

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 from 2025-2026

FIRST YEAR- SEMESTER I

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 101	Ability Enhancement Compulsory Course AECC-1	ES	2	2
BS 102	English	CC-1A	4	4
BS 103	Second language	CC-2A	4	4
BS 104	Optional I	DSC-1A	4T+2P=6	4+1=5
BS 105	Optional II	DSC-2A	4T+2P=6	4+1=5
BS 106	Optional III- Chemistry - I	DSC-3A	4T } = 6 2P }	4 } = 5 1 }
	Laboratory Course - I (Qualitative Analysis - Semi Micro Analysis of Mixtures)			
	Total Credits		28	25

FIRST YEAR- SEMSTER II

BS 201	Ability Enhancement Compulsory Course AECC-2	BCS	2	2
BS 202	English	CC-1B	4	4
BS 203	Second language	CC-2B	4	4
BS 204	Optional I	DSC-1B	4T+2P=6	4+1=5
BS 205	Optional II	DSC-2B	4T+2P=6	4+1=5
BS 206	Optional III- Chemistry - II	DSC-3B	4T } = 6 2P }	4 } = 5 1 }
	Laboratory Course - II (Quantitative Analysis - Titrations)			
	Total Credits		28	25

SECOND YEAR- SEMSTER III

BS 301	A. Safety Rules in Chemistry Laboratory and Lab Reagents B. Remedial methods for pollution, drinking water and Soil fertility	SEC-1 SEC-2	2 2	2 2
BS 302	English	CC-1C	3	3
BS 303	Second language	CC-2C	3	3
BS 304	Optional I	DSC-1C	4T+2P=6	4+1=5
BS 305	Optional II	DSC-2C	4T+2P=6	4+1=5
BS 306	Optional III- Chemistry - III	DSC-3C	4T } = 6 2P }	4 } = 5 1 }
	Laboratory Course - III (Synthesis of Organic compounds)			
	Total Credits		28	25

SECOND YEAR- SEMSTER IV

BS 401	A. Materials and their Applications B. Chemistry of Cosmetics and Food Processing	SEC-3 SEC-4	2 2	2 2
BS 402	English	CC-1D	3	3
BS 403	Second language	CC-2D	3	3
BS 404	Optional I	DSC-1D	4T+2P=6	4+1=5
BS 405	Optional II	DSC-2D	4T+2P=6	4+1=5
BS 406	Optional III- Chemistry - IV	DSC-3D	4T } = 6 2P }	4 } = 5 1 }
	Laboratory Course - IV (Qualitative Analysis of Organic Compounds)			
	Total Credits		28	25

* AECC: Ability Enhancement Compulsory Course, SEC: Skill Enhancement Course, DSC: Discipline Specific Course, GE: Generic Elective, ES: Environmental Science, BCS: Basic computer skills, DSE: Discipline Specific Elective

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THIRD YEAR- SEMESTER V

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 501	Chemistry of Cosmetics, Food Processing, Drugs and Pharmaceuticals	GE	4	4
BS 502	English	CC-1E	3	3
BS 503	Second language	CC-2E	3	3
BS 504	Optional I A/B	DSE-1E	-----	4+1=5
BS 505	Optional II	DSE-2E	-----	4+1=5
BS 506	Optional III- Chemistry – III A/B A. Spectroscopy and Chromatography (Or) B. Metallurgy, Dyes, Batteries and Nanomaterials	DSE-3E	$\left. \begin{matrix} 4T \\ 2P \end{matrix} \right\} = 6$	$\left. \begin{matrix} 4 \\ 1 \end{matrix} \right\} = 5$
	Laboratory Course - V (Experiments in Physical Chemistry)			
	Total Credits			25

THIRD YEAR- SEMSTER VI

BS 601	Projects in Chemistry/Advanced Chemistry			4
BS 602	English	CC-1F	4	4
BS 603	Second language	CC-2F	4	4
BS 604	Optional I	DSE-1F	-----	4+1=5
BS 605	Optional II	DSE-2F	-----	4+1=5
BS 606	Optional III- Chemistry – III A/B A Medicinal Chemistry (Or) B. Agricultural and Fuel Chemistry	DSE-3F	$\left. \begin{matrix} 4T \\ 2P \end{matrix} \right\} = 6$	$\left. \begin{matrix} 4 \\ 1 \end{matrix} \right\} = 5$
	Laboratory Course - VI (Experiments in Physical Chemistry)			
	Total Credits			25
	Grand Total Credits			150

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**BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND COMMERCE,
SAINIKPURI, SECUNDERABAD.**

**Autonomous College
Affiliated to OSMANIA UNIVERSITY, Hyderabad.
(Accredited with 'A' grade by NAAC)
Department of Chemistry**

PROGRAM NAME: B.Sc MbGC, BtMbC, BtGC, MNDC

**B.Sc II Yr CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER III
Paper-III
Chemistry - III**

**COURSE CODE: CT335 & CT335P
YEAR/SEMESTER: II/III**

**HPW: 4
No. Of Credits: Theory – 4
Practical – 1**

COURSE OBJECTIVES-CHEMISTRY

Name of the Course		Semester-III Paper III Chemistry-III
Course Code		CT335
COb1	Classify and identify the different properties of transition elements. Apply the theories of chemical bonding, reaction mechanism in complexes. Analyze the structure and reactivity of metals and metal carbonyls.	
COb2	Learn detailed mechanisms for various fundamental reactions of carboxylic acids. Identify different nitrogen compounds and their properties. To learn various organic reactions of nitrogen compounds in synthesis of organic compounds.	
COb3	Apply the principles of thermodynamics to different systems. Identify the thermodynamic quantities (U, H, S, A, G).	
COb4	Estimates kinds of errors in chemical analysis. Learn detailed mechanisms for various fundamental reactions involving carbanions. Recognize single and two component systems.	

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UNIT I-Inorganic Chemistry-III

1. Chemistry of f-block elements
2. Coordination Compounds-I
3. Metal carbonyls and Organometallic Chemistry

15 h (1 h / w)

5 h

6 h

4 h

UNIT II-Organic Chemistry-III

1. Carboxylic acids and derivatives
2. Nitrohydrocarbons
3. Amines, Cyanides and Isocyanides

15 h (1 h / w)

5 h

3 h

7 h

UNIT III-Physical Chemistry-III

1. Thermodynamics -I
2. Thermodynamics -II

15 h (1 h / w)

10h

5h

UNIT IV - General Chemistry-III

1. Evaluation of analytical data
2. Carbanions-I
3. Phase Rule

15 h (1 h / w)

4 h

5 h

6 h

Unit-I (Inorganic Chemistry)**15 h (1 hr/week)****S3-I-1: Chemistry of f-block elements:****5 h**

Chemistry of Lanthanides: Position in periodic table, Electronic structure, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, anomalous behavior of post lanthanides-complexation- type of donor ligands preferred. Magnetic properties- paramagnetism. Colour and spectra, f-f transitions -occurrence and separation- ion exchange method, solvent extraction.

Chemistry of actinides- general features - electronic configuration, oxidation state, actinide contraction, colour and complex formation. Comparison with lanthanides.

S3-I-2: Coordination Compounds-I**6 h**

Simple inorganic molecules and coordination complexes. Nomenclature - IUPAC rules,

1. Coordination number, coordination geometries of metal ions, types of ligands. 2. Brief review of Werner's theory, Sidgwick's electronic interpretation and EAN rule and their limitations. (Valence bond theory (VBT) - postulates and application to (a) tetrahedral complexes $[\text{Ni}(\text{NH}_3)_4]^{2+}$, $[\text{NiCl}_4]^{2-}$ and $[\text{Ni}(\text{CO})_4]$ (b) Square planar complexes $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Cu}(\text{NH}_3)_4]^{2+}$, $[\text{PtCl}_4]^{2-}$ (c) Octahedral complexes $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Fe}(\text{CN})_6]^{3-}$, $[\text{FeF}_6]^{4-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{CoF}_6]^{3-}$ Limitations of VBT. 3. Isomerism in coordination compounds, stereo isomerism - (a) geometrical isomerism in (i) square planar metal complexes of the type $[\text{MA}_2\text{B}_2]$, $[\text{MA}_2\text{BC}]$, $[\text{M}(\text{AB})_2]$, $[\text{MABCD}]$, (ii) Octahedral metal complexes of the type $[\text{MA}_4\text{B}_2]$, $[\text{M}(\text{AA})_2\text{B}_2]$, $[\text{MA}_3\text{B}_3]$ using suitable examples, (b) Optical isomerism in (i) tetrahedral complexes $[\text{MABCD}]$, (ii) Octahedral complexes $[\text{M}(\text{AA})_2\text{B}_2]$, $[\text{M}(\text{AA})_3]$ using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.

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S3-I-3: Metal carbonyls and Organometallic Chemistry

4 h

Metal carbonyls: Preparation and properties of $\text{Ni}(\text{CO})_4$. Structural features of $\text{Ni}(\text{CO})_4$, $\text{Fe}(\text{CO})_5$, $\text{Fe}_2(\text{CO})_9$, $\text{Fe}_3(\text{CO})_{12}$ and $\text{Cr}(\text{CO})_6$ - 18 valence electron rule. Definition, nomenclature and classification of organometallic compounds. Methods of preparation, properties and applications of alkyl and aryl compounds of Li, Mg & Al.

15h (1 hr/week)

Unit - II (Organic Chemistry)

5 h

S3-O-1: Carboxylic acids and derivatives

Preparation: a) Hydrolysis of Nitriles, amides and esters. b) Carbonation of Grignard reagents. Special methods of preparation of Aromatic Acids - Oxidation of Arenes. Physical properties - hydrogen bonding, dimeric association. Chemical properties - Reactions involving H, OH and COOH groups - salt formation, anhydride formation, Acid halide formation, Esterification (mechanism) & Amide formation. Reduction of acid to the corresponding primary alcohol - via ester or acid chloride. Degradation of carboxylic acids by Huns Diecker reaction, Schmidt reaction (Decarboxylation). Arndt - Eistert synthesis, Halogenation by Hell - Volhard - Zelensky reaction. Carboxylic acid Derivatives - Hydrolysis and Amonolysis of acid halides, Acid anhydrides and esters (mechanism of ester hydrolysis by base and acid). Hydrolysis and dehydration of amides.

3 h

S3-O-2: Nitrohydrocarbons

Preparation of Nitroalkanes. Reactivity - halogenation, reaction with HNO_2 (Nitrous acid), Nef reaction, reduction. Aromatic Nitrohydrocarbons: Preparation of Nitrobenzene by Nitration. Physical properties, chemical reactivity - Reduction of Nitrobenzenes in different media.

7 h

S3-O-3: Amines, Cyanides and Isocyanides

Amines: classification into 1°, 2°, 3° Amines and Quarternary ammonium compounds. Preparative methods - Ammonolysis of alkyl halides, Gabriel synthesis, Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties. Use of amine salts as phase transfer catalysts. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines - Bromination and Nitration, oxidation of aryl and 3° Amines, diazotisation. 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_2 , H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

Cyanides and isocyanides: Structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation.

Unit III (Physical Chemistry)

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15 h (1 hr/week)

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S3-P-1: Thermodynamics –I

10 h

A brief review of - Energy, work and heat units, mechanical equivalent of heat, definition of system, surroundings. First law of thermodynamics statement- various forms mathematical expression. Thermodynamic quantities- extensive properties and intensive properties, state function and 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 first law. Heat changes at constant pressure and heat changes at constant volume. Enthalpy. Heat capacities at constant pressure and constant volume. Derivation of $C_p - C_v = R$. 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. 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 ΔH and ΔV . Variation of heat of reaction with temperature. Kirchhoff's equation and problems. Limitations of first law and need for second law. Statement of second law of thermodynamics. Cyclic process. Heat engine, Carnot's theorem, Carnot's cycle. Derivation of efficiency of heat engine.

Problems. Thermodynamic scale of temperature.

S3-P-2: Thermodynamics-II

5 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 of ideal gases. Free energy Gibb's function (G) and Helmholtz's function (A) as thermodynamic quantities. Concept of maximum work and maximum ΔG as Criteria for spontaneity. Derivation of equation $\Delta G = \Delta H - T\Delta S$. Significance of the equation. Gibbs equations and Maxwell relations. Variation of G with P, V and T.

Unit – IV (General Chemistry)

15 h (1 hr/week)

S3-G-1 Evaluation of analytical data

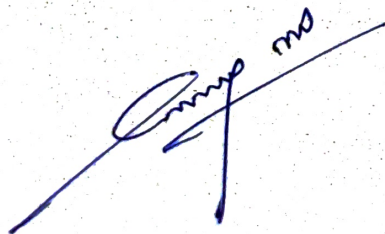
4 h

Significant figures, accuracy and precision. Errors-classification of errors- determinate and indeterminate errors, absolute and relative errors. Problems based on mean, median, range, standard deviation

S3-G-2: Carbanions-I

5 h

Introduction, acidic nature of α -hydrogens and tautomerism in carbonyl compounds, nitro hydrocarbons, ethyl acetoacetate, diethyl malonate. Terminal alkynes. Stability of carbanions
Reactions : Aldol reaction, Perkin reaction, Benzoin condensation, haloform reaction, conversion of smaller alkynes to higher alkynes.




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S3-G-3: Phase Rule

Statement and meaning of the terms – Phase, Component and Degrees of freedom, Gibb's Phase rule, phase equilibria of one component system – water system. Phase equilibria of two-component system – Solid-Liquid equilibria, simple eutectic –Pb-Ag system, desilverisation of lead. Solid solutions – compound with congruent melting point – Mg-Zn system and incongruent melting point – NaCl-H₂O system.

COURSE OUTCOMES-CHEMISTRY

Name of the Course		Semester-III Paper III Chemistry-III
Course Code		CT335
CO1	Identify the basic principles related to structure and properties of lanthanides and Actinides. Apply the concept of lanthanide contraction for separation techniques. Identify the principles, structure and reactivity of selected coordination complexes. Utilise the principles of coordination complexes in understanding the functions of biological systems. Identify the structure and bonding in simple metals. Apply the 18- electron rule to simple and bridged metal carbonyls.	
CO2	Write mechanisms of organic reactions involving reactive intermediates. Analyse different nitrogen compounds by conducting simple experiments.	
CO3	Calculate change in thermodynamic properties. Calculate the absolute value of thermodynamic quantities (U, H, S, A, G).	
CO4	Solve problems based on various analytical tools. Evaluates the effects of systematic errors on analytical results. Write mechanisms of organic reactions carbanions. Use the phase rule to determine the number of components, phases and degrees of freedom of different systems.	

Text books:

Unit - I: Concise Inorganic Chemistry by J.D. Lee 3rd edn

Unit- II: Organic Chemistry by Morrison and Boyd.

Unit- III: Principles of physical chemistry by Prutton and Marron.

Unit- IV: Vogel's Text Book of Qualitative Analysis by G.H.Jeffery, J.Bassett, J.Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999

Reference books: B.Sc.II Year Chemistry: Semester III**Unit- I**

1. Analytical chemistry by G. L. David Krupadanam, D. Vijaya Prasad, K. Varaprasada Rao, K.L.N. Reddy and C. Sudhakar
2. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications(1996).
3. Concise Inorganic Chemistry by J.D. Lee 3rd edn Van Nostrand Reinhold Company(1977)
4. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers (2001).
5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)

6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press(1989).
7. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press (1999).
8. Textbook of Inorganic Chemistry by R Gopalan(Universities Press(2012)
9. College Practical chemistry by V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati Universities Press (India) Limited(2012)

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)
6. Text book of organic chemistry by C N pillai CRC Press (2012)
7. Organic Chemistry by L. G. Wade Jr.
8. Organic Chemistry by M. Jones, Jr
9. Organic Chemistry by John McMurry.

Unit III

1. Principles of physical chemistry by Prutton and Marron. The MacmillanCompany; 4th Edn.(1970)
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand and Sons.(2011)
3. Text Book of Physical Chemistry by Puri and Sharma. S. Nagin chand and Co.(2017)
4. Text Book of Physical Chemistry by K. L. Kapoor. (2012)
5. Colloidal and surface chemistry , M. Satake, Y. Hayashi, Y.Mido, S.A.Iqbal
6. M.S.Sethi, Discovery Publishing Pvt.Ltd (2014)
7. Material science by Kakani & Kakani, New Age International(2016)
8. Physical Chemistry by Ira Levine (Author) McGraw-Hill Education; 6 edition (May 9, 2008)

Unit IV

1. Text book of organic chemistry by Morrison and Boyd, Person(2009)13
2. Text book of organic chemistry by Graham solomons, Wiley(2015)
3. Text book of organic chemistry by Sony, Sultan Chand & Sons; 29th edition (2012)
4. Text book of organic chemistry by Bruice yuranis Powla, (2012)
5. General Organic chemistry by Sachin kumar Ghosh, New Age Publishers Pvt Ltd (2008)

Laboratory Course

Paper III (Organic Synthesis)

45 h (3h/week)

Laboratory Course: Paper code: CT335P

Organic Preparations

► Objective:

To learn various organic reactions and reagents for organic synthesis.

► Outcome:

To use various organic reactions and reagents in a logical manner for organic synthesis.

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1. **Synthesis of Organic compounds:**
 - Acetylation: Acetylation of salicylic acid, Benzoylation of Aniline.
 - Aromatic electrophilic substitution: Nitration: Preparation of Para nitro salicylic acid
 - Halogenation: Preparation of p-bromo acetanilide
 - Oxidation: Preparation of benzoic acid from benzyl chloride.
 - Esterification: Preparation of n-butyl acetate from acetic acid.
 - Methylation: Preparation of - naphthyl methyl ether. (Demo experiment)
 - Condensation: Preparation of benzilidine aniline from Benzaldehyde and aniline.
 - Diazotisation: Azocoupling of β -Naphthol.
2. **Microwave assisted synthesis of Asprin – DEMO (demonstration only)**


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B.Sc. Chemistry II Year Semester-III
Skill Enhancement Course- I (SEC-I) (2 Credits)

SKILL ENHANCEMENT COURSE (SEC)
SEMESTER III

SAFETY RULES IN CHEMISTRY LABORATORY AND PREPARING LAB REAGENTS(credits:02)

(30hrs 15 weeks)

(2h/w)

UNIT I:

Laboratory Safety Rules and Regulations

General rules and regulations for lab safety: Minimizing Risks of Hazards, Personal Protective Equipment (PPE) - Hair, Dressing for the Laboratory, Eye Protection, Eye-wash fountain, Gloves.

Laboratory Protocols- Labeling Chemicals, Careful reading of labels Prevention of Inhaling Harmful Chemicals- Guide to Chemical Hazards, Chemical Spills.

Accidents- use of fire extinguisher and first aid kit in the laboratory, safety symbols

Normality/Molarity and specific gravity of concentrated acids – Preparation of dilute solutions (Numerical problems). Precautions to be taken in the preparation of dilute acids and bases and bases.

Preparation of stock solutions of salts with specific examples. Properties of primary standard salt and preparation of standard solution. Good laboratory practices-maintenance of observation book record.

UNIT II:

Preparation of Lab Reagents:

Preparation of indicators and use of indicators in volumetric analysis- acid base titrations, redox titrations, precipitation titrations and complexometric titrations. Role of an indicator in detecting end point (Phenolphthalein, Methyl orange, Methyl-red, Potassium Chromate, Diphenylamine, EBT, Murexide, etc).

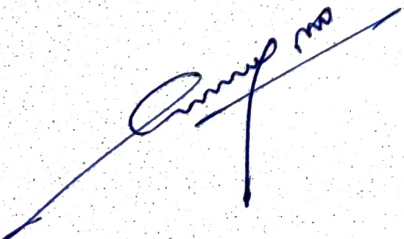
Preparation of buffers – pH 10 ammonical buffer and acetate buffer solutions. Preparation of commonly used reagents : Ammonium hydroxide solution, Ammonium molybdate reagent, Ammonium hydrogen phosphate solution, Bromine water, Dimethyl glyoxime reagent, 2,4-Dinitrophenyl hydrazine reagent, Eriochrome black-T reagent Fehling solution, Ferric chloride solution, Ferrous sulphate solution, Iodine solution, Molisch's reagent, Neutral FeCl₃, Schiff's reagent, Silver nitrate solution, Sodium carbonate solution, Sodium hydroxide (Caustic soda) solution, Starch solution, Tollen's reagent.(reference work and submission of assignments).

RECOMMENDED BOOKS

1. Vogel's Text Book of Quantitative Chemical Analysis, 5th edition.
2. Vogel's Text Book of macro and semimicro qualitative inorganic analysis. G. Svehla, 5th edition.
3. American Chemical Society Safety in Academic Chemistry Laboratories 8th edition.

OUTCOMES FOR SAFETY RULES IN CHEMISTRY LABORATORY AND PREPARING LAB REAGENTS:

- To improve the skills of students in the application of theory and practical knowledge.
- To fill the gap between theory and practicals
- To train the students in understanding laboratory safety rules and to improve the skills in preparation of laboratory reagents
- To make students aware about best lab practices.



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B.Sc. Chemistry II Year Semester-III
Skill Enhancement Course- I (SEC-2) (2 Credits)

BASIC ANALYTICAL CHEMISTRY: (CREDITS :02)

(30hrs 15 weeks)

(2h/w)

5h

INTRODUCTION:

Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the statistical point of view, using a few examples.

5h

ANALYSIS OF SOIL:

Composition of soil, Concept of pH and pH measurement.

a. Determination of pH of soil samples.

b. Estimation of Calcium and Magnesium ions as carbonates by complexometric titration.

5h

ANALYSIS OF WATER:

Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample.

b. Determination of dissolved oxygen (DO) of a water sample.

5h

ANALYSIS OF COSMETICS:

Major and minor constituents and their functions

a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.

b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

10h

LAB COURSE:

a. Determination of macro nutrients in soil samples.

b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.

c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in aerated drinks.

REFERENCE BOOKS:

1. 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.

2. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.

3. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Analytical Chemistry 6th Ed., Saunders College Publishing, Fort Worth (1992).

OUTCOMES OF ANALYTICAL CHEMISTRY:

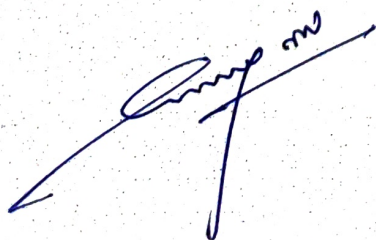
1. It enhances the knowledge and skills required for attaining analytical and critical abilities, logical thinking, and ability to apply knowledge learnt to solve issues and problems related to chemical analysis.

2. Improve the use of statistical tools.

3. Used in determining the water quality refers to the chemical, physical, biological, and radiological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose.

4. pH, hardness, presence of a selected group of chemical parameters, biocides, highly toxic chemicals, and B.O.D are estimated. pH is a measure of hydrogen ion concentration. It is an indicator of relative acidity or alkalinity of water. ... Drinking water should have a pH between 6.5 and 8.5.

5. pH. Soil pH is one of the most important parameter son your soil test report. The pH level of the soil can tell you a lot about the potential availability of plant nutrients and on possible toxicities of other elements (such as aluminum). Soils with pH greater than 7.0 are considered to be alkaline soils.




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B.Sc. II yr CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER IV
Paper-IV
Chemistry - IV

COURSE OBJECTIVES-CHEMISTRY

Name of the Course		Semester-IV Paper IV Chemistry-IV
Course Code		CT435
COb1	To predict the properties of coordination compounds .Describe the stability of complexes and explain their reactivity based on trans effect. Apply HSAB principle for simple salts and complexes.	
COb2	Classify carbohydrates and identify the structure of different class of carbohydrates. Learn to convert them by simple reactions. Classify amino acids and identify their importance. Classify the heterocyclic compounds and differentiate the chemical properties of these compounds.	
COb3	Apply elementary laws of chemical kinetics and analyze reaction mechanisms. Solve problems on rate and rate constants. Explore and apply the basic principles of photochemistry.	
COb4	Analyze the conducting properties of metals from bonding theories. Learn detailed mechanisms for various fundamental reactions involving carbanions. Evaluate basic knowledge of surface and colloid chemistry from a physical-chemical perspective.	

UNIT I-Inorganic Chemistry-III

15 h (1 h /w)

1. Coordination Compounds-II
2. Bioinorganic Chemistry

11 h

4 h

UNIT II-Organic Chemistry-III

15 h (1 h / w)

1. Carbohydrates
2. Amino acids and proteins
3. Heterocyclic Compounds

6 h

5 h

4 h

UNIT III-Physical Chemistry-III

15 h (1 h / w)

1. Chemical Kinetics
2. Photochemistry

11h

4h

UNIT IV - General Chemistry-III

15 h (1 h / w)

1. Theories of bonding in metals
2. Carbanions-II
3. Colloids & Surface Chemistry

4 h

5 h

6 h

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Unit-I (Inorganic Chemistry)

15h (1 h/week)

S4-I-1: Coordination Compounds -II

11 h

Crystal field theory (CFT) - Postulates of CFT, splitting patterns of d-orbitals in octahedral, tetrahedral, square planar with suitable examples. Crystalfield stabilization energies and its calculations for various dⁿ configurations in octahedral complexes. High Spin Low Spin complexes. Colour and Magnetic properties of transition metal complexes. Calculations of magnetic moments spin only formula. Detection of complex formation - basic principles of various methods- change in chemical properties, solubility, colour, pH, conductivity, magnetic susceptibility.

Hard and soft acids bases (HSAB) - Classification, Pearson's concept of hardness and softness, application of HSAB principles - Stability of compounds / complexes, predicting the feasibility of reaction. Thermodynamic and kinetic stability of transition of metal complexes. Stability of metal complexes -stepwise and overall stability constant and their relationship and 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.

S4-I-2: Bioinorganic Chemistry

4 h

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 CO₂ 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).

Semester-IV

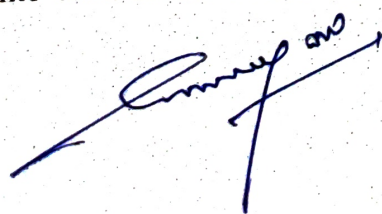
Unit - II (Organic Chemistry)

15h(1 hr/week)

S4-O-1: Carbohydrates

6 h

Introduction: Classification and nomenclature. 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. 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 (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). (Haworth formula and chair conformational formula). Structure of fructose: Evidence of 2 - ketohexose structure. Same osazone formation from glucose and fructose, Hydrogen bonding in osazones,




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cyclic structure for fructose (Furanose structure, Haworth formula).

Inter Conversion of Monosaccharides: Arabinose to D-glucose, D-mannose (Kiliani – Fischer method). Epimers, Epimerisation- Lobry de Bruyn van Ekenstein rearrangement. D-glucose to D-arabinose by Ruff's degradation. Aldohexose(+) (glucose) to ketohexose (-) (fructose) and Ketohexose(Fructose) to aldohexose (Glucose).

S4-O-2: Amino acids and proteins

5 h

Classification. 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. Zwitter ion structure – salt like 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. Primary structure of proteins, dipeptide synthesis

S4-O-3: Heterocyclic Compounds

4 h

Introduction and definition: 5 membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring systems – Numbering. Aromatic character

Resonance structures: Explanation of feebly acidic character of pyrrole, electrophilic substitution, Halogenation, Nitration and Sulphonation. 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 Paul-Knorr synthesis. Structure of pyridine, Basicity – Aromaticity – Comparison with pyrrole – preparation by Hantzsch method and properties – Reactivity towards Nucleophilic substitution reaction – Chichibabin reaction.

Unit III (Physical Chemistry)

15h (1 hr/week)

S4-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 a reaction.

First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half-life period, graph of first order reaction, Examples- Decomposition of H_2O_2 and decomposition of oxalic acid, Problems.

Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems. Second order reaction, derivation of expression for second order rate constant, examples-

Saponification of ester, $2\text{O}_3 \rightarrow 3\text{O}_2$, $\text{C}_2\text{H}_4 + \text{H}_2 \rightarrow \text{C}_2\text{H}_6$. Characteristics of second order reaction, units for rate constants, half-life period and second order plots. Problems

S4-P-2: Photochemistry

4 h

Introduction to photochemical reactions, Difference between thermal and photochemical reactions, Laws of photo chemistry- Grotthuss Draper law, Stark-Einstein's Law of photochemical 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 absorption. Singlet and triplet states. Jablonski diagram. Explanation of internal conversion, inter- system crossing, phosphorescence, fluorescence.

Unit III (General Chemistry)

15h (1 hr/week)

S4-G-1: Theories of bonding in metals

4 h

Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors n-type and p-type, extrinsic & intrinsic semiconductors, and insulators.

S4-G-2: Carbanions-II

5 h

Mannich reaction, Michael addition and Knoevenagel condensation Synthetic applications of Aceto acetic ester. Acid hydrolysis and ketonic hydrolysis: Preparation of ketones, monocarboxylic acids and dicarboxylic acids Malonic ester- synthetic applications. Preparation of (i) substituted mono carboxylic acids and (ii) substituted dicarboxylic acids.

S4-G-3: Colloids & Surface Chemistry

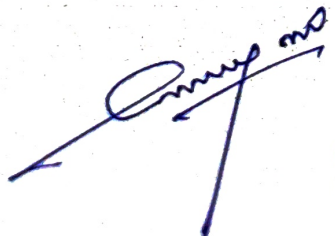
6 h

Definition of colloids. Classification of colloids. Solids in liquids (sols): preparations and properties. – Kinetic, Optical and Electrical stability of colloids. Protective action. Hardy-Schultz law, Gold number. Liquids in liquids (emulsions): Types of emulsions, preparation and emulsifier. Liquids in solids(gels): Classification, preparations and properties, General applications of colloids.

Adsorption: Types of adsorption. Factors influencing adsorption. Freundlich adsorption isotherm. Langmuir theory of unilayer adsorption isotherm. Applications.

COURSE OUTCOMES-CHEMISTRY

Name of the Course		Semester-IV Paper IV Chemistry-IV
Course Code		CT435
CO1	Apply HSAB principle for stability and occurrence of simple salts in nature. Apply the principles of coordination chemistry in qualitative & quantitative analysis	
CO2	Identify the carbohydrates and explain its role in living organisms. Identify the heterocyclic structure in metalloproteins or enzymes. Synthesise them through green chemistry approach.	
CO3	Solve problems on rate and rate constants. Calculate the age of rocks, carbon dating etc. Explain examples of the effects of photochemistry in nature and in various applications.	
CO4	Provide examples of materials that are good insulators and good conductors. Write mechanisms of organic reactions carbanions. Define and explain surface and interfacial phenomena. Demonstrate how colloid and surface chemistry is applied in industry and the environment.	



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Text books:

Unit - I: Concise Inorganic Chemistry by J.D. Lee 3rd edn

Unit- II: Organic Chemistry by Morrison and Boyd.

Unit- III: Principles of physical chemistry by Prutton and Marron.

Unit- IV: Vogel's Text Book of Qualitative Analysis by G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999

References

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications (1996).
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn. Van Nostrand Reinhold Company (1977)
3. Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and Paul L. Gaus 3rd edn Wiley Publishers (2001).
4. Inorganic Chemistry Principles of structure and reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)
5. Chemistry of the elements by N.N. Greenwood and A. Earnshaw Pergamon Press (1989)
6. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press (1999).
7. Textbook of Inorganic Chemistry by R Gopalan, Universities Press, (2012)

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)
6. Text book of organic chemistry by C N pillai CRC Press (2012)
7. Organic Chemistry by L. G. Wade Jr.
8. Organic Chemistry by M. Jones, Jr
9. Organic Chemistry by John McMurry.

General reference: B.Sc II Year Chemistry : Semester IV, Telugu Academy publication, Hyd

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications (1996).
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8. Organic Chemistry by L. G. Wade Jr.
9. Organic Chemistry by M. Jones, Jr
10. Organic Chemistry by John McMurry.

Unit III

1. Principles of physical chemistry by Prutton and Marron. The Macmillan Company; 4th edn. (1970)
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand & sons.(2011)
3. Text Book of Physical Chemistry by Puri and Sharma. S. Nagin chand and Co.(2017)
4. Text Book of Physical Chemistry by K. L. Kapoor. (2012)
5. Physical Chemistry through problems by S.K. Dogra. (2015)
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry by Lewis Glasstone. Macmillan (1966)
8. Industrial Electrochemistry, D. Pletcher, Chapman & Hall, London, 1990)

Unit IV

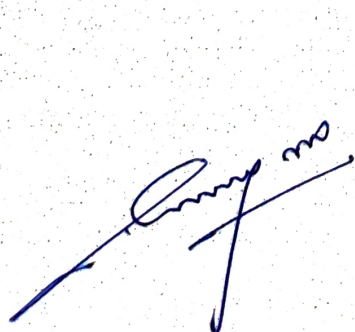
1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications(1996).
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn. Van Nostrand Reinhold Company (1977)
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers (2001).
4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)
5. Text book of organic chemistry by Morrison and Boyd, Person (2009)
6. Text book of organic chemistry by Graham solomons, Wiley (2015)
7. Fundamentals of organic synthesis and retrosynthetic analysis by Ratna Kumar Kar, CBA,(2014)
8. Organic synthesis by Dr. Jagadamba Singh and Dr. L.D.S. Yadav, Pragati Prakashan, 2010
9. Stereochemistry of organic compounds by D. Nasipuri, New Academic Science Limited, 2012
10. Organic chemistry by Clayden, Greeves, Warren and Wothers, Oxford University Press, 2001
11. Fundamentals of Asymmetric Synthesis by G. L. David Krupadanam, Universities, Press 2014).

Paper IV-

Qualitative Analysis of Organic Compounds:

45hrs (3 h/week)

Qualitative analysis: Identification of organic compounds through the functional group analysis - ignition test, determination of melting points/boiling points, solubility test, functional group tests and preparation of suitable derivatives of the following: Carboxylic acids, phenols, urea, carbohydrates, aldehydes, ketones, amides, ester and naphthalene.




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B.Sc. Chemistry II Year Semester-IV
Skill Enhancement Course- I (SEC-3) (2 Credits)

SKILL ENHANCEMENT COURSE (SEC)
SEMESTER IV

GREEN METHODS IN CHEMISTRY(credits:02) (30hrs 15 weeks)

THEORY AND HANDS-ON EXPERIMENTS

(2h/w)

INTRODUCTION:

8h

Definitions of Green Chemistry. Brief introduction of twelve principles of Green Chemistry, with examples, special emphasis on atom economy, reducing toxicity, green solvents, green reactants, green reagents, one pot syntheses. Green Chemistry and catalysis and alternative sources of energy.

GREEN ENERGY AND SUSTAINABILITY. BETTER LIVING THROUGH GREEN CHEMISTRY:

10h

1. Surfactants for Carbon Dioxide –replacing smog producing and ozone depleting solvents with CO₂ for precision cleaning and dry cleaning of garments.
- 2 Designing of Environmentally safe marine antifoulant, green computing.
3. Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments, green pigments.
- 4 An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn, green plastics.
5. Improvement of lab atmosphere-green guidelines.

LAB COURSE:

12h

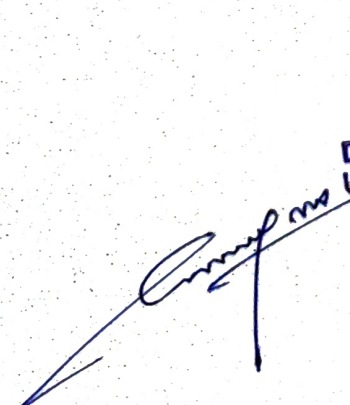
1. Alternate procedure for Lassaignes test
2. Acetylation of primary amine
3. Bromination of acetanilide
4. Transesterification reaction –synthesis of biodiesel.
5. Green photochemical reaction-photoreduction of benzophenone to benzopinacol

REFERENCE BOOKS:

1. Anastas, P. T. and Warner, J. K. Oxford -Green Chemistry-Theory and Practical, University Press, 1998
2. Matlack, A. S., Marcel Dekker, 2001- Introduction to Green Chemistry,
3. Sharma, R. K., Sidhwani, I. T. and Chaudhari, M. K. - Green Chemistry
4. Ahluwalia V. K. Kidwai - New Trends In Green Chemistry

OUTCOMES FOR GREEN METHODS IN CHEMISTRY:

- Know about green lab practices.
- Improving reaction efficiency by changing certain parameters and making it more environment friendly.
- Learning about green reagents and their mode of action in making chemistry less hazardous.
- Atom economy and its usefulness i.e. utilizing 100% of the reactants.
- Different green reactions.


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B.Sc. Chemistry II Year Semester-IV
Skill Enhancement Course- I (SEC-4) (2 Credits)

CHEMINFORMATICS (credits:02)

(30hrs 15 weeks)

INTRODUCTION TO CHEMINFORMATICS:

History and evolution of cheminformatics, use of cheminformatics, prospects of cheminformatics, molecular modelling, structure elucidation. **(2h/w)**
2h

REPRESENTATION OF MOLECULES AND CHEMICAL REACTIONS:

Chemical Nomenclature – (development, representation of elements and, Molecular formulas), types of notations, SMILES coding, matrix representation, structure of Molfiles and Sdfiles, libraries and tool kits, reaction classification. **7h**

SEARCHING CHEMICAL STRUCTURES:

Full structure search, sub-structure search, basic ideas, similarity search, 3D search methods, Basics of computation of physical and chemical data and structure descriptors. **9h**

APPLICATIONS:

Prediction of properties of compounds: Linear free energy relations, Quantitative Structure –Property Relations, Descriptor analysis, model building, modelling toxicity. **12h**

COMPUTER ASSISTED SYNTHESIS DESIGN.

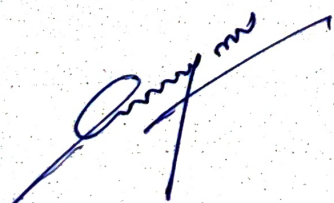
DRUG DESIGN – introduction, Drug discovery process (Target identification and validation, Lead finding and optimization), Application of cheminformatics in drug design (Analysis of HTS data, virtual screening, design of combinatorial libraries, ligand based and structure based drug design).

REFERENCE BOOKS:

1. Andrew R. Leach & Valerie, J. Gillet (2207) An introduction to Cheminformatics.
2. Gasteiger, J. & Engel, T. (2003) Cheminformatics: A text book. Wiley-VCH

OUTCOMES FOR CHEMINFORMATICS:

- Learn about drawing chemical structures on pc
- Using the tools to search the chemicals in the database to help in research.
- Identification of protein targets.
- Spectral predictions of various drugs.
- Molecular modeling
- Hands on experiment on drug development using cheminformatics.
- Hands on molispiration.


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**BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND
COMMERCE, SAINIKPURI, SECUNDERABAD. Autonomous College**

**Affiliated to OSMANIA UNIVERSITY, Hyderabad.
(Reaccredited with 'A' grade by NAAC)**

Department of Chemistry

Program: B Sc Mb,G,C , Bt,G,C , Mb,N&D,C , Mb,Bc,C

CODE: CT535 & CT535P

YEAR/SEMESTER: III/ V

(60 h/ 15 weeks)

HPW:4

**No. Of Credits: Theory – 4
Practical –1**

COURSE OBJECTIVES-CHEMISTRY

Name of the Course	
Semester-V Paper V -Spectroscopy and Chromatography	
Course Code	
CT535	
COb1	The main aim is to provide students a concept about how the commonly used molecular spectroscopy techniques work a theoretical knowledge of each of these methods and their usage in molecular and electronic structure determination.
COb2	To understand the important role of nuclear magnetic resonance spectroscopy in the study of the structures of organic compounds. To develop an understanding of the significance of the number, positions, intensities and splitting of signals in nuclear magnetic resonance spectra and to assign structures to simple molecules on the basis of NMR. Analyze how to find molecular weight, and base peak from a mass spectrum. Identify simple fragmentation patterns and rearrangements in simple molecules.
COb3	1. Recognize the requirement and Importance of separation of components of a mixture. To understand that the choice of the method of separation depends upon the nature of the component of the mixture. Explain the basic principles, operation and application of chromatographic methods. Differentiate between the different chromatographic methods.
COb4	Appraise the different principles involved in the chromatographic techniques. Identify the working of the instruments used in GC, Ion exchange chromatography and HPLC techniques.

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UNIT 1- Molecular Spectroscopy

15 h (1 h /w)

1. Rotational spectroscopy (Microwave spectroscopy)
2. Infra red spectroscopy
3. Electronic spectroscopy

UNIT II- NMR and Mass spectrometry

15 h (1 h / w)

1. Proton Magnetic Resonance Spectroscopy
2. Mass spectrometry

UNIT III- Separation Techniques I

15 h (1 h /w)

1. Solvent Extraction
2. Chromatography
3. Thin layer Chromatography (TLC)
4. Paper Chromatography

UNIT IV - Separation Techniques II

15 h (1 h /w)

1. Column Chromatography
2. Ion exchange chromatography
3. Gas Chromatography
4. High performance liquid chromatography

Unit 1: Molecular spectroscopy

15 h

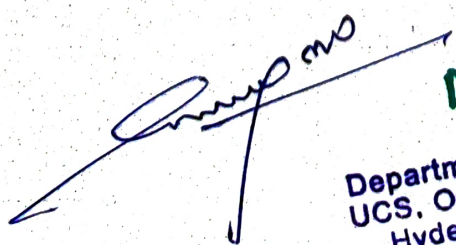
Introduction to electromagnetic radiation, interaction of electromagnetic radiation with molecules, various types of molecular spectra.

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.




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Electronic spectroscopy:

Bonding and antibonding molecular orbitals, electronic energy levels of molecules (σ , π , n), types of electronic transitions: $\sigma \rightarrow \sigma^*$, $n \rightarrow \sigma^*$, $n \rightarrow \pi^*$, $\pi \rightarrow \pi^*$ 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. General features of absorption – spectroscopy, transmittance, absorbance and molar absorptivity. Beer Lambert's law and its limitations.

Unit 2: NMR and Mass spectrometry

15h

Proton Magnetic Resonance Spectroscopy

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. ^1H NMR spectrum of – ethyl bromide, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate and acetophenone.

Mass Spectrometry

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.

Unit 3 Separation Techniques I

15h

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, solid phase and mobile phase used in TLC, eluotropic series, development of the chromatogram, Detection of the spots, visualizing agents, factors effecting R_f values and applications of TLC.

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

Unit 4 Separation Techniques II

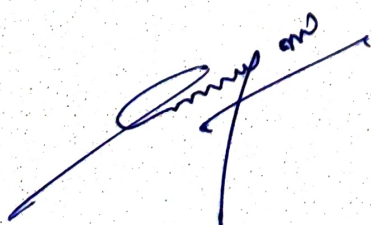
15h

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, de-ionized water.

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

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




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COURSE OUTCOMES-CHEMISTRY

Name of the Course	
Semester-V Paper V- Spectroscopy and Chromatography	
Course Code	
CT314	
CO1	Analyze and interpret spectroscopic data collected by the methods discussed in the course.
CO2	Identify organic compounds by analysis and interpretation of spectral data. Explain common terms in NMR spectroscopy such as chemical shift, coupling constant and anisotropy and describe how they are affected by molecular structure. Solve problems related to the structure, purity and concentration of chemicals and to study molecular interactions by choosing suitable spectroscopic methods and interpreting corresponding data.
CO3	Understand the importance and notice the difference between different modes of chromatographic separation. Apply knowledge of qualitative and quantitative analysis in various fields of chemical- industry, pharmaceutical industry, the environment and other analytics.
CO4	Apply the knowledge in solving specific problems by using the appropriate chromatographic techniques (gas, liquid, ion-pair chromatography, HPLC) and accurately analyze and interpret the results of chromatographic analysis.

Text books and Reference books

Unit- I

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

Unit- II

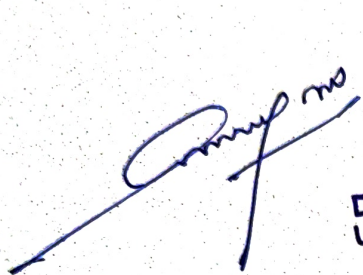
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2. General Organic chemistry by Sachin Kumar Ghosh. New Age Publishers Pvt Ltd (2008)
3. Text book of organic chemistry by Morrison and Boyd. Person(2009)
4. Text book of organic chemistry by Graham Solomons. Wiley(2015)
5. Text book of organic chemistry by Bruice Yuranis Powla. (2012)

Unit III & Unit IV

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 6thEd .,

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- 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)



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Laboratory Course: Paper code: CT535P

Physical Chemistry I

LEARNING OBJECTIVES:

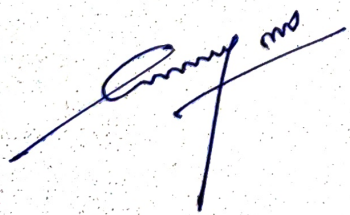
- ▶ Apply Nernst Distribution law and determine the partition coefficient.
- ▶ Understand the basic principles of electrochemistry.

LEARNING OUTCOMES:

- ▶ The implementation of solution for practical problems in the field of physical chemistry in the production and monitoring of the safe and proper use of medicinal products.

Textbooks and Reference books:

1. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
- 3 Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).
- 4 Athawale V. D. and Mathur P. Experimental Physical Chemistry,, New Age Intenational



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COURSE OBJECTIVES-CHEMISTRY

Name of the Course		Semester-V Paper V –Metallurgy, Dyes and Catalysis
Course Code		CT535A
COb1	Evaluate the Extractive metallurgy processes and their relative merits and demerits. Identify the different Pyrometallurgy, Hydrometallurgy and Electrometallurgy operations. Know flow sheets of extraction of different metals.	
COb2	Identify and classify the dyes .Summarize the structures of both natural and synthetic dyes. Illustrate the synthesis of dyes with various examples.	
COb3	Recognize the principles, mechanisms and applications of the different types of catalysts that operate both in homogeneous phase, such as organometallic catalysts and organocatalysts, and in heterogeneous phase. Describe the basic concepts of catalysis, the different types of catalysts. To gain the knowledge of catalyst characteristics, mechanism of catalytic reactions.	
COb4	Understand the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell. Describe and identify the significance of enzyme kinetics.	

Unit I- General principles of Metallurgy and production of non-ferrous metals 15 h (1 h /w)

1. Pyrometallurgy
2. Hydrometallurgy
3. Separation of liquid and solid phases and processing of aqueous solutions
4. Electrometallurgy
5. Refining processes
6. Production of selected non-ferrous metals

Unit II: Natural and Synthetic Dyes

15 h (1 h /w)

1. Dyes
2. Structures of Synthetic Dyes
3. Synthesis of Dyes

Unit III: Catalysis

15 h (1 h /w)

1. Homogeneous and heterogeneous catalysis
2. Acid-base catalysis-
3. Phase transfer catalysis

Unit IV: Catalysis II

15 h(1 h /w)

1. Enzyme catalysis


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B.Sc. Chemistry
Semester V, Paper V
Discipline Specific Elective-B
Metallurgy, Dyes and Catalysis

Unit I: General Principles of Metallurgy and Production of Non Ferrous Metals 15h

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

15h

Dyes: Definition, Classification of dyes- Natural dyes, synthetic dyes; based on chemical constitution of dyes; Chemical nature of dyes; application of dyes.
Structures of natural Dyes: Indigo, Tyrian purple, Alizarin, Indigotin.

Structures of Synthetic Dyes: Nitro dyes, Nitroso dyes, Azodyes (Monoazodyes, Bisazodyes), diaryl methane dyes, triaryl methane dyes, Xanthene dyes, Phenolphthalein, Fluorocin, Acridine dyes.

Synthesis of dyes: Monoazodyes, Bisazodyes (Congored), Auromine O, Malachite Green, Crystal Violet, Rhodamine B, Acridine Yellow, Indigotin.
Binding of dyes to fabric. Application of dyes.

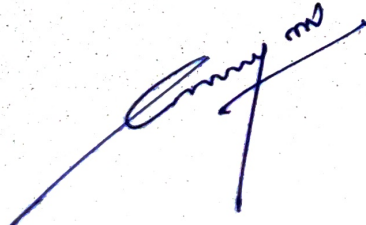
Unit III: Catalysis -I

15h

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. Mutarotation of Glucose. Effect of pH on reaction rate of acid and base catalysed reactions.



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

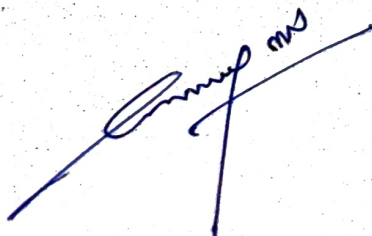
Unit IV: Catalysis II

15h

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 (iv) Zymase in conversion of glucose to ethanol (v) working of carbonic anhydrase and (vi) mechanism of oxidation of ethanol by alcohol dehydrogenase. 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}), Line weaver-Burk plot. Types of enzyme inhibitors.

COURSE OUTCOMES-CHEMISTRY

Name of the Course		Semester-V Paper V- Metallurgy, Dyes and Catalysis
Course Code		CT535A
CO1	Define the relationship between metal properties and alloy composition, microstructure, and processing. Understand microscopic structures present in metals and how they influence metal mechanical properties.	
CO2	They will get detailed knowledge of synthesis of azo dyes, diphenylmethane dyes, nitro dyes nitroso dyes etc. Identify the toxicity in different food dyes and substitute with natural dyes for the betterment of society and environment.	
CO3	To be able to apply the fundamentals of catalysis to the synthesis of chemicals following sustainable and environmentally friendly procedures. To identify and use the most useful sources in the scientific research field of catalysis.	
CO4	Predict possible catalytic mechanisms of given reaction types. Evaluate the strategies for the analysis of kinetic mechanisms of catalyzed reactions. Apply the knowledge for industrial applications of biocatalysis.	




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Textbooks and Reference books:

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 Skotnicová, Monika Losertová, Miroslav Kursa, 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, 8th 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

SEM V

LABORATORY COURSE – V

3h/w

(45h/15weeks)

Practical Paper – (Physical Chemistry)

1. Distribution law

- a) Determination of distribution coefficient of acetic acid between water and butanol.
- b) Determination of molecular status and partition coefficient of benzoic acid in Toluene and water

2. Electrochemistry

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

3. Colorimetry

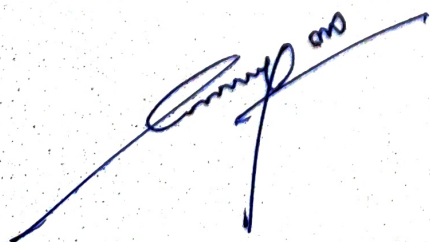
- a) Verification of Beer-Lambert law for KMnO_4
- b) Determination of Concentration of the given KMnO_4 solution.

4. Adsorption

- a) Adsorption of Acetic acid on animal charcoal – Verification of Freundlich adsorption isotherm

5. Physical Constants;

- a) Surface tension of liquids b) Viscosity of liquids (Demonstration experiments)




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COURSE OBJECTIVES-CHEMISTRY

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Course Code		CT535A
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COb3	Recognize the principles, mechanisms and applications of the different types of catalysts that operate both in homogeneous phase, such as organometallic catalysts and organocatalysts, and in heterogeneous phase. Describe the basic concepts of catalysis, the different types of catalysts. To gain the knowledge of catalyst characteristics, mechanism of catalytic reactions.	
COb4	Understand the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell. Describe and identify the significance of enzyme kinetics.	

Unit I- General principles of Metallurgy and production of non-ferrous metals 15 h (1 h /w)

1. Pyrometallurgy
2. Hydrometallurgy
3. Separation of liquid and solid phases and processing of aqueous solutions
4. Electrometallurgy
5. Refining processes
6. Production of selected non-ferrous metals

Unit II: Natural and Synthetic Dyes

1. Dyes
2. Structures of Synthetic Dyes
3. Synthesis of Dyes

15 h (1 h / w)

Unit III: Catalysis

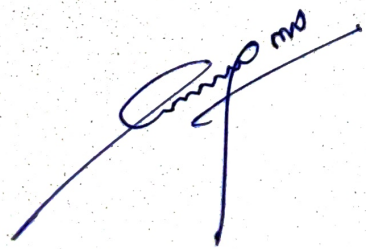
1. Homogeneous and heterogeneous catalysis
2. Acid-base catalysis-
3. Phase transfer catalysis

15 h (1 h /w)

Unit IV: Catalysis II

1. Enzyme catalysis

15 h(1 h /w)




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

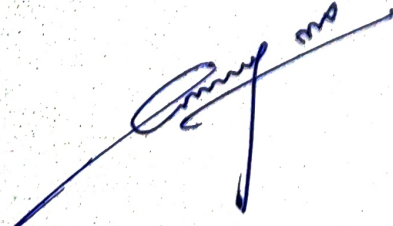
15h

Unit IV: Catalysis II

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 (iv) Zymase in conversion of glucose to ethanol (v) working of carbonic anhydrase and (vi) mechanism of oxidation of ethanol by alcohol dehydrogenase. 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}), Line weaver-Burk plot. Types of enzyme inhibitors.

COURSE OUTCOMES-CHEMISTRY

Name of the Course		Semester-V Paper V- Metallurgy, Dyes and Catalysis
Course Code		CT535A
CO1	Define the relationship between metal properties and alloy composition, microstructure, and processing. Understand microscopic structures present in metals and how they influence metal mechanical properties.	
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CO3	To be able to apply the fundamentals of catalysis to the synthesis of chemicals following sustainable and environmentally friendly procedures. To identify and use the most useful sources in the scientific research field of catalysis.	
CO4	Predict possible catalytic mechanisms of given reaction types. Evaluate the strategies for the analysis of kinetic mechanisms of catalyzed reactions. Apply the knowledge for industrial applications of biocatalysis.	



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3. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
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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, 8th Edn.
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9. Kinetics and mechanism of chemical transformations by Rajarajm and Kuraíacose, 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

SEM V

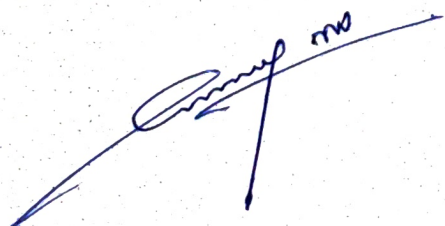
LABORATORY COURSE – V

3h/w

(45h/15weeks)

Practical Paper – (Physical Chemistry)

1. Distribution law
 - a) Determination of distribution coefficient of acetic acid between water and butanol.
 - b) Determination of molecular status and partition coefficient of benzoic acid in Toluene and water
2. Electrochemistry
 - a) Determination of Cell Constant of a Conductivity cell.
 - b) Determination of dissociation constant (K_a) of acetic acid by conductivity measurements.
3. Colorimetry
 - a) Verification of Beer-Lambert law for KMnO_4
 - b) Determination of Concentration of the given KMnO_4 solution.
4. Adsorption
 - a) Adsorption of Acetic acid on animal charcoal –Verification of Freundlich adsorption isotherm
5. Physical Constants:
 - a) Surface tension of liquids b) Viscosity of liquids (Demonstration experiments)




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Laboratory Course: Paper code: CT535P

Physical Chemistry I

LEARNING OBJECTIVES:

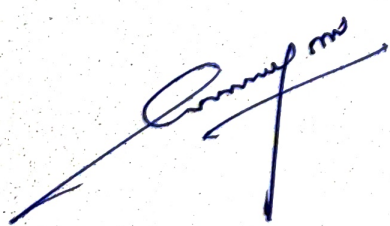
- ▶ Apply Nernst Distribution law and determine the partition coefficient.
- ▶ Understand the basic principles of electrochemistry.

LEARNING OUTCOMES:

- ▶ The implementation of solution for practical problems in the field of physical chemistry in the production and monitoring of the safe and proper use of medicinal products.

Textbooks and Reference books:

1. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
- 3 Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).
- 4 Athawale V. D. and Mathur P. Experimental Physical Chemistry,, New Age Intenational




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COURSE OBJECTIVES-CHEMISTRY

Name of the Course		Semester-V GE-Chemistry of Cosmetics, Food Processing, Drugs and Pharmaceuticals
Course Code		GE 535
COb1	Describe fundamentals of chemistry and the scientific basis of cosmetic formulation and the function of the active ingredients. Identify different cosmetic and perfumes. Analyze the importance and uses of them.	
COb2	To acquire knowledge of emerging / alternative technologies applied to food processing. To enable a student to know the relative advantages / disadvantages over existing technologies. To illustrate the recent developments in the cereals science and technology. To explain modern processing techniques of cereals in food industries. To impart knowledge regarding various processed product lines in food industries. To describe various food additives and contaminants. To illustrate the functionality of food additives. To exemplify the limits of permissible additives in processed foods.	
COb3	Explain the Drugs used for various infectious diseases caused by pathogens. Classify various drugs based on their nature, dosage forms etc. Identify the different routes to administer the drugs.	
COb4	Define the different classes of drug and identify different types of drugs. Outline the function and impact of each class of drugs. Describe the structure activity relation of some important class of drugs. Explain mechanism of action of the drugs.	

UNIT I -Chemistry of Cosmetics and Perfumes

15 h (1 h /w)

UNIT II-Food Processing and Food Adulterants

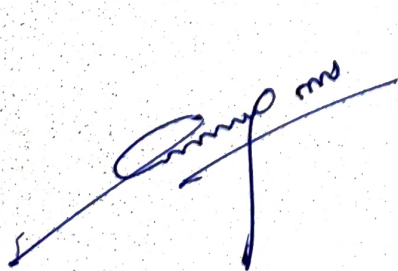
15 h (1 h / w)

UNIT III- General Characteristics of Drugs

15 h (1 h / w)

UNIT IV – Classification of Drugs

15 h (1 h / w)




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GENERIC ELECTIVE (GE) COURSE
CHEMISTRY OF COSMETICS, FOOD PROCESSING, DRUGS AND
PHARMACEUTICALS

UNIT I: Chemistry of Cosmetics and Perfumes

(15h)

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

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

Unit II: Food Processing and food adulteration

(15h)

Food processing: Introduction, methods for food processing, additives and preservatives. Food processing-impact on nutrition.

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, ice creams and tomato sauce.

Food Packaging: Definition and function of packaging- Classification of packaging materials- different types of packaging materials such as glass, wood, metal, paper, plastic etc., advantages and disadvantages of each packaging material. Packaging materials and systems corrugated fiber board boxes, shrink bundles and reusable packages. Effect of packaging materials on nutritive values of food.

Food labeling: Introduction, need and importance

Unit III: General Characteristics of Drugs

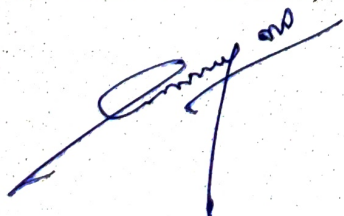
(15h)

Introduction: Diseases- causes of diseases, Drugs -definition and sources. ADME of drugs (brief)-Absorption, distribution, drug mechanism (in liver), elimination (brief), Toxicity

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 trade name-(i) Aspirin (ii) Amoxicillin (ii) ciprofloxacin (iv) Paracetamol (v) Mebendazole

Drug formulations: Definition -need for conversion of drug into Pharmaceutical (drug formulations)- Additives -diluent, binders, lubricants, antioxidants, flavourants, colorants




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sweetness, 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 (Amoxycillin- antibiotic; Omeprazole- antacid). Syrups (B complex syrup; Benadryl- cough syrup)

(ii) **Parenteral (injection forms):** Propranolol (antihypertensive), Heparin (anticoagulant)

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

(iv) **Antiallergic:** Aclometasone (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 IV-Classification of Drugs:

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 -isoniazole; Antiprotozoals- metronidazole.

(ii) **Pharmacodynamic agents:**

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

(b) Drugs acting on PNS: local anesthetics (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 process:**

(a) Vitamins: Common name, source, deficiency, Vitamin A, B2, B6, C, D, E, K - remedy

(b) Hormones: Function(brief)- deficiency of hormones (Insulin, testosterone and Oestrogen)

COURSE OUTCOMES-CHEMISTRY

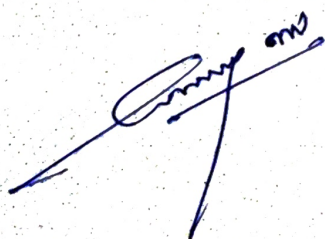
Name of the Course		Semester-V GE-Chemistry of Cosmetics, Food Processing, Drugs and Pharmaceuticals
Course Code		GE 535
CO1	Evaluate the side effects of using synthetic cosmetics and substitute with natural ingredients.	
CO2	Develop an appreciation about need of different emerging techniques used in food processing and preservation. Apply their knowledge on high pressure processing, pulsed electric processing, irradiation and hurdle technology in various food industries. To illustrate the functionality of food additives. To exemplify the limits of permissible additives in processed foods.	
CO3	Correlate between pharmacology of a disease and its mitigation or cure. To	

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	write the chemical synthesis of some drugs. Interpret the structural activity relationship of different class of drugs. Knowledge about the mechanism pathways of different class of medicinal compounds.
CO4	Apply the knowledge about the mechanism pathways of different class of medicinal compounds. Identify the different types of drugs used for different therapeutic action.

Recommended Textbooks and Reference Books:

1. Industrial chemistry, Volume -1, E.Stocchi, Ellis Horwood Ltd. UK.
 2. Engineering Chemistry ,P.C Jain, M.Jain, Dhanpat Rai & Sons, Delhi
 3. Industrial Chemistry ,Sharma, B.K &Gaur, H., Goel Publishing House, Meerut(1996)
 4. Food Processing and Impact on Nutrition. Rameen Devi ,Sc J Agric Vet Sci., Aug-Sept 2015
 5. Perfumes, Cosmetics and Soaps, W A .Poucher,(1993)
 6. A first course in food analysis by A Y Sathe
 7. Food Science by N Potter, CBS Publishers
 8. Food chemistry, Lillian Hoogland Meyer, (2008)
 9. A Handbook of food packaging by F.A. Paine and H.Y. Paine
 10. Fundamental concepts of applied chemistry J.C.Ghosh,S Chand and Co, Ltd, New Delhi
 11. Applied Chemistry K.Bhagavathi Sundar ,MJP Publishers
- Drugs by G L David Krupanandam, D. Vijay Prasad, K. Varaprasad Rao, K.L.N Redd




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Bharatiya Vidya Bhavan

**BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND
COMMERCE, SAINIKPURI, SECUNDERABAD. Autonomous College**

**Affiliated to OSMANIA UNIVERSITY, Hyderabad.
(Reaccredited with 'A' grade by NAAC)**

Department of Chemistry

Program: B Sc Mb,G,C , Bt,G,C , Mb,N&D,C , Mb,Bc,C

COURSE CODE: CT635 & CT635P

HPW:4

YEAR/SEMESTER: III/ VI

**No. Of Credits: Theory – 4
Practical – I**

(60 h/ 15 weeks)

COURSE OBJECTIVES-CHEMISTRY

Name of the Course		Semester-VI Advanced Chemistry
Course Code		CT635-O
COb1	Differentiate types of substitution reaction like SN1, SN2 etc, and difference between acid hydrolysis & base hydrolysis .Discuss how ligand substitution reaction takes place in octahedral and square- planar, trans effect and trans influence and how trans effect is applicable in synthesis of different metal complexes. Discuss the concept of symmetry element, symmetry operation and point groups. Classify & recognize the symmetry elements and their operations as required to specify molecular symmetry. To introduce the students to the existence of solvents other than water for analytical, preparatory, industrial purposes and special purposes. To explain the various behaviour of non-aqueous solvents and compare them with aqueous medium.	
COb2	Explain pericyclic reactions like Electrocyclic reactions, Cycloaddition reactions and Sigmatropic reactions. Illustrate the principles of retrosynthesis and, how to apply them to the synthesis of an organic molecule from readily accessible starting products. Learn the mechanism of the organic reactions and its relationship with issues such as: chemoselectivity, regioselectivity and	


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	stereoselectivity.
COB3	Describe the role of rubber-toughening in improving the mechanical properties of polymers. Identify the repeat units of particular polymers and specify the isomeric structures which can exist for the repeat units. Estimate the number- and weight-average molecular masses of polymer samples given the degree of polymerization and mass fraction of chains present.
COB4	Valuate fundamentals of electrochemistry. Recognize the electrochemical processes. Evaluate electrodes and cells. Express the electrodes materials. Discuss electrode potentials and cell thermodynamics. Explain the type of electrodes.

Unit I (Inorganic Chemistry)

15h

1. Inorganic reaction mechanisms
2. Boranes and Carboranes
3. Symmetry of molecules
4. Non- aqueous solvents

4h

2h

5h

4h

Unit II (Organic Chemistry)

15h

1. Pericyclic Reactions
2. Synthetic strategies
3. Asymmetric synthesis

5h

5h

5h

Unit III (Physical Chemistry)

15h

1. Polymers

Unit IV (General Chemistry)

15h

1. Electro analytical methods

Advanced Chemistry

Unit I (Inorganic Chemistry)

15h

1. Inorganic reaction mechanisms

4h

Labile and inert complexes, Thermodynamic and Kinetic stability based on VBT and 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.

2. Boranes and Carboranes

2h

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

3. Symmetry of molecules

5h

Symmetry operations, symmetry elements. Rotational axis of symmetry and types of rotational axes. Planes of symmetry and types of planes. Improper rotational axis of symmetry. Inversion centre. Identity element.

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4. Non- aqueous solvents

4h

Classification and characteristics of a solvent. Reactions in liquid ammonia -physical properties, auto- ionization, examples of ammono acids and ammono bases. Reactions in liquid ammonia- precipitation, neutralization, solvolysis, solvation- solutions of metals and ammonia, complex formation, redox reactions, reactions in HF- auto-ionization, reactions in HF- precipitation, acid-base reactions protonation.

Unit II (Organic Chemistry)

15h

1. Pericyclic Reactions

Concerted reactions, Molecular orbital of ethane, 1, 3-butadiene and allyl radical. Symmetry properties, HOMO, LUMO, thermal and photochemical pericyclic reactions. Types of pericyclic reactions-electrocyclic, cycloaddition and sigmatropic reactions-one example each and their explanation by FMO theory.

2. Synthetic strategies

5h

Terminology-Disconnection (dix), Symbol (),Synthon, Synthetic equivalent(SE), Functional group interconversion (FGI). Linear, Convergent and Combinatorial syntheses, Target molecule (TM). Retrosynthesis of the following molecules-Acetophenone, Cyclohexene, 2-Phenylethanol

3. Asymmetric synthesis

Selectivity in chemistry – Definition and examples of Chemoselectivity, Regioselectivity and Stereoselectivity – Stereospecific reactions – Definition of enantiomeric and diastereomeric excess (e e and d e) –. Mechanism of Iodide catalysed dehalogenation of meso and active 2,3-dibromobutane

Brief introduction to Asymmetric synthesis

Unit III (Physical Chemistry)

15h

1. Polymers

15h

Classification of Polymers –natural polymers and synthetic polymers examples. Classification of plastics, fibers, elastomers.

Thermosetting, thermoplastic polymers. Branched, cross-linked and co-polymers.

Definition of polymerization-addition and condensation polymerization with examples.

Explanation: chain polymerization, step polymerization, copolymerization and coordination polymerization Kinetics of free radical polymerization. – Tacticity, atacticity, stereospecific synthesis-Ziegler –Natta catalyst.


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Molecular weight of polymers-number average and weight average molecular weight, degree of polymerization, determination of molecular weight of polymers by viscometry, Osmometry.Problems.

Preparation and industrial application of polyethylene, PVC, Teflon, polyacrylonitrile, terelene and Nylon6, 6.

Introduction to biodegradability and examples of important applications of biodegradable polymers in agriculture, medicine, food & packaging industry. Introduction to bio polymers

15h

Unit IV (General Chemistry)

Electro analytical methods

Types of electro analytical methods

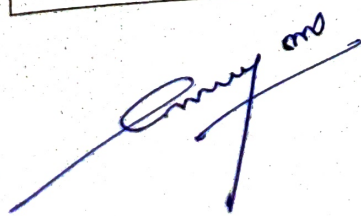
(I)interfacial methods- a) potentiometry: Principle ,Electrochemical cell ,Electrodes- (i) indicator and(ii) Reference electrodes- Normal Hydrogen Electrode, Quinhydrone electrode, Saturated Calomel Electrode. Numerical problems.Applications of Potentiometry- Assay of Sulfanilamide

(b)Voltammetry- three electrode assembly, Introduction to types of voltametric techniques, microelectrodes, Overpotential and Polarization.

(II) Bulk methods- Conductometry, Conductivity Cell, Specific Conductivity, and Equivalent Conductivity. Numerical problems. Applications of conductometry. Estimation of Cl using AgNO_3 .Determination of Aspirin with KOH

COURSE OUTCOMES-CHEMISTRY

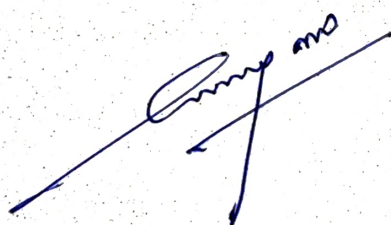
Name of the Course		Semester-VI Advanced Chemistry
Course Code		CT635-O
CO1	Apply trans effect to inorganic complexes and identify its stereoisomerism. Identify different types of clusters .Identify the symmetry and symmetry elements of simple molecules. Apply the concept of non aqueous solvents in industry.	
CO2	Solve practical problems and general issues of synthetic organic chemistry. Able to propose reasonable synthetic procedures for a relative complex organic compound.	
CO3	Demonstrate an ability to distinguish different polymerization reactions and their mechanisms/kinetics. Analyze polymerization data and predict the conversion and molecular weight, which will lead to critical thinking about how to improve the setup for better polymerization.	
CO4	Perform quantitative calculations for each of the methods if provided appropriate information or data. Compare the advantages and disadvantages of the different electrochemical methods of analysis.	



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Recommended text books and Reference books

1. Text book of organic chemistry by R.L.Madan
2. Book of Physical Chemistry by Puri and Sharma and Pathania.
3. Vogel's Text Book of Qualitative Analysis by G.H.Jeffery, J.Bassett, J.Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999
4. Text book of organic chemistry by R.L.Madan
5. Principles of Inorganic Chemistry by Puri, Sharma and Kalia, Vishal Publications 1996.
6. Inorganic Chemistry by J.D. Lee 3rd edn.
7. Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus ,3rd edn ,Wiley Publishers 2001. Chem.
8. Text book of organic chemistry by Morrison and Boyd.
9. Text book of organic chemistry by Graham Solomons.
10. Text book of organic chemistry by Bruce Yuranis Powla



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COURSE OBJECTIVES-CHEMISTRY

Name of the Course	Semester-VI DSE Medicinal Chemistry
Course Code	CT635
COb1	Define and Classify the drugs with examples and structures. Explain the Drugs used for various infectious diseases caused by pathogens. Describe the structure activity relation of some important class of drugs. Explain mechanism of action of the drugs.
COb2	Describe the nomenclature, classification and characteristics of enzymes. Explain the mechanism of enzyme action, enzyme kinetics, factors affecting enzyme reaction rate and the regulation of enzyme activity .Explain the drug-receptor theory and the mechanism involved in enzymes as drug.
COb3	Classify the drugs based on their mode of action .Learn the synthesis of the drugs, their advantages and disadvantages. Knowledge of the connection between the structural features of the drugs and their physico-chemical characteristics, mechanism of action and use.
COb4	Introduction to different types of hormones and neurotransmitters. Discuss the various types of drugs (Antithyroid, Antiparkinson).Discuss the uses of vitamins and Micronutrients in our daily diet.

UNIT I- Introduction and terminology

15 h (1h/w)

1. Diseases
2. Terminology in medicinal chemistry
3. Drugs
4. Ayurveda
5. ADMET

UNIT II- Enzymes and receptors

15 h (1h/w)

1. Enzymes
2. Receptors

UNIT III- Synthesis and therapeutic activity of drugs

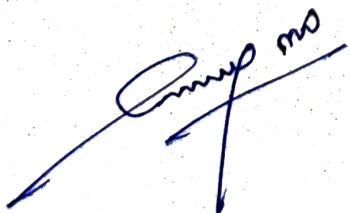
15 h (1h/w)

1. Chemotherapeutics
2. Drugs to treat metabolic disorders
3. Drugs acting on nervous system

UNIT IV – Molecular messengers ,vitamins and micronutrients

15 h (1h/w)

1. Molecular messengers
2. Vitamins
3. Micronutrients



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Semester – VI, Paper -VI
Discipline Specific Elective - A (4 Credits)
Medicinal Chemistry

60h

15 h

Unit-I Introduction and terminology

S6--I: Diseases:

Common diseases, infective diseases - insect borne, air - borne, water - borne and hereditary diseases.

Terminology in medicinal chemistry:

Drug, Active pharmaceutical ingredient (API), Pharmaceuticals, pharmacology, pharmacophore, pharmacodynamics, pharmacokinetics, metabolites, antimetabolites, therapeutic index.

Drugs:

Nomenclature: Chemical name generic names and trade names with examples;

Classification: Classification based on structures and therapeutic activity with examples.

Medicines of Early India.

Ayurveda

Basic concept of Ayurveda: The three Gunas and three Doshas.

Vedic foundation of Ayurveda: Maintenance of good health and treatment of diseases

ADMET:

- a) Absorption: Definition, absorption of drugs across the membranes – 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 reaction
- d) Elimination: definition and renal elimination, toxicity

15 h

Unit-II Enzymes and receptors

S6--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, -NH₂ group, quaternary ammonium salts and double bond. Structure –activity relationships of drug molecules, explanation with sulfonamides.

Unit-III Synthesis and therapeutic activity of drugs

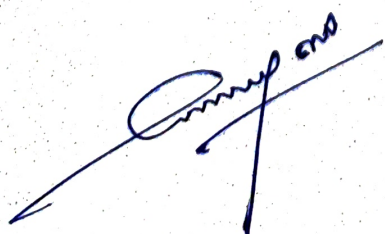
15 h

S6--III:

Introduction, synthesis and therapeutic activity of

Chemotherapeutics:

Sulphanilamide, Dapson, Penicillin-G (semi synthesis), Chloroquin, Isoniazid, Cisplatin and AZT.




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Drugs to treat metabolic disorders: Anti-diabetic - Tolbutamide; anti-inflammatory- Ibuprofen, cardiovascular- Glyceryl trinitrate; antipyretic (paracetamol, aspirin) and antacid - Omeprazole.

Drugs acting on nervous system:

Anaesthetic- definition, Classification – Local and General.

Volatile – Nitrous acid, chloroform uses and disadvantages.

Local anaesthetics – benzocaine

Unit-IV: Molecular messengers, Vitamins and micronutrients

15 h

S6 -IV:

Molecular messengers:

Introduction to hormones and neurotransmitters, Thyroid hormones, Antithyroid drug- Carbimazol.

Adrenaline: Adrenergic drugs- salbutamol, atenolol.

Serotonin: SSRIs- fluoxetine.

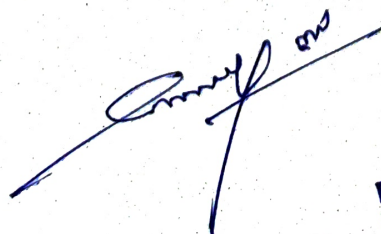
Dopamine: Antiparkinson drug- Levodopa

Vitamins and micro nutrients:

Introduction, vitamin sources, Deficiency disorders and remedy of A, B, C, D, E, K and micronutrients- Na, K, Ca, Cu, Zn and I.

COURSE OUTCOMES-CHEMISTRY

Name of the Course		Semester-IV Medicinal Chemistry
Course Code		CT635
CO1	Correlate between pharmacology of a disease and its mitigation or cure. To write the chemical synthesis of some drugs. Interpret the structural activity relationship of different class of drugs. Knowledge about the mechanism pathways of different class of medicinal compounds.	
CO2	Predict possible catalytic mechanisms of given reaction types. Evaluate the strategies for the analysis of kinetic mechanisms of catalyzed reactions. Apply the concept of drug receptors in molecules with simple functional groups like OH, NH ₂ etc.	
CO3	Define the different classes of drug and identify different types of drugs. Outline the function and impact of each class of drugs. Describe the structure activity relation of some important class of drugs. Explain mechanism of action of the drugs. Application of the gained knowledge about the therapeutic classes of drugs. Recognize the drug structure and predict its pharmacologic action. Recognize the drug physico-chemical and stereochemical features. Describe and perform synthesis of the drugs and determine the reaction yield.	
CO4	Apply the knowledge of vitamins and Micronutrients in our daily diet for a healthy living.	



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CO4	Apply the knowledge of vitamins and Micronutrients in our daily diet for a healthy living.
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Recommended Text Books and reference books

1. Introduction to Medicinal Chemistry, G.L. Patrick, Oxford University Press, New York. 2013.
2. Medicinal Chemistry, Thomas Nogrady, Oxford Univ. Press, New York. 2005
3. Foye's Principles of Medicinal Chemistry David William and Thomas Lemke, Lippincott Williams & Wilkins, 2008.
4. Medicinal Chemistry, Ashutosh Kar, New Age International, 2005.
5. Synthetic Drugs, O.D. Tyagi & M. Yadav, Anmol Publications, 1998.
6. Medicinal Chemistry, Alka L. Gupta, Pragati Prakashan.
7. Drugs, G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy, C. Sudhakar, Universities Press (India) Ltd. 2012.

COURSE OBJECTIVES-CHEMISTRY

Name of the Course	Semester-VI DSE Agricultural and Fuel Chemistry
Course Code	CT635A
COb1	Learn about the different types of pesticides. Use of Neem for natural pest control. Acquire information about the risks associated with the use of pesticides. Define integrated pest management and other pesticide alternatives. Pesticide uses and their potential side effects demands that these chemicals be used safely and effectively in today's agriculture. To study the persistence/dissipation of pesticides in crops and provide alternatives such as biopesticide.
COb2	Discuss types of organic manures, Green/leaf manuring. Fertilizer recommendation approaches. Identify the factors affecting nutrient availability to plants.
COb3	Identify the key learning points in the concept of energy, clean energy, and renewable energy. Coal as a source of energy and characterization of coal. To understand the basic concepts of Renewable and non renewable energy. Discuss the present uses and composition of coal in various industries. The principles of Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and solvent Refining techniques.
COb4	The objectives of the course are to develop an understanding of properties and application of petroleum products. Principle and process of fractional distillation. To understand different lubricants, the principles of their lubrication and their properties. To understand the different kinds of fuels and importance of bio fuels.

UNIT-I -Pesticides

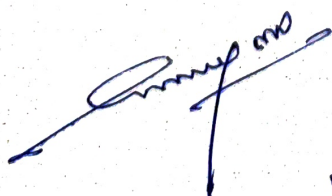
15 h (1h/w)

1. Introduction, Definition
2. Pesticide formulations
3. Biopesticides

II- Fertilizers

15 h (1h/w)

1. Introduction




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2. Nitrogenous fertilizers
3. Phosphate fertilizers
4. Potassium fertilizers
5. Biofertilizers
6. Organic farming

15 h (1h/w)

UNIT III-Energy Sources and Coal

1. Coal

UNIT IV -Petroleum and its products, petrochemicals and non-petroleum fuels

15 h (1h/w)

1. Petroleum
2. Petroleum products
3. Petrochemicals
4. Lubricants
5. Non petroleum fuels

Discipline Specific Elective –B (4 Credits)

Agriculture and Fuel Chemistry

(60h)

15h

UNIT I: Pesticides

S6-E-B-1: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.

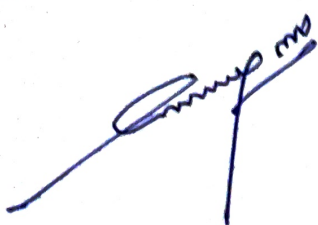
Synthesis, manufacture and uses of representative pesticides: Organochlorines (Cypermethrin); Organophosphates (parathion); Carbamates (Carbaryl); Quinones (Chloranil), Anilides(Alachlor).

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-I) and Pyrethroids(permethrin) and Nicotinoids (Imidacloprid).

UNIT II: Fertilizers

15h



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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 fertilizers: Diammonium 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

15h

S6-E-B-III: Review of energy sources (renewable and non renewable). Classification of fuels and their calorific values.

Coal: Uses of coal (fuel and non-fuel) 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-based chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and solvent Refining.

UNIT IV: Petroleum and its products, petrochemicals and non-petroleum fuels

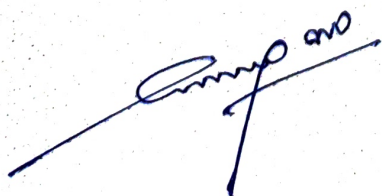
S6-E-B-IV:

15h

Petroleum and its products

Petroleum: Origin, Composition of crude petroleum and classification, Properties – flash point and its determination, Knocking and anti-knocking compounds; Octane number and cetane number. Distillation of crude petroleum, Fractional distillation – Principle and process, refining, Fractions and uses, Cracking -Thermal and catalytic cracking, Reforming

Petroleum products – Petrol, Diesel, LPG, Kerosene, Tar and their applications




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Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene and their uses.

Lubricants: Classification of lubricants – Solid, semisolid and liquids; Properties (viscosity, flash point, firepoint, cloud point, pourpoint) and their determination. Functions of lubricants. Mechanism of lubrication.

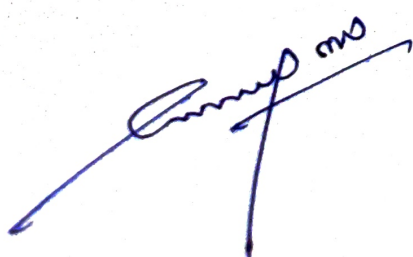
Non petroleum fuels: Natural gas-CNG, LNG, Clean fuels – H₂ gas, ethanol, Fuel from waste – bio-gas, Fuel from biomass – bio ethanol, biodiesel, Synthetic fuel- syngas based.

COURSE OUTCOMES-CHEMISTRY

Name of the Course		Semester-VI DSE Agricultural and Fuel Chemistry
Course Code		CT635A
CO1	Apply the concept of organic pest control methods for better soil nourishment and good yields of crops.	
CO2	Appraise the organic methods of farming .Apply the knowledge of bio fertilizers and vermicomposting and leaf composting to crops and gardens. Recognize the Environmental issues caused by fertilizers. Identify Newer types of fertilizers that can reduce environmental impacts.	
CO3	Analyse the different types of energy sources and their uses.	
CO4	Understand the concepts of energy usage and global energy scenario. Understand types of Fuels and have profoundness in understanding their application. Understand and work out analytical problems related to combustion theory.	

Recommended text books and Reference books

1. Chemistry of pesticides, N.N. Melnikov, Springer-Verlag-Technology & engineering(2012)
2. Pesticide synthesis Handbook, Thomas A. Unger, Elsevier, (200).
3. Pesticides, R.Cremlyn, John Wiley, 1980.
4. Manures and fertilisers, K. Kolay, Published by Atlantic (2007).
5. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996)
6. A textbook of Engineering Chemistry Paperback – 2017 by Shashi Chawla
7. Industrial Chemistry, Vol-I, Stocchi, E, Ellis Horwood Ltd. UK (1990)
8. Jain, P.C and Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
9. Engineering Chemistry by Shashi Chawla, Dhanpat Rai & sons, Delhi.




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LABORATORY COURSE – VI

(45h/15weeks) 3h/w

Practical Paper – (Physical Chemistry)

1. Chemical kinetics:

- Determination of specific reaction rate of the hydrolysis of methyl acetate catalyzed by hydrogen ion at room temperature.
- Determination of rate of decomposition of hydrogen peroxide catalysed by FeCl_3

Electrochemistry:

A. Potentiometry:

- Determination of Redox potential of $\text{Fe}^{2+}/\text{Fe}^{3+}$ by potentiometric titration of Ferrous ammonium sulphate vs. Potassium dichromate
- Precipitation titration of KCl Vs. AgNO_3 – Determination of given Concentration of AgNO_3

B. pH metry:

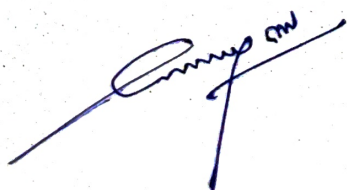
- pH metric titration of strong acid, HCl with strong base NaOH and determination of Concentration of the given acid
- pH metric titration of weak acid, acetic acid with strong base NaOH and calculation of dissociation constant.

C. Conductometry:

- Determination of overall order: Saponification of Methyl acetate with NaOH by conductometric measurements

Laboratory Course: Paper code: CT635P

Physical Chemistry II




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LEARNING OBJECTIVES:

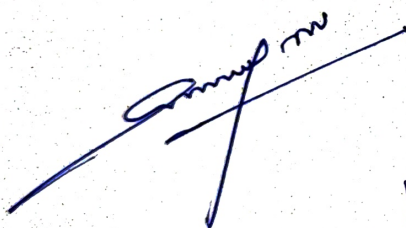
- ▶ Perform experiments in Chemical kinetics and using different instruments like pH meter, potentiometer.

LEARNING OUTCOMES:

Able to perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions

Textbooks and Reference books:

1. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
- 3 Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).
- 4 Athawale V. D. and Mathur P. Experimental Physical Chemistry,, New Age Intenational




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