# H.H. THE RAJAH'S COLLEGE (AUTONOMOUS)

# PUDUKKOTTAI-622 001

## PG & RESEARCH DEPARTMENT OF CHEMISTRY

**B.Sc., CHEMISTRY**

**COURSE STRUCTURE UNDER**

**CREDIT BASED COURSE SYSTEM**

**FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR**

**2018 – 2019 ONWARDS**

# B.Sc., CHEMISTRY - SYLLABUS

| **PROGRAM SPECIFIC OUTCOMES** for **B. Sc. Chemistry** program | |
|---|---|
| After Successful completion of the Degree, students can | |
| **PSO1** | Get solid foundation in chemistry fundamentals which are required to solve chemical, technical and environmental problems. |
| **PSO2** | Develop the skills to design, choose and perform experiments with the precautions and protocols. |
| **PSO3** | Specify, analyze and investigate the information's, data and systems. |
| **PSO4** | Express their thoughts and ideas by effective communication using scientific knowledge |
| **PSO5** | Act as an individual and team member relevant to the professional practice. |

| **PROGRAM OUTCOMES** for **B. Sc. Chemistry** program | |
|---|---|
| After Successful completion of the Degree | |
| **PO1** | Students get the knowledge in different branches of chemistry and understand all the theories, essential facts, core concepts, principles and postulates relating to the chemistry. |
| **PO2** | Students can identify, formulate, survey and analyze complex problems using the basic principles of chemistry. |
| **PO3** | Improves student's technical skills in chemistry by continuous training with lab experiments, handling of chemicals, simple preparations and the operation of lab equipment's. |
| **PO4** | Improves students understanding about the impact of chemistry in day to day life. |
| **PO5** | Develop analytical skills and problem solving skills requiring application of chemical principles. |
| **PO6** | Developing effective communication, co-operation, team work and leadership qualities of the students. |
| **PO7** | Acquire the expertise on the role of Chemistry in Industries and to become entrepreneur |

**H. H. THE RAJAH'S COLLEGE (Autonomous B$^+$), PUDUKKOTTAI**
**PG & RESEARCH DEPARTMENT OF CHEMISTRY**
**CBCS – COURSESTRUCTURE**
**FOR B.Sc. CHEMISTRY (2018-2019 Onwards)**

| PART | SUBJECT | NO.OF PAPERS | CREDITS | SEMESTER |
|---|---|---|---|---|
| PART-I | TAMIL | 4 | 12 | I - IV |
| PART-II | ENGLISH | 4 | 12 | I - IV |
| PART-III | CORE CHEMISTRY | 14 | 60 | I – VI |
| | ELECTIVES | 3 | 14 | |
| | ALLIED | 4 | 20 | |
| | NON MAJOR | 2 | 05 | |
| PART-IV | ES, VE | 2 | 04 | |
| | SBE | 3 | 12 | |
| PART-V | GS | 1 | 01 | |
| | EXTRA-CURRICULAR ACTIVITIES | | | |
| **TOTAL** | | **37** | **140** | **SIX** |

ES- Environmental Science

VE- Value Education

SB- Skill Based

GS – Gender Studies

SBE – Skill Based Education

## CBCS - COURSE PATTERN FOR B.Sc. CHEMISTRY (2018-2019 Onwards)

| PART | SUBJECT CODE | COURSE CODE | TITLE | HRS | EVALUATION (MARKS) | | TOTAL MRKS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | | Int. | Ext. | | |
| **I SEMESTER** | | | | | | | | |
| I | 18ULT1 | LC-I | Tamil - I | 6 | 25 | 75 | 100 | 3 |
| II | 18ULE1 | ELC-I | English - I | 6 | 25 | 75 | 100 | 3 |
| **III** | **18UCH1** | **CC-I** | **General Chemistry - I** | **5** | **25** | **75** | **100** | **5** |
| **III** | **18UCH2P** | **CP-II** | **Volumetric analysis Practical – I*** | **3** | | | | |
| III | 18UBTA1/ 18UMTA1 | AC-I | Allied Botony-I*/Allied Maths-I | 3 | 25 | 75 | 100 | 5 |
| III | 18UBTA2P | AP-II | Allied Botony Practical –I* /[Allied Maths-I] | 3 | -- | -- | -- | |
| **III** | **18USBE1** | **SBE-I** | **Agriculture Chemistry and Soil Science*** | **2** | | | | |
| **IV** | **18UES** | **EVS** | **Environmental Studies** | **2** | **25** | **75** | **100** | **2** |
| | | | **Total** | **30** | **125** | **375** | **500** | **18** |
| **II SEMESTER** | | | | | | | | |
| I | 18ULT2 | LC-II | PART I Tamil - II | 6 | 25 | 75 | 100 | 3 |
| II | 18ULE2 | ELC-II | PART II English - II | 6 | 25 | 75 | 100 | 3 |
| **III** | **18UCH3** | **CC-III** | **General Chemistry - II** | **5** | **25** | **75** | **100** | **5** |
| III | 18UCH2P | CP-II | **Volumetric analysis Practical – I** | 3 | 40 | 60 | 100 | 4 |
| III | 18UBTA1/ 18UMTA2 | AC-I/ AC-II | Allied Botony-I/Allied Maths-II | 3 | 25 | 75 | -- | |
| III | 18UBTA2P | AP-II | Allied Botony Practical –I/ [Allied Maths-II] | 3 | 40 | 60 | 100 | 5 |
| III | 18USBE1 | SBE-I | **Agriculture Chemistry and Soil Science** | 2 | 25 | 75 | 100 | 4 |
| **IV** | **18UVE** | **VE** | **Value Education** | **2** | **25** | **75** | **100** | **2** |
| **Total** | | | | **30** | | | **700** | **26** |

| PART | CODE | COURSE | TITLE | HRS | MARKS | | TOTAL | CREDIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | **Int.** | **Ext.** | | |
| **III SEMESTER** | | | | | | | | |
| I | 18ULT3 | LC-III | PART I Tamil - III | 6 | 25 | 75 | 100 | 3 |
| II | 18ULE3 | ELC-III | PART II English - III | 6 | 25 | 75 | 100 | 3 |
| III | 18UCH4 | CC-IV | **General Chemistry - III** | 5 | 25 | 75 | 100 | 4 |
| III | 18UCH6P | CP-VI | **Inorganic Qualitative Analysis Practical – II*** | 3 | | | | |
| III | 18UPHA3 | AC-III | Allied Physics* | 3 | | | | |
| III | 18UPHA4P | AP-IV | Allied PhysicsPractical* | 3 | | | | |
| III | 18USBE2 | SBE-II | **Polymer Chemistry *** | 2 | | | | |
| IV | 18UCHN1 | NME-I | For Physics students* | 2 | 25 | 75 | 100 | 3 |
| | | | Total | 30 | | | 400 | 13 |
| **IVSEMESTER** | | | | | | | | |
| I | 18ULT4 | LC-IV | PART I Tamil - IV | 6 | 25 | 75 | 100 | 3 |
| II | 18ULE | ELC-V | PART II English - IV | 6 | 25 | 75 | 100 | 3 |
| III | 18UCH5 | CC-V | General Chemistry - IV | 6 | 25 | 75 | 100 | 4 |
| III | 18UCH6P | CP-VI | Inorganic Qualitative Analysis Practical– II | 3 | 40 | 60 | 100 | 4 |
| III | 18UPHA3 | AC-III | Allied Physics | 3 | 25 | 75 | 100 | 5 |
| III | 18UPHA4P | AP-IV | Allied PhysicsPractical | 3 | 40 | 60 | 100 | 5 |
| III | 18USBE2 | SBE-II | Polymer Chemistry | 3 | 25 | 75 | 100 | 4 |
| | | | Total | 30 | | | 700 | 28 |

| PART | CODE | COURSE | TITLE | HRS | MARKS | | TOTAL | CREDIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | Int. | Ext | | |
| **V SEMESTER** | | | | | | | | |
| III | 18UCH7 | CC-VII | Inorganic chemistry-I | 5 | 25 | 75 | 100 | 4 |
| III | 18UCH8 | CC-VIII | Organic chemistry-I | 5 | 25 | 75 | 100 | 4 |
| III | 18UCH9 | CC-IX | Physical chemistry-I | 5 | 25 | 75 | 100 | 4 |
| III | 18UCH13P | CP-XIII | Organic & Gravimetric analysis practical* | 6 | | | | |
| III | 18UCH14P | CP-XIV | Physical chemistry practical* | 3 | | | | |
| III | 18UCHE1 | EC-I | Analytical chemistry(OR) Dye chemistry | 3 | 25 | 75 | 100 | 5 |
| III | 18UCHN2 | NME-II | Water treatment and Analysis (OR) Material Science and Nanomaterials | 2 | 25 | 75 | 100 | 2 |
| IV | 18USBE3 | SBE-III | Computer Programming | 1 | 25 | 75 | 100 | 4 |
| | | | **Total** | **30** | | | **600** | **23** |
| **VI SEMESTER** | | | | | | | | |
| III | 18UCH10 | CC-X | Inorganic chemistry-II | 5 | 25 | 75 | 100 | 5 |
| III | 18UCH11 | CC-XI | Organic chemistry-II | 5 | 25 | 75 | 100 | 5 |
| III | 18UCH12 | CC-XII | Physical chemistry-II | 5 | 25 | 75 | 100 | 4 |
| III | 18UCH13P | CP-XIII | Organic & Gravimetric analysis practical | 6 | 40 | 60 | 100 | 4 |
| III | 18UCH14P | CP-XIV | Physical chemistry practical | 3 | 40 | 60 | 100 | 4 |
| III | 18UCHE2 | EC-II | Medicinal chemistry(OR) Bio fertilizer and Pesticides | 3 | 25 | 75 | 100 | 5 |
| III | 18UCHE3 | EC-III | Industrial chemistry(OR) Fuel Chemistry | 2 | 25 | 75 | 100 | 4 |
| V | 18UGS | GS | Gender Studies | 1 | 25 | 75 | 100 | 1 |
| | | | Total | 30 | | | 800 | 32 |

**Finalized (for the I to VI Semester) in the**

**BOARD OF STUDIES MEETING HELD ON 28.06.2018**
**&**
**APPROVED BY THE ACADEMIC COUNCIL ON 06.10.2018**

# SEMESTER – I

**SUBJECT CODE: 18UCH1** **5 Hrs / 5 Credits**

## CC-I GENERAL CHEMISTRY-I

***Course objectives:***

1. *To learn about the nature of chemical bonding in chemical compounds.*
2. *To study on advanced theories of chemical bonding.*
3. *To learn about on organic compounds, their nomenclature, structure, fission and fission products.*
4. *To understand the structure, aromaticity and reactivity of aromatic compounds and their derivatives*
5. *To learn about the behavoiur of ideal and real gases and derivation of equation of state for ideal and real gases*

### UNIT – I

**Chemical bonding – I**

Electrovalent bonding: Electronegativity - Pauling and Mulliken's scales of electronegativity, polarizing power and polarizability, partial ionic character from electronegativity, Transition from ionic to covalent character and vice versa. Fajan's rules: Concept of hard and soft acids and bases. VSEPR Theory – shapes of simple inorganic molecules –$NH_3$, $H_2O$, $PCl_5$, $BrF_3$, $BeCl_2$, $SF_6$, $IF_7$, XeF6, $BF_3$, and $CH_4$. Hydrogen Bond: Nature, types of effects on properties of compounds. Intermolecular forces: London forces and van der Waals forces. Lattice Energy, Born-Haber cycle – NaCl as an example,

### UNIT – II

**Chemical bonding – II** *(Aim and objectives:* Covalent bond : Valence bond theory – Types of overlapping of orbitals – sigma and pi bonds, Molecular orbital Theory – Bonding and antibonding orbitals, bond order, Molecular Orbital diagram of simple homo-nuclear and hetero-nuclear diatomic molecules and their ions - $H_2$, He, $N_2$, $O_2$, $F_2$, $O_2^+$, CO, $CN^-$, HCl and NO. Comparison of VB and MO theories.

### UNIT – III

**Basic Principles of Organic Chemistry:**

Nomenclature of organic compounds: IUPAC naming of simple and substituted aliphatic, aromatic and alicyclic compounds: Priorities of functional group suffixes in poly-functional groups and trivial names. Hybridization and geometry of molecules – methane, ethane, ethylene and acetylene (sigma and pi-bonds, bond lengths, bond angles, bond energy) - Electron displacement effects: Inductive, inductometric, electromeric, mesomeric, resonance (localized and delocalized chemical bond), hyperconjugation and steric effects. Cleavage of bonds – homolytic and heterolytic fission of carbon–carbon bonds. Reaction

intermediates and their their stability: free radicals, carbocations and carbanions, carbenes, nitrenes and arynes.

## UNIT – IV

### Aromatic Hydrocarbons And Aromaticity

Aromatic compounds: Nomenclature of aromatic compounds (aryl and aralkyl derivatives). Structure and stability of benzene - molecular orbital theory. Aromaticity and the 4n + 2 (Huckel rule). Aromaticity of ions. Polycyclic aromatic compounds, annulenes. Anti aromaticity. Mechanism of reactions: Aromatic electrophilic substitution – Nitration, Sulphonation, Halogenation. Friedel–Crafts alkylation and acetylation reaction and mechanism- orientation and reactivity in substituted benzenes.

## UNIT – V

### Gaseous State:

Gaseous state: Kinetic molecular model of gas-postulates. Kinetic theory of gases and derivation of the equation of state for ideal gas, Real gases: vont Hoff's Factor. Molecular velocities: derivation of expressions for different types of velocities. Collision parameters, collision frequency, collision diameter, mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, Law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.

### Course outcome

*The student understood and acquired the knowledge on the following:*

1. *Chemical bonding among the constituent atoms in molecules.*
2. *VSEPR Theory and structure of simple inorganic molecules.*
3. *Advances in bonding theories and the atomic orbitals and molecular orbitals in chemical molecules. Nomenclature of organic compounds, structure, reaction intermediates, fission and fission products and their stability.*
4. *Electron displacements in organic molecules and their in impact in the physical properties of compounds and chemical reaction rates. Aromaticity, and substitution reactions in aryl and aralkyl compounds.*
5. *Learnt the kinetic theory of gases and derived the equations of states and their application in viscosity and heat capacities.The behaviour of real gases under different Pressure and temperature conditions and derivation of gas laws and their application in gasses.*

### Reference and Text Books:


1. CNR Rao, IUPAC Handbook of Physics and Chemistry:
2. CRC Handbook of Chemistry and Physics 99th Edition .
3. https://www.iupac.org/fileadmin/user_upload/databases/Red_Book_2005.pdf
4. https://www.crcpress.com › Chemistry › General Chemistry
5. hbcponline.com/

**Unit-I**


1. P.L. Soni & Mohan Katyal, Text book of Inorganic chemistry 20th revised Edn. Sultan chand 1992.
2. R.B. Puri & L.R. Sharma, "Principles of Inorganic chemistry", Sultan chand, 1989.
3. R D Madan, "Modern Inorganic Chemistry" 1987, S Chand and co.,


**Unit-II -IV**


4. P.L.Soni & H.M. Chawla "Text book of Organic Chemistry", Sultan chand & sons 1994 Delhi.
5. P L Soni, "Text book of Organic chemistry", Sultan chand & co.,
6. B.S.Bahl and Arun Bahl – Advanced organic chemistry.
7. R.T. Morrison and RW. Boyd – Organic chemistry
8. K S Tewari, S N Mehrotra and N K Vishonoi, "A text book of organic chemistry".
9. M K Jain, "Organic Chemistry" Shoban Lal Nagin chand and co.,
10. https://www.iupac.org/fileadmin/user_upload/publications/.../CompleteDraft.pdf


1.

**Unit-V**


11. B R Puri & L R Sharma and Madan S Pathania, "Principles of physical chemistry" Shoban Lal Nagin Chand and co., Delhi.


**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 6 | 3 | 6 | 9 | 3 | 3 |
| **CO2** | 9 | 6 | 3 | 6 | 9 | 3 | 3 |
| **CO3** | 9 | 6 | 3 | 6 | 9 | 3 | 3 |
| **CO4** | 9 | 9 | 9 | 6 | 9 | 3 | 3 |
| **CO5** | 9 | 9 | 6 | 6 | 9 | 3 | 3 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE : 18UCH2P** **3 Hrs / 4 Credits**

## CP-II Volumetric Analysis Practical

**Course objectives**

1. *To train the students in quantitative analysis of chemicals.*
2. *To estimate the metal ions by permanganometric titrations*
3. *To estimate the metal ions by iodimetric titrations*
4. *To estimate the metal ions by complexometric titrations*

**I SEMESTER**

***1. Permanganometry***

1. *Estimation of Ferrous ion*
2. *Estimation of Oxalic acid*
3. *Estimation of Calcium*
4. *Estimation of Sodium Hydroxide*

***2. Iodometry and Iodimetry***

1. *Estimation of copper*
2. *Estimation of potassium dichromate*
3. *Estimation of $As_2O_3$*

II SEMESTER

**3. Argentimetry**

Estimation of Chloride

**4. Complexometric titrations**

Estimation of Zn or Mg using EDTA.

**Course outcome:**

1. *The students are trained to estimate chemicals by volumetric analytical methods.*
2. *The students learned to estimate metal ions by permanganometric titrations.*
3. *The students learned to estimate metal ions by iodometric titrations.*
4. *The students learned to estimate metal ions by complexometric tireations.*

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO2** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO3** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO4** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO5** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE: 18USBE1** **2 Hrs / 4 Credits**

## SBE-I Agricultural Chemistry and Soil Science

**Course objectives**

1. *To study the soil properties, fertility*
2. *To understand the nature of different kind of fertilizers and their use to increase crop production*
3. *To learn about the organic manures for increased crop production*
4. *To learn about the types of pesticides and their use in agriculture*
5. *To study about the fungicides and herbicides and their use in pest cont*

### Unit – I

**Soil physical properties:**

Soil separates and particle size distribution, soil texture and structure, Bulk density, particle density, pore space, soil air, soil temperature, soil water, soil consistence and significance of physical properties to plant growth. Soil chemical properties, soil colloids: Inorganic colloids, clay minerals, amorphous, exchange reactions, organic colloids, soil organic matter: decomposition, Humus formation, significance of soil fertility, soil reaction. Biological properties of soil: nutrient availability.

### Unit II

**Fertilizers:**

Definition, fertility index, fertilizer selection based on soil testing,. Nitrogenous fertilizers: effect of nitrogen on plant growth and development. Phosphate fertilizers. Effect of phosphorus on plant growth and development. Super phosphates and bone meals. Potassium fertilizers: function of potassium on plant growth. Secondary and micronutrient fertilizers, complex and mixed fertilizers, sources, manufacture, properties and reactions in soils. Bio-fertilizers: nitrogen fixing bio-fertilizers – rhizobium, azospirillum, phosphate mobilizing bio-fertilizer, bacteria, bacillus, pseudomonas, fungi–aspergillus, pencillium.

### Unit III

**Organic manures:**

Nutrient potential of different organic manures. Agricultural, industrial and urban wastes. Preparation of enriched farm yard manures. Zinc enriched organics-Green manures, green leaf manure, bulky organic and concentrated organic manures, compost, enriched farmyard manures, composting of coir pith, sugarcane trash, leaf litters and farm wastes, oil cakes, bone meal, fish meal, guano poultry manures. Integrated nutrient management,Preparation of different fertilizer mixtures.

## Unit IV

**Pesticide management and control:**

Pesticides, Formulations: emulsifiable concentrate, water miscible liquids, wettable powder, dusts, granules. Classification of pesticides, mode of action, characteristics, uses, fate of pesticides in soil and plants, impact of pesticides on environment, safety measures in analysis and handling of pesticides. Insecticides, plant products: Nicotine, pyrethrum, rotenone, petroleum oils. Inorganic pesticides: Arsenical fluorides, borates. Organic pesticides: organochlorine compounds - D.D.T, B.H.C, methoxychlor, chloredane, endosulfon. Organophosphorus compounds – Dichlorvas. Methyl carbamic acid derivatives – carbaryl, structure and mode of action.

## Unit V

**Fungicides and Herbicides:**

Fungicides: Inorganics – Sulphur compounds, Copper compounds, Mercuric compounds. Organics – dithiocarbamates, Dithane, and Boredeaux mixture. Herbicides: Inorganic herbicides – Arsenical compounds, Boron compounds, cyanamide, Cyanides and thiocyanates, chlorates and sulphamates. Organic herbicides and nitro-compounds, chlorinated compounds, 2-4D, Phridine compounds,Triazine compounds, Propionic acid derivatives, urea herbicides, alachlor, alkynes.

***Course Outcome:***

The student understood and acquired the knowledge on the following:

1. *Properties of Soils*
2. *Types of Fertilizers*
3. *Organic manures and their classification*
4. *Types of pesticides and fungicides*
5. *Action of pesticides and fungicides*

**Reference Text books:**

**Unit-I**


1. Nature and properties of soils – Harry, O-Buckman Nyle C.Brandy
2. Soil Science – A. Sankara
3. Soil Science, Jackson.
4. N.C.Brady, The Nature of properties of soils Eurasia publishing house, (P) Ltd., 9th Ed. 1984.
5. Biswas, T.D. and Mukherjee S.K. 1987 Text book of soil science.
6. A.J.Daji (1970) A Text book of soil science – Asia publishing house, Madras


**Unit-II and III**


7. Donahue. R.L. Miller.R.W. and Shickluna, J.C. 1987. soils – An introduction to soils and plant Growth – Prentice Hall of India (P) Ltd., New Delhi.
8. Colling, G.H. 1955, Commercial Fertilizers – McGraw Hill Publishing Co., New York.

9. Tisdale.S.L. Nelson.W.L. and Beaton.J.D. 1990, Soil fertility and fertilizers. Macmillan Publishing company, New York
10. Hesse, P.R. 1971. A text book of soil chemical analysis John Murray, New York.
11. Jackon, M.L. 1958, Soil Chemical Analysis, Prentice Hall of India, New Delhi.

**Units-IV and V**

12. Seeni Rengasamy and Prem Dureja, 2001. Pesticides handbook: Society of Pesticide Science India, Division of Agricultural Chemicals, Indian Agricultural Research Institute, New Delhi.
13. Insecticides, pesticides and agro-based industries – R.K. Gupta, R C Palfal and K.Goel.
14. Buchel, K.H. 1983, Chemistry of pesticides – John wiley & sons, Newyork.
15. Melnikov, N.N.1971. Chemistry of pesticides Vol.36 of Residue Review – springer verlac, New York.
16. Sree Ramula, U.S.1979, Chemistry of Insecticides and Fungicides – Oxford and IBH publishing Co., New Delhi.

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 6 | 6 | 9 | 6 | 6 | 6 |
| **CO2** | 6 | 6 | 6 | 9 | 6 | 6 | 6 |
| **CO3** | 6 | 6 | 6 | 9 | 6 | 6 | 6 |
| **CO4** | 6 | 6 | 6 | 9 | 6 | 6 | 6 |
| **CO5** | 6 | 6 | 6 | 9 | 6 | 6 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

# SEMESTER – II

**SUBJECT CODE : 18UCH3** **5 Hrs / 5 Credits**

## CC-III GENERAL CHEMISTRY – II

**[5 Hours, 5 Credits]**

***Course objectives***

1. *To study about the chemistry of metals and non-metals.*
2. *To learn the reaction involves cations and anions.*
3. *To learn about the preparation and properties of alkanes and alkenes.*
4. *To understand the principle of organic synthesis.*
5. *To learn about the atomic structure and quantum theory.*

### UNIT – I

**Alkali and Alkaline Earth Metals**

Comparative study of alkali metal and alkaline earth metal compounds (oxide, halides, hydroxides, carbonates, sulphates)-Diagonal relationship between lithium and magnesium-Preparation, properties and uses of lithium aluminium hydride and sodium borohydride -Coinage Metals-Comparative study of coinage metals and Chemistry of photography.Transition Metals And Their Compounds -Group study of titanium, vanadium, chromium, manganese. -Metallurgy and uses of V, W and Mo. -Steel and alloy steels. Heat treatment of steel.

### UNIT – II

**Principles of Chemical Analysis**

Qualitative Analysis : Principles of solubility product and common ion effect – complexation reactions including spot tests – principles of elimination of interfering anions – Reaction involves in the separation and identification of cations and anions, Volumetric Analysis : primary and secondary standards – Definition of Normality and molarity – types of Titration - acid - base , redox, precipitation and complexometric Titrations, Indicators – Neutralisation, redox, adsorption and metal ion indicators Effect of change in pH – simple calculation involving volumetric laws.

### UNIT – III

**Chemistry of Alkanes, alkenes and alkynes**

Alkanes : Mechanism of free radical substitution in alkanes-Conformation of ethane and n-butane with energy diagrams – dihedral angle – torsional strain- Alkenes -Properties of alkenes – electrophilic and free radical addition, addition reactions with hydrogen bromide (peroxide effect), sulphuric acid, water, hydroboration, ozonolysis, hydroxylation with $KMnO_4$ – allylic substitution by NBS (with mechanisms of all the above reactions)

–Alkynes- Acidity of alkynes, formation of acetylides, addition of water with $HgSO_4$ catalyst, addition of hydrogen halides and halogens, oxidation, ozonalysis and hydroboration.

## UNIT – IV

### Organo Halogen Compounds

**Alkyhalides:** classification and preparation- Reactions of alkyl halides: Substitution and elimination reactions of alkyl halides.- Uses of alkyl halides as a starting material in organic synthesizes, insecticides, pesticides and refrigerants.Poly halogen derivatives: Preparation and applications of chloroform, carbon tetrachloride, westron and Freon. Halogen derivatives of unsaturated hydrocarbons: Preparation and uses of vinyl chloride, allyl chloride and allyl iodide.

**Aryl halides:** aryl halides and aryl alkyl halides. Preparation, properties and uses of aryl halides. Nucleophilic substitution reactions of chlorobenzen. Bimolecular and elimination - addition (benzyne) mechanisms of nucleophilic substitution reactions. Von Richter reaction of halogenonitrobenzene. Benzyl chloride and benzylidene chloride. Distinguishing aryl and aryl alkyl halogen derivatives. BHC and DDT preparation and properties.

## UNIT – V

### Atomic Structure

Atom – constituents of an atom. Elementary particles and composite particles (hadrons). Atomic Structure: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Atomic spectrum of hydrogen. Zeemann effect. Molecules –Fundamental postulates of quantum mechanics. Time independent Schrodinger equation and meaning of various terms in it. Significance of $\psi$ and $\psi 2$. Schrödinger equation for hydrogen atom- Quantum numbers – principal – orbital – angular momentum quantum numbers (n,l and m). Significances of quantum numbers. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin – spin quantum number (s). Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Relative energies of atomic orbitals – anomalous electronic configurations.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Chemistry of metals and non-metals.*
2. *Interfering ions and type of titrations.*
3. *Preparation methods of alkanes and alkene compounds.*
4. *Chemistry of insecticide and pesticide.*
5. *Atomic structure and particle principles.*

**References**


1. P.L. Soni & Mohankatyal, Text book of Inorganic Chemistry 20th revised Edn. Sultan chand 1992.
2. R.B. Puri & L.R. Sharma, "Principles of Inorganic chemistry", Sultan chand, 1989.
3. P.L.Soni & H.M. Chawla "Text book of Organic Chemistry", Sultan chand & sons 1994 Delhi.
4. K S Tewari, S N Mehrotra and N K Vishonoi, "A text book of organic chemistry".
5. M K Jain, "Organic Chemistry" Shoban Lal Nagin chand and co.,
6. B R Puri & L R Sharma and Madan S Pathania, "Principles of physical chemistry" Shoban Lal Nagin Chand and co., Delhi.
7. Vogel's "Text book of Quantitative Chemical Analysis" E L B S.
8. R D Madan, "Modern Inorganic Chemistry" 1987, S Chand and co.,
9. P L Soni, "Text book of Organic chemistry", Sultan chand & co.,
10. J.D. Lee, Concise Inorganic Chemistry.
11. B.S.Bahl and Arun Bahl – Advanced organic chemistry.
12. R.T. Morrison and RW. Boyd – Organic chemistry


**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

# SEMESTER – III

**SUBJECT CODE : 18UCH4** **5 Hrs / 5 Credits**

## CC-IV GENERAL CHEMISTRY – III

**Course objectives**

1. *To study on comparative aspects of properties of p-block elements*
2. *To learn the chemistry of noble gas elements*
3. *To study the preparation and properties of alcohols and ethers*
4. *To understand the classifications and chemistry of nitro compounds.*
5. *To learn the principle and structure of solids.*

### UNIT – I

**P-Block Elements**

Boron Family: preparation, properties, uses and structure of Boron nitride, Boron carbide, Borazole and diborane. Carbon Family : Comparative study of carbon family elements and their compounds (hydrides, halides and oxides)- Chemistry of cyanogens, hydrocyanic acid, cyanic acid, thiocyanic acid, ammonium thiocyanate and carbon disulphide- Structures of graphite, diamond and fullerene- Nitrogen Family : A comparative study of group VA elements – preparation properties and uses for Hydrazine, Hydro+*------- xylamine and Hydrazoic acid.

### UNIT – II

**Xenon and its compounds**

Position of inert gases in the periodic table – structure and shape of xenon compounds – ($XeF_2$, $XeF_4$, $XeF_6$, $XeO_3$, $XeOF_2$ and $XeOF_4$). Application of inert gases. Interhalogen compounds and pseudo halogens – basic nature of Iodine.

**Volumetric Analysis :**

Basic requirements of titration reaction – concentration terms – standard solutions – primary and secondary standards – types of titrimetric reactions – redox and precipitation titrations – indicators – effect of change in pH – neutralization – mixed and fluorescent indicators.

### UNIT – III

**Alcohols and Ethers**

Classification and nomenclature --Distinction between primary, secondary and tertiary alcohols – Grignard synthesis of alcohols – chemistry of glycol, glycerol and allylalcohol- Methods of preparation of alphatic and aromatic ethers – reactions of ethers – 1,4 – dioxin –Preparation and uses – Epoxides – Preparation and reactions. Acid-base mechanism of cleavage of epoxides -Thioethers – Preparation and uses - Preparation properties and uses of 1, 4-dioxan, diethylether, anisole and phenetole.

## UNIT – IV

**Nitro Compounds and Amines**

Conversion of nitrobenzene to ortho, para and meta dinitrobenzenes. TNT – Aromatic Nitro Compounds – Reduction in neutral, acidic and alkaline media -Relative basic characters of Aliphatic and Aromatic amines-Ring substitution in aromatic amines. Diazotisation and its mechanism synthetic applications of diazonium salts- Diazomethane and diazoacetic ester-preparation, structure and their synthetic uses -Phenylene diamines- Sulphanilic acid, sulphanilamide, saccharin, chloromine T- Diamide- preparation, properties and uses of urea and thiourea.

## UNIT – V

**SolidState**

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, law of symmetry, unit cell, space lattice and Bravais lattice. Crystalline parameters. Seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Lattice energy and calculation of lattice energy. Born – Lande equation and Born – Haber cycle. Applications of lattice energy calculations. Types of crystals: Ionic crystals, general characteristics and crystalline structures of NaCl, CsCl and KCl. Molecular crystals. Covalent crystals, structure of graphite and diamond. Allotropes and isomorphs with suitable examples- Metallic crystals: Properties of metals. Band theory and its significances in explaining conductance, semi conductance and insulators. Defects in crystals and types of crystal defects. Types of semiconductors.

**Course Outcome**

The student understood and acquired the knowledge on the following:

1. *Comparative aspects of p-block elements*
2. *The chemistry of noble gas elements*
3. *Chemistry of alcohols, phenols and ethers*
4. *Physical and chemical properties of nitro compounds and amines*
5. *Characteristics aspects of solid state*

**References**


1. P.L. Soni & Mohankatyal, Text book of Inorganic Chemistry 20$^{th}$ revised Edn. Sultan chand 1992.
2. R.B. Puri & L.R. Sharma, "Principles of Inorganic chemistry", Sultan chand, 1989.
3. P.L.Soni & H.M. Chawla "Text book of Organic Chemistry", Sultan chand & sons 1994 Delhi.
4. K S Tewari, S N Mehrotra and N K Vishonoi, "A text book of organic chemistry".
5. M K Jain, "Organic Chemistry" Shoban Lal Nagin chand and co.,
6. B R Puri & L R Sharma and Madan S Pathania, "Principles of physical chemistry" Shoban Lal Nagin Chand and co., Delhi.
7. Vogel's "Text book of Quantitative Chemical Analysis" E L B S.
8. R D Madan, "Modern Inorganic Chemistry" 1987, S Chand and co.,

9. P L Soni, “Text book of Organic chemistry”, Sultan chand & co.,
10. B.S.Bahl and Arun Bahl – Advanced organic chemistry.
11. R.T. Morrison and RW. Boyd – Organic chemistry

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE: 18UCH6P** **3 Hrs / 4 Credits**

## CP-VI – INORGANIC QUALITATIVE ANALYSIS PRACTICAL-II

**Course objectives**

1. *To train the students in qualitative analysis of chemicals*
2. *To identify the anions by systematic experiments*
3. *To remove the interfering acid radicals and prepare the original solution*
4. *To analyze the cation by group analysis and confirmatory tests*

Analysis of a mixture containing two cations and two anions of which, one will be an interfering ion. Semi micro methods using the conventional scheme with hydrogen sulphide may be adopted.

**Cations to be Studied**

Lead, Copper, Bismuth, Cadmium, Iron, Aluminum, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

**Anions to be Studied**

Carbonate, Sulphite, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate, Phosphate and Chromate.

**Course Outcome**:

The students acquired the practical knowledge and skills on the following:

1. *Analysis of interfering and non-interfering acid radicals*
2. *Preparation of original solution*
3. *Step wise analysis of basic radicals*
4. *Confirmatory and spot tests*

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO2** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO3** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO4** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO5** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation**

**SUBJECT CODE: 18USBE2** **3 Hrs / 4 Credits**

## SBE-II – POLYMER CHEMISTRY

***Course objectives***

1. *To learn about the preparation of polymers.*
2. *To understand the properties of polymers.*
3. *To acquire knowledge on the co polymer & synthesis of adipic acid, vinyl acetate.*
4. *To learn about the properation & uses of polyethylene.*
5. *To learn about the thermoplastics of textile fibres.*

### UNIT I

**Introduction**

Monomer – Polymer – Functionality of monomers and its significance – degree of polymerization – Natural and Synthetic polymers – classification of polymers – addition and condensation polymers-General methods of preparation of polymers – stepwise polymerization – chain growth polymerization and polymerization through ring opening – Polymerisation techniques: Bulk, solution, suspension and emulsion polymerization-Mechanism: Free-radical, cationic and anionic polymerization reactions

### UNIT II

**Polymer structure**

Linear, branched and cross-linked polymers -Properties of polymers: The glassy state and the glass transition temperature – thermal analysis of polymers – poly degradation: Thermal, mechanical, unsaturated oxidative and hydrolytic degradation-Molecular weight of polymers: Number average molecular weight and weight average molecular weight.

### UNIT III

**Copolymerisation**

Definitions : homo polymer and copolymer – Block and Graft copolymers.Kinetics of polymerization: Free-radical polymerization – cationic polymerization. Degree of polymerisaton – Inhibition. Synthesis of reactants and intermediates: Adipic acid, sebacic acid, hexamethylene diamine, caprolactum, vinyl acetate, acrylonitrile and methyl methacrylate.

### UNIT IV

**Polyolefins**

Preparation and uses of polyethylene, PTFE, PVC, PVA, polypropylene and polystyrene-Rubber: Natural and synthetic rubbers – isoprene rule – preparation and uses of

butyl, buna, buna-s, buna-N, neoprene, Thiocol, Polyurethane and silicone rubbers – Compounding of rubber – reclaim rubber, spongy rubber and foam rubber

**UNIT V**

**Plastics and Resins**

Definition: Thermoplastics and thermosetting resins – constituents of plastics – fillers, dye pigments, plasticizers, lubricants and catalysts-Important thermoplastic resins: cellulose derivatives – cellulose acetate and cellulose nitrate. Important thermosetting resins: phenolic resins, amine resins, epoxy resins and silicone resins-Textile Fibres: Definition: Fibres: fibre polyamides: preparation and uses of Nylon 6 and Nylon 66 – polyesters: preparation and uses of terylene and Viscose rayon.

**Course outcome:**

***The student understood and acquired the knowledge on the following:***

1. *Preparation of polymers.*
2. *Properties of polymers.*
3. *Co polymers.*
4. *Polyethylene.*
5. *Thermoplastics & textile fibres.*

**References**

1. V R Gowarikar, N V Viswanathan and Jeyadev Sreedhar, Polymer Science, Wiley Eastern Limited, New Delhi 1986.
2. R B Seymour, Introduction to polymer Chemistry, Mc Graw Hill, New York, 1971.
3. F W Billmeyer, Text Book of polymer science, Wiley Interscience, New York, 1971.
4. A.Ravve, Organic chemistry of macromolecules, Marcel Dekker, New York 1967.

**Course Outcome Vs Programme Outcome**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 6 | 6 | 9 | 6 | 6 | 9 |
| **CO2** | 9 | 6 | 6 | 9 | 6 | 6 | 9 |
| **CO3** | 9 | 6 | 6 | 9 | 6 | 6 | 9 |
| **CO4** | 9 | 6 | 6 | 9 | 6 | 6 | 9 |
| **CO5** | 9 | 6 | 6 | 9 | 6 | 6 | 9 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**NME (for II B.Sc Physics)**

**CHOICE-I**

**SUBJECT CODE : 18UCHN1** **2 Hrs / 3 Credits**

## NME 1 -APPLIED CHEMISTRY

***Course objectives***

1. *To learn about types and applications of soaps and detergents*
2. *To understand the characteristics of preservation additives.*
3. *To learn about constituents of cosmetics and tooth powder.*
4. *To learn about the types of paints and polymers.*
5. *To learn about applications of variousfertilizer.*

### UNIT – 1

Cleaning agents – soaps- detergents- types–composition-manufacture –foaming, colouring and building agents . shampoo, washing powder and bleaching powder. Water-types-hardness of water- types. Water pollution, causes, prevention.

### UNIT – II

Food-importance-spoilages-causes, preservation-additives – colouring, flavouring agents, beverages. Soft drinks, aerated water-manufacturing . Fruits,vegetables,dairy products-storage,preservation. Minerals in food - toxins and anti oxidants.

### UNIT – III

Cosmetics- Face powder-constituents uses-side effects. Nail polish, hairdye- composition and side effects . Tooth powder- composition and manufacturing . Medicines in day- to-day life - analgesics, anti pyretics, anti inflammatory, antibiotics, antiseptic and disinfectants- definition, examples and uses.

### UNIT – IV

Corrosion-definition,control. Paints and varnishes-constituents, manufacturing-medium - binder –pigments- types of paints -requirements of a good paints, Polymers-types- plastics.Rubber-vulcanization -application .. Adhesives- composition, manufacturing and uses.

### UNIT – V

Building materials –cement- composition –manufacturing- mixture, concrete,RCC- use of steel . Fertilizers- fertilizer industries in India .Manufacture of ammonium salts, urea, super phosphates.

**Course outcome:**

The student understood and acquired the knowledge on the following:

1. *More knowledge of cleaning agents.*
2. *Complete knowledge of colouring agent.*
3. *More knowledge of cosmetics.*
4. *Acquire knowledge of type of fertilizer.*

**References**

1. Industrial Chemistry – B.K.Sharma
2. Engineering Chemistry - P.C. Jain & Monika Jain
3. Industrial Chemistry – B. N. Chakarbarty
4. Engineering Chemistry – Kuria Kose **&**Chemical technology - Shukla

**Course Outcome Vs Programme Outcome**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

## CHOICE-II

## CHEMISTRY IN EVERY DAY LIFE

***Course objectives:***

1. *To instruct on the air component and effect.*
2. *To instruct on the types of plastic.*
3. *To instruct on the proteins, fats and carbohydrates.*
4. *To instruct on the manufacture of fertilizer.*
5. *To instruct on the pigments and dyes.*

### Unit-I

General survey of chemicals used in every day life- Air-Components and their importance; photosynthetic reaction, air pollution, green house effect and their impact on our life style. Water – Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution.

### Unit-II

Building materials – cement, ceramics, glass and refractories – definition, composition and application only. Plastics – polythene, PVC, bakelite, polyesters, melamine formaldehyde resins - preparation, structures and uses only.

### Unit-III

Food and Nutrition – Carbohydrates, Proteins, Fats – definition and their importance as food constituents- balanced diet- Calorie- minerals and vitamins (sources and their physiological importance)-Cosmetics – Tooth pastes, face powder, soaps and detergents, shampoos, nail polish, perfumes – general formulation and preparations- possible hazards of cosmetics use.

### Unit-IV

Chemicals in food production – fertilizers – need, natural sources; urea, NPK fertilizers and super phosphate.-Fuel – classification – solid, liquid and gaseous; nuclear fuel – examples and uses; fuel cells – principle and uses only.

### Unit-V

Pharmaceutical drugs – analgesics and antipyretics - paracetamol and aspirin. Colour chemicals – pigments and dyes – examples and applications- Explosives – classification and examples.

**Course outcome:**

The student understood and acquired the knowledge on the following:

1. *Everyday life use in clean air and water.*
2. *Building materials of cement and plastics.*
3. *Food and nutrients, cosmetics.*
4. *Type of fertilizer and uses.*
5. *Use of pharmaceutical drugs and dyes.*

**References**

1. P.L.Soni,: Text Book of Inorganic Chemistry, S.Chand & Co., New Delhi (1999)

2. B.R.Poori, &L.R.Sharma : Principles of Inorganic Chemistry, Shoban Lal, Nagin Chand & Co., New Delhi (2000)

3. R.D.Madan, G.D.Tuli and S.M.Malik, Selected Topic in Inorganic Chemistry, S.Chand & Co., New Delhi (1988)

4. J.D.Lee : Concise Inorganic Chemistry, E.L.B.S., IV Edn,m (1991)

5. Jeffery et al : ―Vogel Text Book of Inorganic Quantitative Analysis‖, Longman (1984)

6. D.A.Skoog and D.M.West : ―Fundamentals of Analytical Chemistry W.B.Saunders, New York (1983)

7. P.K.Bhattacharya : Chemical Applicationas of Group Theory, Himalaya Publishing House, Mumbai. (1998)

8. F.A.Cotton, Chemical Application of Group Theory,‖ Third Edition, JohnWiley and Son , New York, 2002

9. M.S.Gopinath and V.Ramakrishnan : Group Theory and Applications (1988)

10. D.F.Shriver and P.W .Atkins, ― Inorganic chemistry ― III rd Edition, Oxford University Press, 1999

11. M.C.Day and Selbin , ―Theoretical Inorganic Chemistry ― ,Second Edition : Affiliated East- West Press New Delhi, !969

**Course Outcome Vs Programme Outcome**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

# SEMESTER – IV

**SUBJECT CODE : 18UCH5** **6 Hrs / 4 Credits**

## CC-V GENERAL CHEMISTRY – IV

**Course objectives:**

1. *To study about lanthanides and actinides.*
2. *To understand the redox reaction and non-aqueous solvents.*
3. *To learn about the types of photo chemical reaction and synthesis of dyes.*
4. *To understand the physical properties of liquids and adsorption.*
5. *To learn the basic concepts of thermodynamics and thermochemistry.*

### UNIT – I

**Inner transition elements**

Lanthanides – occurrence – general study of lanthanides involving electronic configuration, oxidation states, magnetic properties and complexation behaviour- Lanthanides – separation by ion exchange and solvent extraction methods – lanthanide contraction- Actinides – Occurrence – electronic configuration, oxidation states, magnetic properties and complexation behaviour.-Comparison of lanthanides and actinides and their position in the periodic table-Elements with atomic number 104 and 105; preparation and their position in the periodic table- Chemistry of thorium and uranium – occurrence, ores, extraction and uses.

### UNIT – II

**Redox reactions and non-aqueous solvents**

Oxidation – reduction reactions and solvents- Oxidation number concept – Balancing redox equations by oxidation number and ion – electron methods – Equivalent weight of oxidizing and reducing agents. Solvents - Different types of solvents – Non – aqueous media (aprotic solvents) :Acid–base behaviour in non-aqueous solvents. Liquid ammonia, Liquid hydrogen fluoride, Sulfuric acid, fluorosulfonic acid, Bromine trifluoride, Dinitrogen tetraoxide Ionic liquids Supercritical fluids.

### UNIT – III

**Organic photochemistry and Dyes**

Photochemical reactions: Primary and secondary photochemical reactions. Norrish type – I, type – II and type –III reactions. Barton reaction and Paterno – Buchi reaction and photochemical isomerisation reactions. Photosensitized reactions.

Dyes: Definition- theories of colour and chemical constitution- chromophores and auxochromes. -Classification of dyes based on applications and chromophores- Requirements of a dye- Definition of mordants and examples. Nomenclature of dyes-Synthesis and uses of

dyes: synthesis, structure and uses of crystal violet, congo red, fluorescein, alizarin and indigo dyes. Fluorescent brightening agents. Food colours.

## UNIT – IV

**Liquid state & Surface chemistry**

Qualitative treatment of the structure of the liquid state. Vacancy theory of liquids and free volume in a liquid. Physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Temperature dependence of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of water. Cohesive forces. Mixture of liquids. Henry's law.Classification of liquid crystals with suitable examples. Theory of liquid crystals. Uses of liquid crystals.

**Adsorption** – definition of adsorption, adsorbents and adsorbates. Adsorption of gases on solids. Classification of adsorptions with examples. Differences between kinds adsorptions. Adsorption isotherms, derivation of Langmuir's and BET adsorption isotherms. Adsorption from solutions. Gibb's adsorption isotherm- Catalysts – characteristics of catalysts – classification of catalysts – theories of catalysis – specific and general acid base catalysis. Enzyme catalysis – characteristics of enzyme catalysis – lock and key mechanism – Michaelis – Menten equation.

## UNIT – V

**Thermodynamics and thermochemistry**

System and surrounding – isolated closed and open systems – Intensive and extensive properties – Thermodynamic processes – isothermal, adiabatic, cyclic, reversible and Irreversible processes. State and path functions – Exact and Inexact differentials – concept of heatand work. First law of Thermodynamics – statement – definition of Internal Energy (E), enthalpy (H) and heat capacity – Relationship between Cp and Cv. Calculation of q, w, dE and Dh for expansion of ideal gas under isothermal and adiabatic reversible and irreversible process – Joule – Thomson co-efficient ($\mu_{JT}$) for ideal and real gases – Inversion temperature variation of heat of reaction with temperature. Kirchoff's equation Bond energy and its calculation from thermochemical data – Integral and differential heats of solution and dilution.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Complete knowledge of lanthenides and actinides.*
2. *More knowledge of redox reaction and non-aqueous solvents.*

3. *Clear knowledge of photochemical reaction and dyes.*
4. *Various types of liquid states and type of adsorption.*
5. *More knowledge of thermodynamics and thermochemistry.*

**References**


1. P.L. Soni & Mohankatyal, Text book of Inorganic Chemistry 20th revised Edn. Sultan chand 1992.
2. R.B. Puri & L.R. Sharma, "Principles of Inorganic chemistry", Sultan chand, 1989.
3. P.L.Soni & H.M. Chawla "Text book of Organic Chemistry", Sultan chand & sons 1994 Delhi.
4. K S Tewari, S N Mehrotra and N K Vishonoi, "A text book of organic chemistry".
5. M K Jain, "Organic Chemistry" Shoban Lal Nagin chand and co.,
6. B R Puri & L R Sharma and Madan S Pathania, "Principles of physical chemistry" Shoban Lal Nagin Chand and co., Delhi.
7. Vogel's "Text book of Quantitative Chemical Analysis" E L B S.
8. R D Madan, "Modern Inorganic Chemistry" 1987, S Chand and co.,
9. P L Soni, "Text book of Organic chemistry", Sultan chand & co.,
10. V S Parmer& H M Chawla – "Principles of reactions mechanism in organic chemistry"
11. B.S.Bahl and Arun Bahl – Advanced organic chemistry.
12. R.T. Morrison and RW. Boyd – Organic chemistry
13. I L Finar, "Organic chemistry" Volume – I E L B S, London.


**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

# SEMESTER – V

**SUBJECT CODE : 18UCH7** **5 Hrs / 4 Credits**

## CC-VII – INORGANIC CHEMISTRY – I

**Course objectives:**

1. *To understand the basic principle and theories of coordination compounds.*
2. *To learn about stability and applications of coordination compounds..*
3. *To study on classification and preparation of metal carbonyls*
4. *To understand the biological role of metals and their compounds*
5. *To learn about the principle of group theory in chemistry.*

### UNIT – I

**Coordination Compounds-I**

Classification of inorganic compounds as double salts and complexes. Differences between normal compounds and co-ordination compounds. Ligands, classification of ligands with suitable examples for each class. Chelates. Ambidentate ligands. Co-ordination number. IUPAC nomenclature of complexes. EAN rule and calculation of effective atomic number of a complex-Theories of co-ordination compounds: Werner's theory, valence bond theory, crystal field theory and ligand field theory. Strong and weak ligands and spectrochemical series. Calculating crystal field stabilization energies.

### UNIT – II

**Coordination Compounds-II**

Isomerisation – stability of complexes – factors affecting the stability of complexes Unimolecular and bimolecular nucleophilic substitution reactions in octahedral and square planar complexes – Trans effect. Application of coordination compounds – Detection of potassium ions, separation of copper and cadmium ions. Estimation of nickel using DMG and aluminium using oxime. Structure of EDTA and its complexes. Complexometric titration – principles and applications.

### UNIT – III

**Metal carbonyls**

Classification of mtal carbonyls with suitable examples. General methods of synthesis of homoleptic metal carbonyls. Physical and chemical properties of metal carbonyls such as oxidation and reduction, basicity of metal carbonyls, reactions of carbonyl. 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π -

acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

## UNIT – IV

**Bioinorganic Chemistry:**

Essential elements in biological systems. Features of dose response curve for an essential element. A survey of metals in biological systems and their functions as charge carriers, structural units, as electron transfers, transporters and in enzyme catalysis-Electron transfer: complementary and noncomplementary electron transfer reactions with examples. - Metal porphyrin complexes: Structure and mechanism of oxygen transporting by haemoglobin. Factors regulating oxygen transport capacity of oxygen carriers. Structure and role of chlorophyll in photo synthesis-Metallo enzymes: Iron, magnesium and zinc enzymes. Hemocyanin structure and enzymatic activity.

## UNIT – V

**Group Theory And Its Applications**

Definition of a group. Various symmetry elements and corresponding symmetry operations. Identification of possible symmetry elements in a molecule. Deduction of point group. Order of a group, sub – groups and classes-Group multiplication table. Construction group multiplication tables for $C_{2V}$ and $C_{3V}$with suitable examples.Matrix representation of symmetry operations-Applications of symmetry operations and group theory in chemistry.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *IUPAC nomenclature to complexes.*
2. *Checking of hardness of water.*
3. *Drawing a MO diagram of carbonyls.*
4. *Biological role of metals and their compounds.*
5. *Calculating in molecule point group.*

**References**

1. P.L. Soni, Text Book of inorganic chemistry, S.Chand & Co., New Delhi (1999)
2. B.R.Poori & L.R. Sharma : Principles of inorganic chemistry, Shoban Lal, Nagin Chand & Co., New Delhi (2000)
3. R.D. Madan, G.D.Tuli and S.Malick, Selected Topics in Inorganic Chemistry, S.Chand & Co., New Delhi (1988)
4. J.D.Lee : Concise Inorganic Chemistry, E.L.B.S. IV Edn., (1991)

5. Jeffery et al : “Vogel Text Book of Inorganic Quantitative Analysis”, Longman (1984)
6. D.A. Skoog and D.M.West : “Fundamentals of Analytical Chemistry” W.B. Saunders, New York (1983)
7. P.K. Bhattacharya : Chemical Applications of Group Theory, Himalaya Publishing House, Mumbai (1998)
8. M.S.Gopinath and V.Ramakrishnan : Group Theory and Applications (1988)

**Course Outcome Vs Programme Outcome**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE : 18UCH8** **5 Hrs / 4 Credits**

## CC-VIII– ORGANIC CHEMISTRY – I

***Course objectives***

1. *To learn about types of isomerism exhibited by organic compounds*
2. *Understand the optical activity and conformational analysis of isomeric commpounds*
3. *To study about the reactions of carbonyl compounds.*
4. *To learn about the preparation and properties of acid and acid derivatives.*
5. *To learn about the preparation and properties of heterocyclic compounds.*

### UNIT – I

**Stereo chemistry-I**

Stereo Isomerism – I – Stereoisomerism – definition, classification into optical and geometrical isomerisms. Optical Isomerism : optical activity – optical and specific rotations – conditions for optical activity in solid, liquid and gaseous phases – criteria for optical activity – asymmetric centre – chirality – achiral molecule – meaning of + and – and D and L notations – elements of symmetry. Recemization – methods of recemizations (by substituting and tautomerism). Resolution– asymmetric synthesis (partial and absolute asymmetric synthesis) – Walden inversion – Vant Hoffs rule of superposition –. Projection formula – Fischer – Flying wedge – Sawhorse and Newmann projection formula-notation for optical isomers – Cahn – Ingold – Prelog rules – R.S. notations for optical isomers with one asymmetric carbon – Erythro and Threo representations.

### UNIT – II

**Stereo chemistry – II**

Optical activity in compounds containing no symmetric carbons – Biphenyls – Allenes and Spirans. Geometrical isomerism – Cis – Trans, Syn-Anti and E-Z notations – geometrical isomerisms in maleicacids and ketoximes — methods of determining of configuration of geometrical isomers. (no details required) Conformational analysis – conformers of cyclohexane (boat, chair and skew boat forms) Axial and equatorial bonds-ring flipping showing axial and equatorial bonds – ring flipping showing axial – equatorial interconversions – conformations of mono substituted cyclohexane.

## UNIT – III

**Reactions of Carbonyl Compounds**

Carbonyl polarization – reactivity of carbonyl group – acidity of hydrogen – mechanism of Aldol – Perkin, Knoevenegal and Benzoin condensation – mechanism of Claisen – Reformatsky – Wittig and Cannizaro reactions – mechanism of sodium borohydride, Wolf-kishner and MPV reductions – mechanism of haloform reaction and Michael addition – photo chemistry of carbonyl compounds – Norrish type I and II.

α, β – unsaturated carbonyl compounds- Preparation and properties of α, β unsaturated carbonyl compounds- Conjugated nucleophilic additions- Reactions of α, β unsaturated compounds with Grignard reagent and with Gilman reagent- Preparation and properties of acetyl acetone and acetonyl acetone-Active methylene group and generation of carbanion.

## UNIT – IV

**Acids and Acid Derivatives**

Preparation and properties of aliphatic and aromatic mono – carboxylic acids.. Comparison of acidity of aliphatic and aromatic carboxylic acids. Effects of substituents and their position on the acidity of carboxylic acids. Ortho effects. Reactions of carboxylic acids and formation acyl halides, amides, esters, etc.

Dicarboxylic acids – preparation and properties of oxalic, malonic, succinic, glutaric and adipic acids – malonic and acetoacetic esters – characteristics of active methylene group – synthetic uses of these esters. Tautomerism – definition – keto – enol tautomerism – identification – acid and base catalysed – interconversion mechanism – estimation – amido – imido and nitroacinitro tautomerisms. Naturally occurring lipids – oils – triglycerides – phospholipids – biological role.

## UNIT – V

**Heterocyclic Compounds**

Aromatic characteristics of heterocyclic compounds – preparation properties and uses furan – pyrole, thiophene structure – synthesis and reactions of pyridine and piperidine – comparative basis characters of pyrrole – pyridine and peperidine with amines. Synthesis and reactions of Quinoline – Isoquinoline and indole with special reference to skraup – Bischler Napieralski and fisher indole synthesis.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. Arrangements of atoms in space and isomers.

2. Compound containing no asymmetric carbon atom and conformation analysis.
3. The reaction of carbonyl compounds.
4. The preparation and properties of acids and its derivatives.
5. The preparation and properties of heterocyclic compounds.

**Reference**

1. Organic chemistry – volume II – I.L.Finar
2. Advanced organic chemistry – Bahl & Arun Bahl
3. Organic Chemistry – Jerry March
4. Reagents and reactions – Gurdeep Chatwal
5. R.T. Morrison and RW. Boyd – Organic chemistry

**Course Outcome Vs Programme Outcome**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE : 18UCH9** **5 Hrs / 4 Credits**

## CC-IX – PHYSICAL CHEMISTRY – I

***Course objectives:***

1. *To learn about the colligative properties and their applications*
2. *To study the characteristics of phase diagrams.*
3. *To study about the rate of the reactions and their determinations.*
4. *To understand the principle of the various photo physical processes.*
5. *To learn about the second law of thermodynamics.*

### UNIT – I

**Colligative properties**

solutions of gases in liquids. Henry's law. Fugacity and activity of liquids in liquids. Raoult's law. Binary liquid mixtures. Ideal solution. Deviation from ideal behaviour. Thermodynamics of ideal solutions. V.P.Composition, V.P. temperature curves. Azeotropic distillation, review of colligative properties of dilute solutions. One method of determination of mol.wt. calculation. Thermodynamic derivation of elevation of boiling point and depression in freezing point, Van't Hoff factor, abnormal molar mass. Distribution, thermodynamic derivation, applications.

### UNIT – II

**Phase equlibria**

Phase rule (statement only), definition of terms. Application to one component systems – water, sulphur. Thermal analysis and cooling curves. Phase diagram. Two component systems of solid – liquid equilibria simple eutectic – lead – silver. Compound formation with congruent – Zn – Mg and incongruent – Na – K melting points, salt hydrates – $KI.H_2O$, $FeCl_3$, $H_2O$, freezing mixtures. Partially miscible liquids. CST, effect of impurities of CST. Immiscible liquids.

### UNIT – III

**Chemical kinetics-I**

Methods for determination of rate of the reactions. Derivation of rate constant and characteristics of first, second, third and Zero order reactions. Derivation of time for half change with examples. Methods of determining the order of a reaction. Arrhenius equation, effect of temperature of the rate of a reaction, concept of energy of activation. Collision theory and derivation of rate constant of a bimolecular reaction, failure of the theory. Theory of

absolute reaction rates and thermodynamic derivation of the rate constant for a bimolecular reaction.

**UNIT – IV**

**Chemical kinetics-II**

Comparison between collision theory and absolute reaction rate theory. Significance of entropy and free energy of activation. Consecutive, parallel and reversible reactions – examples only (no derivation of rate law). Photochemistry : Laws, quantum yield – fluorescence and phosphorescene. Primary and secondary reactions. Decomposition of hydrogen iodide, hydrogen – chlorine reaction hydrogen – bromine reaction. Photosensitization.

**UNIT – V**

**Thermodynamics**

Second law of thermodynamics : Need for the law. Different statements of law. Concept of entropy : Entropy as a state function – entropy as a function of P.V and T. Entropy changes in phase changes. Entropy as a criterion of spontaneous and equilibrium processes in isolated system. Gibbs and Helmholtz function : Thermodynamics equation of state. Maxwell's relations. Application of II law of thermodynamics & third law – Partial molar quantities – chemical Potential of component in an ideal mixture – Gibbs Duhem equation – Variation of chemical potential with T.P. Reaction isotherm – van't Hoff's equation – van't Hoff's isochore. Clapeyron equation and Clausius Clapeyron equation – Applications. Need for the law. Nernst heat theorem. III law of thermodynamics – statement and concept of residual entropy. Evaluation of absolute entropy from heat capacity data. Exception to third law.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Colligative properties.*
2. *Phase equilibria.*
3. *Rate of the reactions.*
4. *Photo physical processes.*
5. *Second law of thermodynamics.*

**Reference**

1. "Principles of Physical Chemistry", B R Puri & Sharma
2. "Text Book of Chemistry", P L Soni
3. "Advanced Physical Chemistry", Gurdeep Raj
4. "Essential of Physical Chemistry", B S Bahl, G D Tuli & Arun Bahl, S Chand & co., New Delhi.

5. “Simplified course in Physical Chemistry”, R L Madan, G D Tuli, S Chand & Co., New Delhi.
6. B R Puri & L R Sharma, Principles of Physical Chemistry
7. R P Varma & Pradeep Physical Chemistry
8. Dr.S Jain & S P Jankar, Physical Chemistry, Principles & Problems, “Tata McGraw Hill”, New Delhi, 1990

**Course Outcome Vs Programme Outcome**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**CHOICE-I**

**SUBJECT CODE : 18UCHE1** **3 Hrs / 5 Credits**

## EC-I – ANALYTICAL CHEMISTRY

***Course objectives:***

1. *To learn about the laboratory hygiene and safety.*
2. *To study on the error analysis and statistical methods.*
3. *To learn about the different types of quantitative analysis.*
4. *To study on the separation and purification methods.*
5. *To understand principle of the thermogravimetric analysis.*

### UNIT – I

**Laboratory hygiene and safety**

Storage and handling of corrosive flammable – Explosive – Toxic – Carcinogenic and poisonous chemicals. Simple first aid procedure for accidents – Acid in eye – Alkali in eye – Acid burns – Alkali burns – Bromine burns – poisoning – inhalation of gases –heat burns.

### UNIT – II

**Data Analysis**

Errors in chemical Analysis – Classification of Errors – Determinate Errors – Instrument Errors – Methods of errors – Personal Errors – Constant Errors – Random Errors or Indeterminate Errors – precision – Accuracy and Rejection of Results – Significant figures – Mean Deviation and Standard Deviation Curve fitting – Method of least squares.

### UNIT – III

**Quantitative Analysis**

Standard solution – Titration Equivalence point and End point Indicator Basic requirement of a Titrimetric reaction – Types of Titration – Acid – base Titration – Redox Titration – precipitation Titration and complexometric Titration. Titration Curve – Indicators – Acid base Indicators Mixed indicators and Fluorescent Indicators. Gravimetric Analysis – Characteristics of precipitating agent – choice of precipitants – Specific and selective precipitant – Condition of precipitation – Types of Precipitants – Precipitate formation – purity of Precipitate – Co – Precipitation and post Precipitation, sequestration.

### UNIT – IV

**Separation and purification Techniques**

General principle involved in the separation of Precipitates – Solvent Extraction. Chromatography – principles involved in Absorption – partition and Ion-Exchange-paper thin

Layer – column – Gas – Liquid and Ion Exchange Chromatography – Electrophoresis – Applications. Desiccants – Vacuum Drying – Distillation – Fractional Distillation – steam Distillation Azeotropic Distillation Crystallisation and sublimation Principles and Techniques.

**UNIT –V**

**Thermo Analytical Methods**

Principle involved in Thermo Gravimetric Analysis and differential Thermal Analysis – Instrumentation – Characteristics of TGA ($CaC_2O_4$ – $H_2O$, $CuSO_45H_2O$) and DTA curves ($CaC_2O_4$ . $H_2O$) – Factors affecting TGA and DTA curves. Thermometric Titration (HCl * NaOH). Analytical Electrochemistry – Redox Potential – Measurement and application – Interpretation of chemical behaviour – Electrolytic Separations – Principles of Electro deposition – Electrogravimetry (Estimation of copper and silver).

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Laboratory hygiene and safety.*
2. *Data analysis.*
3. *Quantitative analysis*
4. *Separation and purification techniques.*
5. *Thermo analytical methods.*

**References**


1. R. Gopalan, P S Subramanian and K Rengarajan, Elements of Analytical chemistry. Sultan and Chand, New Delhi, 1995.
2. B K Sharma, Instrumental methods of chemical analysis, Goel Publishing House, Meerut, 1999.
3. S M Khopkar, Basic concepts of Analytical chemistry, New Age International p Limited, New Delhi, 1998.
4. D A Skoog and D M West, Fundamentals of Analytical chemistry, W B Saunders, New York, 1982.


**Course Outcome Vs Programme Outcome**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO2** | 6 | 3 | 9 | 6 | 9 | 9 | 9 |
| **CO3** | 6 | 9 | 9 | 6 | 9 | 9 | 9 |
| **CO4** | 6 | 9 | 9 | 9 | 9 | 9 | 9 |
| **CO5** | 6 | 9 | 9 | 9 | 9 | 9 | 9 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

## CHOICE-II

## EC-I – DYE CHEMISTRY

***Course objectives:***

1. *To learn about colour and constitution of organic compounds.*
2. *To study on the manufacture of dyes..*
3. *To learn about the specific dyes and uses*
4. *To study on the preparation of anthroquinone dyes.*
5. *To learn about the types and applications of pigments.*

### UNIT I

**Colour and Constitution:**

Relationship of colour observed to wavelength of light absorbed – Terms used in colour chemistry – chromophores, Auxochromes, Bathochromic shift, Hypsochrmic shift. Quinonoid theory and modern theories: Valence bond theory, molecular orbital theory.

### UNIT II

**Chemistry of organic intermediates used in dye manufacture.**

Benzene,Naphathalene and Anthroqucnone intermediates. Nitro dyes, Nitrosodyes, Azo dyes – principles governing azo coupling – mechanism of diazotization coupling with amines, coupling with phenols. Classification according to the number of azo groups and application – Tautomerism in azo dyes.

### UNIT III

**Synthesis of specifics dyes and uses**

Orange IV, Diamond Block F, Metanil yellow, Tartrazines Direct Deep Black, Eriochrome Black T, Eriochrome Red B, Cellition Scarlet B, Congo Red, Malachite green, methylene blue, Safranine – T, Acid Magenta, Cyanin Green G, Alizarine, Benzanthrone, Indigo, Copper phthalo cyanine, Sulphur black – T .

### UNIT IV

Synthesis, reactions and applications of xanthene dyes, ‘Cyanine dyes, acridine dyes, Sulphur dyes, Anthranquinone dyes: Anthraquinone mordant dyes, Anthroquinone acid dyes and Anthraqyinone disperse dyes.

## UNIT V

Pigments – Introduction - Requirements of organic pigments Types of Pigments– Applications. Fluorsecent. Brightening agents – application of dyes in other areas – Leather, paper, medicine, chemical analysis, cosmetics, colouring agents Food and Beverages

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Colour and constitution*
2. *Manufacture of dyes*
3. *Specific dyes and uses*
4. *Preparation of anthraquione dyes*
5. *Types of pigments*

**Reference:**

1. Organic chemistry volume – I I.L. Finar
2. The chemistry of synthetic dyes volume I, III, III+IV K. Venkataraman.
3. Synthetic Dyes – Gurdeep R. Chatwal
4. An Introduction to synthetic drugs and dyes Ra. Chawathe. Shah.
5. An introduction to industrial chemistry B.K. Sharma

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO2** | 6 | 3 | 9 | 6 | 9 | 9 | 9 |
| **CO3** | 6 | 9 | 9 | 6 | 9 | 9 | 9 |
| **CO4** | 6 | 9 | 9 | 9 | 9 | 9 | 9 |
| **CO5** | 6 | 9 | 9 | 9 | 9 | 9 | 9 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE : 18USBE3** **1 Hrs / 4 Credits**

## SBE-III – COMPUTER PROGRAMMING

***Course objectives:***

1. *To learn about the basic components of the computer.*
2. *To understand different languages used in computer programming*
3. *To write the computer programme using C language.*
4. *To learn the applications of C language*
5. *To understand the basics of the chem informatics.*

### UNIT – I

**Historical introduction** – The block diagram of a PC and the functions of the various units of a Computer – Algorithms and flowcharts – High level Programming Languages.

### UNIT – II

**Introduction to BASIC language** – A simple program in BASIC language.

### UNIT – III

**Features of C language** – Question mark operator – control statements – Loops – Recursion.

### UNIT – IV

**Examples of simple chemistry programs in C language**.

1. Conversion of Celsius temperature to Kelvin temperature
2. Application of Beer Lambert Law
3. Molecular weights from atomic weights
4. Use of question mark operator – work of isothermal or adiabatic expansion of ideal gases
5. Calculation of number of resonance structure of conjugated systems – Recursion
6. Linera least squares fit – log k (vs.) I/T plot to get Arrhenius parameters.
7. Calculation of molecular weights of different organic compounds from formulas and data on atomic weights of C, H, N, S, O and halogens.

### UNIT V

**Chem informatics**- Molecular representation by SMILES notation, PDB file--Protein sequencing – Docking – conformational analysis.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Basic components of computer*
2. *Computer languages*
3. *Importance of C language*
4. *Applications of C language*
5. *Principle of Chem informatics*

**References**

1. K V Raman, Computers in chemistry Tata McGraw Hill co., New Delhi (1993)
2. B G Gottfried, BASIC programming McGraw Hill International Ltd., (1980)
3. B G Gottfried, C language programming McGraw Hill International Ltd., (1987)
4. E Balagurusamy, C programming Tata McGraw Hill co., New Delhi (1997)
5. K V Raman Chemistry Education, New Delhi July (1992)

**Course Outcome Vs Programme Outcome**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
|---|---|---|---|---|---|---|---|
| **CO1** | 6 | 3 | 3 | 3 | 9 | 6 | 6 |
| **CO2** | 6 | 3 | 3 | 3 | 9 | 6 | 6 |
| **CO3** | 6 | 3 | 3 | 3 | 9 | 6 | 6 |
| **CO4** | 6 | 3 | 3 | 3 | 9 | 6 | 6 |
| **CO5** | 6 | 3 | 3 | 3 | 9 | 6 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**CHOICE-I**

**SUBJECT CODE : 18UCHN2** **2 Hrs / 2 Credits**

**NME-II**

# WATER TREATMENT AND ANALYSIS

***Course objectives***

1. *To learn about the physical and chemical characteristics of water*
2. *To analyse the water sample by titration method using clark's process*
3. *To understand the principle of electrodiaysis and water treatment.*
4. *To learn about the techniques for the water analysis.*
5. *To understand the principle and adverse effect of the water pollution,*

## UNIT-I

**Characteristics of water**

Introduction - characteristics of water - alkalinity - hardness - unit of hardness - Total solids - Oxidation - transparency - Silica content. -Purification of water for drinking purpose - potability of water - clarification – coagulation, sterilization & disinfection of water - precipitation - ozonisation - Chlorination.

## UNIT-II

**Methods of water softening**

Water softening methods - Clark's process - lime soda process - modified lime soda process - permutit or zeolite process - Ion exchange process - demineralization of water. - Determination of hardness of water - Titration method - complexometric method using EDTA - expressing hardness - equivalents of calcium carbonate - problems to determine temporary & permanent hardness.

## UNIT-III

**Water treatment**

Hard water and industries - industrial water treatment - boiler feed water method of softening - prevention of plumbo solvency - scales in boilers - consequences - internal conditioning methods. Desalination of brackish water - elecrodiaysis - Reverse osmosis.

## UNIT-IV

**Water analysis**

Water analysis - sampling of water for analysis - chemical substances affecting potability - colour, turbidity odour, taste, temperature, pH and electrical conductivity. Analysis of solids present in water - suspended solids - dissolved solids - total acidity - alkalinity - free CO2 - free chlorine - Ca, Mg, Fe, Mn, Ag & Zn.

## UNIT-V

**Water pollution**

Water pollution: Hydrological cycle –aquatic environment-classification of water pollution – organic pollutants, inorganic pollutants, sediments, radioactive materials, Analysis of chemical substances affecting health - NH3, Nitrate, Nitrite, cyanide, sulphate, sulphide, chloride, fluoride - measurement of toxic chemical substances - analysis of chemical substances indicative of pollution - Dissolved oxygen - Bio Chemical Oxygen Demand (BOD) - Chemical Oxygen Demand (COD).

**Course outcom:**

**The student understood and acquired the knowledge on the following:**

1. *Physicochemical characteristics of water*
2. *Water purification techniques*
3. *Recycling of waster water*
4. *Analytical techniques used for water analysis*
5. *Adverse effect water pollution and their paramters.*

**References**

1. Industrial Chemistry (including chemical - engineering) - B.K. Sharma - Goel publishing house, Meerut.
2. Pollution control in process industries - S.P. Mahajan - Tata McGraw - Hill Publishing Company Ltd., New Delhi.
3. Water pollution and management - C.K. Varashney - Wiley Eastern Ltd., Chennai - 20.
4. Environmental Chemistry-AK De, Wiley eastern Ltd., New Delhi (1993).
5. A text book of Environmental Chemistry-Krishnan & Kannan, Anmol Publications, New Delhi (1992).
6. Environmental chemistry & pollution control – Dhar, S.Chand &Co., New D

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |
| **CO2** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |
| **CO3** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |
| **CO4** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |
| **CO5** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

## CHOICE-II

## NME-II
## MATERIAL SCIENCE AND NANOMATERIALS

***Course objectives:***

1. *To study on the electrochemical cells.*
2. *To learn about the alloys.*
3. *To learn about the glasses and ceramics.*
4. *To study about the synthetic organic materials.*
5. *To understand the principle and applications of nanomaterials.*

### UNIT I

**Ionic Conductivity and Electrochemical cells**

Types of ionic crystals – alkali halides – silver chloride – alkali earth fluorides – simple stoichiometric oxides.

Types of Ionic conductors – halide ion conductors – oxide ion conductors – solid electrolytes and its applications.

**Electrochemical cell:** Principle, batteries sensors and fuel cells. Crystal defects in solids: Line and plane defects – point defects – Schottky and Frenkel defects – electronic properties and band theory: metals, semiconductors. Inorganic solids, colour, magnetic properties, optical properties, luminescence and lasers.

### UNIT II

**Alloys**

**Definition:** Alloys – purpose of making alloys – composition and uses of alloys of iron, copper, aluminium, lead, nickel and titanium.

**Ferrous alloys:** Fe-C phase transformation in ferrous alloys – carbon and ferrous alloys – Properties and uses of various types of carbon steels – stainless steel.

**Non-ferrous alloys:** Properties and applications.

### UNIT III

**Glass, Ceramics and Composites**

Glassy state, glass formers and glass modifiers and their applications.

Ceramic structure – mechanical properties – clay products – refractories – characterisation – properties and applications.

Microscopic composites, dispersion – strengthened and particle reinforced, fibre reinforced composites, macroscopic composites. Nano-crystalline phase: Preparation, properties and applications.

### UNIT IV

**Synthetic Organic Metals**

Conducting organics, organic super conductors, magnetism in organic materials. Electrically conducting organic solids – organic metals – Preparation and applications of conjugated polymers: Doped polyacetylene, polyparaphenylene, polyaniline and polypyrrole.

Blends and composites of polymer materials – Organic charge-transfer complexes and new superconductors: Fullerenes – doped fullerenes as superconductors – Nanocarbon and its applications

**UNIT V**

**Nanomaterials – Synthesis and Characterisation**

Preparative method for nanoparticles: Sol-gel thermolysis, combustion method, solvothermal method and microemulsion method

Thinfilm deposition techniques: Physical methods – vaccum evaporation, sputtering, Pulse laser deposition, chemical methods, CVD, chemical solution deposition, electrochemical deposition, spray pyrolysis deposition.

Materials Characterization Techniques: Physical characterization techniques: XRD, XPS, Laser Raman spectroscopy. Microscopic techniques: SEM, AFM and TEM.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Ionic conductivity.*
2. *Alloys.*
3. *Glasses and ceramics.*
4. *Synthetic organic metals.*
5. *Nano materials*.

**Books for Reference:**

1. Solid state chemistry and its application; Anthony.R. West, John Wiley & Sons (1989)
2. Materials Science; R.S.Khurmi and R.S.Sedha, S.Chand & Company Ltd (2000)
3. Materials Science and Engineering, V.Raghavan, Prentice – Hall of India Pvt. Ltd., (2001)
4. K.I.Chopra and I.Kaur, Thin film Devices and Their Applications, Plenum Press, New York, 1983.
5. J.P.Sibilia, A Guide to Materials Characterisation, VCH Publishers Inc., New York 1998.

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |
| **CO2** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |
| **CO3** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |
| **CO4** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |
| **CO5** | 3 | 3 | 9 | 9 | 9 | 6 | 9 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE : 18UCH13P** **6 Hrs / 4 Credits**

## CP-XIII – ORGANIC AND GRAVIMETRIC ANALYSIS PRACTICAL

**Course objectives:**

1. *To prepare organic compounds using various reaction path ways.*
2. *To analyse the organic compounds to confirm the functional groups.*
3. *To determine the melting and boiling points.*
4. *To estimate the metal ions by gravimetric analysis*

**ORGANIC ANALYSIS**

1. Preparation involving oxidation, reduction, hydrolysis, nitration, sulphonation, halogenatin and diazotization.
2. Characterisation of organic compounds by their functional groups and confirmation by preparation of derivatives.
3. Determination of melting and boiling points of simple organic compounds.

**GRAVIMETRIC ANALYSIS**

1. Estimation of calcium as calcium oxalate.
2. Estimation of barium as barium sulphate.
3. Estimation of barium as barium chromate.
4. Estimation of lead as lead sulphate.
5. Estimation of lead as lead chromate.
6. Estimation of nickel as nickel dimethylglyoxime complex.
7. Estimation of Mg as oxinate.

**Course outcome:**

1. *Understood the preparation methods of organic compounds*
2. *Analysed the parent organic compound by functional group anlaysis.*
3. *Learned the techniques to determine the melting and boiling of organic comounds.*
4. *Learned the estimation methods of inorganic compounds and metal ions present.*

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO2** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO3** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO4** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO5** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE : 18UCH14P** **3 Hrs / 4 Credits**

## CP-XIV – PHYSICAL CHEMISTRY PRACTICAL

**Course objectives:**

1. *To learn about the distribution law and its application to determine partition coefficient.*
2. *To study about the kinetics of ester hydrolysis*
3. *To determine the molecular weight of solute by Rast method*
4. *To understand the CST in phenol water system*
5. *To perform the titration by electrochemical techniques*

1. Distribution law
2. Kinetics

   Acid catalyzed hydrolysis of an ester (Methyl acetate or Ethyl acetate)
3. Molecular weight :

   Rast's method : Naphthalene, m-dinitrobenzene and diphenyl as solvents.
4. Heterogeneous equilibrium
   a. Critical solution temperature of phenol-water system-effect of impurity on CST (2% NaCl or 2% succinic acid solutions)
   b. Simple eutectic system : Naphthalene – Biphenyl, Napthalene Diphenylamine
   c. Determination of transition temperature : Sodium acetate, Sodium thiosulphate, $SrCl_2.6H_2O$ & $MnCl_24H_2O$
5. Electro Chemistry
   a. Conductivity
      5. Cell constant
      6. Equivalent conductivity
      7. Conductometric titrations
   b. Potentiometry : potentiometric titrations

**Course outcome:**

1. *Learned about the distribution law and its application to determine partition coefficient.*
2. *Understood the kinetics of ester hydrolysis*
3. *Learned to determine the molecular weight of solute by Rast method*
4. *Understood the CST in phenol water system*
5. *Learned the titration methods by electrochemical techniques*

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO2** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO3** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO4** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |
| **CO5** | 3 | 3 | 9 | 9 | 9 | 9 | 9 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

# SEMESTER – VI

**SUBJECT CODE : 18UCH10** **5 Hrs / 5 Credits**

## CC-X – INORGANIC CHEMISTRY – II

***Course objectives:***

1. *To learn about the principle of nuclear chemistry and stability of the nucleus.*
2. *To learn about the applications of radioactive elements in various fields.*
3. *To learn about the methods of mineral refining.*
4. *To understand the principle and applications of nanoparticles.*.
5. *To study the metallic bonding, crystal defects and types of conductors.*

### UNIT – I

**Nuclear Chemistry**

Constitution of nuclei – stability of nuclei and (n-p) ratio – relationship. Magic number, mass defect, mass energy relationship, binding energy and calculation of binding energy from mass defect. Radioactivity: Natural radioactivity – Q value, cross sections, types of reactions, — Soddy's group displacement law – Radioactivity equilibrium – Rate of radioactive disintegration – half life period and average life period– radioactive disintegration series.

### UNIT – II

**Radioactivity and Nuclear Transformations**

Detection and estimation of radioactivity, G. M. Counter, ionization counter and proportional counter.Artificial radioactivity: Definition and various types of induced nuclear reactions.Nuclear fission & fusion: Theory of nuclear fission, fissionable and non-fissionable elements, nuclear chain reactions, critical size. Applications – principle of atom bomb and nuclear power generation. Theory of nuclear fusion, proton – proton chain reactions. Solar and Stellar energy – principle of hydrogen bomb- Applications of radioactivity: medicine – agriculture – industry – structural elucidations– carbon dating.Radioactive technique; tracer technique, neutron activation analysis.Particle accelerators: linear accelerator – cyclotron.

### UNIT – III

**Metallurgy**

Basic principles of Metallurgy : Ore dressing: Gravity separation – Froath flotation – Magnetic separation – Roasting– Calcination – Smelting – Flux – Purification – Electrolytic

refining – Zone refining – Van-Arkel vapour phase refining – Alumino thermit process-Oxides: classification of oxides on the basis of composition, acidic and basic characters with suit examples. Preparation of hydrogen peroxide and its properties.-Hydrides: definition classification of hydrides with suitable examples. Preparation, properties, structure and uses of boranes. Sodium borohydride, lithium aluminium hydride. Hydrides as reducing agents-Carbides: Definition, classification, preparation and uses.

**UNIT – IV**

**Material Chemistry**

Nanomaterials: definition of nanoparticles. Properties of nanomaterials. Semiconducting nanoparticles and metallic nanoparticles. Optical properties of nanoparticles-Fabrication of nanoparticles, solution based synthesis of nanoparticles, vapour phase synthesis of nanoparticles such as physical vapour deposition and chemical vapour deposition-Bulk materials: synthesis of bulk materials by direct reactions in sold phase, by condensation reaction in solution and by chemical deposition

**UNIT – V**

**Metallic bonding**

Packing of atoms in metal (BCC,FCC (CCP), HCP) -Theories of metallic bonding – electron gas, pauling and band theories-Structure of alloys – substitutional and interstitial solid solutions – HUME Rothery ratios – crystal defects-Semi conductors – Extrinsic and intrinsic – n-type and p-type- composition, structure and uses in electronic industry.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Calculation of (n/p) ratio*
2. *Awareness of atom bomb.*
3. *Gain of knowledge in reducing agent.*
4. *Drawing the structure of SMILY notation.*
5. *Manufacture of solar cell.*

**References**

1. P.L.Soni, Mohan Katyal, “Text book in inorganic chemistry”, 20th revised edn., Sultan Chand, 1992.
2. Esmarch S.Gilreath, ‘Fundamental concepts of Inorganic Chemistry’, International students edn., Mcgraw – Hill Kogakusha, Ltd., 1958.
3. Gurdeep Chatwal and M.S.Yadu, ‘Co-ordination Chemistry’, First edn., Himalaya Publishing House, 1992.

4. B.R.Puri and L.R.Sharma, 'Principles of inorganic chemistry', shoban Lal Nagin Chand and Co., 1989.
5. Cotton and Wilkinson, 'Advanced inorganic chemistry', 5th edn.,
6. R.D.Madam, 'Modern inorganic chemistry'.
7. S.Glasstone, 'source book on Atomic Energy', 3rd edn., Affiliated east west press, 1967.

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE : 18UCH11** **5 Hrs / 5 Credits**

## CC-XI – ORGANIC CHEMISTRY – II

***Course objectives:***

1. *To learn about the preparation, properties of phenol and its derivatives & dyes.*
2. *To study the chemistry of carbohydrates.*
3. *To learn about the chemistry of terpenes, steroids & proteins.*
4. *To understand various rearrangements reactions in organic chemistry*
5. *To learn about the principle and applications of UV, Visible, IR & NMR.*

### UNIT – I

**Phenols and its derivatives**

Phenols : Acidic nature of phenols – explanation on the basis of resonance – ring substitution in phenols – orientation of phenolic groups towards electrophilies – esterification – nitration – sulphonation – halogenation – coupling with diazonium compounds – Kolbe's, Reimer – Tieman, Gatterman, Leaderer – Manske, Houben – Hoesh reaction. Cresols – nitro and amino phenols-pi and trihydric phenols – alpha and beta napthols – preparation and properties. Dyes – theory of colour and constitution – classification – according to structure and application – azodyes – methylorange and bismarkbrown. Triphenyl methane dyes – malachite green – Vat dye – indigo – pthalein dyes – phenolphthalein – and flourescein – anthraquinone dye – alizarin.

### UNIT – II

**Carbohydrates**

Carbohydrates : glucose and fructose – reaction and constitution – osazone formation, mutarotation – mechanisms. Cyclic structure – pyrnose and furanose structures – determination of ring forms – chain lengthening and chain shortening of aldoses – interconversation of aldoses and ketoses. Disaccharides – reactions and structure of maltose – lactose and sucrose. Starch and cellulose – a brief study.

### UNIT – III

**Natural products**

Terpenes – gereniol – nerol – menthol and alpha terpenieol alkaloids : general methods of isolation and general methods of structure determination – conine – peperidine and nicotine. Vitamins – pyridoxine and ascorbic acid – occurance – biological importance.

Steroids and Hormones: definition and classification of steroids- Occurrence- structure and physiological activities of cholesterol, estrogens and testosterone -Amino acids and proteins: Definition and classification of amino acids.- Essential amino acids.- Peptide linkage and protein formation from amino acids-Structure of proteins-Tests for amino acids and proteins.

**UNIT –IV**

**Rearrangements**

Classification – anionotropic and cationotropic – inter and intra molecular rearrangements. Pinacol – pinacolone rearrangement – mechanism – evidence for carbocation formation – migratory aptitude of groups. Beckman – Hoffman – Curtuius – benzidine – and benzylic acid mechanism only. Claisen – sigmatroppic rearrangement – evidences for intramolecular and allylic carbon attachment – para Claisen rearrangement - Cope rearrangements - Fries rearrangement –mechanisms.

**UNIT –V**

**Applications of spectroscopy**

Fundamentals: definition and various types of spectroscopy and their inferences- UV and Visible spectroscopy: possible electronic transitions in an organic compound. Selection rules. Solvent effect. Chromophores and auxochromes. Various types of shifts in λ max. and in εmax.. Calculation of λ max of an organic compound. Applications of UV &Visible spectroscopy in organic chemistry.

Infra red (IR) spectroscopy: various types of vibrations and number of Vibrational degrees of freedom. Selection rule. Solvent effect. Effect of hydrogen bond. Finger print region. The characteristic ranges of absorption of IR radiation of various functional groups.

Spin resonance spectroscopy: NMR active nuclei. Equivalent and non-equivalent protons and number of signals. Reference compound (TMS). Relative signal intensities and number of hydrogens. Chemical shift and various factors influencing chemical shift. Spin – spin splitting, splitting constant. NMR spectrum of simple molecules.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Preparation, properties of phenol and its derivative & dyes.*
2. *Chemistry of carbohydrates.*
3. *Chemistry of terpenes, steroids & proteins.*
4. *The types of rearrangements.*
5. *Various types of spectroscopic techniques such as UV, Visible, IR & NMR.*

**References**

1. Organic Chemistry – Volume I and II – I.L.Finar
2. Advanced Organic Chemistry – Bahl & Bahl
3. Natural products chemistry – Gurdeep Chatwal
4. Pamer and Chawk, Reaction mechanism
5. R.T. Morrison and RW. Boyd – Organic chemistry
6. R Chang "Basic principles of spectroscopy"
7. Dyer "Organic Application of spectroscopy"
8. Y R Sharma, Elementary organic spectroscopy, principles and Applications, S Chand, New Delhi, 1992

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE : 18UCH12** **5 Hrs / 4 Credits**

## CC-XII – PHYSICAL CHEMISTRY II

***Course objectives:***

1. *To understand the principle and applications of conductometric titrations.*
2. *To learn about the electrochemical devices and electrode potentials.*
3. *To understand the principle and applications of fuel cells.*
4. *To learn about principles of spectroscopy and electronic transitions.*
5. *To study the chemistry of colloids and their applications.*

### UNIT – I

**Electrochemistry**

Metallic and electrolytic conduction – specific, equivalent and molar conductance with dilution for strong and weak electrolytes (qualitative) – ionic mobility – transport number – determination by Hittorf and moving boundary methods – relation between ionic mobility and ionic conductance – determination of ionic mobilities – Kohlrausch law – Theory of strong electrolytes – Debye Huckel Onsager theory – Verification of Debye Huckel Onsager equation (no derivation). pH of salt solution – buffer solutions – Henderson equation – solubility – solubility product of sparingly soluble salts. Applications of conductivity measurements in the determination of pH, $K_a$, and solubility product -- conductometric titrations.

### UNIT – II

**Electrochemical cells**

Galvanic cells – reversible and irreversible cells – emf and its measurement – standard cells. Types of reversible electrodes – electrode reaction. Measurement of electrode potentials using reference electrodes – standard hydrogen electrode calomel electrode. Derivation of Nernst equation for EMF of cells and electrode potentials. Standard electrode potentials – sign conversion. Electrochemical series and its significance. Concentration cells with and without transference – liquid junction potentials. Expressions and their derivation (for emf of concentration cells and liquid junction potential).

### UNIT – III

**Electrochemical techniques**

Application of emf of measurements. Application of Gibbs Helmholtz equation in the calculation of thermodynamic quantities of galvanic cells. Determination of pH using

quinhydrone and glass electrodes. Potentiometric titrations. Applications of concentration cells valency of ions, transport number, $K_{sp}$ and activity coefficients. Polarization and overvoltage – decomposition voltage, corrosion and its prevention, Storage cells – lead acid storage battery – mechanism of charging and discharging – fuel cells.

**UNIT – IV**

**Fundamentals of Spectroscopy**

Introduction : electromagnetic radiation, regions of the spectrum, basis features of different spectrometers, statement of the Born – Oppenheimer approximation, degrees of freedom.. Electronic spectrum : Concept of potential energy curvey for bonding and antibonding molecular orbitals, qualitative description of selection rules of Frank – condon principle – types of electronic transition, chromospheres, auxochromes, absorption bands and intensity factors affecting maximum and intensity.

Rotational spectrum : Diatomic molecules. Energy levels of a rigid rotor selection rules Vibrational spectrum : Infrared spectrum : energy levels of simple harmonic oscillator, selection rules Raman spectrum : Rayleigh and Raman scattering stokes and antistokes lines, concept of polarizability

**UNIT – V**

**Colloidal state:**

Colloids -definition-colloids, solutions and suspensions- Classification of colloids-. Sols- classification of sols -lyophilic and lyophobic sols. Hydrophilic and hydrophobic sols-. Purification of colloids – dialysis. Stability of colloids and double layer theory-Zeta potential -Coagulation - Hardy – Schulz law- Hofmeister's series-Protective colloids – gold number.

Properties of colloids: Optical property – kinetic properties – electrical properties - electrophoresis and electro osmosis. Applications of colloids in medicine, pollution control – Cottrell precipitator – waste water treatment. Delta formation – smoke screen. Explanation of cleaning action of detergents. Separation of proteins.

Emulsions: definition – classification – stability of emulsion – emulsifier – Bancraft's rule. Gels: classification of gels. Imbition – syneresis – thixotropy.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Preparing buffer solution.*
2. *By using reference electrode.*
3. *Manufacturing storage cells.*
4. *Awareness of chromosphere.*

5. *Applications of colloids in medicine.*

**References**


1. "Principles of Physical Chemistry", B R Puri & Sharma
2. "Text Book of Chemistry", P L Soni
3. "Advanced Physical Chemistry", Gurdeep Raj
4. "Essential of Physical Chemistry" B S Bahl, G D Tuli & Arun Bahl, S Chand & Co., New Delhi
5. "Simplified course in Physical Chemistry", R L Madan, G D Tuli, S Chand & Co., New Delhi
6. B R Puri & L R Sharma, Principels of Physical Chemistry
7. R P Varma & Pradeep, Physical Chemistry
8. C N Banswell, Fundamental molecular spectroscopy. Tata Mcgraw Hill Publications, New Delhi 11th repring 1991
9. William kemp, Organic spectroscopy, ELBS, Second Edn. 1987
10. Dr.S.Jain & S P Jankar, Physical Chemistry, Principles & Problems, "Tata McGraw Hill", New Delhi, 1990
11. K V Raman "Spectroscopy and mathematics of Quantum chemistry in print"
12. R Chang "Basic principles of spectroscopy"
13. Dyer "Organic Application of spectroscopy"
14. Y R Sharma, Elementary organic spectroscopy, principles and Applications, S Chand, New Delhi, 1992


**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO2** | 9 | 9 | 3 | 6 | 9 | 3 | 6 |
| **CO3** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO4** | 9 | 9 | 9 | 6 | 9 | 3 | 6 |
| **CO5** | 9 | 9 | 6 | 6 | 9 | 3 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**CHOICE-I**

**SUBJECT CODE : 18UCHE2** **3 Hrs / 5 Credits**

## EC-II – MEDICINAL CHEMISTRY

***Course objectives:***

1. *To study about indian medicinal plants and therapeutic uses.*
2. *To learn about the principle of drug administration.*
3. *To study about the mechanism of sulpha drugs.*
4. *To understand the different principles and chloraonphenical.*
5. *To learn about the various diseases and their prevention and control.*

### UNIT – I

**Indian medicinal plants and alkaloids**

Medicinal plants in cure of diseases – spices as medicines – medicinal plants and uses—tulasi, keezhanelli, mango, chemparuthi, adathodai, thuthuvalai, vembu, atthi, arugambul, and keerai. General methods of isolation of alkaloids from plant sources—color tests for identification. Extraction, structures, Stucture,activity relationship(SAR) and uses of morphine and quinine.

### UNIT – II

**Drug design and distribution**

Introduction – Analogous and prodrugs – concept of 'LEAD' – Factors governing drug design – Rational approach, Method of variation-- disjunction and conjunction for drug design – 'TAILORING' of drugs. Factors governing ability of drugs to reach active site – Absorption, distribution, excretion and bio- transformation. Routes of drug administration –-Advantages and disadvantages of oral & parental routes.– $LD_{50}$, $ED_{50}$ and and therapeutic index – encapsulation and naming of drugs.

### UNIT – III

**Sulphonamides and antimalarials**

Sulphonamides : Definition – mechanism and action of sulpha drugs –synthesis and uses of sulphadiazine sulphathiazole, sulphapyridine and sulpha furazole.

Antimalarials-- Introduction—classification. Synthesis and uses of quinoline analogues – chloroquinine phosphate, amodiaquine, paraquinine and mepacrine hydrochloride.

### UNIT – IV

**Anti biotics and analgesics**

Microbial synthesis, assay, structure and uses of different penicilins and chloramphenical, SAR—penicillin intolerance—detection of penicilin allergy.

Analgesics—definition, classification—norcotic and non norcotic. Pharmacological action and uses of pethidine, methadone, heroin and codeine.

Antipyretic analgesics—salicylic acid derivatives – methyl salicylate, aspirin, para amino phenol derivatives – para acetamol, phenacetin and ibuprofen.

**UNIT –V**

**Anesthetics and First Aid**

Anesthetics—definition – classification--local and general. Volatile—nirous oxide, ether, chloroform, cyclo propane. Non volatile – intravenous – thio pental sodium, metho hexatone. Local anesthetics – cocaine and benzo caine.

Anti anaemic drugs – iron, vitamin $B_{12}$ and folic acid – mode of action.

AIDS – causes, prevention and control.

First Aid – definition—cause and symptoms of food poisoning, botulism and mushroom poisoning—first aid to poisoning bleeding and maintain breathing.

**Programme outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Uses of medicinal plants.*
2. *Advantages of LD50, ED50.*
3. *Synthesis of sulpha drugs.*
4. *Structure of penicilins.*
5. *Preparing to vitamin B12.*

**References**

1. Pharmaceutical chemistry by S.Lakshmi, Sultan chand & sons
2. Medicinal chemistry by Ashutoshkar, New Age International
3. A Text book of pharmaceutical chemistry by Jayashree Ghosh, Sultan Chand & sons

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |
| **CO2** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |
| **CO3** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |
| **CO4** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |
| **CO5** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |

**4.**

**5. Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

## CHOICE-II

## EC-II – BIOFERTILIZERS AND PESTICIDES

***Course objectives:***

1. *To learn about the classification of manures and agricultural applications*
2. *To study about various fertilizers and manufacturing techniques*
3. *To understand the principle and applications of bio fertilizers.*
4. *To learn about the chemistry of agro chemicals.*
5. *To study about various types of herbicides, insecticide and fungicides.*

### Unit-I

Manures: Definition – types – composition and value – sources and production of manures –Compost- Different composting technologies-Mechanical compost plantsVermicomposting-Green manures-Oilcakes-Sewage sludge-Biogas plant slurry-Plant and animal refuges.

### Unit II

Fertilizers-classification- Nitrogenous,phosphatic and potassic fertilizers Nitrogenous fertilizers: Organic N forms, Synthetic N fertilizers – Manufacturing of ammonium sulphate, ammonium chloride, ammonium nitrate and urea. Phosphatic fertilizers: P fertilizer sources – processing rock phosphate, bones for bone meal preparation – basic slag – preparation of single, triple super phosphate and thermo-phosphate. Potassic fertilizers: K fertilizer – natural sources – manufacturing of potassium chloride, potassium sulphate and potassium nitrate.

### Unit III

Mixed and complex fertilizers: Sources and compatibility – preparation of major, secondary and micronutrient mixtures. Complex fertilizers – manufacturing of ammonium phosphates, nitro phosphates and NPK complexes. Biofertilizers and their advantage-Fertilizer control order and fertilizer storage

### Unit IV

Organic chemistry as prelude to agrochemicals-Diverse type of agrochemicals - Botanical insecticides-Pyrethrum-Synthetic pyrethroids- Synthetic organic insecticides-Major classes- synthesis and properties of some important insecticides under each class.

### Unit V

Herbicides-Major classes-Synthesis and properties of 2,4-D,atrazine,glyphosate, butachlor and benthiocarb.- Fungicides- Majior classes- synthesis and properties of

carbendazim, carboxin, captantridemorph and copper oxy chloride- Insectides act and plant growth regulators.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Manures.*
2. *Fertilizers.*
3. *Bio-fertilizers.*
4. *Agro chemicals.*
5. *Insecticides.*

**References**


1. Buchel, K. H. 1983 Chemistry of pesticides. John Wiley and Sons New York.
2. Collings G. H. 1955 Commercial Fertilizers. Mc Graw Hill Publishing Co. New York.
3. Geroge W. W 1986. Fundamentals of pesticides A self-instruction Guide. Thomas publication P.O. Box 9335. Frenocalifornia.
4. Sree Ramulu, U. S. 1979. Chemistry of Insecticides and Fungicides. Oxford and IBH Publishing House Co. New Delhi.


**Course Outcome Vs Programme Outcome**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
|---|---|---|---|---|---|---|---|
| **CO1** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |
| **CO2** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |
| **CO3** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |
| **CO4** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |
| **CO5** | 6 | 6 | 6 | 9 | 9 | 6 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**CHOICE-I**

**SUBJECT CODE : 18UCHE3** **2 Hrs / 4 Credits**

## EC-III – INDUSTRIAL CHEMISTRY

***Course objectives:***

1. *To learn about the cane sugar manufacture, recovery of sugar from molasses and know about points of vanishes.*
2. *To learn about the manufacture of cement and fertilizers.*
3. *To know the applications of petroleum & fuel gases.*
4. *To study about the electrochemical industries and their production*
5. *To understand the principle of chemical explosives and pollution of water.*

### UNIT – I

**Sugar** : Cane sugar manufacture, recovery of sugar from molasses, sugar estimation. Paints & Varnishes : Primary constituents of paints. Dispersion medium (solvent) binder, pigments, oil bases paints, latex paints (alkyd resins) formulation of paints and varnishes.

### UNIT – II

**Cement** : Manufacture – Wet Process and Dry Process. Setting of cement, Cement industries in India. Fertilizers : Fertilizer industries in India, Manufacture of ammonia, urea, super phosphate, triple super phosphate.

### UNIT – III

**Petroleum** : Origin, refining, Cracking, reforming knocking and octane number, LPG, synthetic gas, synthetic petrol. Fuel Gases : Large scale production, storage, hazards and uses of coal gas, water gas, producer gas and oil gas.

### UNIT – IV

**Electrochemical industries** : Production of materials like chlorine, caustic soda. Sodium chlorate, potassium permanganate, hydrogen peroxide. hydroxyl amine, Electro synthesis of aniline, p-aminophenol.

### UNIT – V

**Chemical Explosives** : Origin of explosive, preparation and chemistry of nitrocellulose, TNT, gunpowder, Water in Industry : Pollution of water by fertilizers, detergents, pesticides, and industrial wastes, BOD and COD.

**Course outcome:**

1. *Learned about the cane sugar manufacture, recovery of sugar from molasses and know about points of vanishes.*
2. *Learned about the manufacture of cement and fertilizers.*
3. *Studied the applications of petroleum & fuel gases.*

4. *Learned the electrochemical industries and their production*
5. *Understood the principle of chemical explosives and pollution of water.*

**References**

1. B.N. Chakrabarty, Industrial Chemistry, Oxford & IBH Publishing Co., New Delhi, 1981.
2. B.K.Sharma, Industrial Chemistry, Geol Publishing House, Meerut.
3. P.P.Singh, T.M.Joseph, R.G.Dhavale, College Industrial Chemistry, Himalaya Publishing House, Bombay, 4th edn., 1983.

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |
| **CO2** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |
| **CO3** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |
| **CO4** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |
| **CO5** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

## CHOICE-II

## EC-III – FUEL CHEMISTRY

***Course objectives:***

1. *To learn about the renewable and non-renewable energy sources.*
2. *To study about the coal and gas.*
3. *To understand composition of LPG, LNG & CNG.*
4. *To learn about applications of petrochemicals.*
5. *To study about the classifications and uses of lubricants.*

### UNIT I

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

### UNIT III

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal.Coal gas, producer gas and water gas—composition and uses.

Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and

### UNIT III

Solvent Refining. Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels.

### UNIT I

Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

## UNIT V

Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

**Course outcome:**

**The student understood and acquired the knowledge on the following:**

1. *Coal and gas.*
2. *LPG & LNG*
3. *Petrochemicals.*
4. *Lubricants.*

**References**


1. Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
2. Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).


**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |
| **CO2** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |
| **CO3** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |
| **CO4** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |
| **CO5** | 6 | 6 | 9 | 9 | 6 | 6 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**SUBJECT CODE : 18UCHA3** **3 Hrs / 5 Credits**

## AC-ALLIED CHEMISTRY

***Course objectives:***

1. *To learn about the atomic orbitals and its hybridization.*
2. *To understand the electron displacement effects and aromatic electrophilic substitution reactions.*
3. *To study the heterocyclic compounds, nuclic acid and proteins.*
4. *To learn about the thermodynamics and phase rule.*
5. *To understand the principle of electrodes and conductometric titration.*

### UNIT – I

**Atomic orbitals**

Shapes of atomic orbitals – overlapping of atomic orbitals – sigma- and pi- bonds. Hybridisation – sp, $sp^2$ and $sp^3$ explanation with suitable examples – VSEPR theory.Molecular Orbital Theory-bonding, antibonding and nonbonding orbitals. M.O. diagrams of Hydrogen, Helium, Nitrogen, discussion of bond order and magnetic properties.

### UNIT – II

**Electron displacements**

Electron displacement effects : Inductive, mesomeric, hyper conjugative and Steric effects. Mechanism of aromatic electrophilic substitution, Nitration, Sulphonation, Halogenation and Friedel craft's reaction.

### UNIT – III

**Heterocyclics, proteins and aminoacids**

Preparation and properties of Furan, Thiophen, Pyrrole and Pyridine. Nucleic acids : Types – DNA & RNA composition of polynucleotide chain and biological function. Amino acids and proteins : classification, structure and stereochemistry of amino acid, preparation and reaction of α- amino acids. Classification of proteins. End group analysis – denaturation of proteins..

### UNIT – IV

**Thermodynamics**

Second Law of Thermodynamics need for second law, various statements of II Law-- Entropy and its significance. Free energy change. Criterion for spontaneous and reversible process.

Phase rule : Definition of terms, phase diagram of water system and Pb – Ag system

### UNIT – V

**Electrocbemistry**

Kohlrausch law -measurement of conductance, pH determination. Conductometic titrations. Galvanic cells-EMF-standard electrode potentials, reference electrodes- - Reference electrodes – SHE and calomel electrode single electrode potential and standard electrode potential. Daniel cell – cell reaction and cell E.M.F. Determination of pH by E.M.F. method- – Corrosion: Methods of prevention.

**Course outcome:**

1. *Learned about the atomic orbitals and its hybridization.*
2. *Understood the electron displacement effects and aromatic electrophilic substitution reactions.*
3. *Studied the heterocyclic compounds, nuclic acid and proteins.*
4. *Learned about the thermodynamics and phase rule.*
5. *Understood the principle of electrodes and conductometric titration.*

**References**


1. P.L. Soni & Mohankatyal, Text book of Inorganic Chemistry 20th revised Edn. Sultan chand 1992.
2. R.B. Puri & L.R. Sharma, "Principles of Inorganic chemistry", Sultan chand, 1989.
3. P.L.Soni & H.M. Chawla "Text book of Organic Chemistry", Sultan chand & sons 1994 Delhi.
4. K S Tewari, S N Mehrotra and N K Vishonoi, "A text book of organic chemistry".
5. M K Jain, "Organic Chemistry" Shoban Lal Nagin chand and co.,
6. B R Puri & L R Sharma and Madan S Pathania, "Principles of physical chemistry" Shoban Lal Nagin Chand and co., Delhi.
7. R D Madan, "Modern Inorganic Chemistry" 1987, S Chand and co.,
8. P L Soni, "Text book of Organic chemistry", Sultan chand & co.,
9. V S Parmer& H M Chawla – "Principles of reactions mechanism in organic chemistry"


**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 6 | 6 | 3 | 9 | 6 | 3 | 3 |
| **CO2** | 6 | 6 | 3 | 9 | 6 | 3 | 3 |
| **CO3** | 6 | 6 | 3 | 9 | 6 | 3 | 3 |
| **CO4** | 6 | 6 | 3 | 9 | 6 | 3 | 3 |
| **CO5** | 6 | 6 | 3 | 9 | 6 | 3 | 3 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**

**Subject Code: 18CHYD4P** **3 Hrs / 5 Credits**

## AP-ALLIED CHEMISTRY PRACTICALS

**Course objectives:**

1. *To learn the principle of strong acid base tirations*
2. *To perform the redox titrations to estimate ferrous ions*
3. *To estimate the potassium permanganate using standard potassium dichromate*
4. *To estimate the amount of copper suing standard potassium dichromate*
5. *To analyse organic compound to confirm the functional groups.*

**Titrimetry**

1. Estimation of Sodium hydroxide using standard sodium carbonate
2. Estimation of hydrochloride acid – Standard Oxalic acid
3. Estimation of Oxalic acid – Standard sulphuric acid
4. Estimation of Ferrous sulphate – Standard Mohr's Salt solution
5. Estimation of Oxalic acid – Standard ferrous sulphate
6. Estimation of Potassium Permanganate – Standard Sodium hydroxide
7. Estimation of copper – Standard potassium dichromate.

**Organic Analysis**

Reactions of Phenols, acids (mono and di), aromatic primary amine, aldehydes (aliphatric and aromatic), di-amide, dextrose, systematic analysis of organic compounds containing one functional group and characterization by confirmatory methods, tests for derivative.

**Course outcome:**

1. *Learned the principle of strong acid base tirations*
2. *Performed the redox titrations to estimate ferrous ions*
3. *Estimated the potassium permanganate using standard potassium dichromate*
4. *Estimated the amount of copper suing standard potassium dichromate*
5. *Analysed organic compound to confirm the functional groups.*

**Course Outcome Vs Programme Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 6 | 3 | 9 | 9 | 6 | 6 | 6 |
| **CO2** | 6 | 3 | 9 | 9 | 6 | 6 | 6 |
| **CO3** | 6 | 3 | 9 | 9 | 6 | 6 | 6 |
| **CO4** | 6 | 3 | 9 | 9 | 6 | 6 | 6 |
| **CO5** | 6 | 3 | 9 | 9 | 6 | 6 | 6 |

**Level of correlation: 9 – High; 6 – Medium; 3 – Low; and 0- no correlation.**