



Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. I Drug Chemistry

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2024-2025

1. **Title:** B. Sc. Drug Chemistry
2. **Year of Implementation:** 2024-2025
3. **Preamble:** This updated syllabus is prepared for first year undergraduate students. At this level, to develop their interest towards drug chemistry as basic science and also to prepare them for the academic and industrial exposure simultaneously. Introduction of microbial techniques with the regular chemistry exercises will help to enhance rational thinking of the students towards drug Chemistry. The interdisciplinary approach with vigor and depth is compatible to the syllabi of other universities, at the sametime is not rigid for the students at first year of their graduation. The units in the syllabus are well defined with scope and the number of lectures. The references are mentioned with relevance.

4. General objectives of the course:

1. To develop the content of the syllabus according to the UGC norms.
2. To inculcate fundamental principles of chemical sciences in students.
3. To establish the link between theory and laboratory practice by conducting laboratory experiments which help students to improve the understanding of the concepts.
4. To enhance student's sense of enthusiasm for chemistry and to involve them in an intellectually stimulating experience of learning in a supportive environment.

5. **Duration:** One year

6. **Pattern:** Semester

7. **Medium of Instruction:** English

8. Structure of Course:

Level	Sem	Course I		Course II		Course III		OE, IKS VEC,			Total
		T	P	T	P	T	P	OE	IKS	VEC	
4.5	I	4	2	4	2	4	2	2	2		22
	II	4	2	4	2	4	2	2		2	22

Structure and Titles of Course I (Drug Chemistry)

Semester I

Course I: Paper I- Introduction to Drug Chemistry (BDCT 111)

Subject	Unit No.	Title	Hrs	Credits
Introduction to Drug Chemistry	I	Introduction to Drug Chemistry	09	2
	II	Sources of Drug	05	
	III	Classification of Drug	07	
	IV	Chemical Communication	09	
Grand Total			30	

Course I: Paper II- Fundamentals of Drug (BDCT 112)

Subject	Unit No.	Title	Hrs.	Credits
Fundamentals of Drug	I	Fundamentals of Biological Chemistry	08	2
	II	Basic Biomolecules	08	
	III	Amino Acids	07	
	IV	Bioavailability and Permeability	07	
Grand Total			30	

Structure and Titles of Course I (Drug Chemistry)

Semester II

Course I: Paper III: Introduction to Biochemistry (BDCT 121)

Subject	Unit No.	Title	Hrs	Credits
Introduction to Biochemistry	I	Hormones	09	2
	II	Vitamins	08	
	III	Minerals	06	
	IV	Body Fluid and Blood	07	
Grand Total			30	

Course I: Paper IV- **Analysis Techniques** (BDCT 122)

Subject	Unit No.	Title	Hrs	Credits
Analysis Techniques	I	Acid-Base Titration	08	2
	II	Oxidation Reduction Titration	08	
	III	Precipitation Titration	07	
	IV	Theory of Gravimetric Analysis	07	
Grand Total			30	

Credit 2	SEMESTER– I Course I Paper I- Introduction to Drug Chemistry (BDCT-111)	Contact hours (30)
<p>Course Objectives: Students should be able to...</p> <ol style="list-style-type: none"> 1. Understand the basic concepts in drug chemistry. 2. Know different natural sources of drugs 3. Study the classification of drugs. 4. Learn chemical communication in human body. 		
Unit No.	Content	No. of hours per unit
Unit – I	<p>Introduction to Drug Chemistry 1.1. Definition, history, scope and development of Pharmacognosy 1.2. Definition of drug, ideal properties of drug, prodrug, Soft drug, hard drug. 1.3. Pharmacopoeia, History, Development of pharmacopoeia, study of different pharmacopeia.</p>	(09)
Unit – II	<p>Sources of Drug 2.1 Biological 2.2 Marine 2.3 Mineral 2.4 Synthetic 2.5 Plant tissue cultures as sources of drugs.</p>	(05)
Unit – III	<p>Classification of Drugs 3.1 Alphabetical, morphological- Doctrine of nature, taxonomical classification of drugs 3.2 Chemical classification of drugs 3.3 Pharmacological classification of drugs 3.4 Classification of drugs based on therapeutic effects and areas</p>	(07)
Unit – IV	<p>Chemical Communication 4.1 Various types of communication systems 4.2 Endocrine hormones and their action Pituitary gland. 4.3 Endocrine hormones and their action adrenal gland.</p>	(09)
<p>Course Outcomes: After completion of the course students will be able to...</p> <ol style="list-style-type: none"> 1. Explain fundamentals of drug chemistry 2. Classify natural sources of drugs 3. Acquire knowledge to classify drugs. 4. Describe chemical communication in human body 		

References:

1. Dr. Jain J. L., Fundamentals of Biochemistry, S. Chand & Company Ltd. New Delhi.
2. Barar F. S., Essentials of Pharmacotherapeutics, S. Chand & Company Ltd. New Delhi
3. Gaud R. S. & Dr. Gupta G. D, Practical Pharmaceutics, CBS Publishers and Distributors, New Delhi.
4. Choudhary N. C. And Gurbani N. K., Pharmaceutical Chemistry. Vallabh Prakashan, Delhi
5. Jain N. K, Textbook of Professional Pharmacy, Vallabh Prakash, Delhi
6. Mithal B. M., A text book of Pharmaceutical formulation, Vallabh Prakash, Delhi
Stenlake & Beckett, Practical Pharmaceutical Chemistry, Part-I, CBS Publishers and Distributors, New Delhi

Credits 2	SEMESTER – I Course I Paper-II Fundamentals of Drug	Contact hours (30)
<p>Course Objectives: Students should be able to...</p> <ol style="list-style-type: none"> 1. Study the fundamentals of biological chemistry. 2. Know about basic biomolecules. 3. Gain knowledge about amino acids and proteins. 4. Familiar with the term bioavailability. 		
Unit No.	Content	No. of hours per unit
Unit – I	<p>Fundamentals of Biological Chemistry</p> <p>1.1 Configuration and Information in 3D structure of biomolecules 1.2 Stereochemistry, chiral interaction, enantiomers etc. 1.3 Interaction between biomolecules, stereo specificity 1.4 Types of bonds in biomolecule [Covalent (glycoside, peptide, phosphodiester), ionic, hydrogen, Van der Waals, hydrophobic, coordinate)] their formation and interaction.</p>	(08)
Unit – II	<p>Basic Biomolecules</p> <p>2.1 Carbohydrates: Introduction, biological importance. Definition 2.2 Classification, { glyceraldehyde, Simple Aldose, Simple Ketoses, D-glucose, Conformation of D-glucose } 2.3 Monosaccharide's other than glucose, glycosidic bond, disaccharides 2.4 Polysaccharides [starch, glycogen] peptidoglycan, proteoglycan matrix.</p>	(08)
Unit – III	<p>Amino acids</p> <p>3.1 Introduction to amino acids, classification, Structure and properties of amino acids. 3.2 Acid base behaviour of amino acid, analysis, reactions, Zwitterions 3.3 Structure-peptide bond.</p>	(07)

Unit – IV	Bioavailability And Permeability	(07)
	<p>4.1 Bioavailability : Definition in pharmacology, nutritional science, environmental science,</p> <p>4.2 Absolute bioavailability, relative bioavailability And bioequivalence</p> <p>4.3 Factors influencing bioavailability, bioavailability of drugs versus dietary supplements</p> <p>4.4 Nutritional Science: reliable and universal bioavailability.</p> <p>4.5 Permeability: Diffusion – Definition, significance, mechanism, laws and factors affecting diffusion.</p>	

Course Outcomes: After completion of the course students will be able to...

1. Explain different types of bonds present in biomolecules.
2. Discuss reactions of protein.
3. Classify carbohydrates based on monomers present in it.
4. Describe bioavailability and Permeability

References:

1. Shukla And Upadhyaya (2009) Economic Zoology, 4th Edition, Rastogi Publications
2. H. D. Kumar (1999) Biodiversity and sustainable conservation (Oxford & IBH, New Delhi).
3. Eric Conn & Paul Stumpf; John Wiley and Sons (2009), Outlines of Biochemistry: 5th Edition, USA.
4. Donald Voet & Judith Voet, John Wiley and Sons (2008) Fundamentals of Biochemistry. 3rd Edition, Inc. USA
5. Jeffery Zubey (1997), Principles of Biochemistry, 4th edition McGraw-Hill College USA.
6. Jeremy Berg, Lubert Stryer W.H.Freeman and company(2012), Biochemistry7th Edition
7. Lehninger David Nelson & Michael Cox, W. H. Freeman and company (2008) Principles of Biochemistry 5th Edition, NY.
8. Reginald Garrett and Charles Grisham, Brook/Cole, Biochemistry. 5th Edition Boston, USA

Credits 2	SEMESTER – I Course I Practical Paper I (BDCP 113)	No. of hours (60)
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Course Objectives: Students will be able to...

1. Study safety measures in laboratory.
2. Understand purification methods.
3. Learn functional group detection.
4. Know estimation technique of protein.

1	Safety symbol and labels on pack of chemicals and its meaning	
2	Details about MSDS and its importance	
3	Purification of organic pharmaceutical compounds (Any 2)	
4	Determination of solubility, MP and BP of drug (Any 4)	
5	Detection of elements and functional group (Any 4)	
6	Estimation of tincture iodine	
7	Spot test for carbohydrates & amino acids	
8	Isolation of starch from potato	
9	Isolation of protein from plant source	
10	Isolation of oil from plant source	
11	Estimation of protein by Biuret method	
12	Estimation of protein by Lowry method	
13	Synthesis of Aspirin	

Course Outcomes: - After completion of the course students will be able to...

1. Read MSDS for given chemical
2. Purify given pharmaceutical compound
3. Isolate starch from potato
4. Estimate the protein from given sample.

References:

1. Parikh D. M. Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
2. Beckett A. H. & Stenlake's, J. B. Practical Pharmaceutical Chemistry Vol I & II 4th edition, Stahlone, Press of University of London.
3. Paye M. Barel A. O, Maibach H., Handbook of Cosmetic Science and Technology.

Credit 2	SEMESTER – II Course – I Paper- III Introduction to Biochemistry (BDCT 121)	Contact hours (30)
<p>Course Objectives- Students should be able to...</p> <ol style="list-style-type: none"> 1. Study fundamentals of the endocrine system. 2. Know about vitamins in detail and its importance in our life, 3. Gain knowledge about mineral metabolism. 4. Learn in detail about body fluid and blood. 		
Unit No.	Content	No. of hours per unit
Unit – I	<p>Hormones</p> <p>1.1 Introduction to Endocrine system, Types, Glands</p> <p>1.2 Hormones, Functions and Diseases related to hormones</p> <p>1.3 Thyroid hormones and anti-thyroid drugs, parathormone, calcitonin and Vitamin D</p> <p>1.4 Chemical Messengers, Feedback Mechanism,</p> <p>1.5 Androgens and anabolic steroids, Estrogens, progesterone and oral contraceptives, Drugs acting on the uterus.</p>	(09)
Unit – II	<p>Vitamins</p> <p>2.1 Concept of Vitamins, Types of vitamins- fat soluble and water soluble,</p> <p>2.2 Various vitamins- its solubility, food sources, deficiency diseases, Interaction with other nutrients</p> <p>2.3 Antagonists and analogues of vitamins.</p>	(08)
Unit – III	<p>Mineral Metabolism</p> <p>3.1 General definition and history of minerals; causes of macro and micro mineral deficiencies in India.</p> <p>3.2 Chronology, chemistry, distribution, functions, absorption transport, metabolism, deficiency manifestations.</p> <p>3.3 Nutritional requirements, methods of assay of all the minerals.</p> <p>Interactions of minerals with other nutrients, antagonists and analogues of minerals.</p>	(06)

Unit – IV	Body Fluid and Blood 4.1 Introduction to Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, 4.2 Blood grouping, Rh factors, transfusion, its significance and disorders of blood, 4.3 Reticulo endothelial system. 4.4 Lymphatic system Lymphatic organs and tissues, lymphatic vessels, lymph, circulation and functions of lymphatic system.	(07)
Course Outcomes: After completion of the course students will be able to... 1. Explain endocrine system and importance of various hormones 2. Draw the structures of vitamins. 3. Explain mineral metabolism. 4. Categories body fluid and blood.		
References: 1. Palmetto G.T, Principles of Anatomy and Physiology, GA, U.S.A. 2. Dr. Chatterjee. C. C., Human Physiology (vol 1 and 2), Academic Publishers Kolkata. 3. Conn E. E and. Stumpf P. K, Outlines of Biochemistry, John Wiley and Sons, New York. 4. Harish C. and A. Leo, Fundamentals and Applications in Chemistry and Biology, ACS Book Catalog. 5. Harrow B. and Mazur A, Textbook of Biochemistry, W. B. Saunders Co., Philadelphia. 6. . Lehninger A. L, Biochemistry, Worth Publisher, Inc., 7. Lehninger A. L., Principles of Biochemistry, CBS Publishers and Distributors.		

Credits 2	SEMESTER – II Course – I Paper- IV Analysis Techniques (BDCT 122)	Contact hours (30)
Course Objectives: Students should be able to... <ol style="list-style-type: none"> 1. Study fundamentals of titrations. 2. Learn acid base titrations. 3. Know about oxidation reduction titration. 4. Familiar with gravimetric analysis. 		
Unit No.	Content	No. of hours per unit
Unit - I	Acid Base Titrations 1.1 Acid base concepts, Role of solvent, Relative strengths of acids and bases, Ionization 1.2 Law of mass action, Common Ion effect, Ionic product of water 1.3 pH, Hydrolysis of salts, Henderson-Hasselbach equation, Buffer solutions 1.4 Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, mixed indicators 1.5 Polyprotic system, Polyamine and amino acid systems, Amino acid titration, applications in assay of HIO_4 , NaOH , CaCO_3	(08)
Unit – II	Oxidation Reduction Titrations 2.1 Concepts of oxidation and reduction, Redox reactions, Strengths and equivalent weights of oxidising and reducing agents 2.2 Theory of redox titrations, Redox indicators, Cell representations, Measurement of electrode potential, Oxidation-reduction curves 2.3 Iodimetry and Iodometry, Titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate; titanous chloride and Sodium 2, 6- dichlorophenol indophenol	(08)
Unit – III	Precipitation Titrations 3.1 Precipitation reactions, Solubility products, Effect of acids, temperature and solvent upon the solubility of a precipitate. 3.2 Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, Indicators 3.3 Gay-Lussac method; Mohrs method, Volhard's method and Fajan's method.	(07)

Unit - IV	Theory of Gravimetric Analysis 4.1 Precipitation techniques, Solubility products; The colloidal state, Super saturation co-precipitation, Post precipitation 4.2 Digestional washing of the precipitate, Filtration, Filter papers and crucibles, Ignition, Thermo gravimetric curves 4.3 Specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic Precipitants.	(07)
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Course Outcomes: After completion of the course students will be able to...

1. Define titration and know about its type.
2. Apply knowledge of titrations in analysis.
3. Describe the importance of different analytical techniques.
4. Discover importance of thermal methods of analysis.

References :

1. Beckett A. H. & Stenlake's J. B., Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London.
2. Vogel A. I, Text Book of Quantitative Inorganic analysis.
3. Gundu P Rao, Inorganic Pharmaceutical Chemistry.
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. Kennedy J. H, Analytical chemistry principles.
6. Khopkar S. M, Concepts in analytical chemistry.

Credits 2	SEMESTER – II Course I Practical Paper– II (BDCP 123)	No. of hours (60)
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Course Objectives: Students should be able to...

1. Understand neutralisation reactions
2. Learn the oil extraction process.
3. Know gravimetric Estimation.
4. Study detection of food adulteration.

1-4	Tools for chemical analysis. (The learner should draw diagrams and write ups providing uses, care and maintenance mentioned in a, b, c, d) Analytical glassware like burette, pipette, std. Flask, separating funnel. Weighing tools like, two pan, mono pan and digital balance. Incineration devices like burners, electrical incinerator, muffle furnace. Drying devices like deciators, vaccum deciators, and oven.	
5	Acid-Base titrations (at least 3)	
6	Redox titrations (permanganometry)	
7	Redox titration by iodometry method	
8	Precipitation titrations (at least 2)	
9	Complexometric titration (Calcium /Magnesium).	
10	Chromatographic Separation of lipid, amino acids and carbohydrates	
11	Determination of adulteration in milk and milk products	
12	Determination of adulteration in fats and oil	
13	Determination of adulteration in sweetening agents and miscellaneous products.	

Course Outcomes: After completion of the course students will be able to...

1. Determine strength of given acid or base sample.
2. Separate given mixture of carbohydrates and lipids by chromatographic method
3. Determine adulteration in given sample of food materials.
4. Categorize oxidizing and reducing agents.

References:

1. Parikh M.D: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
2. Beckett A. H. & Stenlake's J. B., Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London.
3. Dr. Naskar S. (1 January 2014) , A Handbook of Practical Pharmaceutical Chemistry I edition, Pharmamedix India Publication Pvt. Ltd.;
4. Dr. Mondal P and Dr. Mondal S, Handbook of Practical Pharmaceutical Organic, Inorganic and Pharmaceutical Chemistry, educreation publishing, rz 94, Sector - 6, Dwarka, New Delhi

Structure and Titles of Course II (Chemistry)

Semester I

Paper I: Physical Chemistry (BDCT 114)

Subject	Unit No.	Title	Hrs.	Credits
Physical Chemistry	I	Units and Conversions	08	2
	II	Concentration Units	08	
	III	Chemical Thermodynamics	08	
	IV	Calculations Based on Chemical Equations	06	
Grand Total			30	

Paper II: Inorganic Chemistry (BDCT 115)

Subject	Unit No.	Title	Hrs.	Credits
Inorganic Chemistry	I	Introduction to Periodic Table	08	2
	II	Orbital Hybridization	08	
	III	Pharmaceutical Substances and their Purity	08	
	IV	Electrolytes and Gastrointestinal Agents	06	
Grand Total			30	

Semester II

Paper III: Fundamental Organic Chemistry (BDCT 124)

Subject	Unit No.	Title	Hrs.	Credits
Fundamental Organic Chemistry	I	Fundamentals of Organic Reaction Mechanism	08	2
	II	Alcohols, Phenols and Ethers	08	
	III	Aldehydes, Ketones and Carboxylic Acids	08	
	IV	Cycloalkanes, Cycloalkanes and Alkadienes	06	
Grand Total			30	

Paper IV: Basic Analytical Chemistry (BDCT 125)

Subject	Unit No.	Title	Hrs.	Credits
	I	Scope and Importance of Analytical Chemistry	08	
Basic Analytical Chemistry	II	Laboratory Reagents	08	2
	III	Laboratory Equipment's and Their Uses	08	
	IV	Analytical Approaches	06	
Grand Total			30	

Credits 2	Course II Paper I: Physical Chemistry (BDCT 114)	Contact hours (30)
<p>Course Objectives: Students should be able to...</p> <ol style="list-style-type: none"> 1. Understand the basic units used in Chemistry. 2. Learn the various concentration units. 3. Study the use of mathematical concepts required for Chemistry. 4. Acquire the knowledge of chemical calculations and balancing equations. 		
Unit No.	Content	No. of hours per unit
Unit I	<p>Units and Conversions:</p> <ol style="list-style-type: none"> 1.1 Introduction, General Requirements 1.2 SI Units 1.3 CGS Unit 1.4 Conversions-Rounding procedure and practice 1.5 Conversion Factors 	(08)
Unit II	<p>Concentration Units:</p> <ol style="list-style-type: none"> 2.1 Solute and Solvent, Polar, Non-polar, Protic, Aprotic, Aqueous, Non-Aqueous solvents, Acidic, Basic, Amphiprotic, Neutral solvents, Acidity of base, Basicity of acid 2.2 Methods of expressing the concentration of solutions on volume and weight basis-Normality, Molarity, Molality, Formality, Mole Fraction 2.3 Numerical Problems involving preparations of standard solutions, dilution of solutions 2.4 Percent composition, part per million (ppm), part per billion (ppb), parts per trillion (ppt) calculations 	(08)
Unit III	<p>Chemical Thermodynamics:</p> <ol style="list-style-type: none"> 3.1 Introduction, Basic Terms 3.2 Spontaneous and non-spontaneous process with examples, Statement of Second law of Thermodynamics, Carnot's cycle, its efficiency, Carnot's Theorem (Heat engine) 3.3 Concept of entropy, physical significance of entropy. Entropy as a function of volume and temperature, pressure and temperature, entropy of mixing of gases, entropy change accompanying phase transition 3.4 Third law of thermodynamics Numerical problems 	(08)

Unit IV	Calculations Based on Chemical Equations: 4.1 Mole concept-Determination of molecular weight by gram molecularvolume relationship, problems based on mole concept 4.2 Oxidation reduction-Definition and related terms 4.3 Balancing of redox reactions using oxidation number method and ion electron method	(06)
Course Outcomes: After completion of the course students will be able to... 1. Solve the numerical based on concentration units. 2. Explain the laws of thermodynamics 3. Apply their understanding to balance chemical equations and related calculations.		
References: 1. Puri B.R., Sharma, L.R., Pathania M.S. 2020. Principles of Physical Chemistry: Vishal PublishingCompany. 2. Soni P. L., Dharmrha O. P., Dash U. N. 2011. Text Book of Physical Chemistry: Sultan Chandand Sons. 3. Bahl Arun, Bahl B. S., Tuli G. D. 2020. Essential of Physical Chemistry: SChand. And Company Ltd. 4. Rao, C. N. R. 2009. University General Chemistry -An Introduction to Chemical Science: NewDelhi, Macmillan.		

Credits 2	SEMESTER I Course II Paper- II Inorganic Chemistry (BDCT-115)	Contact hours (30)
<p>Course Objectives: Students should be able to...</p> <ol style="list-style-type: none"> 1. Recall the Periodic table and different trends. 2. Understand shapes of orbitals, their overlapping and different hybridizations and their applications. 3. Study the fundamentals of metals, metal cluster, their locations and applications. 4. Study the fundamentals of non-metals, isomorphism and Applications 		
Unit No.	Content	No. of hours per unit
Unit I	<p>Introduction to Periodic Table:</p> <ol style="list-style-type: none"> 1.1 Introduction 1.2 Mendeleev's Periodic law and Periodic table 1.3 Modern periodic law and periodic table 1.4 Advantages of modern periodic table 1.5 Division s, p, d and f block elements and general electronic configuration 1.6 Physical properties: valence, atomic radii, ionic radii, ionization energy, electron affinity and electro negativity 	(08)
Unit II	<p>Orbital Hybridization:</p> <ol style="list-style-type: none"> 2.1 Introduction 2.2 Shapes of orbitals and orbital overlapping 2.3 Sigma and pi bond formation 2.4 Types of hybridization 2.5 Examples of sp, sp², sp³, sp³d, sp³d² and sp³d³ hybridization 	(08)
Unit III	<p>Pharmaceutical substances and their purity:</p> <ol style="list-style-type: none"> 3.1 Sources and types of impurities 3.2 principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metal 3.3 modified limit test for Chloride and Sulphate 	(06)
Unit IV	<p>Electrolytes & Gastrointestinal agents</p> <ol style="list-style-type: none"> 4.1 Functions of major physiological ions 	(08)

4.2 Electrolytes used in the replacement therapy: General methods of preparation, assay for the compounds properties and medicinal uses of inorganic compounds Sodium chloride, Potassium chloride, Calcium gluconate and Oral Rehydration Salt (ORS),

4.3 Physiological acid base balance.

Gastrointestinal agents

4.4 **Acidifiers:** Preparation and assay of Ammonium chloride, Dil. HCl

4.5 **Antacid:** Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate, Aluminum hydroxide gel, Magnesium hydroxide mixture

4.6 **Cathartics:** Magnesium sulphate, Sodium ortho phosphate Kaolin and Bentonite

4.7 **Antimicrobials:** Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide, Chlorinated lime, Iodine and its preparations

Course Outcomes: After completion of the course students will be able to...

1. Identify different elements and their position in periodic table.
2. Apply knowledge of metals and non-metals in various fields.
3. Name metal cluster, their shapes and applications.
4. Identify different isomorphs and their applications.

References:

1. Lee J. D. 2008. Concise Inorganic Chemistry 5th Edition: Wiley India Pvt. Ltd.
2. Shriver, D. F., Atkins, P. W., Langford C. H. 1994. Inorganic Chemistry: W. H. Freeman.
3. Cotton F. A., Wilkinson G., Murillo C. A., Bochmann M. 1999. Advanced Inorganic Chemistry: Wiley.
4. Manku G. S. 1982. Theoretical Principles of Inorganic Chemistry: McGraw Hill Education.
5. Mehrotra R. C., Sing A. Organometallic Chemistry: Wiley Eastern Ltd. New Delhi.

Credits 2	SEMESTER I Course II Practical Paper I: BDCP116	No. of Hrs. 60
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Course Objectives: Students should be able to...

1. Study the preparation and standardization of different solutions.
2. Learn the preparation solutions for trace analysis.
3. Gain the knowledge of plotting graph from given data.
4. Study the preparation of different inorganic complexes.
5. Gain knowledge and analytical skills of complexometric titration.

	Content	
	<ol style="list-style-type: none"> 1. Measurement of pH of water samples from different resources. 2. Preparation and standardization of solution. <ol style="list-style-type: none"> 2.1 Oxalic acid/Hydrochloric acid 2.2 Sodium Hydroxide 2.3 Potassium dichromate. 2.4 Sodium carbonate. 3. Preparation of solutions for trace analysis. <ol style="list-style-type: none"> 3.1 ppm 3.2 ppb 3.3 ppt 4. Heat of ionization 5. Preparation of Mohrs salt 6. Identification of halides in given sample qualitatively. 7. Identification of basic radicals (Spot test). 8. Preparation of Hexa-amine cobalt (III) chloride. 9. Complex metric titration of given sample. 10. Limit test for Chlorides and Sulphate 11. Preparation of inorganic pharmaceuticals <ul style="list-style-type: none"> Boric acid Potash alum Ferrous sulphate 	

Course outcomes: After completion of the experiments students will be able to...

1. Measure the pH of different water samples.
2. Prepare and standardize different solutions.
3. Prepare different inorganic complexes.
4. Get expertise in quantitative estimation using titrimetry.

References:

1. Sindhu, P. S. 2006. Practical in Physical Chemistry A Modern Approach: MacmillanPublication.
2. Khosla, B. D., Garg V. C., Gulati A. 2018. Senior Practical Physical Chemistry: R. Chand andCo.
3. Athawale V. D., Mathur P. 2001. Experimental Physical Chemistry: New Age InternationalPrivate Ltd.
4. Findlay Alexander. 2015. Experimental Physical Chemistry-Scholar's Choice Edition: Creative

Media Partners, LLC.

5. Vogel Arthur. 1989. Vogel's Text Book of Quantitative Analysis:Longman.

6. Vogel Arthur, Bassett John. 1980. A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumentation Analysis:Longman Sc and Tech.

Credits 2	SEMESTER II Course II Paper III: Fundamental Organic Chemistry (BDCT 124)	Contact hours (30)
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Course Objectives: Students should be able to...

1. Learn the fundamentals of Organic Reaction Mechanism.
2. Study the concepts of Alcohols, Phenols and ethers.
3. Recall the knowledge of aldehydes, ketones and carboxylic acids.
4. Understand concept of Cycloalkane, cycloalkene and alkadiene.

Unit No.	Content	No. of hours per unit
Unit I	Fundamentals of Organic Reaction Mechanism: 1.1 Introduction, curved arrow notation 1.2 Cleavage of bonds: homolytic and heterolytic fission 1.3 Reagents, their types such as nucleophiles and electrophiles 1.4 Electronic Effects: Inductive effect, Resonance Effect, electromeric effect, hyperconjugation effect 1.5 Types of organic reactions: Substitution reaction, addition reaction, elimination reaction, rearrangement reactions.	(08)
Unit II	Alcohols, Phenols and Ethers: 2.1 Classification 2.2 Nomenclature 2.3 Structures of Functional Groups: 2.4 Alcohols and Phenols: Preparations 2.5 Some commercially Important Alcohols 2.6 Ethers: Preparations, 2.7 Physical and Chemical Properties and uses of ethers	(08)
Unit III	Aldehydes, Ketones and Carboxylic Acids: 3.1 Nomenclature and structure of Carbonyl groups 3.2 Preparation of aldehydes and ketones 3.3 Physical, Chemical Properties and uses 3.4 Nomenclature and structure of Carboxylic groups 3.5 Preparation of carboxylic Acids 3.6 Physical, Chemical Properties and uses	(08)
Unit IV	Cycloalkanes, Cycloalkenes and Alkadienes: 4.1 Cycloalkanes- Introduction, Methods of formation, Chemical properties 4.2 Cycloalkenes -Introduction, Methods of formation, Chemical properties 4.3 Alkadienes- Introduction, Classification, Methods of formation, Chemical Properties	(06)

Course Outcomes: After completion of the course students will be able to...

1. Apply the fundamental principles of organic chemistry to reaction mechanism.
2. Explain the preparations and uses of alcohols, phenols and ethers.
3. Describe preparations and uses of aldehydes, ketones and carboxylic acids.
4. Differentiate between the properties of cycloalkanes, cycloalkenes and alkadienes.

References:

1. Morrison Robert, Boyd Robert. 1998. Organic Chemistry: Prentice Hall.
2. Sykes Peter. 2003. A Guidebook to Mechanism in Organic Chemistry: Pearson Education.
3. Mukharji S. M., Singh S. P., Kapoor R. P., Dass R. 2017. Organic Chemistry- As per UGC Syllabus: New Age International Publisher.
4. Eliel Ernest, Welen Samuel. 1994. Stereochemistry of Carbon Compounds: Wiley India Edⁿ.
5. Kalsi P. S. 2017. Stereochemistry: Conformation & Mechanism: New Age International Publishers.
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Credits 2	SEMESTER II Course II Paper IV: Basic Analytical Chemistry (BDCT 125)	Contact hours (30)
<p>Course Objectives: Students should be able to...</p> <ol style="list-style-type: none"> 1. Understand the basic concepts in analytical chemistry. 2. Get familiar with the basic laboratory reagents and their uses. 3. Learn the safety symbols and proper use of equipment. 4. Gain the knowledge of analytical approaches required for chemical analysis. 		
Unit No.	Content	No. of hours per unit
Unit I	<p>Scope and Importance of Analytical Chemistry:</p> <p>1.1 Introduction-Scope and importance of Analytical Chemistry</p> <p>1.2 Chemical Analysis-Qualitative and Quantitative, Major, Minor, Trace constituents</p> <p>1.3 Steps in Chemical Analysis</p> <p>1.4 Uses of Chemical Analysis</p>	(08)
Unit II	<p>Laboratory Reagents:</p> <p>2.1 Classification of reagents according to their action-Acids, Bases, Salts, Complexing Agents, Oxidizing Reducing Agents, Precipitating Agents, Chelating Agents</p> <p>2.2 Primary and Secondary Standards-Definitions, Characteristics, Uses</p> <p>2.3 Introduction to terms: Bulk chemicals and Fine chemicals</p> <p>2.4 Chemicals and their grades</p>	(08)
Unit III	<p>Laboratory Equipments and Their Uses:</p> <p>3.1 Introduction-Laboratory safety</p> <p>3.2 Laboratory Symbols</p> <p>3.3 Analytical Balance</p> <p>3.4 Glasswares and their uses</p>	(08)
Unit IV	<p>Analytical Approaches:</p> <p>4.1 Types of errors</p> <p>4.2 precision & accuracy</p> <p>4.3 absolute and relative uncertainty</p> <p>4.4 Significant figures; significant figures in Arithmetics</p> <p>4.5 Addition, subtraction, multiplication and division. Mean and standard Deviation</p>	(06)

Course Outcomes: After completion of the course students will be able to...

1. Classify the qualitative and quantitative analysis.
2. Identify the various reagents as per their action.
3. Conduct the experiments using proper set of apparatus.
4. Identify and calculate errors in chemical analysis.

References:

1. Dahm Donald, Nelson Eric. 2012. Calculation in Chemistry: W. W. Norton & Company.
2. Rao C. N. R. 2015. University General Chemistry -An Introduction to Chemical Science: Laxmi Publications.
3. Soni P., Dharmarha O., Dash U. 2011. Text book of Physical Chemistry: SultanChand and Son.
4. Bassett J., Denney R. C., Jeffary G. H., Medha J., 1994. Vogels Textbook of Quantitative Inorganic Analysis: Longman Higher Education.
5. Chatwal Gurdeep, Anand Shyam. 2016. Instrumentation Methods of Chemical Analysis: Himalaya Publishing House.
6. Sharma B. K. 2000. Industrial Chemistry: Goel Publishing Housing.

Credits 2	SEMESTER II Course II Practical Paper II BDCP 126	No. of Hrs. 60
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Course Objectives: Students should be able to...

1. Study the different elements in organic compound qualitatively.
2. Determine the functional groups of molecules by qualitative analysis.
3. Gain the knowledge of preparation of organic compounds.
4. Study the qualitative determination of acids, bases and adulteration of milk.
5. Learn the calibration techniques of glass wares.

1. Detection of elements Nitrogen from the given samples by Lassaignes test:

- 1.1 Urea
- 1.2 Aniline
- 1.3 Thiourea
- 1.4 Acetanilide

2. Preparation of p-nitroacetanilide from acetanilide.

3. Identification of functional groups from given organic compounds.

- 3.1 Benzoic acid
- 3.2 2-naphthol
- 3.2 Aniline
- 3.3 Ethyl acetate
- 3.4 Ethyl methyl ketone

4. Identify acids and bases from given solution (HCl, H₂SO₄, CH₃COOH etc.)

- 4.1 pH indicator
- 4.2 pH metry

5. Adulteration of milk for qualitative determination for presence of:

- 5.1 Detergent
- 5.2 Starch
- 5.3 Glucose
- 5.4 Urea

6. Calibration of laboratory glasswares

- 6.1 Beakers
- 6.2 Measuring cylinders
- 6.3 Volumetric Flasks

Course Outcomes: After completion of the experiments students will be able to...

1. Identify organic compounds using qualitative analysis.
2. Prepare different organic compounds.
3. Identify the acids and bases from unknown samples.
4. Recognize the adulteration of milk.
5. Calibrate the laboratory glasswares.

References:

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2. Venkateswaran V. 2012. Basic Principles of Practical Chemistry: Sultan Chand and Sons.
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5. Aparnathi K. D., Shaikh A. I., Patel S. I. 2020. Qualitative Tests for Detection of Common Adulterants in Milk: Director of Research Anand Agricultural University Anand-388110.
6. Verma N. K., Vermani B. K., Verma N., Comprehensive Practical Chemistry: Laxmi Publication (P) LTD.

