

B.Sc., Chemistry, Iii Year, Cbcs Syllabus

**Telangana State Council Of Higher Education, Govt. of Telangana,  
B.Sc., CBCS Common Core Syllabi for All Universities in Telangana  
Proposed Scheme for Choice Based Credit System in  
B.Sc., Chemistry,  
Generic Elective-I (GE-I) and Generic Elective-II (GE-II) Courses for  
B.Sc. Non Chemistry/B.A/B.Com Students**

**THIRD YEAR- SEMSTER - V**

Code	Course Title	Course Type	HPW	Credits
BS 501	<b>Materials and their Applications</b>	<b>SEC-3</b>	<b>2</b>	<b>2</b>
BS 502	<b>Pharmaceuticals</b> (For B.Sc. Non Chemistry/B.A/B.Com Students)	<b>GE-1</b>	<b>2T</b>	<b>2</b>
BS 503	Optional –I	DSC-1E	3T+2P=5	3+1=4
BS 504	Optional – II	DSC-2E	3T+2P=5	3+1=4
BS 505	<b>Optional – III Chemistry - V</b>	<b>DSC-3E</b>	<b>3T</b> } = 5 <b>2P</b> }	<b>3</b> } = 4 <b>1</b> }
	<b>Laboratory Course (Organic Synthesis and TLC)</b>			
BS 506	Elective-A/B Optional – I	DSC-1E	3T+2P=5	3+1=4
BS 507	Elective-A/B Optional – II	DSC-2E	3T+2P=5	3+1=4
BS508A	Elective-A (Chemistry–VI) <b>Instrumental Methods of Analysis</b>	<b>DSC-3E</b>	<b>3T</b> } = 5 <b>2P</b> }	<b>3</b> } = 4 <b>1</b> }
BS508B	Elective-B (Chemistry – VI) <b>Industrial Chemistry and Catalysis</b>			
	<b>Laboratory Course (Experiments in Physical Chemistry-I)</b>			
	<b>Total Credits</b>		<b>34</b>	<b>28</b>

**SEMSTER - VI**

BS 601	<b>Chemistry of Cosmetics and Food Processing</b>	<b>SEC-4</b>	<b>2</b>	<b>2</b>
BS 602	<b>Materials and Their Applications</b> (For B.Sc. Non Chemistry/B.A/B.Com Students)	<b>GE-2</b>	<b>2T</b>	<b>2</b>
BS 603	Optional – I	DSC-1F	3T+2P=5	3+1=4
BS 604	Optional – II	DSC-2F	3T+2P=5	3+1=4
BS 605	<b>Optional – III Chemistry - VII</b>	<b>DSC-3F</b>	<b>3T</b> } = 5 <b>2P</b> }	<b>3</b> } = 4 <b>1</b> }
	<b>Laboratory Course (Qualitative and Spectral Analysis of Organic Compounds)</b>			
BS 606	Elective-A/B Optional – I	DSC-1F	3T+2P=5	3+1=4
BS 607	Elective-A/B Optional – II	DSC-2F	3T+2P=5	3+1=4
BS 608A	Elective-A (Chemistry – VIII) <b>Medicinal Chemistry</b>	<b>DSC-3F</b>	<b>3T</b> } = 5 <b>2P</b> }	<b>3</b> } = 4 <b>1</b> }
BS 608B	Elective-B (Chemistry – VIII) <b>Agricultural and Fuel Chemistry</b>			
	<b>Laboratory Course (Experiments in Physical Chemistry-II)</b>			
			<b>34</b>	<b>28</b>
	<b>Total Credits</b>			<b>164</b>

\* **Optional III Chemistry,**

AECC: Ability Enhancement Compulsory Course; SEC: Skill Enhancement Course; DSC: Discipline Specific Course; GE: Generic Elective

**B.Sc. Chemistry III Year**  
**Semester - V**  
**Skill Enhancement Course- III (SEC - III) (2 Credits)**  
**Materials and their Applications**

**30 Hrs**

**Unit – I: Types of Materials**

**15 Hrs**

**Introduction:** Materials and their importance. Classification of Materials, Advanced materials and their need.

**Types of Materials:** Metals, ceramics, polymers and composites; Nature of bonding (Type of bond present).

**Types and applications of metal alloys:** Classification- ferrous and non-ferrous alloys. Ferrous alloys -types and their applications. Non-ferrous alloys – Cu, Al, Ti alloys, their applications and super alloys.

**Field Work- Collection of Metal Alloy Samples**

**Types and Applications of Ceramics:**

Classification of Ceramics based on their application- glasses, clay products, refractories, abrasives, cements, and advanced ceramics.

**Glasses:** Compositions and Characteristics of Some of the Common Commercial Glasses; Properties and applications of glass ceramics - preparation of charts depicting various types of glass and their use.

**Clay products:** Structural clay products and the white wares.

**Refractories:** Compositions of four Common Ceramic Refractory Materials, fireclay, silica, basic refractories ex. MgO and special refractories ex. Alumina and Zirconia

**Cements:** Classification, preparation of cement and the setting process; quick setting cements; applications.

**Field Work-Visit to industries and collection of samples of materials**

**Unit - II Types of Polymers and Applications 15 Hrs Classification of Polymeric materials**

**based on application:** Coatings, adhesives, films, foams examples

**Polymer Additives:** Fillers, Plasticizers, Stabilizers, Colorants, Flame Retardants with examples.

**Advanced Materials:** Types of advanced materials - semiconductors, bio-compatible materials, smart materials, advanced polymeric materials and nano-engineered materials.

**Biocompatible materials:** Definition. Materials used as biomaterials and their properties. Metals and alloys used in bone and joint replacement. Filling and restoration materials – dental cements, dental amalgams, dental adhesives.

**Field Work- Visit to Dental Clinics and interaction with Doctors regarding materials used in Dental treatments**

**Smart materials:** Shape memory alloys- definition and examples (Ni-Ti alloys, Cu based alloys), applications.

Conducting polymers: - Introduction, Electrically conducting polymers and their uses (polyaniline, polypyrrole, polyacetylene and polythiophene).

**References:**

1. A Text book on 'Materials and their Applications', First Edition, Authors: Dr Mudvath Ravi, Gopu Srinivas, Putta Venkat Reddy, Vuradi Ravi Kumar, Battini Ushaiah.
2. Materials Science and Engineering An Introduction by William D. Callister, Jr. John Wiley & Sons, Inc.
3. Material Science by Kakani and Kakani New Age International Pvt Ltd, 2004
4. Sujata V., Bhat., "Biomaterials", Narosa Publication House, New Delhi, 2002
5. M. V. Gandhi and B. S. Thompson, "Smart Materials and Structures", Chapman and Hall, London, First Edition, 1992.
6. Duerig, T.W., Melton, K. N, Stockel, D. and Wayman, C.M., "Engineering aspects of Shape Memory Alloys", Butterworth – Heinemann, 1990.
7. Chandrasekhar, Prasanna Ashwin-Ushas Conducting Polymers, Fundamentals and Applications A Practical Approach Authors: Corp., Inc. Kluwer Academic Publishers. Boston.

## Semester V

### Generic Elective (GE) Course - I (2 Credits)

#### Generic Elective-I (GE-I) Course for B.Sc. Non Chemistry/B.A/B.Com Students

##### Pharmaceuticals

30Hrs

#### Unit – I: General Characteristics of Drugs

15Hrs

**Introduction** - Diseases – causes of diseases, Drug – definition and sources.

ADME of drugs (brief) – Absorption, distribution, drug action (site of action), metabolism (in liver), elimination (brief).

Examples (i) Zintac (Ranitidine, antacid) (ii) Paracetamol (antipyretic) (iii) Benadryl (Cough syrup). Characteristics of an ideal drug.

**Nomenclature of Drugs** – chemical name – generic name – trade name. Trade names for the given generic names – (i) Aspirin (ii) Amoxicillin (iii) Ciprofloxacin (iv) Paracetamol (v) Mebendazole

**Drug formulations:** Definition – need for conversion of drug into medicine (drug formulations) – Additives – diluents, binders, lubricants, antioxidants, flavourants, sweeteners, colourants, coating agents. Classification of Drug formulations: oral, parenterals and topical dosage forms – advantages and disadvantages.

**(i) Oral Dosage forms:** Tablets (Aspirin – analgesic; Ciprofloxacin - antibacterial). Capsules (Amoxicillin – antibiotic; Omeprazole-antacid). Syrups (B-complex syrup; Benadryl- Cough syrup).

**(ii) Parenterals** (Injection forms): Propranolol (antihypertensive), Heparin (anticoagulant)

**(iii) Topical dosage forms:** Creams and Ointments

**(iv) Antiallergic:** Acemetasone (Aclovate), Betamethasone valerate(2%) Multiple purposes,

**(v) Anti-itching:** Doxepin Zonalon), **Antifungal:** Miconazole (Dactarin, Neomicol), Ketoconazole, (Nizoral Cream), Fluconazole, **Anesthetic-** Lidocaine, (Lidocaine ointment) and

**Antiseptic:** Boro Plus Cream, For burns -Iodine ointment

#### Unit – II: Classification of Drugs

15Hrs

Classification of Drugs based on therapeutic action–Chemotherapeutic agents, Pharmacodynamic agents and drugs acting on metabolic processes. (brief explanation for the following)

**(i) Chemotherapeutic agents:** Antimalarials – Chloroquine; Antibiotic – Amoxicillin; Antitubercular drugs – isoniazide; Antiprotozoals – metronidazole

**(ii) Pharmacodynamic agents**

(a) Drugs acting on CNS: Diazepam (CNS depressant), General anesthetic (thiopental sodium), antipyretic and analgesic (Ibuprofen)

(b) Drugs acting on PNS : local anaesthetics (Benzocaine)

(c) Drugs acting on cardiovascular system : Metoprolol (antihypertensive agents), Nifedipine antianginal and antihypertensive agent )

(d) Drugs acting on renal system: Diuretics (Acetazolamide)

**(iii) Drugs acting on metabolic processes**

(a) Vitamins: Common name, source, deficiency, vitamin A, B2, B6, C, D, E and K – remedy

(b) Hormones: Function (brief) - deficiency of hormones (Insulin, Testosterone and Oosterone)

**References:**

1. Drugs by G.L.David Krupadanam, D.Vijaya Prasad, K.Varaprasad Rao, K.L.N.Reddy, C.Sudhakar, Universities Press (India) Limited 2007.
2. An Introduction to Medicinal Chemistry by Graham L. Patrick, Oxford University Press, New York. 1995
3. Chemistry text book for B.Sc., Vol. IV published by Telugu Academy, Govt. of Telangana

**B.Sc III yr CHEMISTRY**  
**SEMESTER WISE SYLLABUS**  
**SEMESTER V**  
**Paper-V**  
**Chemistry - V**

**Unit-I ( Inorganic Chemistry) 11 h**

**S5-I-1: Coordination compounds –II 9 h**

Crystal field theory (CFT)- Postulates of CFT, splitting patterns of d-orbitals in octahedral, tetrahedral, square planer with suitable examples. Crystalfield stabilization energies and its calculations for various  $d^n$  configurations in octahedral complexes. High Spin Low Spin complexes.

Magnetic properties of transition metal complexes- para, dia, ferro, anti ferromagnetic properties, determination of magnetic susceptibility (Guoy method), spin only formula, calculations of magnetic moments.

Electronic spectra of metal complexes – colour of transition metal aqua complexes– d-d transitions. Detection of complex formation - basic principles of various methods- change in chemical properties, solubility, colour, pH, conductivity, magnetic susceptibility.

Thermodynamic and kinetic stability of transition of metal complexes . Stability of metal complexes –stepwise and overall stability constant andf their relationship. Factors effecting the stability constants. Chelate effect, determination of composition of complex by Job's method and mole ratio method.

**Applications of coordination compounds**

Applications of coordination compounds a) in quantitative and qualitative analysis with suitable examples b) in medicine for removal of toxic metal ions and cancer therapy c) in industry as catalysts polymerization – Ziegler Natta catalyst d) water softening.

**S5-I-2: Boranes and Carboranes: 2 h**

Definition of clusters. Structures of boranes and carboranes- Wade's rules, closo, nido, arachno Boranes and carboranes

**Unit-II (Organic Chemistry) 11 h**

**S5-O-1: Amines, Cyanides and Isocyanides 7 h**

**Amines:**

Nomenclature, classification into  $1^0$ ,  $2^0$ ,  $3^0$  Amines and Quarternary ammonium compounds. Preparative methods – 1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties and basic character – Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline- comparative basic strength of aniline, N-methylaniline and N,N- dimethyl aniline (in aqueous and non- aqueous medium), steric effects and substituent effects. Use of amine salts as phase transfer catalysts. 4. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. 5. Reaction with Nitrous acid of  $1^0$ ,  $2^0$ ,  $3^0$  (Aliphatic and aromatic amines).

Electrophilic substitutions of Aromatic amines – Bromination and Nitration, oxidation of aryl and 3<sup>o</sup> Amines, diazotisation. 6. Diazonium salts: Preparation with mechanism. Synthetic importance – a) Replacement of diazonium group by – OH, X (Cl)- Sandmeyer and Gatterman reaction, by fluorine (Schiemann's reaction), by iodine, CN, NO<sub>2</sub>, H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

#### **Cyanides and isocyanides:**

Nomenclature (aliphatic and aromatic) structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. 2. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation.

### **S5-O-2: Heterocyclic Compounds**

**4 h**

Introduction and definition: Simple 5 membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring systems – presence in important natural products like hemoglobin and chlorophyll. Numbering the ring systems as per Greek letter and Numbers. Aromatic character – 6- electron system (four-electrons from two double bonds and a pair of non-bonded electrons from the hetero atom). Tendency to undergo substitution reactions.

Resonance structures: Indicating electron surplus carbons and electron deficient hetero atom. Explanation of feebly acidic character of pyrrol, electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions. Reactivity of furan as 1,3-diene, Diels Alder reactions (one example). Sulphonation of thiophene purification of Benzene obtained from coal tar). Preparation of furan, Pyrrole and thiophene from 1,4,-dicarbonyl compounds only, Paul-Knorr synthesis, structure of pyridine, Basicity – Aromaticity – Comparison with pyrrole – one method of preparation and properties – Reactivity towards Nucleophilic substitution reaction – chichibabin reaction.

### **Unit-III(Physical Chemistry)**

#### **S5-P-1: Chemical Kinetics**

**11 h**

Introduction to chemical kinetics, rate of reaction, variation of concentration with time, rate laws and rate constant. Specific reaction rate. Factors influencing reaction rates: effect of concentration of reactants, effect of temperature, effect of pressure, effect of reaction medium, effect of radiation, effect of catalyst with simple examples, order of reaction.

First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half- life period, graph of 1<sup>st</sup> order reaction, examples. Decomposition of H<sub>2</sub>O<sub>2</sub> and decomposition of oxalic acid.

Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems. Second order reaction, derivation of expression for 2<sup>nd</sup> order rate constant, examples- Saponification of ester,  $2O_3 \rightarrow 3O_2$ ,  $C_2H_4 + H_2 \rightarrow C_2H_6$ . Characteristics of second order reaction, units for rate constants, half- life period and second order plots.

Zero order reaction: derivation of rate expression, examples i) combination of  $H_2$  and  $Cl_2$  to form  $HCl$ , ii) thermal decomposition of  $HI$  on gold surface characteristics of Zero order reaction units of  $k$ , half-life period and graph, problems.

Determination of order of reaction: i) method of integration, ii) half life method, iii) Vant-Hoff differential method iv) Ostwald's isolation method. Problems

Kinetics of complex reactions (first order only): opposing reactions, parallel reactions, consecutive reactions and chain reactions. Problems.

Effect of temperature on reaction rate, Arrhenius equation. Temperature coefficient. Concept of energy of activation, determination of energy of activation from Arrhenius equation and by graphical method, problems. Simple collision theory based on hard sphere model explanation of frequency factor, orientation or steric factor. The transition state theory (elementary treatment).

#### **Unit-IV (General Chemistry)**

**12 h**

#### **S5-G-2: Molecular spectroscopy**

**8 h**

Introduction to electromagnetic radiation, interaction of electromagnetic rations with molecules, various types of molecular spectra.

#### **Rotational spectroscopy (Microwave spectroscopy)**

Rotational axis, moment of inertia, classification of molecules (based on moment of inertia), rotational energies, selection rules, determination of bond length of rigid diatomic molecules eg.  $HCl$ .

#### **Infra red spectroscopy**

Energy levels of simple harmonic oscillator, molecular vibration spectrum, selection rules. Determination of force constant. Qualitative relation of force constant to bond energies. Anharmonic motion of real molecules and energy levels. Modes of vibrations in polyatomic molecules. Characteristic absorption bands of various functional groups. Finger print nature of infrared spectrum.

#### **Electronic spectroscopy:**

Bonding and antibonding molecular orbitals, electronic energy levels of molecules ( $\sigma$ ,  $\pi$ ,  $n$ ), types of electronic transitions:  $\sigma\text{-}\sigma^*$ ,  $n\text{-}\sigma^*$ ,  $n\text{-}\pi^*$ ,  $\pi\text{-}\pi^*$  with suitable examples. Selection rules, Terminology of chromophore, auxochrome, bathochromic and hypsochromic shifts. Absorption of characteristics of chromophones: diene, enone and aromatic chromophores. Representation of UV-visible spectra.

#### **S5-G-3: Photochemistry**

**4 h**

Introduction to photochemical reactions, Difference between thermal and photochemical reactions, Laws of photo chemistry- Grotthus - Draper law, Stark – Einstein's Law of photo chemical equivalence. Quantum yield. Examples of photo chemical reactions with different quantum yields. Photo chemical combinations of  $H_2 - Cl_2$  and  $H_2 - Br_2$  reactions, reasons for the high and low quantum yield. Problems based on quantum efficiency, Consequences of light absorptions. Singlet and triplet states. Jablonski diagram Explanation of internal conversion, inter- system crossing, Phosphorescence, fluorescence.



## References:

### Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications (1996).
2. Concise Inorganic Chemistry by J.D. Lee 3<sup>rd</sup> edn. Van Nostrand Reinhold Company(1977)
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3<sup>rd</sup> edn Wiley Publishers (2001). Chem.
4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4<sup>th</sup> edn. (2006)
5. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press (1989).
6. Inorganic Chemistry by Shriver and Atkins 3<sup>rd</sup> edn Oxford Press (1999).

### Unit- II

1. Text book of organic chemistry by Soni. Sultan Chand & Sons; Twenty Ninth edition (2012)
2. General Organic chemistry by Sachin Kumar Ghosh. [New Age Publishers Pvt Ltd](#) (2008)
3. Text book of organic chemistry by Morrison and Boyd. Person(2009)
4. Text book of organic chemistry by Graham Solomons. Wiley(2015)
5. Text book of organic chemistry by Bruice Yuranis Powla. (2012)

### Unit III

1. Principles of physical chemistry by Prutton and Marron. The Macmillan Company; 4th edition (1970)
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand & sons.(2011).
3. Text Book of Physical Chemistry by Puri,Sharmaand Pattania. chand and Co.(2017)
4. Physical Chemistry by Atkins & De Paula, 8<sup>th</sup> Edition
5. Text Book of Physical Chemistry by K. L. Kapoor. (2012)
6. Physical Chemistry through problems by S.K. Dogra. (2015)
7. Text Book of Physical Chemistry by R.P. Verma.
8. Elements of Physical Chemistry byLewis Glasstone. Macmillan (1966)
9. Basics of Chemical Kinetics by G.L. Agarwal, New Delhi : Tata-McGraw-Hill, 1990.
10. Kinetics and mechanism of chemical transformations by Rajaram & Kuriacose, Macmillan/Laxmi Publications (P) Ltd., New Delhi(2010)

### Unit IV

1. Bioinorganic Chemistry, M.N.Huges, [Hussain K. Reddy](#)(2013)
2. Organic spectroscopy, William Kemp, Palgrave Macmillan; 2nd Revised edition edition (1 February 1987)
3. Text Book of Physical Chemistry by Puri,Sharmaand Pattania. chand and Co.(2017)
4. Photochemistry by Gurdeep Raj, Goel publishing house, 5<sup>th</sup> edition

**Laboratory Course:**

**Paper V(Organic Synthesis and TLC) (CHE 551)**

**45 h (3h/w)**

**1. Synthesis of Organic compounds:**

Acetylation: Acetylation of salicylic acid, Benzoylation of Aniline.

Aromatic electrophilic substitution: Nitration: Preparation of nitro benzene and m-dinitro benzene.

Halogenation: Preparation of p-bromo acetanilide, Preparation of 2,4,6-tribromo phenol

Oxidation: Preparation of benzoic acid from benzyl chloride.

Esterification: Preparation of n-butyl acetate from acetic acid. Methylation: Preparation of - naphthyl methyl ether.

Condensation: Preparation of benzilidine aniline and Benzaldehyde and aniline.

**Diazotisation: Azocoupling of  $\beta$ -Naphthol.**

**2. Thin layer Chromatography**

Determination of R<sub>f</sub> values and identification of organic compounds: preparation and separation of 2,4-dinitrophenyl hydrazones of acetone and 2-butanone using toluene and light petroleum(40:60)

Separation of ortho & para nitro aniline mixtures

**B.Sc. Chemistry III Year**  
**Semester-V, Paper-VI**  
**Elective- A (3 Credits)**  
**Instrumental Methods of Analysis**

**45Hrs**

**Unit I: Chromatography I**

**11Hrs**

**S5-E-A-I: Solvent Extraction-** Principle, Methods of extraction: Batch extraction, continuous extraction and counter current extraction. Application – Determination of Iron (III).

**Chromatography:** Classification of chromatographic methods, principles of differential migration, adsorption phenomenon, nature of adsorbents, solvent systems.

**Thin layer Chromatography (TLC):** Advantages, preparation of plates, development of the chromatogram, Detection of the spots, factors effecting R<sub>f</sub> values and applications.

**Paper Chromatography:** Principle, choice of paper and solvent systems, development of chromatogram – ascending, descending, radial and two dimensional chromatography and applications.

**Unit II: Chromatography II 11Hrs S5-E-A-I: Column Chromatography-** Principle, Types of stationary phases, Column packing – Wet packing technique, Dry packing technique. Selection criteria of mobile phase solvents for eluting polar, non-polar compounds and its applications.

**Ion exchange chromatography:** Principle, cation and anion exchange resins, its application in separation of ions.

**Gas Chromatography:** Theory and instrumentation (Block Diagram), Types of stationary phases and carrier gases (mobile phase).

**High performance liquid chromatography:** Theory and instrumentation, stationary phases and mobile phases. Analysis of paracetamol.

**Unit III: Colorimetry and Spectrophotometry 12Hrs S5-E-A-III:** General features of absorption – spectroscopy, transmittance, absorbance, and molar absorptivity. Beer Lambert's law and its limitations, difference between Colorimetry and Spectrophotometry.

Instruments – Single beam UV- Visible Spectrophotometer, Double beam UV- Visible Spectrophotometer. Lamps used as energy sources. Verification of Beer's law. Estimation of iron in water samples by thiocyanate method. Estimation of (i) Chromium and (ii) Manganese in steel.

**IR Spectrophotometer:** Principle, Sources of Radiations, Sampling, Block diagram of FT-IR Spectrophotometer.

**Unit IV: Electroanalytical methods**

**11Hrs**

**S5-E-A-IV:** Types of Electroanalytical Methods.

**I) Interfacial methods** – a) Potentiometry: Principle, Electrochemical cell, Electrodes- (i) Indicator and (ii) Reference electrodes – Normal Hydrogen Electrode, Quinhydrone Electrode, Saturated Calomel Electrode. Numerical Problems. Application of Potentiometry – Assay of Sulphanilamide

b) Voltametry – three electrode assembly; Introduction to types of voltametric techniques, micro electrodes, Over potential and Polarization.

**II) Bulk methods** – Conductometry, Conductivity Cell, Specific Conductivity, Equivalent Conductivity. Numerical Problems. Applications of conductometry. Estimation of  $\text{Cl}^-$  using  $\text{AgNO}_3$ . Determination of Aspirin with KOH.

**Recommended Text Books and Reference Books**

1. Analytical Chemistry by David Krupadanam, Universities Press (India) Limited.
2. D.A. Skoog, F.J. Holler, T.A. Nieman, Principles of Instrumental Analysis, Engage earning India Ed.
3. D. A. Skoog, D.M. West, F.J. Holler, Fundamentals of Analytical Chemistry 6<sup>th</sup> Ed., Saunders College Publishing, Fort worth (1992).
4. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
5. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.2007.
6. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
7. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India.
8. Freifelder, D. Physical Biochemistry 2nd Ed., W.H. Freeman and Co., N.Y. USA, 1982.
9. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16, 1977.
10. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.
11. Vogel, A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.
12. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc, New York (1995).
13. Analytical Chemistry 7<sup>th</sup> edition by Gary D. Christian (2004).
14. B. K. Sharma, Industrial Chemistry (including Chemical Engineering). Edn. (1997).
15. M.N Sastry, Separation Methods, Paperback (2004), Himalaya Publications.
16. Usharani Analytical Chemistry Paperback (2000) Narosa Publications.

**B.Sc. Chemistry III Year**  
**Semester-V, Paper-VI**  
**Elective-B(3 Credits)**  
**Industrial Chemistry and Catalysis**

**45 Hrs**

**Unit I: General Principles of Metallurgy and Production of Non Ferrous Metals 11 Hrs**

**S5-E-B-I: Pyrometallurgy:** Drying and calcination, roasting, smelting, products of smelting, **Hydrometallurgy:** Leaching methods, leaching agents, leaching of metals, oxides and sulphides.

**Separation of liquid and solid phases and processing of aqueous solutions**

**Electrometallurgy:** Electrolysis, Refining electrolysis, electrolysis from aqueous solutions, fused-salt electrolysis

**Refining processes:** Chemical and physical refining processes

**Production of selected non-ferrous metals (Copper, Nickel, Zinc):** Properties, raw materials, production (flow charts presentations and chemical reactions involved) and uses.

**Unit II: Natural and Synthetic Dyes**

**12Hrs**

**S5-E-B-II:** Classification of dyes. Sources of natural dyes: Indigoid, Anthraquinone, Naphthoquinone, Benzoquinone, Flavonoid, Carotenoid and Tannin-based dyes.

**Synthetic Dyes:** Acidic, basic, dispersive, direct, reactive and vat dyes with examples.

Extraction of natural dyes and their sustainability: The different methods for extraction of coloring materials from natural dyes. Aqueous extraction, alkali or acid extraction, microwave and ultrasonic assisted extraction, fermentation, solvent extraction, super critical fluid extraction. Drying methods. Application of natural dyes on textiles, Mordanting- types of mordanting - metallic mordants, oil mordants, Tannins and Tannic acid. Present scenario and sustainability issues in usage of natural dyes and cost considerations.

**Unit III: Catalysis I 11Hrs S5-E-B-III: Homogeneous and heterogeneous catalysis -**

Definition of a catalyst and catalysis. Comparison of homogeneous and heterogeneous catalysis with specific examples. General characteristics of catalytic reactions.

**Acid-base catalysis-** Examples of acid and base catalysed reactions, hydrolysis of esters. Kinetics of acid catalysed reactions. Specific acid and general acid catalysis, Kinetics of base catalysed reactions. Specific base and general base catalysis. Examples-Aldol condensation and decomposition of nitramide, base catalysed conversion of acetone to di acetone alcohol. Effect of  $P^H$  on reaction rate of acid and base catalysed reactions.

**Phase transfer catalysis:** Principle of phase transfer catalysis, classification of phase transfer catalysts. Factors influencing the rate of PTC reactions.

**Unit IV: Catalysis II 11Hrs S5-E-B-IV: Enzyme catalysis-** Characteristics of enzyme catalysis, Examples: (i) Invertase in inversion of cane sugar (ii) Maltase in conversion of maltose to glucose (iii) Urease in decomposition of urea and (iv) Zymase in conversion of glucose to ethanol. Factors affecting enzyme catalysis. Effect of temperature, pH, concentration and inhibitor on enzyme catalysed reactions.

Kinetics of enzyme catalysed reactions: Michaelis-Menton Equation. Mechanism of enzyme catalysed reactions. Significance of Michaelis constant ( $K_m$ ) and maximum velocity ( $V_{max}$ ), Lineweaver-Burk plot.

### References

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
4. **Kateřina Skotnicov, Monika Losertov, Miroslav Kurs**, Theory of production of non-ferrous metals and alloys Study.
5. K Venkataraman, the Chemistry of Synthetic Dyes, Volume 4, Elsevier, Technology & Engineering.
6. Sujata Saxena and A. S. M. Raja by Natural Dyes: Sources, Chemistry, Application and Sustainability Issues.
7. Physical Chemistry by Atkins and De Paula, 8<sup>th</sup> Edn.
8. Physical Chemistry by Puri, Sharma and Pattania, 2017.
9. Kinetics and mechanism of chemical transformations by Rajarajm and Kuraiacose, Published by Macmillan India Ltd.
10. Text book of Physical Chemistry by K.L. Kapoor Macmillan, 1999.
11. Catalysis by J.C. Kuriacose, Macmillan Macmillan Publishers India Limited, 1980.

**Semester - V**  
**Laboratory Course**  
**Experiments in Physical Chemistry-I**

**Paper VI (Physical Chemistry)**

**45hrs (3 h / w)**

**1. Distribution law**

- a) Determination of distribution coefficient of iodine between water and carbon Tetrachloride/determination of molecular status and partition coefficient of benzoic acid in Toluene and water.
- b) Determination of distribution coefficient of acetic acid between n-butanol and water.

**2. Electrochemistry**

- a) Determination of cell constant of conductivity cell.
- b) Determination of dissociation constant ( $K_a$ ) of acetic acid by conductivity measurements.

**3. Colorimetry**

Verification of Beer's law using  $KMnO_4$  and determination of the concentration of the given solution.

**4. Adsorption**

Adsorption of acetic acid on animal charcoal, Verification of Freundlich adsorption isotherm.

**5. Physical constants**

Surface tension and viscosity of liquids. (Demonstration Experiment)

**B.Sc. Chemistry III Year**  
**Semester VI**  
**Skill Enhancement Course- IV (SEC - IV) (2 Credits)**

**Chemistry of Cosmetics and Food Processing**

**30 Hrs**

**Unit-I: Chemistry of Cosmetics and Perfumes**

**15 Hrs**

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, sunscreen lotions, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to eugenol, geraniol, sandalwood oil, eucalyptus, 2-phenyl ethyl alcohol.

Demonstration experiments or illustration of experimental procedures through charts for the preparation of talcum powder, shampoo and vanishing cream. Analysis of deodorants and antiperspirant - Aluminum, Zinc, Boric acid, Chloride and Sulphide.

**Unit-II: Food Processing and Food Adulteration 15 Hrs** **Food processing:** Introduction, methods for food processing, additives and preservatives. Food processing- impact on nutrition, analysis of calcium in milk by complexometric titration, spectrophotometric analysis of iron in foods, Spectrophotometric identification and determination of caffeine and benzoic acid in soft drinks.

**Field Work -Visit to Food Industries.**

**Food adulteration:** Adulterants in some common food items and their identification: Pulses, chilli powder, turmeric powder, milk, honey, spices, food grains and wheat flour, coffee powder, tea leaves, vegetable oil, ghee, ice creams, tomato sauce.

**Field Work-**Collection of adulterated food samples, demonstration of a minimum of five experiments for testing adulterants in food items.

**References**

1. E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK.
2. P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).
4. Rameen Devi, Food Processing and Impact on Nutrition, Sc J Agric Vet Sci., Aug-Sep 2015; 2(4A):304-311.
5. W.A. Poucher, Perfumes, Cosmetics and Soaps (1993).
6. Srilakshmi, Food Science. Edition: 3<sup>rd</sup> (2004).
7. Lillian Hoagland Meyer, Food chemistry (2008).
8. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, S. Ranganna, Tata McGraw-Hill Education, 1986 – Food.
9. Fundamental concepts of applied chemistry J.C Ghosh, S. Chand and Co, Ltd, New Delhi.
10. Applied Chemistry K .Bhagavathi Sundhar, MJP publishers.



**Semester VI**  
**Generic Elective (GE) Course - II (2 Credits)**

**Generic Elective-II (GE-II) Course for B.Sc. Non Chemistry/B.A/B.Com Students**

**Materials and their Applications 30 Hrs**

**Unit – I: Types of Materials**

**15 Hrs**

**Introduction:** Materials and their importance: Classification of Materials, Advanced Materials and their need.

**Types of Materials:** Metals, ceramics, polymers and composites; Nature of bonding.

**Types and applications of metal alloys:** Classification: ferrous and non-ferrous alloys. Ferrous alloys-types and their applications. Non-ferrous alloys – Cu, Al, Ti alloys and their application, Super alloys.

**Types and Applications of Ceramics:** Classification of Ceramics based on their application- glasses, clay products, refractories, abrasives, cements and advanced ceramics.

**Glasses:** Compositions and characteristics of some of the common commercial glasses; Properties and applications of glass ceramics.

**Clay products:** Structural clay products and white wares.

**Refractories:** Compositions of four common ceramic refractory materials - fireclay, silica, basic refractories ex. MgO and special refractories ex. alumina and zirconia

**Cements:** Classification, preparation of cement and the setting process; quick setting cements and their applications.

**Unit - II Types of Polymers and Applications**

**15 Hrs**

**Polymeric materials classification based on application:** Coatings, adhesives, films, foams with examples.

**Polymer Additives:** Fillers, plasticizers, stabilizers, colorants, flame retardants with examples

**Advanced Materials:** Types of advanced materials- semiconductors, bio-compatible materials, smart materials and advanced polymeric materials with examples.

**Conducting polymers:** Introduction, Electrically conducting polymers and their uses (polyaniline, polypyrrole, polyacetylene and polythiophene),

**References:**

1. William D. Callister Materials Science and Engineering An Introduction, John Wiley & Sons, Inc, 2006.
2. Material science by Kakani and Kakani.
3. Sujata V., Bhat., "Biomaterials", Narosa Publication House, New Delhi, 2002.
4. M. V. Gandhi and B. S. Thompson, "Smart Materials and Structures", Chapman and Hall, London, First Edition, 1992.
5. Duerig, T. W., Melton, K. N, Stockel, D. and Wayman, C.M., "Engineering aspects of Shape Memory Alloys", Butterworth – Heinemann, 1990.
6. Conducting Polymers, Fundamentals and Applications A Practical Approach Authors: Chandrasekhar, Prasanna Ashwin-Ushas Corp., Inc. Kluwer Academic Publishers. Boston

**B.Sc. III yr CHEMISTRY**  
**SEMESTER WISE SYLLABUS**  
**SEMESTER VI**  
**Paper-VII**  
**Chemistry - VII**

**Unit-I (Inorganic Chemistry) 11 h**

**S6-I-1: Inorganic reaction mechanisms 4h**

Labile and inert complexes, Thermodynamic and kinetic stability based on VBT & CFT: ligand substitution reactions –  $S_N1$  and  $S_N2$  in Octahedral complexes; substitution reactions of square planar complexes – Trans effect and applications of trans effect. Reactions of tetrahedral complexes - Hydrolysis of silicon halides and phosphorous oxides.

**S6-I-2: Bioinorganic chemistry 5h**

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride ( $Cl^-$ ). Toxic metal ions As, Hg & Pb  
Oxygen transport and storage – structure of hemoglobin, binding and transport of oxygen. Fixation of  $CO_2$  in photosynthesis- overview of light and dark reactions in photosynthesis. Structure of chlorophyll and coordination of magnesium. Electron transport in light reactions from water to  $NADP^+$  (Z – scheme).

**S6-I-3: Hard and soft acids bases (HSAB) 2h**

Classification, Pearson's concept of hardness and softness, application of HSAB principles – Stability of compounds / complexes, predicting the feasibility of reaction

**UNIT - II (Organic Chemistry) 11 h**

**S6-O-1: Carbohydrates 6 h**

Introduction: Classification and nomenclature – classification into mono, oligo and polysaccharides, into pentoses, hexoses *ETC.*, into aldoses and ketoses.

Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Evidences for straight chain pentahydroxy aldehyde structure (Acetylation, reduction to n-hexane, cyanohydrin formation, reduction of Tollen's and Fehling's reagents and oxidation to gluconic and saccharic acids). Number of optically active, isomers possible for the structure, configuration of glucose based on D-glyceraldehyde as primary standard (No proof for configuration is required). Evidence for cyclic structure of glucose (some negative aldehyde tests and mutarotation). Cyclic structure of glucose: Proposition of cyclic structure (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). Different ways of writing pyranose structure (Haworth formula and chair conformational formula). Structure of fructose: Evidence of 2 – ketohexose structure (formation of penta acetate, formation of cyanohydrin its hydrolysis and reduction by HI to give 2-Carboxy-n-hexane) Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure, Haworth formula).

Inter Conversion of Monosaccharides: Aldopentose to aldo hexose – eg: Arabinose to D-glucose, D- mannose (kiliani – Fischer method). Epimers, Epimerisation- Lobry de bruyn van Ekenstein rearrangement. Aldo hexose – Aldopentose eg: D-glucose to D-arabinose by Ruff's degradation. Aldo hexose(+) (glucose) to keto hexose (-)(Fructose) and Keto hexose (Fructose) to aldo hexose (Glucose).

### **S6-O-2 Amino acids and proteins**

**5 h**

acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, valine and Leucine) by following methods: a) From halogenated Carboxylic acid b) Malonic ester synthesis c) strecker's synthesis. Physical properties: Optical activity of naturally occurring amino acids: L – configuration, irrespective of sign of rotation. Zwitter ion structure – salt like character, solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups – Lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins, peptide synthesis

### **Unit-III (Physical Chemistry)**

**11 h**

#### **S6-P-1: Thermodynamics –I**

**11h**

A brief review of - Energy, work and heat units, mechanical equivalent of heat, definition of system, surroundings. I law of thermodynamics statement- various forms mathematical expression. Thermodynamic quantities- extensive properties and intensive properties, state function, path functions energy as a state function, and exact differential. Work of expansion and heat absorbed as path function.

Expression for work of expansion, sign convention problems on I law. Heat changes at constant pressure and heat changes at constant volume. Enthalpy. Heat capacities at constant pressure and constant volume. Derivation  $C_p - C_v = R$ .

Isothermal adiabatic processes. Reversible and irreversible processes. Reversible change and maximum work. Derivation of expression for maximum work for isothermal reversible process. Problems. Internal energy of an ideal gas. Joules experiment and Joule-Thompson coefficient. Adiabatic changes in ideal gas derivation of equation,  $PV^\gamma = \text{constant}$ . P-V curves for isothermal and adiabatic processes.

**Heat of a reaction at constant volume and at constant pressure, relation between  $\Delta H$  and  $\Delta V$ .**

Variation of heat of reaction with temperature. Kirchoff's equation and problems. Limitations of I law and need for II law. Statement of II law of thermodynamics. Cyclic process. Heat engine, Carnot's theorem, Carnot's cycle. Derivation of efficiency of heat engine problems. Thermodynamic scale of temperature.

**Unit-IV** **12 h**

**S6-G-1: Proton Magnetic Resonance Spectroscopy** **4h**

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals – spin-spin coupling, representation of proton NMR spectrum – Integrations. <sup>1</sup>H NMR spectrum of – ethyl bromide, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate and acetophenone.

**S6-G-2: Mass Spectrometry** **4 h**

Electron Impact Mass: Basic principles, Nitrogen rule, types of ions: Molecular ion, fragment ion and isotopic ions, representation of mass spectrum, types of peaks (molecular ion, fragment and isotopic ion peaks). Determination of molecular weight Mass spectrum of ethyl chloride, ethyl bromide and acetophenone.

**S6-G-3: Thermodynamics- II** **4 h**

Entropy: Definition from Carnot's cycle. Entropy as a state function. Entropy as a measure of disorder. Sign of entropy change for spontaneous and non-spontaneous processes & equilibrium processes. Entropy changes in i). Reversible isothermal process, ii). reversible adiabatic process, iii). phase change, iv). reversible change of state of an ideal gas. Problems. Entropy of mixing inert perfect gases. Free energy Gibb's function (G) and Helmholtz's function (A) as thermodynamic quantities. Concept of **maximum work and net work ΔG as criteria for spontaneity. Derivation of equation  $\Delta G = \Delta H - T\Delta S$ . significance of the equation.** Gibbs equations and the Maxwell relations. Variation of G with P, V and T.

## References :

### Unit- I

1. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3<sup>rd</sup> edn Wiley Publishers (2001).
2. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4<sup>th</sup> edn. (2006)
3. Metal Ions In Reaction mechanisms, K.Veera Reddy. Galgotia Publications Pvt Ltd(2004)

### Unit- II

1. Text book of organic chemistry by Soni. Sultan Chand & Sons; Twenty Ninth edition (2012)
2. General Organic chemistry by Sachin Kumar Ghosh. . [New Age Publishers Pvt Ltd](#) (2008)
3. Text book of organic chemistry by Morrison and Boyd. Person(2009)
4. Text book of organic chemistry by Graham Solomons. Wiley(2015)
5. Text book of organic chemistry by Bruice Yuranis Powla. 2<sup>nd</sup> Edition (2012)

### Unit III

1. Principles of physical chemistry by Prutton and Marron. The Macmillan Company; 4th edition (1970)
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand & sons.(2011)
3. Text Book of Physical Chemistry by Puri, Sharmaand Pattania. chand and Co.(2017)
4. Physical Chemistry by Atkins & De Paula, 8<sup>th</sup> Edition, 2009
5. Text Book of Physical Chemistry by K. L. Kapoor. (2012)
6. Physical Chemistry through problems by S.K. Dogra. (2015)
7. Text Book of Physical Chemistry by R.P. Verma.
8. Elements of Physical Chemistry byLewis Glasstone. Macmillan (1966)
9. Thermodynamics by Rajaram, [Vishal Publishing Co](#),(2013)

### Unit IV

1. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3<sup>rd</sup> edn Wiley Publishers (2001).
2. Organic Spectroscopy, William Kemp Palgrave Macmillan; 2nd Revised edition edition (1 February 1987)
3. Principles of physical chemistry by Prutton and Marron.( The Macmillan Company; 4th edition (1970)
4. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand & sons.(2011).
5. Text Book of Physical Chemistry by Puri,Sharmaand Pattania. chand and Co.(2017)
6. Thermodynamics by Rajaram. [Vishal Publishing Co](#),(2013)

**Semester - VI**  
**Laboratory Course**  
**Paper VII**

**Qualitative and Spectral Analysis of Organic Compounds: 45hrs (3 h/w)**

**Qualitative analysis:** Identification of an Organic compound through the functional group analysis, determination of melting points/boiling points, functional group tests and preparation of suitable derivatives of the following:

Carboxylic acids, phenols, amines, urea, thiourea, carbohydrates, aldehydes, ketones, amides, nitro hydrocarbons, ester and naphthalene.

**Spectral analysis** Determination of structures from combined spectral data (IR,  $^1\text{H-NMR}$  and Mass): Minimum of five problems.

**B.Sc. Chemistry III Year**  
**Semester-VI, Paper-VIII**  
**Elective-A (3 Credits)**

**Medicinal Chemistry**

**45Hrs**

**Unit- I: Introduction and Terminology**

**11Hrs**

**S6-E-A-I: Diseases:** Common diseases, infective diseases–insect borne, air-borne, water-borne and hereditary diseases.

**Terminology in Medicinal Chemistry:** Drug, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics, metabolites, anti metabolites and therapeutic index.

**Drugs:** Nomenclature: Chemical name, Generic name and Trade names with examples;  
Classification: Classification based on structures and therapeutic activity with examples. **ADME:**  
a) Absorption: Definition, absorption of drugs across the membrane – active and passive absorption, routes of administration of drugs. b) Distribution: definition and effect of plasma protein binding. c) Metabolism: definition, phase I and phase II reactions.  
d) Elimination: definition and renal elimination.

**Unit-II: Enzymes and Receptors 11Hrs S6-E-A-II: Enzymes:** Introduction. Mechanism and factors affecting enzyme action, Specificity of enzyme action (including stereo specificity), Enzyme inhibitors and their importance. Types of inhibition - reversible, irreversible and their subtypes with examples.

**Receptors:** Introduction, Drug action-receptor theory, Mechanism of drug action, concept of agonists and antagonists with examples. Drug receptor interactions involved in drug receptor complex. binding role of –OH group, –NH<sub>2</sub> group, quaternary ammonium salts and double bond. Structure – activity relationships of drug molecules, explanation with sulfonamides.

**Unit- III: Synthesis and Therapeutic Activity of Drugs**

**12Hrs**

**S6-E-A-III:** Introduction, synthesis and therapeutic activity of :

**Chemotherapeutics:** Sulphanilamide, dapsone, Pencillin-G ( semi synthesis), Chloroquin, Isoniazid, Cisplatin and AZT.

**Drugs to treat metabolic disorders:** Anti diabetic - Tolbutamide; Antiinflammatory – Ibuprofen; Cardiovascular- Glyceryl trinitrate; Antipyretic (paracetamol, aspirin) and Antacid-Omeprazole.

**Drugs acting on nervous system:** Anesthetics-definition, Classification-local and general. Volatile- Nitrous oxide, chloroform uses and disadvantages. Local anesthetics – benzocaine.

**Unit- IV: Molecular Messengers and Health Promoting Drugs 11Hrs S6-E-A-IV:**

**Molecular Messengers:** Introduction to hormones and neurotransmitters, Thyroid hormones, Antithyroid drug-Carbimazol. Adrenaline: Adrenergic drugs- salbutamol, atenelol. Serotonin: SSRIs- fluoxetine. Dopamine: Antiparkinson drug- Levodopa .

**Health promoting drugs:** Introduction, sources, Deficiency disorders and remedy of Vitamins A,B, C, D, E K and micronutrients – Na, K, Ca, Cu, Zn and I .

**Reference books**

1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, New York. 2013.
2. Thomas Nogrady, Medicinal Chemistry, Oxford Univ. Press, New York.2005.
3. David William and Thomas Lemke, Foye's Principles of Medicinal Chemistry, Lippincott Williams & Wilkins, 2008.

4. Ashutosh Kar Medicinal Chemistry, New Age International, 2005.
5. O.D.Tyagi & M.Yadav Synthetic Drugs by, Anmol Publications,1998.
6. Medicinal Chemistry by Alka L. Gupta, Pragati Prakashan.
- 7.G. L. David Krupadanam, D.Vijaya Prasad, K.Varaprasad Rao, K. L. N. Reddy, C. Sudhakar, Drugs, Universities Press (India) Ltd. 2012.



**B.Sc. Chemistry III Year**  
**Semester –VI, Paper-VIII**  
**Elective-B (3 Credits)**  
**Agricultural and Fuel Chemistry**

**45 Hrs**

**Unit I: – Pesticides**

**12Hrs**

**S6-E-B-I: Introduction**, Definition, classification of pesticides based on use (target). Toxicity and chemical structure with examples. Adverse effects of pesticides and its impact on environmental pollution.

Synthesis, technical manufacture and uses of representative pesticides in the following classes: Organochlorines (Cypermethrin); Organophosphates (Parathion); Carbamates (carbaryl); Quinones (Chloranil), Anilides (Alachlor).

**Pesticide formulations:** Dusts, Granules, Wettable powders, Emulsions and Aerosols.  
**Biopesticides :** Introduction: Potential pesticidal plants of India, Role of Neem in plant protection-constituents, Azadirachtin and its role in pest control, Structure and mode of action of Pyrethrins( pyrethrin-1) and Pyrethroids (permethrin) and nicotinoids (Imidacloprid).

**Unit II: – Fertilizers**

**11Hrs**

**S6-E-B-II: Introduction:** (need of fertilizers), functions of essential plant nutrients (N, P, K), Classification formula and uses of fertilizers:

**Nitrogenous fertilizers:** Ammonium nitrate, Urea, Calcium Cyanamide, Calcium Ammonium Nitrate, Sodium Nitrate, Ammonium Chloride and their uses.

**Phosphate fertilizers:** Normal super phosphate, Triple Super Phosphate, Ammonium Phosphate and their uses.

**Potassium fertilizers:** Potassium chloride, potassium nitrate, potassium sulphate and uses.

**Complex fertilisers:** Diaammonium Phosphate and mixed fertilizers their uses. Manufacture of urea and Super phosphate of lime and their reactions in the soil.

**Biofertilizers** – Introduction, definition, classification, Rhizobium, Azatobactor, Azospirillum, Azolla, Blue Green Algae, Vermicomposting and uses.

**Organic farming:** The principal methods, crop rotation, green manures and compost, biological pest control, and mechanical cultivation and uses.

**Unit III: Energy Sources and Coal 11Hrs. S6-E-B-III:** Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

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 Solvent Refining.

**Unit IV: Petroleum, Petrochemical Industry and Lubricants 11Hrs. S6-E-B-IV: 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 of Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from

biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene and their uses.

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

### **Reference books**

1. N. N. Melnikov, Chemistry of pesticides; Springer-Verlag- Technology & Engineering (2012).
2. Thomas A. Unger Pesticide Synthesis Handbook; Elsevier, (2000).
3. R. Cremllyn Pesticides; John Wiley, 1980.
4. A. K. Kolay Manures and Fertilisers; Published by Atlantic (2007).
5. Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
6. Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
7. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).

## Semester - VI

### Laboratory course

#### Experiments in Physical Chemistry-II

Paper VIII (Physical Chemistry)

45hrs (3 h/w)

#### 1. Kinetics

- a) Determination of specific reaction rate of the hydrolysis of methyl acetate catalyzed by hydrogen ion at room temperature.
- b) Determination of rate of decomposition of hydrogen peroxide catalyzed by  $\text{FeCl}_3$ .

#### 2. Electrochemistry

##### A. Potentiometry:

- a) Determination of redox potential of  $\text{Fe}^{2+}/\text{Fe}^{3+}$  by potentiometric titration of ferrous ammonium sulphate vs. potassium dichromate.
- b) Precipitation titration of  $\text{KCl}$  vs.  $\text{AgNO}_3$  -Determination of given concentration of silver nitrate.

##### B. pH metry:

- a) pH metric titration of strong acid ( $\text{HCl}$ ) vs. strong base- Determination of the concentration of the given acid.
- b) pH metric titration of weak acid(acetic acid) with strong base(  $\text{NaOH}$ ).- Determination of acid dissociation constant ( $K_a$ ) of weak acid.

#### 3. Conductometry:

Determination of overall order: Saponification of ethyl acetate with  $\text{NaOH}$  by conductance measurements.