry, Harper & Row Publishers, New York (1981).

2. S.H. Mukargee and S. P. Singh, Reaction mechanisms in organic chemistry, Mc Millan (1976).
3. Raj K.Bansal, Organic Chemistry Reaction mechanisms, Hill Publishing Company Ltd (2006).
4. Ernest L. Eliel, Stereochemistry of Carbon Compounds, T.M.H Edition, Tata Mc Graw-Hill Publication Companies (1975).


THE HEAD,
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ADDITION

**VIVEKANANDHACOLLEGEOFARTS&SCIENCESFORWOMEN**
**(AUTONOMOUS)**

62%

**DEPARTMENTOFCHEMISTRY**

| SUBJECTCODE:17P1CH01 | | |
|---|---|---|
| **SEMESTER –I** | **CREDIT:5** | **HOURS:75** |

# ORGANICCHEMISTRY–I

## OBJECTIVES

To enable the students to learn about the chemistry of organic compounds and to enrich the knowledge in various organic reactions.

***LearningOutcome***

*Students will be known to name the organic compounds systematically and they will be able to assess the physical and chemical properties of organic compounds.*

*Students can able to understandtheformationofintermediatesinorganicreactionsandthestudentscanableto determine the mechanism of new organic reactions.*

*Students can able to predict the aromaticity of any organic compounds.*

**Unit–I: Basics of organic chemistry (15Hours)**

17%

Nomenclature of aromatic heterocyclic compounds (containing one or two heteroatoms) – Nomenclature of alicyclic, bicyclic and tricyclic compounds.

Electron displacement effect – Inductive and field effect – Delocalized bonds – Rules of resonance – steric inhibition and steric enhancement of resonance, Hyper conjucation – hydrogen bonding – intra and inter molecular hydrogen bonding – effect of hydrogen bonding and hyperconjucation on physical and chemical properties.

20%

**Unit II: Reactive intermediates and methods of determining reaction mechanism (15Hours)**

Structure, Stability, Generation and Reactions of Carbocation (Classical andNonclassical), carbanions, carbenes, nitrenes and free radicals. Ylides – Generation, typesand reactions. Enamines - Generation and reactions.

Thermodynamic and kinetic control – methods of determination of reactionmechanisms – product analysis – determination of the presence of intermediate, isolation,detection, trapping – cross of experiments – isotopic labeling - isotopic effect – stereochemical evidence – kinetic evidence. Microscopic reversibility – Hammond Postulate -Linear free energy relationship – Hammette equation – Taft equation - Limitations, application and deviations.

**Unit–III: Aromaticity** **(15Hours)**

Concept of Aromaticity – aromatic character of benzene and heterocyclic compounds–benzene, pyrrole and pyridine. Effect of aromaticity on bond length, resonance energy and induced ring currents. Huckels rule – concept of homoaromaticity and antiaromaticity.

Nonbenzenoid aromatic compounds – cyclopropenium cation, cyclopentadienyl anion, ferrocene, diazocyclopentadiene, sydnones, azoulene, tropolone ion, tropylium ion and annulenes – their structures and aromaticity.

**Unit–IV: Substitution reactions** **(15Hours)**

Aliphatic Nucleophilic substitution reactions: $S_N1$, $S_N2$, $S_Ni$ mechanism – factors affecting nucleophillic substitution - Neighboring group participation, ambient nucleophiles and ambient substrates. Substitution at vinyl carbon, allylic carbon and bridge head carbon. Von Braun reaction, Claisen condensation and Hydrolysis of ester. Aliphatic Electrophilic substitution reactions: $S_E1$ and $S_E2$ reactions – Mechanism and reactivity. Reaction involving the migration of double bond – Halogenation of carbonyl compounds – Stork Enamine reactions – decarboxylation of aliphatic acids. Friedel craft acylation of olifinic carbon.

10%

Aromatic Electrophilic substitution reactions: Introduction – Mechanism of Electrophilic substitutions with examples. Orientation and reactivity – Electrophilic substitution on monosubstituted and disubstituted benzenes. Aromatic Nucleophilicsubstitution reactions: $S_N1$,$S_N2$ and $S_N^{AR}$mechanism. Typical reactions such asGateman reaction, Gattermann Koch reaction, Reimer – Tiemann reaction, Koblereaction. Ziegler alkylation – Chichibabin reaction – Cine substitutions.

**Unit–Stereochemistry** **(15Hours)**

Principles of symmetry- concept of chirality, Molecular symmetry and chirality, Newmann, Sawhorse, Fischer and Wedge representations and interconversions. Types of moleculesexhibitingopticalactivity.Configurationalnomenclatureofacyclicandcyclic

15%

molecules: *cis-trans*, *E* &*Z*, *D* &*L*, (+ or –),*d* &*l*, *R* &*S*, erythro and threo; *syn* &*anti*. Stereospecific, Chemo, Regio, Enantio and stereo - selective organic transformations, asymmetric synthesis – Crams rule.

Conformational analysis – 1, 2-disubstitutd ethane derivatives – disubstitutedcyclohexanes and their stereo chemical features. Conformation and reactivity of substitutedcyclohexanols (oxidation and acylation) cyclohexanones (reduction) and cyclohexane carboxylic acid derivatives (esterification and hydrolysis).

**CONTENTBEYONDTHESYLLABUS**

1. Name a tetra cyclic compound with appropriate IUPAC regulations.
2. Select anyone name reactions and identify the nature of intermediate involves in that reaction.
3. Design a molecule in your own and mention its aromatic nature.
4. What is the influence onSN1mechanismwhenasubstituentpresenton theβ-carbon atom
5. Writeaboutconformationandreactivityonoxidationofsubstitutedcyclohexanones.

**TEXTBOOKS**


1. Mukargee S.H. and SinghS.P. Reaction mechanisms inorganic chemistry, McMillan (1976).
2. RajK.Bansal, Organic Chemistry Reaction mechanisms, Hill Publishing Company Ltd (2006).
3. Ernest L. Eliel, Stereochemistry of Carbon Compounds ,T.M.HEdition, TataMcGraw-Hill Publication Companies(1975).
4. Kalsi P.S., Stereochemistry-Conformation And Mechanism,6$^{th}$Edn.,New Age International Publishers(2005).

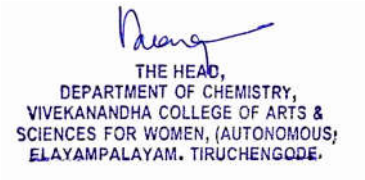

**REFERENCE BOOKS**


1. Jerry March, Advanced organic chemistry- Reactions mechanism and structure, McGraw HillKogakusha Ltd., (1977).
2. Lowry and Richardson, Mechanism and theory inorganic chemistry, Harper & Row Publishers, New York (1981).
3. FinarI.L.,Organic chemistry, Vol. I and Vol. II .Pearson Education(P)Ltd(2011).


**ONLINE SOURCES**

1. https://www.masterorganicchemistry.com/2017/02/23/rules-for-aromaticity/
2. https://chem.libretexts.org/Textbook_Maps/Organic_Chemistry_Textbook_Maps/Map%3A_Organic_Chemistry_(McMurry)/Chapter_15%3A_Benzene_and_Aromaticity/15.03_Aromaticity_and_the_Huckel_4n___2_Rule

3. www.introorganicchemistry.com
4. http://www.chem.ucalgary.ca/courses/351/Carey5th/Ch08/ch8-0.html



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**(AUTONOMOUS)**

NO ADDITION

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS**

| | |
|---|---|
| **SEMESTER –I** | **TOTAL HRS: 75** |
| **14PICH02** | **CREDIT: 5** |

## INORGANIC CHEMISTRY-I

**Unit –I: Chemical Bonds** **(15)**

Covalent bond: Heitler-London theory-VB theory-application of VBT to heteronuclear diatomic molecules-hybridisation- calculation of s and p characters- Bent's rule- MO theory: LCAO approximation- symmetry of MO's – application of MOT to heteronuclear diatomic molecules like NO and CO and polyatomic molecules like $CH_4$ and $NH_3$.Comparision between molecules like diborane and metal alkyls- structure of covalent molecules- VSEPR theory.

**Unit II : Periodic Properties of Lanthanides and Actinides:** **(15)**

Periodic properties of elements like ionization potential – electron affinity- atomic and ionic radii-electro negativity-various scales- spectral terms – ground and higher states –Symmetry elements and symmetry operations – Point groups – identification and representation of groups – comparison of Molecular symmetry with Crystallographic symmetry – Reducible and irreducible representation – Direct product representation – Great orthogonality theorem and its consequences – Character Table and their uses.

**Unit-III: Metal Complexes** **(15)**

Stability of complexes: Step wise and overall stability constants-determination factors affecting the stability of complexes –stabilization of unusual valence state –VBT ;qualitative treatment for bonding in co- ordination compounds-CFT: splitting of d-orbital in various environments of ligands- factors affecting the magnitude of 10 Dq- CFSE in octahedral and tetrahedral symmetries-site selection in spinels-spectrochemical series-nephlauxetic effect-LFT: evidence for covalent nature of M-L bonds-MOT: construction of M.O diagram for $\sigma$ and $\pi$ bonded $O_h$ complexes.

**Unit IV: Solid state chemistry** **(15)**

Crystal systems- elements of symmetry-space lattice-unit cell- Miller indices- crystal analysis-rotating crystal method- powder method-packing of atoms and ions in solids- Electrical properties of solids – Band Theory, semiconductors, super conductors, solid state electrolytes; Magnetic properties – dia, para, ferro, antiferro and ferrimagnetism; hysterisis; Optical properties – solid – state lasers and Inorganic phosphors.

Reactions in solid state and phase transitions – diffusion coefficient, diffusion mechanism, vacancy and interstitial diffusions, formation of spinels; solid solutions, order-disorder transformations and super structure

**Unit V: Co-ordination Chemistry** **(15)**

Lability-inertness-ligands displacement reactions in square planar complexes- factors affecting the reactivity of square planar complexes- trans effect-trans effect in synthesis- mechanism of the trans effect- trans influence-kinetics and reaction rates of octahedral substitution reaction without the cleavage of M-L bond- mechanisms- electron transfer reactions-outer sphere mechanism-inner sphere mechanism-complementary and non-complementary reaction.

**TEXT BOOKS**


1. W.U. Malik, G.D. Tuli and R.D. Madan, Selected topics in Inorganic Chemistry, 6th edition S.Chand & company Ltd., (2005)
2. B.R.Puri, L.R. Sharma and K.C. Kalia., Principles of Inorganic Chemistry, S. Chand & Co (2004)
3. Samuel Glasstone, Source book of Atomic Energy, 3rd edition, East west Press (reprint 2000)
4. R.D. Madan, Modern Inorganic Chemistry, S. Chand publishers (2004).
5. C.N. Banwell, Fundamentals of Molecular Spectroscopy, Mc Graw Hill, Newyork (2001).


**REFERENCE BOOKS**


1. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry, 4th edition, Pearson education (2006).
2. Gurudeep Raj, Advanced Inorganic Chemistry Vol. I & Vol. II, 6th edition, Goel publishing house (1999)
3. G.S. Manku, Theoretical Principles of Inorganic Chemistry, Tata McGraw –Hill Publishing Company ltd., (reprint 2001)
4. Raymond chang, Basic principles of Spectroscopy, McGraw Hill Ltd., New York, (1971).


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ADDITION 100%

# INORGANIC CHEMISTRY - I

| SUBJECT CODE: 17P1CH02 | | |
|---|---|---|
| **SEMESTER – I** | **CREDIT : 5** | **HOURS : 75** |

## OBJECTIVES

1. To gain knowledge on physical and chemical properties of transition and inner transition elements.
2. To give elaborate insight into the field of nuclear chemistry.

***Learning Outcome***

*Students will learn the metallurgy and general properties of transition, and inner transition elements.*

*Students will be introduced to the basic principles of nuclear chemistry. In future, it will help the students to explore constructive application of nuclear chemistry.*

*Students will know the present national and international status in nuclear mission.*

20%

**Unit–I: Transition Elements** **(15 Hours)**

Position in the periodic table - Electronic configuration - General characteristics - Atomic radii - Ionic radii - Variation along the period and group - Variable valency - Colour - Magnetic properties - Catalytic property - Non-stoichiometry - Stabilization of unusual oxidation states - Structure (only) of d-block elements - $[Nb_6Cl_{12}]^{2+}$ - $[Re_2Cl_8]^{2-}$ - $[Mo_6Br_8]^{4+}$ -$[Ni_2(dmg)_2]$.

20%

**Unit–II: Inner Transition Elements** **(15 Hours)**

Position in the periodic table - Electronic configuration - Oxidation state - Solubility - Magnetic properties - Colour and Spectra - Separation of lanthanides - Lanthanide contraction - Cause and consequences - Gadalonium break - Shift reagents -Extraction of Thorium and Uranium - Comparison of lanthanides and actinides.

20%

**Unit–III: Fundamentals of Nuclear Chemistry** **(15 Hours)**

Nuclear structure-mass and charge - Nuclear moments - Binding energy - Semi empirical mass equation - Stability rules - Magic numbers - - *n/p* ratio - Nuclear forces - Modes of radioactive decay - Alpha decay - range - Ionizing power - Energy spectrum - Geiger-Nutta's rule, Theories of alpha decay - Tunnel effect - Beta decay - $\beta^+$ and $\beta^-$ decay - Electron capture - Absorption - Range and Energy - Gamma ray - radioactive de-excitation - decay constant - Nuclear isomerism - Internal conversion - Auger effect.

**Unit–IV: Nuclear Reactions and Instrumental Techniques (15 Hours)** 20%

Bethe's notation - Q value - Reaction cross section - Threshold energy - Columbic barrier - Excitation function - Various types of nuclear reactions - Scattering - evaporation - photonuclear - Spallation - Fragmentation - Fission - Fusion - Stripping - Pick-up reactions - Detection and measurement of radioactivity - Proportional counter - Geiger-Muller counter - Scintillation counter - Semiconductor detector - Cloud chamber - Charged particle accelerator - Linear accelerator - Cyclotron - Beatron - Synchroton.

20%

**Unit–V: Nuclear Energy and Trace Elements (15 Hours)**

Nuclear fission and Nuclear reactors - Four factor formula - Characteristics of fission reactions - Product distribution of fission, Theories of fission - Fissile and fertile isotopes - Nuclear fusion and stellar energy - Fusion bomb - synthetic elements - Nuclear wastes - nuclear reprocessing - radiation hazards and prevention. Applications of isotopes - neutron activation analysis - isotopic dilution analysis - Uses of tracers in structural and mechanistic studies, agriculture, medicine and industry - Radio carbon dating - hot atom chemistry - Atomic Power Projects in India.

## CONTENT BEYOND THE SYLLABUS

1. Identify the complex used in the field of medicine.
2. List out the application of inner transition elements and their complexes in the field of medicine.
3. How to measure the radiation level in the atmosphere.
4. Mention the sub-atomic particles and their applications.
5. Write a note on Boson's particle.

## TEXT BOOKS

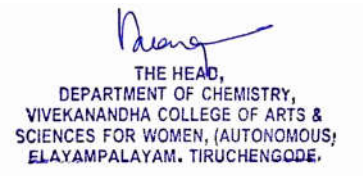

1. 1. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th Edn., New Age International (2005).
2. U.N. Dash, Nuclear Chemistry, (1971).
3. J.E.Huheey, E.A. Keiter, and R.L. Keiter, Inorganic Chemistry Principles of Structure and Reactivity, 4th Edn. Harper Collins College Publishers, New York (1993).
4. J.D. Lee, Concise Inorganic Chemistry, 6thEdn. ELBS, London (1998).
5. Samuel Gladstone, Source book of Atomic Energy, 3rdEdn. East west Press (Reprint 2000).
6. G. Choppin, J. Liljenzin, J. Rydberg, and Ekberg C., Radiochemistry and Nuclear Chemistry, 4th Edn. Elsevier, Amsterdam (2013).


## REFERENCE BOOKS


1. D. Shriver, M. Weller, T. Overton, J. Rourke, and F. Armstrong, Inorganic Chemistry, 6thEdn. WH Freeman and Company, New York (2014).
2. G.L. Miessler, P.J. Fischer, and D.A. Tarr, Inorganic Chemistry, 5thEdn. Pearson Education, Inc., New York (2014).
3. C.E. Housecroft, and A.G. Sharpe, Inorganic Chemistry, 4thEdn. Pearson Education Limited, Essex (2012).


## ONLINE SOURCES

1. https://chem.libretexts.org/Textbook_Maps/General_Chemistry_Textbook_Maps/Map%3A_General_Chemistry_(Petrucci_et_al.)/23%3A_The_Transition_Elements/23.1%3A_General_Properties_of_Transition_Metals
2. http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch23/history.php



**VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN**

**(AUTONOMOUS)**

**DEPARTMENT OF CHEMISTRY**

NO ADDITION

**SYLLABUS**

| | |
|---|---|
| **SEMESTER -I** | **TOTAL HRS: 75** |
| **14P1CH03** | **CREDIT: 5** |

## PHYSICAL CHEMISTRY-I

### Unit I: Thermodynamics (15)

II Law -Definition of entropy -entropy changes -Car not efficiency. Helmholtz and Gibb's functions, Criteria of equilibrium and the Maxwell relations. Partial molar properties -Chemical potential- variation of chemical potential with temperature and pressure. Fugacity -Definition determination of fugacity of gases by graphical method and from equations of state -variation of fugacity with temperature and pressure. Third Law -Need for III law, Nernst' Heat Theorem and other statements of III law.

### Unit II: Surface Chemistry (15)

Adsorption -Types of adsorption, difference between physical and chemical adsorptions. Adsorption isotherm-Freundlich's adsorption isotherm, Langmuir's adsorption isotherm and its limitations, B.E.T. - multilayer adsorption isotherm and its application. Heat of adsorption. Estimation of surface areas -solids from solution adsorption studies. Chemisorption's -its kinetics and thermodynamics. Surface reactions and their mechanisms.

### Unit III: Chemical Kinetics (15)

Reactions in solution: Comparison between gas-phase and solution reactions. The influence of the solvent- reactions between ions. Influence of ionic strength on rates of reactions in solution - Primary salt effect. Influence of pressure on rates of reactions in solution Significance of volume and entropy of activations.

Study of Fast reactions: Flow methods, pulse methods, relaxation methods, Chain reaction – stationary and non-stationary chain-explosion and explosion limits- $H_2O_2$ reaction of explosive reaction.

### Unit IV: Quantum Chemistry (15)

Postulates of quantum Mechanics. Linear and Hermitian operators. Methods of getting quantum mechanical operators, Eigen functions, Eigen values and degeneracy. Expansion theorem orthogonally and normalization of wave functions, Eigen function of commuting operators, and uncertainty principle, Schrodinger time independent wave equation. Application of quantum mechanics to Particle moving in one dimensional box with V= 0 inside and V = $\mu$ outside. Particle

moving in 3 dimensional cubic box with V=0 inside and V =μ Outside Rigid rotator Simple Harmonic Oscillator. Schrodinger equation-Hydrogen and Hydrogen like atoms.

**Unit: V Group Theory** **(15)**

Introduction -symmetry elements and-symmetry operations - sub group and classes. Group multiplication table, Molecular point groups, Flow sheet for the identification of point groups. Introduction of matrices, Matrix representation of symmetry operations –Reducible and Irreducible representation. Properties of irreducible representation. Orthogonal theorem. Construction of character table for point groups ($C_2v$, $C_3V$,$C_2D$, $D_2h$,and $D_4h$), direct product representations.

Chemical applications of group theory: Mutual Exclusion Principle. Selection rules for electronic transitions-Electronic spectra of formaldehyde.

**TEXT BOOKS**


1. Raman .K.V., Group Theory, Tata McGraw - Hill Education (2004).
2. R.K.Prasad., Quantum Chemistry, Viva Books Private Limited (2013).
3. Laidler. K.J., Chemical Kinetics, Pearson (2009).


**REFERENCE BOOKS**


1. S. Glasstone, Thermodynamics for Chemists, East West Press (2010).
2. Mc Quarrie, Simon J.D., Physical Chemistry a molecular approach, Viva Books Private Limited (2008).
3. Donal Mc Quarrie., Quantum Chemistry, Viva Books Private Limited (2013).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ADDITION

**VIVEKANANDHACOLLEGEOFARTS&SCIENCESFORWOMEN (AUTONOMOUS)**

**DEPARTMENTOFCHEMISTRY**

44%

| SUBJECTCODE:17P1CH03 | | |
|---|---|---|
| **SEMESTER –I** | **CREDIT:5** | **HOURS:75** |

# PHYSICALCHEMISTRY-I

## OBJECTIVES

1. To impart knowledge of classifying the molecules based on symmetry and acquire knowledge in identifying the point group of the given compounds.
2. Understand the concept of kinetics and catalysis.

***Learning Outcome***

*Studentswillbeabletoidentifypointgroupsusingsymmetryelementsandrecognisesymmetryoperations. Students will learn to integrate knowledge to make rational answers in solving chemical problems.*

*Students can measure the rate of a chemical reaction.*

*Students will learn to evaluate the effect of catalyst, temperature on the rate of a chemical reaction and determine the activation energy.*

**Unit–I: GroupTheory-I** **(15Hours)**

2%

Principles of group theory - Symmetry elements - Symmetry operations - Properties of group - abelian, non abelian and cyclic groups - Group multiplication tables - Classes – Subgroups-Molecularpointgroups-Introductionofmatrices-Matrixrepresentationof symmetry elements - Reducible and irreducible representations - Properties of irreducible representation - Great orthogonality theorem and its consequences - Construction of character table for point groups ($C_{2v}$, $C_{3V}$and $C_2$h).

UNIT-II **Group Theory-II** **(15Hours)**

20%

ApplicationsofGrouptheory-Standardreductionformularelatingreducibleand Irreduciblerepresentations-Hybridizationschemesforatomsinmoleculesofdifferent Geometry-AB4tetrahedral, $AB_3$triangularplanar.Symmetriesofvibrationalmodes in non-linear molecules($H_2O$,$NH_3$and $BF_3$)-Integrationmethod-Selectionrulesinspectroscopy –IR&Ramanactive–Vibrationalmodes-Mutualexclusionrule-Symmetryincrystals-Hermann-Mauguinsymbols-.Spacegroupsofcrystals-Translationalelementsof

Symmetry–Comparison of crystal symmetry with molecular symmetry

**Unit–III: Chemical Kinetics (15Hours)**

Reactions in solution: Comparison between gas phase and liquid phase reactions - Effect of dielectric constant and ionic strength on reactions in solutions-Primary salt effect - Influence of pressure on rates of reactions in solution - Significance of volume and entropy of activations - Study of fast reactions: Flow methods, pulse methods, relaxation methods, Chain reactions - Stationary and non-stationary chain - explosion and explosion limits - Explosive reaction of $H_2O_2$. Linear free energy relation - Hammett and Taftequation.

20%

**Unit–IV: Kineticsand Catalysis (15Hours)**

Acid-base catalysis – Definitions-vantHoff and Arrhenius intermediates-Mechanism-protolyticandprototropiccatalysislaws-Bronstedcatalysislaw–Enzyme Catalysis-Michaelis-Mentenequation-Rateofenzymecatalysedreaction-Factors Affecting substrate, concentration, pH and temperature on enzyme catalyzed reaction-Inhibition of enzyme catalyzed reaction.

**Unit–V: Surface Chemistry (15Hours)**

2%

Adsorption - Types of adsorption - Difference between physical and chemical adsorptions - Adsorption isotherm: Freundlich's adsorption isotherm - Langmuir's adsorption isotherm and its limitations - Brunauer-Emmett-Teller (BET) adsorption isotherm and its applications - Heat of adsorption - Estimation of surface areas – B.E.T method, Titration method–Acetic acid, Nitrophenol method-Solids from solution

Adsorption studies - Chemisorption's: kinetics and thermodynamics - surface reactions and their mechanisms.

## CONTENTBEYONDTHESYLLABUS

1. Hybridization of aromatic organic molecules using group theory.
2. Role of Slater determinants in arriving hybridization of molecules.
3. Role of bio-organic catalyst inorganic synthesis.
4. Different types of organic reactions and their kinetic studies.
5. Show the predominance of nano particles in the field of catalysis.

## TEXTBOOKS


1. K.V.Raman., Group Theory, Tata McGraw-Hill Education (2004).
2. Ramakrishnan and M.S.Gopinathan, Group theory in chemistry, Vishal

Publications, 1988.

3. A.S.Kunju, G.Krishnan. Group Theory and Its Applications In Chemistry, 2ndEdn, PHI learning private Ltd (2015).
4. B.R.Puri, L.R.Sharma, M.S.Pathania., PrinciplesofPhysicalChemistry, Vishal Publishing Co. (2016).
5. J. Rajaram and J.C.K. Kuriakose. Kinetics and mechanism of chemical transformations, Macmillan India Ltd (1993).
6. K.J.Laidler., Chemical Kinetics, Pearson (2009).
7. M.S.GopinathanandV.Ramakrishnan., GroupTheoryinChemistry, Vishal Publishers, (1988).
8. K.VeeraReddy. SymmetryandSpectroscopyofMolecules, Newageinternational (2009).
9. GurudeepRaj, Advanced Physical Chemistry, Goel Publishing House, (2014).

**REFERENCE BOOKS**

1. F.A.Cotton., Chemical Applications of GroupTheory2ndEdn, Wiley Eastern Ltd (1989).
2. CapellosandB.H.J.Bielski, Kinetic systems,Willey interscience,Newyork,1968.
3. P.W.Atkins., Physical Chemistry, 6th Edn, Oxford University Press, (1998).
4. Alan Vincent, Molecular Symmetry and Group theory – Programmed Introduction to chemical applications, Wiley, Newyork, 1977.

**ONLINE SOURCES**

1. http://vlab.amrita.edu/?sub=2&brch=193&sim=1013&cnt=1
2. http://unicorn.mcmaster.ca/teaching/4PB3/SymmetryLectureNotes2009-Vallance-Oxford-level2.pdf
3. http://cbc.arizona.edu/~salzmanr/480a/480ants/kinintro/kinintro.html
4. http://nptel.ac.in/courses/122101001

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ELAYAMPALAYAM. TIRUCHENGODE.

**VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN**

**(AUTONOMOUS)**

NO ADDITION

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS**

| | |
|---|---|
| **SEMESTER -I** | **TOTALHRS: 75** |
| **14P1CHE01** | **CREDIT: 5** |

## ELECTIVE – I

## NANOCHEMISTRY

**Unit I: Introduction and Types of Nano chemistry (15)**

Introduction - Importance and Characterization of Nano materials - stability of nanoparticles in solutions. Different types of nanomaterials - Nanotubes: Single and Multiwalled carbon nanotubes- nanowires, nanorods & nanofibres.

**Unit II: Synthesis of metal nanomaterials (15)**

Physical methods –Laser Ablation, Physical Vapour Deposition (PVD) – Evaporation, sputerring and Solvated Metal Atom Dispersion (SMAD).

Chemical methods –Thermolysis - sonochemical approach, reduction of metal ions- reduction by hydrogen, reduction by sodium citrate, and reduction by hydrazine - borohydride reduction –alkali metal reduction - phase transfer processes in nanomaterials synthesis - Biosynthesis of nanoparticles.

**Unit III: Synthesis of Semiconductor Nanomaterials (15)**

Precipitation methods -Thermal decomposition of complex precursors - synthesis of ceramic nanoparticles - Physical methods - Gas Condensation Method, sand, Laser Methods –Chemical method - Sol-gel synthesis - Properties of Nanostructured materials - size effects – optical & electrical properties - magnetic properties.

**Unit IV: Characterizations of nanomaterials (15)**

Electron Microscopy: Transmission Electron Microscopy (TEM), Photo Electron Spectroscopy (xps), Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), Thermal gravimetric analysis TGA /Differential Scanning Calorimetry DSC –UV spectroscopy.

**Unit V: Nanosciences of biological materials (15)**

Introduction: Biological building blocks - size of building blocks and nanostructures - protein nanoparticles. Nucleic Acids - DNA Double Nanowire, Genetic code and protein synthesis - Biological nanostructures - Multilayer films.

**TEXT BOOKS**


1. K.L.Choy, Process principles and applications of novel and cost- effective ESAVD based methods, World Scientific Publishing, Singapore, (2002).

2. G.Schmid (Eds),Nanoparticles, Wiley-VCH, (2004).
3. P.Ajayan, L.S.Schadler, P.V.Brawn, Nanocomposite Science and Technology, Wiley-VCH, (2003).

4. G.Hodes(Eds.), Electrochemistry of Nanomaterials , Wiley-VCH, (2001).

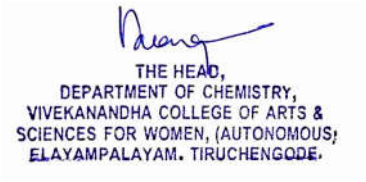

**REFERENCE BOOKS**


1. A.Jones and M.Mitchell, Nanotechnology-Commercial Opportunity, Evolution Capital Ltd. London, (2001).

2. Nishit Mathur , Nanochemistry RBSA publishers 340,Chaura rasta ,Jaipur (2010).

3. M.Kohler, W.Fritzsche, Nanotechnology, Wiley-VCH, (2004).

4. Charles P.Poole, Jr., Frank J.Owens, Introduction to Nanotechnology, Wiley (reprint 2012).

ADDITION

**VIVEKANANDHACOLLEGEOFARTS&SCIENCESFORWOMEN**
**(AUTONOMOUS)**

**DEPARTMENTOFCHEMISTRY**
**SYLLABUS**

44%

| SUBJECTCODE:17P1CHE01 | | |
|---|---|---|
| **SEMESTER –I** | **CREDIT:4** | **HOURS:60** |

**ELECTIVEPAPER–I NANOCHEMISTRY**

## OBJECTIVES

1. To introduce the students to the world of nanotechnology.
2. To enrich the knowledge of students in novel synthetic methods to prepare nanoparticles.
3. To acquire knowledge about advanced experimental methods, to predict the chemical structure, properties, and reactivities of unique nanostructures.
4. To understand the applications of nanotechnology in diversefield.

***Learning Outcome***

*Studentswillacquireknowledgeonvarioussyntheticmethodsofnanoparticlesandtechniquesto characterize them.*

*Students will be able to understand various types of nanoparticles and their properties.*

*Students learn about the promising applications of nanotechnology.*

**Unit–I: Introduction to Nanoscience** **(12Hours)**

20%

Definition, classification, a historical perspective, nanoparticles, nanocrystal, quantum dot, nanometer, new properties of nanomaterials, nanomaterials in medicine, information storage, sensors, new electronic devices, environmental remediation, clean catalyst. Metal nano particles, chemical bonding and properties of bulk metals as well as

metal nano particles. Gas phase and chemical synthetic methods to metal nanoparticles, nano electrons, conductivity of nanoelectrons.

**Unit–II:Synthesis of Nanomaterials** **(12Hours)** 2%

Physical methods –Laser Ablation, Physical Vapour Deposition (PVD) – Evaporation, sputerring and Solvated Metal Atom Dispersion (SMAD). Chemical methods –Thermolysis - sonochemical approach, reduction of metal ions- reduction by hydrogen, reduction by sodium citrate and reduction by hydrazine –boro hydride reduction–alkali metal reduction. Precipitation methods -Thermal decomposition of complex precursors - synthesis of ceramic nanoparticles-Physical methods-Gas Condensation Method, sand, Laser Methods –Chemical method-Sol-gel synthesis

**Unit–III: Characterizations of nanomaterials** **(12Hours)** 2%

Electron Microscopy: Transmission Electron Microscopy (TEM), Photo Electron Spectroscopy (xps), Scanning ElectronMicroscopy (SEM), X-ray Diffraction (XRD),Thermal gravimetric analysis TGA /Differential Scanning Calorimetry DSC –UV spectroscopy.

**Unit–IV: Properties and Applications of Nanoparticles (12Hours)** 20%

Nanotubes (CNT), nanocrystal shape, sequestration of gases, destructive adsorption of environmental toxins, optical properties and magnetic properties of nanoscale materials. Size dependent properties such as coercivity (magnetic memory) and saturation magnetization, nanoparticles in polymers, ink, fluids, dyes and catalysis. Nanoparticles as colorants, ultraviolet absorbers, electronics and in biomedical applications.

**Unit–V: Nanosciences of biological materials** **(12Hours)**

Introduction: Biological building blocks-size of building blocks and nanostructures - Protein nanoparticles. Nucleic Acids - DNA Double Nanowire, Genetic code and protein synthesis - Biological nanostructures - Multilayer films.

**CONTENTBEYONDTHESYLLABUS**

1. Discuss the green synthesis of nanoparticles and its advantages.
2. Application of microwave in the synthesis of nanomaterials.
3. Application of BET in characterization of nanomaterial.
4. Application of nanoparticles in renewable energy generation.
5. Nanomaterials as superconductors.

## TEXT BOOKS


1. Kenneth.klabunde,NanoscaleMaterialsinChemistry,JohnWiley&Sons,Inc.2002
2. MarkRatner,DanielRatner,Nanotechnolgy,PearsonEducation,Inc.2007
3. NishitMathur, Nanochemistry RBSA publishers 340, Chaurarasta,J aipur (2010).
4. G.Schmid(Eds),Nanoparticles, Wiley-VCH,(2004).
5. G.Hodes(Eds.),ElectrochemistryofNanomaterials,Wiley-VCH,(2001).
6. M.Kohler,W.Fritzsche,Nanotechnology,Wiley-VCH,(2004).
7. P.Ajayan, L.S.Schadler,P.V.Brawn, Nano composite Science and Technology,Wiley-VCH, (2003).


## REFERENCE BOOKS


1. K.L.Choy, Process principles and applications of novel and cost-effective ESAVD based methods, World Scientific Publishing, Singapore, (2002).
2. A.JonesandM.Mitchell, Nanotechnology-CommercialOpportunity,EvolutionCapital Ltd.London, (2001).
3. Mick Wilson Kannangara, Geoff Smith, Michelle simmons and Burkhard Raguse, Nanotechnology basic science and emerging technologies, overseas press.
4. CharlesP.Poole,Jr.,FrankJ.Owens,IntroductiontoNanotechnology,Wiley(reprint 2012)


## ONLINE SOURCES

1. nptel.ac.in/courses/103103033/module9/lecture1.pdf
2. http://folk.ntnu.no/fredrol/Nanomaterials%20and%20Nanochemistry.pdf
3. https://www.ceitec.eu/nanoparticles-for-biomedical-applications/f33079
4. https://chem.libretexts.org/

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**VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN**

**(AUTONOMOUS)**

NO ADDITION

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS**

| | |
|---|---|
| **SEMESTER –II** | **TOTAL HRS: 75** |
| **14P2CH04** | **CREDIT: 5** |

## ORGANIC CHEMISTRY –II

### UNIT-I: Substitution reactions-II (15)

**Aromatic electrophilic substitution reactions** – Introduction - Mechanism of electrophilic substitution. reactions such as halogenation, nitration, sulphonation and Friedel – Crafts alkylation's and acylation reactions. Orientation and reactivity-Electrophilic substitution on monosubstituted and disubstituted benzenes. Typical reactions such as Gattermann reaction, Gattermann Koch reaction, Reimer – Tiemann reaction, Kolbe reaction, Hofmann- Martius and Jacobson's reactions.

**Aromatic nucleophilic substitution reactions** - $S_N^1$, $S_N^2$, $S_N^{AR}$ and benzyne mechanisms. Ziegler alkylation - Chichibabin reaction - Cine substitution - diazonium group as leaving group.

### UNIT-II: Elimination Reactions (15)

Elimination Reactions: Mechanisms; $E_1$,$E_2$, $E_1CB$ – Stereochemistry of elimination, Hofmann and Saytzeff rules – Competition between elimination and substitution - Pyrolytic cis elimination, Chugaev reaction – Examples such as dehydration, dehydrohalogenation, Hofmann degradation, Cope elimination – Bredt's rule with examples.

### UNIT-III: Addition Reactions (15)

Addition across C-C multiple bonds- Electrophilic, Nucleophilic and Free radical addition to double bond and triple bonds, orientation and reactivity- Epoxidation, Michael addition, Hydroboration and Birch reduction. Addition reactions to Carbonyl compounds- Mechanism of Nucleophilic addition – Mannich reaction, Grignard, Stobbe, Thorpe and Benzoin reactions.

### UNIT-IV: Conformational Analysis (15)

Conformational analysis of simple cyclic (chair and boat cyclohexanes) and acyclic (n-butane) systems, conformation of simple 1,2 disubstituted derivatives – (ethylene chlorohydrin and ethylene glycol), conformational analysis and stereochemical features of disubstituted cyclohexanes (1,2–, 1,3– and 1,4–dialkyl cyclohexanes), conformation and stereochemistry of decalins, Effects of conformation on reactivity in acyclic and cyclohexanes, oxidation and acylation of cyclohexanols,

reduction of cyclohexanones, esterification and hydrolysis of cyclohexane carboxylic acid derivatives.

**UNIT-V: Reagents in Organic Synthesis (15)**

**Reduction:** Catalytic hydrogenation – Wilkinson Catalyst, dehydrogenation, reduction with LAH, $NaBH_4$, tertiarybutoxy aluminum hydride, $NaCNBH_3$, tributyltin hydride, alkali metals for reduction, reductions involving hydrazine (wolff kishner reduction).

**Oxidation:** osmium tetroxide, chromyl chloride, ozone, DDQ, dioxiranes, lead tetra acetate, selenium dioxide, DMSO with either $Ac_2O$ or oxalyl chloride, DCC, synthesis involving phase transfer catalysis (PTC), use of crown ethers.

**TEXT BOOKS**


1. S.H. Mukhergee and S. P. Singh, Reaction mechanisms in organic chemistry, McMillan (1976).
2. I.L. Finar, Organic chemistry, Vol. I and Vol. II. Pearson Education (P) Ltd (2011).
3. Ernest L. Eliel, Stereochemistry of Carbon Compounds, T.M.H Edition, Tata McGraw - Hill Publication Companies (1975).
4. P. S. Kalsi, Stereochemistry- Conformation And Mechanism, 6th Edition, New Age International Publishers (2005).


**REFERENCE BOOKS**


1. Jerry March, Advanced organic chemistry - Reactions mechanism and structure, McGraw Hill Kogakusha Ltd., (1977).
2. Lowry and Richardson, Mechanism and theory in organic chemistry, Harper & Row Publishers, New York (1981).
3. Raj K.Bansal, Organic Chemistry Reaction mechanisms, Hill Publishing Company Ltd (2006).


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ADDITION

73%

**VIVEKANANDHACOLLEGEOFARTS&SCIENCESFORWOMEN**
**(AUTONOMOUS)**

**DEPARTMENTOFCHEMISTRY**
**SYLLABUS**

| SUBJECTCODE:17P2CH04 | | |
|---|---|---|
| **SEMESTER –II** | **CREDIT:5** | **HOURS:75** |

**CORE PAPER - IV**

**ORGANICCHEMISTRY–II**

## OBJECTIVES

1. To enrich the students' knowledge in the field of reactions and reagents involved organic chemistry.
2. To impart knowledge in understanding the reaction conditions to arrive required product.
3. To understand the mechanism with which a reaction takes place.
4. To understand the various factors influencing a reaction.

***Learning Outcome***

*Students will learn the addition and elimination reactions taking place in the organic molecules. Students acquire deep understanding on diverse molecular rearrangements.*

17%

**Unit I: Addition reactions** **(15Hours)**

Addition across C-C multiple bonds – Electrophilic, Nucleophillic, Free radicals, orientation and reactivity –Addition of halogen and nitrosyl chloride to olefin. Hydrationofolefins and acetylenes. Epoxidation, Hydroboroation, Hydroxylation, Michael addition and Brich reduction. Diels Alder reaction,1,3-dipolaradditions. Carbenes, Nitrenes and theiraddition to double bond. Simmon-Smith reaction, Mannich, Stobbe, Darzen, Wittig, Wittig- Horner, Grignard, Thope and Benzoin condensation.

**UnitII:Eliminationreactions** **(15Hours)**

Elimination reactions–Mechanism of$E_1$,$E_2$ and $E_1$CB–stereochemistry of elimination,HofmannandSaytzeffrules–competitionbetweenEliminationand substitution–

Pyrolytic–Ciselimination,Chugaevreaction–Typicalreactionssuchas Dehydration, dehydroh alogenatio n, Hofmann degradation, Cope elimination – Bredt's rule.

**Unit III: Molecularrearrangements (15Hours)** 20%

A detailed study of the mechanism of the following rearrangements. Wagner – Meerwin, Demyanov, Dienone–Phenol, Favorski, Baeyer – Villiger, Wolff, Stevens, Von – Richter, Beckmann, Kornblum–DeLaMare, Smiles, Jacobsen, Neber, Fries, Ireland-Claisen,Hofmann–Martius rearrangements.

20%

**UnitIV:Organic naming reactions and applications (15Hours)**

Adetailedstudyofthefollowingnamingreactions-Biginellireaction,Hoeben – Hoesch reaction, Vilsmeyer formylation, Bucherer reaction, Pauson – Khandreaction, Heck reaction, Suzzuki, Stille, Sonogashira, Negishi, Cadiot–Chodkiewicz coupling reactions. Huigens synthesis. Baylis-Hillman, Luche, Yamaguchi.

**UnitV: Reagents for Organic synthesis (15Hours)**

Aluminiumchloride, Alumnium isopropoxide, N-Bromosuccinimide,$OsO_4$,DCC,N-Chlorosuccinimide, Diazomethane, Fenton's reagent, Hydrogen peroxide, Lead tetraacetate,Lithium aluminium hydride, Perbenzoic acid, Periodic acid, Seleniun dioxide,Sodium borohydride, $NaCNBH_3$, DDQ, Wilkinson catalyst, Wolff Kishner reagent, Wittig reagent. 16%

**CONTENTBEYONDTHESYLLABUS**

1. Discuss the addition of nitrenes and carbenes upon triple bond and their stabilityparameters.
2. Listoutorganicreactionsperformedinaqueous medium.
3. Identifytheadvantagesofaqueousmediumorganicsynthesis.
4. Identify the disadvantages of aqueous medium organic synthesis and find a solution to overcome the problem.
5. Write a synthetic route for the synthesis of thiazolidones, tetrazoles and oxindoles with reference to the biological applications.

**TEXTBOOKS**

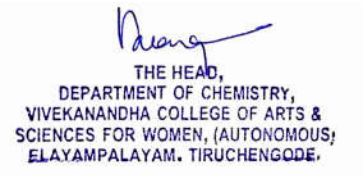
1. JerryMarch,Advanced organicchemistry-Reactionsmechanismandstructure, McGraw Hill Kogakusha Ltd., (1977).
2. S.H. Mukhergee andS.P.Singh, Reaction mechanisms in organic chemistry, McMillan (1976).
3. Raj K.Bansal, Organic Chemistry Reaction mechanisms, Hill Publishing Company Ltd (2006).
4. I.L.Finar, Organicchemistry,Vol.II. PearsonEducation(P)Ltd(2011).

**REFERENCE BOOKS**

1. S.N.Sanyal,Reactions,RearrangementsandReagents,BharatiBhavanPublishers& Distributor (2013)
2. V.K.Ahluwalia,RakeshKumarParasharandR.K.Parashar,OrganicReaction Mechanisms NarosaPublishingHouse(2002).

**ONLINE SOURCES**

1. http://www.name-reaction.com/list
2. http://www.synarchive.com/named-reactions
3. https://chem.libretexts.org/
4. http://www.chem.ucalgary.ca/courses/351/Carey5th/Carey.html



**VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN**

**(AUTONOMOUS)**

NO ADDITION

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS**

| | |
|---|---|
| **SEMESTER II** | **TOTAL HRS: 75** |
| **14P2CH05** | **CREDIT: 5** |

## INORGANIC CHEMISTRY II

### UNIT I: Stereo Chemistry of Complexes (15)

Geometrical and optical isomerism of octahedral and square planar complexes. Electronic spectra of complexes -interpretation including charge transfer spectra- Orgel diagrams -Tanabe - Sugano diagram.

Metal Carbonyls –Binuclear and tri nuclear carbonyls of iron, cobalt and manganese - Preparation, properties, uses. Nature of M-CO bond in carbonyls. Metallic Nitrosyls - Nitrosyl carbonyls, Metal Nitrosyl hydroxide, metal nitrosyl thio compound - Nature of M - NO bonding - structure of $Fe(NO)_4$, $Fe_2(NO)_4$, $Fe(NO)_3Cl$, $Fe(NO)_2(CO)_2$.Organo metallic compounds of transition elements -classification, Pi olefinic complexes Pi sandwich complexes-Ferrocene, -Preparation, Properties and structure –MO theory and 18 electron rule.

### UNIT II: Nuclear and radiation chemistry (15)

Nuclear structure-mass and charge- Nuclear moments- Binding energy- Semi empirical mass equation- Stability rules- Magic numbers- Nuclear models- Shell, Liquid drop, Fermi gas, Collective and optical models- Equation of radioactive decay and growth- half life and average life. Radioactive equilibrium- Transient and secular equilibrium- Determination of half-lives- Nuclear reactions- Energetic of nuclear reaction- Types of nuclear reactions- Spontaneous and reduced fission- Neutron capture cross section and critical size- Principle and working of GM, Proportional, Ionization and Scintillation counters.

### UNIT III: AAS, PES and Crystal Studies (15)

Atomic absorption spectroscopy and flame emission spectroscopy: Basic principles- flame characteristics - atomizers and burners- interference instrumentation and applications of AAS and FES.PES –theory of XPES,UVPES-evaluation of ionization potential-chemical identification of elements-ESCA-Koop Mann's theorem-chemical shift-UPES,XPES of $N_2$,$O_2$, and HCL-evaluation of vibration constants from UPES-spin orbit coupling. X-ray diffraction and neutron diffraction.

A brief account of the principles of molecular structure-single crystal method -Neutron diffraction-application of molecular structure determination-advantages of X-ray diffraction studies.

**UNIT IV: Bio-Inorganic Chemistry: (15)**

Porphyrin ring system-Metalloporphyrins-Hemoglobin and Myoglobin-structures and work functions –synthetic oxygen carriers –Cytochromoes-structure and work functions in respiration – chlorophyll, structure photo synthetic sequence-iron –Sulphur proteins-(Non –Haemo-Iron protein)-Copper oxidizes- bluecarbon proteins, carboxyl peptidase A –structure, function-carbonic Anhydrase-Inhibition and poisoning –Corin ring system- vitamin $B_{12}$,co-enzymes-in vivo and in vitro nitrogen fixation- essential and trace elements in biological systems-metal ion ,toxicity and detoxifications-molecular mechanism of ion transport across the membrane-Na and K ions pumps-Chelate therapy-Cis plating.

**UNIT V: Non-aqueous solvents (15)**

Reactions in non-aqueous solvents- Solute-Solvent interactions- Reactions in liquid ammonia-Solutions of metals in liquid ammonia- Reactions in anhydrous Sulphuric acid, liquid Sulphur dioxide, liquid HF and liquid Dinitrogen Tetroxide. Distribution law, Extraction process, liquid - liquid Extraction, Extractants, Factors Effecting Extraction, Technique for solvent Extraction, Completion of analysis, Quantitative Treatment of solvent Extraction Equilibria, Classification of solvent extraction Systems, Types of extraction systems, types of inorganic extraction systems, Transition of a substance from an aqueous phase.

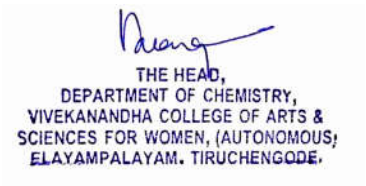
**TEXT BOOKS**


1. W.U. Malik, G.D. Tuli and R.D. Madan, Selected topics in Inorganic Chemistry, 6$^{th}$edition S.Chand & company Ltd., (2005).
2. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry, 4th edition, Pearson education (2006).
3. Gurudeep Raj, Advanced Inorganic Chemistry Vol. I & Vol. II, 6th edition, Goel publishing house (1998).
4. B.R.Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, S.Chand & company Ltd., (2004).
5. G.S. Manku, Theoretical Principles of Inorganic Chemistry, Tata McGraw –Hill Company Publishing ltd., (1999).


**REFERENCE BOOKS**


1. Gurudeep Raj, Ajay Bhagi and Vinod Jain, Group theory and symmetry in Chemistry, Krishna Prakashan Media (p) Ltd, Meerut, (2002).
2. M.S.Gopinathan and V. Ramakrishnan, Group theory in Chemistry, Vishal Publishing & Co (2000).
3. K.V. Raman. Group theory and its applications to chemistry, Tata McGraw-Hill, (1990).

4. Cotton and Wilkinson, Advanced Inorganic Chemistry, Wiley Inter science Publications (2000).
5. B.K.Sharma, Instrumental Methods of Chemical Analysis, Krishna Prakashan Media, (2000).



ADDITION

**CORE PAPER - V**

100%

**INORGANIC CHEMISTRY II**

| SUBJECT CODE: 17P2CH05 | | |
|---|---|---|
| **SEMESTER – II** | **CREDIT : 5** | **HOURS : 75** |

## OBJECTIVES

1. To impart the knowledge on types of bonding in simple and complex molecules.
2. To understand the concept of HOMO and LUMO, and their influence in bond formation.
3. To acquire knowledge about formation of complexes and their stability parameters with appropriate mechanisms.
4. To acquire knowledge about LS coupling, terms, levels, states and term symbol parity.

***Learning Outcome***

*Students will acquire sound knowledge on bonding in inorganic molecules.*

*Students will learn the theories, mechanism of complex formation and the electronic spectra of coordination complexes.*

**Unit I: Ionic Bonding (15 Hours)**

20%

Ionic bonding – Lattice energy – Born equation – Born-Haber cycle - Radius ratio rule – Born Meger equation – Kapustinskii modification – energetics of the dissolution of ionic compounds in polar solvents - polarization- Fajan's rule – results of polarization. Electronegativity – determination – methods of estimating charges, electronegativity equalization – Types of chemical forces – effects of chemical forces - melting and boiling points, solubility and hardness.

20%

**Unit II:Covalent Bonding and Molecular Structure (15 Hours)**

Covalent bonding: Formal charges - Limitations of octet rule- Hybridisation and geometry - VSEPR model: $CH_4$, $NH_3$, $H_2O$, $PCl_3F_2$ - Bent's rule: $SF_4$, $BrF_3$, $[ICl_2]^-$, $[ICl_4]^-$, $XeF_4$, $XeOF_4$, $XeO_4$, $XeO_3$, $XeF_6$, $XeF_2$ - Bond angle - *s*, *p* character relationship - Failures of VBT - MO theory: LCAO method - Molecular orbitals in homo nuclear diatomic molecules: $O_2$, $Be_2$, $N_2$ and $C_2$ - hetero nuclear diatomic molecules: HCl, NO and CO - HOMO and LUMO concepts in bonding.

20%

**Unit III: Coordination Theories (15 Hours)**

CFT: Splitting pattern of d-orbital in various environments of ligands (octahedral, tetrahedral, square-planar) - CFSE - Factors affecting the magnitude of CFSE - Weak and strong fields - Pairing energy – Jahn Teller distortion - Nephlauxetic effect - Limitations of CFT - LFT: Evidence for covalent nature of metal-ligand bonds - pi-bonding theory - Construction of MO diagram for σ and π bonded $O_h$ complexes.

**Unit IV: Reaction Mechanism in Coordination Complexes (15 Hours)** 20%

Stability of complexes, Thermodynamic and kinetic stability – stability constants - Substitution reactions: General mechanism - Schemes of octahedral, tetrahedral and square planar complexes - Trans effect - Theories of trans effect - pi-bonding theory and polarisation theory - Applications of trans effect - Catalysis by transition metal complexes: Hydrogenation of alkene (Wilkinson's catalyst), Hydroformylation (Oxo process), Wacker process and Zieglar-Natta catalysis.

**Unit V: Electronic Spectra and Organometallics (15 Hours)** 20%

Spectroscopic term symbols for $d^n$ ions – derivation of term symbols and ground state term symbols – Energy level diagrams. Electronic spectra of complexes - Orgel diagram - interpretation of electronic spectra of $d^1$ to $d^9$ - Tanabe-Sugano diagrams - charge transfer spectra - Carbonyls: Binuclear and tri nuclear carbonyls of iron, cobalt and manganese - preparation, properties, uses - Nature of M-CO bond in carbonyls - Nitrosyls - Nitrosyl carbonyls - Metal nitrosyl hydroxide - Metal nitrosyl thio compound - Nature of M-NO bonding - structure of $[Fe(NO)_4]$, $[Fe_2(NO)_4]$, $[Fe(NO)_3Cl]$, $[Fe(NO)_2(CO)_2]$ - Metallocenes: Ferrocene, Cobaltocene - Preparation, Properties and structure.

## CONTENT BEYOND THE SYLLABUS

1. Discuss the applications of organic metallics in catalysis.
2. The role of organic metallic compounds in biological systems.
3. The function of coordination compounds as homogeneous and heterogeneous catalyst.
4. Discuss on stability parameters of various metal-nitrosyl compounds.

## TEXT BOOKS

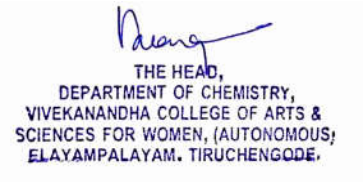

1. J. E. Huheey, E. A. Keiter and R. L. Keiter., Inorganic Chemistry, 4th Edn, Pearson education (2006).
2. F. A. Cotton, G. Wilkinson., Advanced Inorganic Chemistry, 3rd Edn, John Wiley & Sons, Inc (1972).
3. W. U. Malik, G. D. Tuli and R. D. Madan., Selected topics in Inorganic Chemistry, 6th Edn S. Chand & company Ltd., (2005).
4. B. R. Puri, L. R. Sharma and K. C. Kalia., Principles of Inorganic Chemistry, S. Chand & Co (2004).
5. R. D. Madan., Modern Inorganic Chemistry, Chand Publishers (2004).

## REFERENCE BOOKS


1. C. N. Banwell., Fundamentals of Molecular Spectroscopy, Mc Graw Hill, Newyork (2001).
2. G. Raj., Advanced Inorganic Chemistry Vol. I & Vol. II, 6th Edn, Goel publishing house (1999).
3. G. S. Manku., Theoretical Principles of Inorganic Chemistry, Tata McGraw –Hill Publishing Company Ltd., (Reprint 2001)
4. R. Chang., Basic principles of Spectroscopy, McGraw Hill Ltd., New York, (1971).


## ONLINE SOURCES

1. http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch8/vsepr.html
2. https://chem.libretexts.org/Core/Inorganic_Chemistry/Crystal_Field_Theory/Orgel_diagrams
3. http://www.chem.iitb.ac.in/people/Faculty/prof/pdfs/L5.pdf



**VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN**

**(AUTONOMOUS)**

NO ADDITION

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS**

| | |
|---|---|
| **SEMESTER II** | **TOTAL HRS: 75** |
| **14P2CHE02** | **CREDIT: 5** |

# ELECTROCHEMISTRY AND PHOTOCHEMISTRY

## (ELECTIVE-II)

### UNIT – I: Electro Chemistry - I (15)

Introduction to electrochemical cells-Types-Chemical cells with and without transferences-Concentration cells- types- electrode concentration cells-electrolytic concentration cells- with and without transferences-Liquid liquid junction-Diffusion potential-derivation-salt bridge- Electrokinetic phenomena: Electrical double layer, theories of double layer, electro-capillary phenomena, electro-capillary curve. Electro-osmosis electrophoreses. Streaming and Sedimentation potentials.

### UNIT-II: Electro Chemistry - II (15)

Debye - Huckel theory of inter-ionic attraction, ionic atmosphere, time of relaxation, relaxation and -phoretic effects, Debye-Huckel-Onsagar equation and its validity for dilute solutions at appreciably concentrated solutions. Debye-Falkenhagen and Wein effects. Abnormal ionic conductance of hydroxyl and hydrogen ions. Activity coefficients: forms of activity coefficients and their interrelationship. Debye-Huckel limiting law, applications of concentrated solutions. Debye-electro Huckel Bronsted equations. Quantitative and qualitative verification of Debye- Huckel limiting law, ion association and Bjerrum theory

### UNIT-III: Photochemistry – I (15)

Absorption of light and nature of electronic spectra, electronic transition, Frank- Condon principle, selection rules, photodissociation, predissociation, photochemical reactions: photoreduction, photo-oxidation, photodimerization, photochemical substitution, photoisomerization, photochemistry of environment: Green house effect. Photo physical phenomena: Electronic structure of molecules, molecular orbital,electronically excited singlet states, designation based on multiplicity rule, life time of electronically excited state, construction of Jablonski diagram.

**UNIT-IV Photochemistry – II** **(15)**

Electronic transitions and intensity of absorption bands, photophysical pathways of excited molecular system (radioactive and non-radioactive), prompt fluorescence, delayed fluorescence, and phosphorescence, fluorescence quenching: concentration quenching, quenching by excimer and exciplex emission, fluorescence resonance energy transfer between photo excited donor and acceptor systems. Stern-Volmer relation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisional quenching and Stern-Volmer equation.

**UNIT-V: Photochemistry in nature & Applied Photochemistry** **(15)**

Photochemistry reaction in the atmosphere-oxygen and ozone- nitrogen oxide-chlorofluoro carbons-organic compounds- chemistry of vision-photography-photosensitisers-ultraviolet screening agents-optical bleach-photochronism-photoimaging-photochemistry of polymers-Photopolymerization: imaging,curing-photodegradation and photostabilization.

**TEXT BOOKS**


1. K. K. Rohatgi - Mukharjii, Wiley Eastern., Fundamentals of Photochemistry, New age international.,(P)., Ltd., New Delhi (2011) .
2. S. Glasstone, D. Van Nostrand., An introduction to Electrochemistry., Affilated East west press Pvt., Ltd., New Delhi, (2004).
3. Jagdamba singh, Jaya singh, Photochemisty & Pericyclic Reaction, New age international publishers (2012).


**REFERENCE BOOKS**


1.. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House ., (1999).

2. M.S Yadav Electrochemistry- Anmol Publication Pvt Ltd. New Delhi, (2011).

3. J.G.Calverts & J.N.Pitts - An introduction to Photochemistry, New age international (p) Ltd., New Delhi

4. Wells, Introduction to Photochemistry, New age international (P) Ltd., (2010).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ELAYAMPALAYAM. TIRUCHENGODE.

ADDITION

2%

**VIVEKANANDHACOLLEGEOFARTS&SCIENCESFORWOMEN**
**(AUTONOMOUS)**

**DEPARTMENTOFCHEMISTRY**
**SYLLABUS**

| SUBJECTCODE:17P2CHE02 | | |
|---|---|---|
| **SEMESTER –II** | **CREDIT:4** | **HOURS:60** |

**ELECTIVE PAPAER-II**

**ELECTROCHEMISTRYANDPHOTOCHEMISTRY**

## OBJECTIVES

1. To impart the basic concepts electrochemistry.
2. To understand the application of electrochemistry and electrochemical cells.
3. To acquire knowledge about electro chemical reactions.
4. To enrich the students' knowledge with the basic principles and application of photochemistry.
5. To study various types of photochemical reactions.

***Learning Outcome***

*Students will understand the basic principles of electrochemistry and different types of electrochemical cells.*

*Students will learn about the basic concepts of photochemistry and their importance in various fields.*

**UNIT–I : Electrochemistry–I** **(12Hours)**

Introduction to electrochemical cells-Types-Chemical cells with and without transferences-Concentration cells- types- electrode concentration cells-electrolytic concentration cells - with and without transferences - liquid junction - salt bridge - derivation- Electrical double layer, theories of double layer - Electrokinetic phenomena: Electroosmosis – electrophoresis - Diffusion, Streaming and Sedimentation potentials - electro-capillary phenomena, electro-capillary curve.

2%

**UNIT–II: Electrochemistry-II** **(12Hours)**

Debye - Huckel theory of inter-ionic attraction, ionic atmosphere, time of relaxation, relaxation and - phoretic effects, Derivation of Debye-Huckel-Onsagar equation and its validity for dilute solutions at appreciably concentrated solutions. Debye-Falkenhagen and Wein effects. Mean ionic activity coefficients and their determination. Debye - HuckelBronsted equations - Derivation of Debye-Huckel limiting law, Quantitative and qualitative verification, ion association and Bjerrum theory.

**UNIT–III: Photochemistry** **(12Hours)**

Absorption of light and nature of electronic spectra, electronic transition, Frank-Condon principle, selection rules, photodissociation, predissociation, photochemical reactions: photoreduction, photo-oxidation, photodimerization, photochemicalsubstitution, photoisomerization, photochemistry of environment: Green house effect. Photo physical phenomena: Electronic structure of molecules, molecular orbital, electronically excited singlet states, designation based on multiplicity rule, life time of electronically excited state, construction of Jablonski diagram. Stern-Volmer equation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisional quenching.

**UNIT–IV Organic Photochemistry** **(12Hours)**

Fundamental concepts - Photooxidation reaction (Formation of Peroxycompounds)–Photoreduction of ketones and enones, Norrish typeI and II reactions-

Photochemistry of Alkenes, Dienes and Aromatic compounds - Photoisomerisation – Cisand Trans isomerization - Photoaddition reaction-Paterno-Buchi reaction- Photo rearrangements - Photo–Fries rearrangement and photorearrangement of 2,5-Cyclohexadienones.

**UNIT–V: Applied Photochemistry** **(12Hours)**

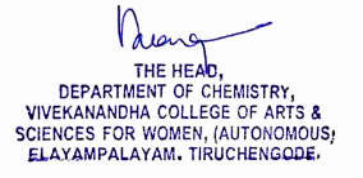
Photochemistry reaction in the atmosphere - oxygen and ozone - nitrogen oxide - chlorofluoro carbons - organic compounds - chemistry of vision – photography - photosensitisers-ultraviolet screening agents - optical bleach – photochronism - photoimaging - photochemistry of polymers - Photo polymerization: imaging, curing - photodegradation and photostabilization.

## TEXTBOOKS


1. K. K. Rohatgi - Mukharjii, Wiley Eastern., Fundamentals of Photochemistry, New age international.,(P)., Ltd., New Delhi (2011)
2. S. Glasstone,D. Van Nostrand., An introduction to Electrochemistry., Affilated Eastwest press Pvt., Ltd., New Delhi, (2004).
3. GurdeepRaj, Advanced Physical Chemistry, Goel Publishing House. (1999).
4. Jagdambasingh ,Jayasingh, Photochemisty &Pericyclic Reaction, Newage international publishers (2012).


## REFERENCE BOOKS


1. M.SYadav Electrochemistry-Anmol Publication PvtLtd. NewDelhi, (2011).
2. J.G.Calverts&J.N.Pitts-An introduction to Photochemistry, Newage international (p)Ltd., NewDelhi. Wells, Introduction to Photochemistry, Newage international (P) Ltd., (2010).

# VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN

**(AUTONOMOUS)**

NO ADDITION

## DEPARTMENT OF CHEMISTRY

## SYLLABUS

| | |
|---|---|
| **Semester- III** | **Total Hrs: 75** |
| **Paper Code: 14P3CH07** | **Credit: 5** |

CORE PAPER - VII

## INORGANIC CHEMISTRY – III

### UNIT I: Theories of Acid-Base Concept (15)

Lewis concept of acids and bases – classification of acids and bases – solvolysis reaction, formation of metal complexes- The solvent system concept of acids and bases – Usanovich concept – strength of hydracids, strength of oxyacids - Pauling rule – Hard and Soft acids and bases (HSAB) – Pearson's principle – applications of HSAB -principle – symbiosis – theoretical basis of Hardness and Softness – Electronegativity of Hardness and Softness.

### UNIT II: Nuclear Chemistry – II (15)

Different type of nuclear reactions with natural and accelerated particles - transmutation - stripping and pick-up - spallation – fragmentation – reaction cross section, Q value, threshold energy – nuclear fission - characteristics of fission reaction - product distribution and theories of fission - fissile and fertile isotopes - $U^{235}$, $U^{238}$, $Th^{232}$ and $Pu^{239}$ - atom bomb - nuclear fusion - stellar energy - synthesis of trans uranium elements - principles underlying the usage of radioisotopes in analysis - agriculture - industry and medicine - uses of radioisotopes in analytical chemistry - isotopic dilution analysis - neutron activation analysis and dating methods.

### UNIT III: Chains, Rings And Cages (15)

Chain catenation – Heterocatenation: Silicate minerals, one dimensional conductors. Rings: Borazines – Phosphazenes and its polymers – Homocyclic inorganic systems. Cages: Introduction – boranes: closo, nido and arachno boranes – Carboranes.

Poly acids – Isopolyacids of V, Cr, Mo and W, Heteropoly acids of Mo and W.

### UNIT IV Organometallic Compounds (15)

Definition of organometallic compounds – classification of organometallic compounds – The metal carbon bond types – ionic bond, sigma covalent bond, electron deficient bond – delocalized bond and dative bond. Metal alkyl complexes – stability and structure – synthesis by alkylation of metal halides, by oxidative addition, by nucleophilic attack on coordination ligands – metal alkyls and 18 electron rule – reactivity of metal alkyls – M-C bond cleavage reactions – insertion of CO to M-C bonds – double carbonylation. Metallocene: Structure and bonding of Ferrocene.

**UNIT V Organometallic Compounds In Catalysis – II (15)**

Alkene complexes - synthesis of alkene complexes by ligand substitution, by reduction, by metal atom synthesis - bonding of alkenes to transition metals - bonding in diene complexes - reactivity of alkene complexes - ligand substitution with nucleophiles - olefin hydrogenation (Wilkinson's catalyst) – hydrosilation – Wacker's process - Zeigler-Natta polymerization of olefins - reactions involving carbon monoxide such as hydrocarbonylation of olefins (Oxo reactions) using Co and Rh catalysts – cyclooligomerisation of acetylene using Ni catalyst (Reppe's catalyst).

**TEXT BOOKS**

1. B.R.Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic ,Shoban Nagincchand & Co,(2004)
2. R.D. Madan S. Chand, Modern Inorganic Chemistry publishers 2004.
3. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry 4th edition Pearson education (2006).
4. G.S. Manku, Theoretical Principles of Inorganic Chemistry, Tata McGraw – Hill Publishing Company ltd., (reprint 2001)

**REFERENCE BOOKS**

1. H.J.Arnikar,Essentials of Nuclear chemistry .
2. Cotton and Wilkinson 5th A Wiley, Advanced Inorganic Chemistry Interscience Publications (2000).
3. W.U. Malik, G.D. Tuli and R.D. Madan, Selected topics in Inorganic Chemistry ,6th edition S.Chand & company Ltd., (2005)
4. Gurudeep Raj, Advanced Inorganic Chemistry Vol. I & Vol. II 6th edition Goel publishing house (1999)

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ADDITION

80%

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**DEPARTMENTOFCHEMISTRY**
**SYLLABUS**

# INORGANIC CHEMISTRY - III

| SUBJECT CODE: 17P3CH07 | | |
|---|---|---|
| **SEMESTER – III** | **CREDIT : 5** | **HOURS : 75** |

**OBJECTIVES**

1. To gain knowledge on non-aqueous solvents, cages ,chains and clusters.
2. To give elaborate insight into the field of solid state and bio-inorganic chemistry.
3. To understand the working and application of various analytical tools to deduce ctystal structure of solids.

***Learning Outcome***

*Students will learn the application and properties of non-aqueous solvents general properties and formation of liquid and gaseous molecules.*

*Students will be introduced to variety of inorganic molecule of commercial application. In future, it will help the students to explore constructive application of silicates , Zeolites,Ultramarine silicones.*

*Students are enable to understand the basic of crystal structure, application of the analytical tools like XRD,AAS and PES tools in elucidating three dimentional structure of the inorganic molecules.*

**Unit – I: Non-aqueous solvents (15 Hours)**

20%

Classification of non aqueous solvents- Solute-Solvent interactions- Reactions in liquid ammonia- metals in liquid ammonia- Reactions in anhydrous sulphuric acid, liquid sulphur dioxide, liquid HF and liquid, dinitrogen tetroxide. Distribution law, extraction process, liquid - liquid extraction, extractants, factors affecting extraction, technique for solvent extraction, quantitative

treatment of solvent extraction equilibria, Classification of solvent extraction systems, Transition of a substance from an aqueous phase.

**Unit – II: Inorganic chains, rings, cages and clusters (15 Hours)**

Silicate minerals – ortho-, pyro-, and meta-silicates – pyroxene, amphiboles – two-dimensional silicates – talc, mica and three dimensional aluminosilicates, zeolites. Silicones-preparation, properties and uses - Iso and hetero-polyacids - Structures of $[TeMo_6O_{24}]^{6-}$ and $[Mo_7O_{24}]^{6-}$ ions and $[PMo_{12}O_{40}]^{3-}$ ion – Polymeric sulphur nitride – borazines, phosphonitrilic compounds-trimers and tetramers - homocyclic inorganic ring systems – Concept of multi-centered bond – structure of $B_2H_6$, $B_4H_{10}$, $[B_{12}H_{12}]^{2-}$, $B_6H_{10}$, Wade's rules, closo, nido, arachno boranes and carboranes and "styx" code.

**Unit – III: Solid State Chemistry (15 Hours)** 20%

Space lattice - unit cell- crystal systems- elements of symmetry- space groups-Miller indices-crystal analysis- XRD - rotating crystal method- powder method - packing of atoms and ions in solids- Electrical properties of solids – Band theory, semiconductors, super conductors, theory of super conductivity – defects in solids - solid state electrolytes; magnetic properties of solids – dia, para, ferro, antiferro and ferrimagnetism; hysterisis; Optical properties – solid – state lasers and Inorganic phosphors. Reactions in solid state and phase transitions – diffusion coefficient, diffusion mechanism, vacancy and interstitial diffusions, formation of spinels and inverse spinels; solid solutions.

**Unit – IV: Atomic absorption, emission spectroscopy and Crystal Studies (15 Hours)** 20%

Atomic absorption spectroscopy and flame emission spectroscopy: Basic principles - flame characteristics - atomizers and burners- interference instrumentation and applications of AAS and FES. PES –theory of XPS, UPES-evaluation of ionization potential-chemical identification of elements – ESCA - Koopmann's theorem-chemical shift - UPES, XPS of $N_2$, $O_2$, and HCl-evaluation of vibration constants from UPES-spin orbit coupling.

20%

**UNIT – V: Bio-inorganic Chemistry (15 Hours)**

Porphyrin ring system - Metalloporphyrins - Haemoglobin and Myoglobin-structures and work functions - other oxygen carriers - Cytochromes: Structure and work functions in respiration - Chlorophyll, structure - photo synthetic sequence - Sulphur proteins - (Non -Haemo iron protein) -

Copper oxidizes - Blue copper proteins - Carboxyl peptidase A: Structure, function - Carbonic anhydrase: Inhibition and Poisoning - Corrin ring system - Vitamin $B_{12}$, In vivo and in vitro nitrogen fixation - Molecular mechanism of ion transport across the membrane - Na and K ion pumps-Chelate therapy-cis-platin

**CONTENT BEYOND THE SYLLABUS**

1. Nonaqueous solvent as a medium to conduct organic reactions.
2. Application of silicates, silicones and zeolites ,felspar,aluminosilicates in the field of medicine.
3. Minerals present in the human body.
4. Applications of different MEMBRANES USED IN AAS.
5. Solid state chemistry in human welfare.

**REFERENCES**


1. J. E. Huheey, E. A. Keiter and R. L. Keiter., Inorganic Chemistry, 4th Edn, Pearson education (2006).
2. F. A. Cotton, G. Wilkinson., Advanced Inorganic Chemistry, 3rd Edn, John Wiley & Sons, Inc (1972).
3. G. Raj., Advanced Inorganic Chemistry Vol. I & Vol. II, 6th Edn, Goel publishing house (1999).
4. G. S. Manku., Theoretical Principles of Inorganic Chemistry, Tata McGraw –Hill Publishing Company Ltd., (Reprint 2001).
5. R. Chang., Basic principles of Spectroscopy, McGraw Hill Ltd., New York, (1971).


**TEXT BOOKS**


1. U. Malik, G. D. Tuli and R. D. Madan., Selected topics in Inorganic Chemistry, 6th EdnS. Chand & company Ltd., (2005).
2. B. R. Puri, L. R. Sharma and K. C. Kalia., Principles of Inorganic Chemistry, S. Chand & Co (2004).
3. R. D. Madan., Modern Inorganic Chemistry, Chand Publishers (2004).

**VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN**

**(AUTONOMOUS)**

NO ADDITION

**DEPARTMENT OF CHEMISTRY**

# SYLLABUS

| | |
|---|---|
| **Semester- III** | **Total Hrs: 75** |
| **Paper Code: 14P3CH08** | **Credit: 5** |

CORE PAPER – VIII

## PHYSICAL CHEMISTRY – II

### UNIT - I Spectroscopy-I (15)

**Introduction**: Electromagnetic radiation, Interaction of light with matter, mechanism of absorption & emission of radiation. Rotational, vibrational, and electronic energy levels and transitions in molecules; regions and representation of spectra.

**Micro wave Spectroscopy**: Diatomic molecules as rigid rotors: rotational energy levels, intensity of spectral lines, selection rules, effect of isotopic substitution. Diatomic molecules as non-rigid rotors. Rotational spectra of polyatomic molecules.

### UNIT - II Spectroscopy-II (15)

**Vibrational Spectroscopy**: Vibrating diatomic molecule: energy of diatomic molecules as simple harmonic and Unharmonic oscillator - energy levels, vibrational transitions, and selection rules; Diatomic vibrating rotator: Born-Oppenheimer approximation, vibration-rotational spectra, selection rules; P, Q, R branches. Vibrations of polyatomic molecules: fundamental vibrations and its symmetry, normal modes of vibration, overtones and combination of bands.

**Raman Effect**: Rayleigh and Raman scattering, Stokes and anti-Stokes lines, molecular polarizability, Raman selection rules. Raman spectra: rotational Raman spectra- linear molecules, symmetric top and spherical top molecules; vibrational Raman spectra-symmetry and Raman active vibrations, rule of mutual exclusion.

### UNIT – III Quantum Chemistry-II (15)

Quantum theory : Approximation methods -Perturbation and Variation methods-application to hydrogen and helium atom- self consistent approximation- Hartree and Hartree-Fock's SCF - Discussion of the wave functions-radical distribution function- orbital and orbital diagrams- their significance-VB and MO theory-application to hydrogen molecule- Eigen value calculations for Hydrogen based on analytical functions

### UNIT – IV Chemical Kinetics-II (15)

Explosion reaction – $H_2$-$O_2$ mechanism - Rice Herzfeld mechanism- Kinetics of $H_2$-$Cl_2$ and $H_2$-$Br_2$ – Decomposition of Acetaldehyde. Theories of reaction rates: Arrhenius theory, Hard - sphere collision theory of gas – phase reactions. Activated complex theory of reaction rates, Eyring equation. Rice-Ramberger , Kassel – Marcus theory, Reaction in molecular beams. Relation between activated - complex theory and hard - sphere collision theory. Thermodynamic formulations of activated complex theory - kinetic isotopic effects.

**UNIT-V GROUP THEORY-II (15)**

Applications to Vibrations and Raman Scattering –Fundamental Procedures and Determination of representation of vibrational modes in non-linear molecules such as $H_2O$, $CH_4$ , $XeF_4$, $SF_6$ and $NH_3$ – Fundamental Procedures and Symmetry of Hybrid orbitals in non-linear molecule Such as $BF_3$, $CH_4$, $XeF_4$, $PCl_5$ and $SF_6$.

**TEXT BOOKS**


1. R.K.Prasad, Text book of Quantum Chemistry, New Age International Publishers, New Delhi. 2000.
2. Arun Bahl, B.S.Bahl, G.D.Tuli, Essentials of Physical Chemistry, Multicolour Revised Edition, S.Chand and Company Ltd, 2008.
3. Thermodynamics for Chemists – S. Glasstone, East-west Press Pvt.Ltd,2002.
4. K.J.Laidler, Chemical Kinetics, Third Edition, Pearson Education Pvt.Ltd, 2004.
5. K.V.Raman, Group Theory and its applications to Chemistry, Tata McGraw Hill, New Delhi, 2002.


**REFERENCE BOOKS**


1. C. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy, 4th edition, Tata McGraw Hill, New Delhi, 2010.
2. G.Aruldhas, Molecular Structure and Spectroscopy, Prentice-Hall of India Pvt.Ltd, 2005.
3. R.K. Prasad, Quantum Chemistry through problems and Solutions, New Age International Publishers, New Delhi, 2001.
4. Charles M Quinn, Computational Quantum Chemistry, Elsevier India Pvd.Ltd, 2008.
5. J.Rajaram, JC. Kuriacose , Kinetics and Mechanisms of Chemical Transformations, Macmillan Publishers India Ltd,2011.
6. Mool Chand Gupta, Atomic and Molecular Spectroscopy, New Age International Publishers, New Delhi. 2010.


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ELAYAMPALAYAM. TIRUCHENGODE.

ADDITION

50%

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**(AUTONOMOUS)**

**DEPARTMENTOFCHEMISTRY**
**SYLLABUS**

# PHYSICAL CHEMISTRY - II

| SUBJECT CODE: 17P3CH08 | | |
|---|---|---|
| **SEMESTER – III** | **CREDIT : 5** | **HOURS : 75** |

**OBJECTIVES**

1. To impart knowledge in the field of Quantum chemistry, Thermodynamics and Spectroscopy.
2. To impart knowledge in the field of spectroscopy to understand the spectroscopic result in the application

| ***Learning Outcome*** |
|---|
| *Students will be able to identify wave functions using operators and recognize functions and values.* |
| *Students will learn applications of quantum mechanics to resolve difference in the behavior of micro and macro systems.* |
| *Students enable to understand the application of rotational. Vibrational and electronic spectroscopy.* |

20%

**Unit I: Quantum Chemistry-I (15Hours)**

Quantum theory: Inadequacy of classical mechanics - Black body radiation - Born's interpretation of wave function - Operators: Commutator - Linear operators and Hermitian operator- Eigen functions and Eigen values - Hamiltonian operator - Postulates of quantum mechanics - Schrodinger equation and its solution to the problem to a particle moving in one dimensional box and three dimensional box - Rigid rotor - Simple harmonic oscillator - Schrodinger equation for the H-atom.

**UNIT-II: Quantum Chemistry-II** **(15 Hours)** 20%

Approximation methods : Perturbation and variation methods - application to ground state energy of hydrogen and helium atom - self consistent field approximation - Hartree and Hartree-Fock's SCF method - VB and MO theory-application to hydrogen molecule – Huckel's MO theory – Application to ethylene and benzene.

**Unit-III: Thermodynamics -I** **(15 Hours)**

Thermodynamics of non-ideal systems - Concept of chemical potential - Gibbs-Duhem equation - Variation of chemical potential with temperature and pressure - Concept of fugacity of gases - Determination by graphical method and from equation of state - Variation of fugacity with temperature and pressure - Fugacity coefficient - Activity and activity coefficient - Variation of activity of a gas with pressure and temperature. Determination of solvent activity by vapour pressure method and Cryoscopic method. 10%

**Unit-IV: Microwave spectra** **(15 Hours)**

Introduction: Electromagnetic radiation, Interaction of light with matter, mechanism of absorption & emission of radiation. Rotational, vibrational, and electronic transitions in molecules; regions and representation of spectra.

Micro wave Spectroscopy: Diatomic molecules as rigid rotors: rotational energy levels, intensity of spectral lines, selection rules, effect of isotopic substitution. Diatomic molecules as non-rigid rotors. Rotational spectra of polyatomic molecules.

**Unit-V: Vibrational Spectra** **(15 Hours)**

Vibrational Spectroscopy: Vibrating diatomic molecule: energy of diatomic molecules as simple harmonic and Unharmonic oscillator - energy levels, vibrational transitions, selection rules; Diatomic vibrating rotator: Born-Oppenheimer approximation, vibration-rotational spectra, selection rules; P, Q, R branches. Vibrations of polyatomic molecules: fundamental vibrations and its symmetry, normal modes of vibration, overtones and combination of bands.

Raman Effect: Rayleigh and Raman scattering, Stokes and anti-Stokes lines, molecular polarizability, Raman selection rules. Raman spectra: rotational Raman spectra- linear molecules, symmetric top and spherical top molecules; vibrational Raman spectra-symmetry and Raman active vibrations, rule of mutual exclusion.

**CONTENT BEYOND THE SYLLABUS**

1. Superiority of Quantum chemistry over classical mechanics.
2. Approximation methods in arriving hybridization of smaller molecules.
3. Non-ideal systems in pressure and temperature dependent reactions.
4. Electromagnetic radiations- application and associated physical events.
5. Complementary role of Raman spectra to IR spectra.

**REFERENCES**


1. R. K. Prasad., Quantum Chemistry, Viva Books Private Ltd (2013).
2. D. McQuarrie., Quantum Chemistry, Viva Books Private Limited (2013).
3. A. K. Chandra., Introductory Quantum Chemistry, Tata McGraw Hill (1994).
4. W. J. Moore., Physical Chemistry, Longmann's (1975).
5. C. N. Banwell and E. M. McCash., Fundamentals of Molecular Spectroscopy, 4th Edn, Tata McGraw Hill, (2010).
6. I. N. Levine, Quantum Chemistry, 4th Edn., Prentice Hall India, (1994).
7. B. K. Sen., Quantum Chemistry Including Spectroscopy, Kalyani publishers (2004).
8. S. Glasstone., Thermodynamics for Chemists - East-west Press Pvt.Ltd, (2002).
9. Jag Mohan., Organic Spectroscopy - Principles and Applications, CRC press (2004).


**TEXT BOOKS**


1. Arun Bahl, B. S.Bahl, G. D.Tuli., Essentials of Physical Chemistry, Multicolour Revised Edn, S.Chand and Company Ltd, (2008).
2. Y. R. Sharma., Elementary Organic Spectroscopy, Chand Publications (2007).
3. R. Chang., Basic principles of Spectroscopy, McGraw-Hill Inc.,US (1971).
4. Gurudeep Raj, Advanced Physical Chemistry, Goel Publishing House, (2014).


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**VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN**

**(AUTONOMOUS)**

NO ADDITION

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS**

| | |
|---|---|
| **Semester- IV** | **Total Hrs: 75** |
| **Paper Code: 14P4CH09** | **Credit: 5** |

CORE PAPER – IX

## PHYSICAL CHEMISTRY – III

### UNIT-I: Quantum Chemistry-III (15)

Huckel Molecular orbital theory for conjugated π-system-Applications to simple system-Ethylene, Butadiene, Benzene .Concept of hybridization- Explanation of sp, $sp^2$, $sp^3$ hybridisation. Spin-Orbit Interactions-L-S Coupling- J-J Coupling-Term symbols and spectroscopic states. Ground state term symbols for simple atoms. Slater type orbitals-Calculation of screening constant, effective nuclear charge-Slater rule-Examples, Calculations using Slater Orbitals on analytical Functions.

### UNIT-II: Non-Equilibrium Thermodynamics (15)

Local equilibrium-its postulates- Entropy production-Entropy production in heat flow and matter flow. Forces and fluxes-Flows and coupled flows-Linear laws- Phenomenological law-Onsager reciprocal relation-Proof by Microscopic reversibility-Verification by Electro-kinetic phenomenon-Diffusion. Non-Equilibrium stationary states-Applications of non-equilibrium thermodynamics.

### UNIT-III: Spectroscopy-III (15)

**NMR Spectroscopy**-principle-nuclear zeeman effect-chemical shift-spin-spin coupling-NMR of simple AX and AMX type molecules-Brief discussion on FT- NMR, Calculation of coupling constant.

**ESR spectroscopy**-principle-hyperfine interactions-Spin densities- McConnell relationship - selection rules in ESR-'g' value and coupling constant.

**Mossbauer spectroscopy**-line width- isomer shift-quadrupole interaction-magnetic interactions- structural elucidation of iron and tin complexes.

### UNIT – IV: Statistical Thermodynamics (15)

Objectives of Statistical thermodynamics – concept of thermodynamically and mathematical probabilities – Distribution of distinguishable and non – distinguishable particles. Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac statistics Law – comparison and its applications.

Partition Function – evolution of Translational, Vibrational, Rotational and Electronic partition Functions – Thermodynamic Functions in terms of partition Function – Statistical expression for equilibrium constant – Calculation of Equilibrium constant from partition Function – (isotopic exchange equilibria and dissociation of diatomic molecules)

**UNIT – V: Kinetics of Catalysis** **(15)**

Acid – base catalysis – Definitions and mechanism –Bronsted catalysis law – The rate of reaction catalysis by enzymes-Michaelis-menten equation- Rate of enzyme catalysed reaction – Factors affecting substrate, concentration, pH and temperature on enzyme catalysed reaction – inhibition of enzyme catalyzed reaction. Linear free energy relation – Hammett and Taft equation – QSAR – Hansch equation.

**TEXT BOOKS**


1. Arun Bahl, B.S.Bahl, G.D.Tuli, Essentials of Physical Chemistry, Multicolour Revised Edition, S.Chand and Company Ltd, 2008.
2. R.K.Prasad, Textbook of Quantum Chemistry, New age International Publishers, New Delhi. 2000. Charles M Quinn, Computational Quantum Chemistry, Elsevier India Pvd.Ltd, 2008.
3. M.C.Gupta, Statistical Thermodynamics, New Age International Pvt.Ltd, 2010.
4. C. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy, 4th edition, Tata McGraw Hill, New Delhi, 2010.


**REFERENCE BOOKS**


1. G.Aruldhas, Molecular Structure and Spectroscopy, Prentice-Hall of India Pvt.Ltd, 2005.
2. Vimal Kumar Jain, Introduction to Atomic and Molecular Spectroscopy, Narosa Publishing House Pvt.Ltd, 2007
3. Thermodynamics for Chemists – S. Glasstone, East-west Press Pvt.Ltd,2002.
4. J.Rajaram, Jc. Kuriacose , Kinetics and Mechanisms of Chemical Transformations, Macmillan Publishers India Ltd,2011.
5. R.P.Rastogi, R.R.Misra, An introduction to Chemical Thermodynamics, Sixth Edition, Vikas Publishing House Pvt.Ltd, 2005


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ADDITION

58%

**VIVEKANANDHACOLLEGEOFARTS&SCIENCESFORWOMEN**
**(AUTONOMOUS)**

**DEPARTMENTOFCHEMISTRY**
**SYLLABUS**

| SUBJECTCODE:17P4CH09 | | |
|---|---|---|
| **SEMESTER –IV** | **CREDIT:5** | **HOURS:75** |

**PHYSICALCHEMISTRY-III**

**OBJECTIVES**

1. To enable the students to acquire knowledge on statistical thermodynamics.
2. To understand the difference between classical and statistical thermodynamics.
3. To acquire knowledge in the field of UV-Vis spectroscopy and its application to organic molecules.
4. To impart knowledge in the field of various spectroscopic techniques like NMR,NQR, MASS, EPR and ESR and their applications in the characterisation of molecules.

***Learning Outcome***

*Students enable to calculate theoretical* ($\lambda_{max}$ and $\varepsilon_{max}$) values.

*Students enable to imply the spectral results to resolve the structure of organic and inorganic molecules.*

*Students enable to select the appropriate spectral technique for their requirement in characterisation of of*

20%

**Unit-I: Statistical Thermodynamics (15Hours)**

Objectives of Statistical thermodynamics – concept of thermodynamically and mathematical probabilities – Distribution of distinguishable and non – distinguishable particles. Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac statistics Law – comparison and its applications. Partition Function – evolution of Translational, Vibrational, Rotational and Electronic partition Functions – Thermodynamic Functions in termsofpartitionFunction–Statisticalexpressionforequilibriumconstant–Calculationof Equilibrium constant from partition Function. Heat capacities of solids - Einstein's and Debye's theories of heat capacities of solids.

**Unit-II: Non-Equilibrium Thermodynamics (15Hours)**

Non-Equilibrium -its postulates- Entropy production-Entropy production in heat

flow and matter flow. Forces and fluxes-Flows and coupled flows-Linear laws-Phenomenological law-Onsager reciprocal relation-Proof by Microscopic reversibility-Verification by Electro-kinetic phenomenon-Diffusion. Non-Equilibrium stationary states-Applications of non-equilibrium thermodynamics.

20%

**Unit-III: UV and fluorescence Spectroscopy (15Hours)**

UV-spectroscopy: Theory - Instrumentation-Beer-Lamberts Law - bands in UV-VISspectrum - Possible electronic transitions - Types of electronic transitions based onselection rules - Characteristic absorption (λmax and εmax) of carbonyl - Isolated doublebond - Conjugated double bond systems and aryl groups - Factors influencing theabsorption - Spectroscopic terms: Chromophore - Auxochrome - Bathochromic shift - Hypsochromic shift - Hypochromic shift - Hyperchromic shift – applications.

Fluorescence Spectroscopy: Primciples, Instrumentation and applications.

**Unit-IV: NMR and ESR Spectroscopy (15Hours)**

2%

NMR Spectra: Theory of nuclear resonance - Instrumentation - Chemical shift - Factors influencing chemical shift - Shielding and deshielding mechanisms - Spin-spin coupling - Coupling constant - Nuclear overhauser effect - Applications of NMR spectra to simple organic molecules - Introduction to13C NMR, 19F NMR, 31P NMR.

ESR Spectroscopy: Theory - derivative curves - 'g' values - Hyperfine splitting - Isotropic and anisotropic systems - Applications of ESR.

16%

**Unit-V: MassandMossbauer Spectroscopy (15Hours)**

Mass Spectroscopy: Theory - Instrumentation - Types of ions: Molecular ion -Fragment ion rearrangement ion - Metastable ion - odd & even ions - Molecular ion peak -Base peak - Metastable ion peak - Determination of molecular formula - Nitrogen rule and ring rule-Isotopic abundance analysis - Fragmentation process: Retro Diels-Alder rearrangement - Mclattery rearrangement - Double bond and ring equivalence -Fragmentation of organic compounds with respect to their structural determination(alcohol, hydrocarbon, carbonyl compounds and nitro compounds).

Mossbauer Spectroscopy:line width- isomer shift-quadrupole interaction-magnetic interactions- structural elucidation of iron and tin complexes.

**CONTENTBEYONDTHESYLLABUS**

1.Application of distribution law and approximations

2.ClassicalandStatisticalthermodynamicsadvantages.

3. Application of spectroscopic techniques.

**REFERENCES**


1. S.Glasstone, Thermodynamics for Chemistry, Read Books (2007).
2. P.W.Atkins.,Physical Chemistry,6$^{th}$Edn, Oxford University Press, (1998).
3. M.C.Gupta.,Statistical Thermodynamics, Wiley Eastern Limited(1990).
4. B.R.Puri, L.R.Sharma, M.S.Pathania.,Principles of Physical Chemistry, Vishal Publishing Co.(2016).
5. P.S.Kalsi., Spectroscopy of Organic Compounds, NewAge International (2007).


**TEXTBOOKS**


1. Y.R.Sharma., Elementary Organic Spectroscopy,Chand Publications(2007).
2. GurudeepRaj, Advanced Physical Chemistry, Goel Publishing House,(2014).
3. L.K.Nash.,Chemical Thermodynamics,2$^{nd}$Edn,AddisionWesleyPublishing(1976).
4. JagMohan.,Organic Spectroscopy-PrinciplesandApplications,CRCpress (2004).
5. D.N.Sathyanarayana.,IntroductiontoMagneticresonanceSpectroscopy,IKInternational Publishing House Pvt. Ltd., (2013).


**ONLINESOURCES**

1. nptel.ac.in/courses/103103033/module9/lecture1.pdf
2. http://folk.ntnu.no/fredrol/Nanomaterials%20and%20Nanochemistry.pdf
3. https://www.ceitec.eu/nanoparticles-for-biomedical-applications/f33079
4. https://chem.libretexts.org/

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# VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN

**(AUTONOMOUS)**

NO ADDITION

## DEPARTMENT OF CHEMISTRY

## SYLLABUS

| | |
|---|---|
| **Semester- IV** | **Total Hrs: 75** |
| **Paper Code: 14P4CHE04** | **Credit: 4** |

### ENVIRONMENTAL CHEMISTRY

**UNIT -I : FUNDAMENTALS OF ENVIRONMENTAL CHEMISTRY (15)**

Fundamentals of Environmental Chemistry- Chemical potential, chemical equilibria, acid base reactions and carbonate system, sampling techniques for air, water, and soil.

**UNIT- II :WATER CHEMISTRY (15)**

Water chemistry- properties of water, nature of metal ions in water, solubility of gases in water, occurrence of chelating agents in water; Redox potential, Significance of redox equilibiria in natural and waste water; microorganisms; The catalyst of aquatic chemical reactions, water pollution and its effects, eutrophication concept of DO, BOD, COD, Sedimentation. Coagulation and filtration.

**UNIT -III : POLLUTANTS FROM INDUSTRY (15)**

**Polymers and Plastics**: – The classification – The characteristics – Environmental Implications of polymers and plastics – abatement procedures for polymers and plastics pollution. **Asbestos**: Structural characteristics of Asbestos – applications of asbestos – sources of asbestos in the environment – analysis of asbestos – effects of asbestos pollution – Mitigation of asbestos pollution.

**Polychlorinated Biphenyls**: The need – Fate of poly chlorinated Biphenyls in the Environment – Environmental Implications of Polychlorinated Biphenyls – Abatement procedures for poly chlorinated Biphenyls pollution.

**UNIT- IV : POLLUTANTS FROM AGRICULTURE (15)**

**Fertilizers**: The classification – Environmental implications of fertilizers – Abatement procedures for fertilizers pollution – Eutrophication.

**Insecticides**: The classification – The characteristics –Environmental implications of insecticides – Abatement procedures for insecticides pollution – Bhopal Episode.

**Fungicides and Herbicides**: The need – The classification – The characteristics – Environmental Implications of Fungicides and Herbicides – Abatement procedures for fungicides and Herbicides pollution.

**UNIT- V : WASTE MANAGEMENT AND RECYCLING (15)**

Wastemanagement – Land filling – Incineration – Disposal of medicinal waste – New technique to treat industrial and farm effluents – Reduce,reuse and recycle – Wealth from waste (recycling) – Recycling technique – Utilizing agricultural waste – Waste into energy – Municipal waste into road making – Electricity from tannery waste – Plastic recycling techniques – Waste water and its treatment(recycling of sewage) – Removal of hazardous wastes from contaminated metals.

**TEXT BOOKS**


1. B.K.Sharma, Environmental Chemistry, Goel publishing house, Meerut, Seventh Revised, 2003
2. S.K. Banerji, Environmental Chemistry, Prentice Hall of India, New Delhi, 2003.
3. De, A.K., Environmental Chemistry, New Age International Publishers Private Ltd., New Delhi, Fifth Edition, 2008.
4. Dara, S.S., Environmental Pollution and Control, S.Chand & Co., New Delhi, First Edition, 1993.


**REFERENCE BOOKS**


1. Sharma and Kaur, Environmental Chemistry, Krishna Publishers, New Delhi, 2000.
2. Sodhi, G.S., Fundamantal Concepts of Environmental Chemistry, Narosa Publishing House Pvt. Ltd., New Delhi, Third Edition, 2009.
3. J.Rose Gordon and Breach (Ed.), Environmental Toxicology, Science Publication,New York, 1993.
4. S.Ladsberger and Creatchman (Ed.), Elemental Analysis of Airborne Particles, Gordon and Breach Science Publication New York, 1998.
5. S.E Manahan, Environmental Chemistry, Lewis Publishers, London, 2001.
6. S.M. Khopkar, Environmental Pollution analysis, Wiley Eastern, New Delhi, 1994.


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ADDITION

**VIVEKANANDHACOLLEGEOFARTS&SCIENCESFORWOMEN (AUTONOMOUS)**

**DEPARTMENTOFCHEMISTRY**
**SYLLABUS**

37%

| SUBJECTCODE:17P4CHE04 | | |
|---|---|---|
| **SEMESTER –IV** | **CREDIT:4** | **HOURS:75** |

**ELECTIVE PAPER - IV ENVIRONMENTALCHEMISTRY**

**OBJECTIVES**

1. To impart knowledge in the field environment and pollution.
2. To acquire knowledge on the structure of atmosphere.
3. To impart knowledge on water quality and water treatment.
4. To impart knowledge in the field of industrial and agricultural pollutants and waste management.

19%

**UNIT-I: FUNDAMENTALSOFENVIRONMENTALCHEMISTRY (15Hours)**

Concept of environmental chemistry, Composition of atmosphere, verticaltemperature and vertical structure of the atmosphere, Hydrological cycle, carbon andnitrogen cycle, Environmental pollution, air, water and soil pollution. Prevention andcontrol of pollutions. Biogeochemical cycles in environment, Biological control of chemicalfactors in the environment.

**UNIT-II:WATER CHEMISTRY (15Hours)**

18%

Characteristics of water, Quality of natural water, quality requirements of portable water, organic, humic and colloidal material in water, chemical composition of waterbodies, Commercial water purification method- acidity and alkalinity reverse osmosis method-disinfection of water- purification method of water for industrial purpose (lime-sodaprocess,ionexchangeprocess,zeoliteprocess).Waterpollutionanditsenvironmental impact, eutrophication, concept of TDS, DO, BOD, COD.

**UNIT-III: POLLUTANT SFROMINDUSTRY (15Hours)**

**Polymers and Plastics**: – The classification – The characteristics – Environmental Implications of polymers and plastics – abatement procedures for polymers and plastics pollution.

**Asbestos**: Structural characteristics of Asbestos – applications of asbestos – sources of asbestos in the environment – analysis of asbestos – effects of asbestos pollution – Mitigation of asbestos pollution.

**Polychlorinated Biphenyls**: The need – Fate of poly chlorinated Biphenyls in the Environment – Environmental Implications of Polychlorinated Biphenyls – Abatement procedures for poly chlorinated Biphenyls pollution.

**UNIT-IV: POLLUTANTS FROM AGRICULTURE (15Hours)**

**Fertilizers**: The classification – Environmental implications of fertilizers – Abatement procedures for fertilizers pollution – Eutrophication.

**Insecticides**: The classification – The characteristics –Environmental implicationsof insecticides – Abatement procedures for insecticides pollution – Bhopal Episode.

**Fungicides and Herbicides**: The need – The classification – The characteristics – Environmental Implications of Fungicides and Herbicides – Abatement procedures for fungicides and Herbicides pollution.

**UNIT-V: WASTEMANAGEMENT AND RECYCLING (15Hours)**

Waste management – Land filling – Incineration – Disposal of medicinal waste –New technique to treat industrial and farm effluents – Reduce, reuse and recycle – Wealth fromwaste(recycling)–Recyclingtechnique–Utilizingagriculturalwaste–Wasteinto energy – Municipal waste into road making – Electricity from tannery waste – Plastic recycling techniques – Waste water and its treatment(recycling of sewage) – Removal of hazardous wastes from contaminated metals.

**REFERENCES**

1. De,A.K.,EnvironmentalChemistry,NewAgeInternationalPublishers PrivateLtd., New Delhi, Fifth Edition, 2008.
2. Sodhi, G.S., Fundamantal Concepts of Environmental Chemistry, Narosa Publishing House Pvt. Ltd., New Delhi, Third Edition, 2009.
3. J.Rose Gordon and Breach(Ed.),EnvironmentalToxicology,SciencePublication, New York, 1993.
4. S.Ladsberger and Creatch man(Ed.),ElementalAnalysisofAirborneParticles, Gordon and Breach Science Publication New York, 1998.
5. S.M.Khopkar, Environmental Pollution analysis, Wiley Eastern, NewDelhi, 1994.

**TEXTBOOKS**

1. Sharma and Kaur,Environmental Chemistry, Krishna Publishers, NewDelhi, 2000.
2. Dara, S.S., Environmental Pollution and Control, S.Chand & Co., New Delhi, First Edition, 1993.
3. S.EManahan, Environmental Chemistry,Lewis Publishers, London,2001.
4. S.K.Banerji,Environmental Chemistry, Prentice Hallof India, NewDelhi,2003.
5. B.K.Sharma,EnvironmentalChemistry,Goelpublishinghouse,Meerut,Seventh Revised, 2003

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**(AUTONOMOUS)**

NO ADDITION

**DEPARTMENT OF CHEMISTRY**

# SYLLABUS

| | |
|---|---|
| **Semester- III** | **Total Hrs: 75** |
| **Paper Code: 14P3CHED01** | **Credit: 4** |

## EDC- APPLIED POLYMER CHEMISTRY

### UNIT – I: Chemistry of Polymerisation (15)

Monomers and Polymers: Definition – Classification – Chemistry of Polymerisation: Chain Polymerisation: Free radical, Ionic, Coordination - Step Polymerisation: Polycondensation, Polyaddition – Ring Opening Polymerisation – Copolymerisation: Free radical, Ionic, Co-Polycondensation.

### UNIT – II: Chemical Structure and Polymer Properties (15)

Fabrication methods – Mechanical Properties – Thermal Stability – Flammability & Flame Resistance – Chemical Resistance – Degradability – Electrical Conductivity – Nonlinear Optical Properties.

### UNIT – III: Molecular Weight Determination (15)

Average Molecular Weight: Number Average Concept and Weight Average Concept – Measurement of Number Average Molecular Weight: End Group Analysis, Membrane Osmometry - Measurement of Weight Average Molecular Weight: Light Scattering, Viscometry.

**Glass Transition Temperature:** Glass Transition Temperature: Factors influencing the Glass Transition Temperature – Glass Transition Temperature andMolecular Weight – Importance of Glass Transition Temperature.

### UNIT – IV: Commercially Important Polymers (15)

Synthesis and Uses of Polyethylene – Polypropylene – Polyacrylonitrile – Polymethylmethaacrylate – Polyesters – Polyamides – Polyurethanes – Polyvinylchloride – Polytetrafluoroethylene

### UNIT – V: Resins and Natural Polymers (15)

Synthesis and Uses of Phenol–Formaldehyde Resins – Urea-Formaldehyde Resins – Melamine-Formaldehyde Resins

**Natural Polymers** Rubber – Structure of Cellulose and Starch – Synthesis of Polypeptides – Protein Structure

**TEXT BOOKS**

1. Dr. M. S. Bhatnagar, A Textbook of Polymer Chemistry, New Delhi, S. Chand & Co., (2012).

2. V. R. Gowariker, N.V. Viswanathan, Jayadev Sreedhar, Polymer Science, New Delhi, Newage International Publishers, (2012).

**REFERENCE BOOKS**

1. Malcolm. P. Stevens, Polymer Chemistry, Oxford University Press (2008).

2. G. S. Misra, Introductory Polymer Chemistry, New Delhi, Newage International Publishers, (2005).

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ADDITION

64%

**VIVEKANANDHACOLLEGEOFARTS&SCIENCESFORWOMEN**
**(AUTONOMOUS)**

**DEPARTMENTOFCHEM**
**ISTRY SYLLABUS**

| SUBJECTCODE:17P3CHED01 | | |
|---|---|---|
| **SEMESTER –III** | **CREDIT:4** | **HOURS:75** |

## EDC–APPLIED POLYMER CHEMISTRY

**OBJECTIVES**

1. To impart the knowledge in the field of polymer chemistry.
2. To acquire knowledge in the preparation methods of addition polymers.
3. To impart knowledge in the preparation of syndiotactic, atactic and isotactic polymers using Zeiler-Natta catalyst.
4. To impart understanding in the field of processing of polymers.
5. To explore the applications of various synthetic polymers.

***Learning Outcome***

*Students enable to understand polymer preparation methods.*

*Acquire knowledge in polymer types and processing techniques.*

*Studentsenabletounderstandimportanceofpolymersusedforcommercialapplications.*

**UNITI: Basic Concepts** **(15Hours)**

6%

Monomers, degree of polymerization, Linear, branched and network Polymers. Addition polymerization: Mechanism of Free radical, cationic and anionic Polymerization. Condensation Polymerization in homogeneous and heterogeneous Systems.

**UNIT II: Co-ordination and co-polymerization** **(15Hours)**

20%

Kinetics, mono and bimetallic mechanism of co-ordination polymers. Advantages of Zeigler-Natta catalyst. Co-polymerization: Block and graft co-polymers,kinetics of copolymerization. Typesofco-polymerization. Reactivity ratio. Cross-linked polymers and their applications.

**UNITIII: Molecular Weight and Properties** **(15Hours)**

Polydispersion–average molecular weight concept, number, weight and viscosity average molecular weights. Measurement of molecular weights. Viscosity, light scattering, osmotic and ultracentrifugation methods. Polymer structure and physical properties–crystalline melting point $T_m$. Glass transition temperature ($T_g$), Determination of $T_g$.Relationship between $T_m$and $T_g$.

20%

**UNIT IV** **Polymer Processing** **(15Hours)**

Plastics, elastomers and fibres. Compounding, processing techniques: calendaring, diecasting, rotational casting, film casting, injectionmoulding, blow moulding extrusion, moulding, thermoforming, foaming, reinforcing and fibre spinning.

18%

**UNIT V: Preparation and applications of Commercial Polymers** **(15Hours)**

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers, Fire retarding polymers and electrically conducting polymers. Biomedical polymers–contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

**CONTENTBEYONDTHESYLLABUS**

1. Crosslinked polymers and their commercial applications.
2. Green polymer processing techniques.
3. Biodegradable polymers in the place of artificial polymers.

**REFERENCES**


1. F.W.Billmeyer, Textbook of Polymer Science, 3rdEdition, J.Wiley,(2003).
2. H.R.Alcock and F.W.Lamber, Con temporary Polymer Chemistry, Prentice Hall, (1981).
3. P.J.Flory, Principles of Polymer Chemistry, Cornell University press, New York, (1953).
4. G. Odin, Principles of Polymerization, 2nd Edition, John Wiley & Sons, New York, (1981).

**TEXTBOOKS**

1. V.R.Gowariker, N.V.Viswanathan and J.Sreedhar, Polymer Science, New Age Int., (1986).

**ONLINESOURCES**

1. http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch8/vsepr.html
2. https://chem.libretexts.org
3. http://www.chem.iitb.ac.in/people/Faculty/prof/pdfs/L5.pdf

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TIRUCHENGODE TK, NAMAKKAL DT
TAMIL NADU