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

Semester V

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
BS 501	Chemisty of Cosmetics, Food Processing, Drugs & Pharmaceuticals	GE	4		4	4		4
BS 502	English	CC-1E	3		3	3		3
BS 503	Second Language	CC-2E	3		3	3		3
BS 504	Optional 1	DSE-1E						5
BS 505	Optional 2	DSE-2E						5
BS 506	Optional 3- Chemistry Spectroscopy & Chromatography (OR) Mettalurgy Dyes & Catalysis	DSE-3E	4	3	7	4	1	5
	Laboratory Course -V Experiments in Physical Chemistry - I							

Semester VI

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
BS 601	Project in Chemistry/ Advanced Chemistry							4
BS 602	English	CC-1F	3		3	3		3
BS 603	Second Language	CC-2F	3		3	3		3
BS 604	Optional 1	DSE-1F						5
BS 605	Optional 2	DSE-2F						5
BS 606	Optional 3- Chemistry Medicinal Chemistry (OR) Agricultural and Fuel Chemistry	DSE-3F	4	3	7	4	1	5
	Laboratory Course -VI Experiments in Physical Chemistry - II							

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Department of Chemistry

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

CODE: CT535 & CT535P

HPW:4

YEAR/SEMESTER: III/ V

No. Of Credits: Theory – 4
Practical –1

(60 h/ 15 weeks)

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	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 rations with molecules, various types of molecular spectra.

Rotational spectroscopy (Microwave spectroscopy)

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

Infra red spectroscopy

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

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Electronic spectroscopy:
Bonding and antibonding molecular orbitals, electronic energy levels of molecules (σ, π, n), types of electronic transitions:σ-σ*, n-σ*, n-л*, л-л* 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, eluotopic series, development of the chromatogram, Detection of the spots, visualizing agents, factors effecting Rf 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		CT535
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

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

Unit III &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

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India Ed.
3. D. A. Skoog, D.M. West, F.J. Holler, Fundamentals of Analytical Chemistry 6thEd ., 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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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

1. Dyes **15 h (1 h / w)**
2. Structures of Synthetic Dyes
3. Synthesis of Dyes

Unit III: Catalysis

1. Homogeneous and heterogeneous catalysis **15 h (1 h /w)**
2. Acid-base catalysis-
3. Phase transfer catalysis

Unit IV: Catalysis II

1. Enzyme catalysis **15 h(1 h /w)**

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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 o f 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- Naturaldyes, synthetic dyes; based on chemicalconstitution of dyes; Chemical nature of dyes; application of dyes.
Structures of natural Dyes: Indigo, Tyrian purple, Alizarin, Indigotin.

Structures of Synthetic Dyes: Nitrodyes, Nitrosodyes, Azodyes(Monoazodyes, Bisazodyes),diaryl methane dyes, triaryl methane dyes, Xanthene dyes, Phenolphthalein, Fluorocein, Acridine dyes.

Synthesis of dyes: Monoazodyes, Bisazodyes (Congored), Auromine O, Malachite Green, Crystal Violet, Rhodamine B, Acridine Yellow, Indigotin.
Binding of drugs 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 maltoseto 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 (Km) and maximum velocity (Vmax), 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 **(45h/15weeks)**

3h/w

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 –diluents, 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: Miconozole (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) nefidipine (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 Osterone)

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-Sepr 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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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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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
2. Nitrogenous fertilizers
3. Phosphate fertilizers
4. Potassium fertilizers
5. Biofertilizers

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LABORATORY COURSE – VI **(45h/15weeks) 3h/w**

Practical Paper – (Physical Chemistry)

1. Chemical kinetics:

a) Determination of specific reaction rate of the hydrolysis of methyl acetate catalyzed by hydrogen ion at room temperature.

b) Determination of rate of decomposition of hydrogen peroxide catalysed by $FeCl_3$

Electrochemistry:

A.Potentiometry:

a) Determination of Redox potential of Fe^{2+}/Fe^{3+} by potentiometric titration of Ferrous ammonium sulphate vs. Potassium dichromate

b) Precipitation titration of KCl Vs.$AgNO_3$ –Determination of given Concentration of $AgNO_3$

B. pH metry:

a) pH metric titration of strong acid, HCl with strong base NaOH and determination of Concentration of the given acid

b) pH metric titration of weak acid, acetic acid with strong base NaOH and calculation of dissociation constant.

C. Conductometry:

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

Laboratory Course: Paper code: CT635P

Physical Chemistry II

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

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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 –1

(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 4h
2. Boranes and Carboranes 2h
3. Symmetry of molecules 5h
4. Non- aqueous solvents 4h

Unit II (Organic Chemistry) **15h**

1. Pericyclic Reactions 5h
2. Synthetic strategies 5h
3. Asymmetric synthesis 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, stereospecifc synthesis-Zeigler –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

Unit IV (General Chemistry) **15h**

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 Publications1996.

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 Bruice Yuranis Powla

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Semester – VI, Paper -VI

Discipline Specific Elective - A (4 Credits)

Medicinal Chemistry

60h

Unit-I Introduction and terminology **15 h**

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, pharmacodyanamics, 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

Unit-II Enzymes and receptors **15 h**

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 agonist s and antagonists with examples. Drug receptor interactions involved in drug receptor complex. Binding role of -OH group, $-NH_2$ 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- Ibuprufen, 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

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