Estd. 1962
"A++" Accredited by
NAAC (2021)
With CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA

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शिवाजी विद्यापीठ, कोल्हापूर -४१६००४,महाराष्ट्र

दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्याससमंडळे विभाग दुरध्वनी ०२३१—२६०९०९४
०२३१—२६०९४८७

SU/BOS/Science/11 **Date: 02/01/2024**

To,

The Principal, All Concerned Affiliated Colleges/Institutions Shivaji University, Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science) Shivaji University, Kolhapur.

Subject: Regarding syllabi of as per NEP-2020 under the Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of degree programme under the Faculty of Science and Technology.

1.	B.Sc Part II Drug Chemistry (1.0)
2.	B.C.A. Part II NEP 2020 (2.0)
3.	B.C.A. Part III NEP 2020 (1.0)
4.	Department of AGPM:-Value Added Course : **1) Sericulture,** **2)Bio-fertilizers and Manures**
5.	Syllabus Open Elective for All Faculty UG & PG Program : **1.छत्रपती शिवाजी महाराज जीवनपरिचय(Online MOOC)** **2.Innovation and Entrepreneurship-I** **3. Innovation and Entrepreneurship-II**

This syllabus, nature of question and equivalence shall be implemented from the academic year 2024-2025 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020 (Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2024 & March/April 2025. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

By Registrar
Dr. S. M. Kubal

Copy to:

1	The Dean, Faculty of Science & Technology	5	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	6	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	7	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	8	Centre for Distance Education

SHIVAJI UNIVERSITY, KOLHAPUR

Established: 1962

A^{++} Accredited by NAAC (2021) with CGPA 3.52
Structure and Syllabus in Accordance with

National Education Policy - 2020

Bachelor of Science

Part - II

Drug Chemistry

under
Faculty of Science and Technology

(To Be Implemented From Academic Year 2024-25)

Structure of the Course:

2) Semester III

Sr. No.	Subject title	Theory					Practical	
		Course code	Title of Course	No. of lectures per week	Credits		No. of lectures per week	Credits
1.	Drug Chemistry	BDCT-301	Elemental Drug Chemistry -I	6	4	Drug Chemistry practical BDCP 307	8	4
		BDCT - 302	Bioinstruments-I	6	4			
2.	Drug Chemistry	BDCT-303	Physicochemical Properties	6	4	Drug Chemistry practical BDCP 308	8	4
		BDCT-304	Fundamentals of Pharmaceutics	6	4			
3.	Chemistry	BDCT-305	Organic Chemistry	6	4	Chemistry practical BDCP 309	8	4
		BDCT-306	Analytical Chemistry	6	4			
4.	Environment			2	2			

2) Semester IV

Sr. No	Subject title	Theory					Practical	
		Course No. and Course Code	Title of Course	No. of lectures per week	Credits		No. of lectures per week	Credits
1.	Drug Chemistry	BDCT 401	Biochemistry	6	4	Practical BDCT 407	8	4
		BDCT 402	Analysis Techniques-II	6	4			
2.	Drug Chemistry	BDCT 403	Spectroscopic Techniques-I	6	4	Practical BDCT 408	8	4
		BDCT 404	Bioinstruments-II	6	4			
3.	Chemistry	BDCT 405	Physical Chemistry	6	4	Practical BDCT 409	8	4
		BDCT 406	Inorganic Chemistry	6	4			

B.Sc. II : Evaluation structure

Semester III

	ESE	Internal Exam			Practical			Submission	Total
		ISE-I	ISE-II	Home Assignment		Exam	Journal	Student Performance	
BDCT-301	30	5	5	10	Practical-BDCT-307	15	5	5	150
BDCT-301	30	5	5	10		15	5	5	

Semester IV

	ESE	Internal Exam			Practical			Submission	Total
		ISE-I	ISE-II	Home Assignment		Exam	Journal	Industrial visit/ Educational Tour + Student Performance	
BDCT-401	30	5	5	10	Practical-BDCT-407	15	5	5	150
BDCT-401	30	5	5	10		15	5	5	

Structure and titles of the course of B.Sc. II Course

Semester III

Code	Name of Course	Units
BDCT-301	**Elemental Drug Chemistry-I** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:** Introduction to Medicinal Chemistry **Unit II:** Indian System of medicine and Homoeopathy **Unit III :** Drug Absorption and Distribution **Unit IV :** Drug Metabolism
BDC-302	**Bio-instruments-I** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:** Introduction to Bioinstruments **Unit II**: Centrifugation and its types **Unit III :** Basic Chromatographic Techniques **Unit IV :** Advance chromatographic Techniques
BDCT-303	**Physicochemical Properties** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:**Thermoregulation **Unit II:** Electrophoresis **Unit III:** Electromotive Force **Unit IV:** Surface Chemistry
BDCT-304	**Fundamentals of Pharmaceutics** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:** Mixing and Homogenization **Unit II:** Clarification and Filtration **Unit III:** Extraction and Galenicals **Unit IV:** Distillation
BDCT-305	**Organic Chemistry** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:** Amine and Diazonium Salt **Unit II:** Chemistry of biomolecules **Unit III:** Organic Name Reactions and Synthetic Reagents **Unit IV:** Stereochemistry

BDCT-306	**Analytical Chemistry** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:** Optical methods of analysis **Unit II:** Atomic Absorption Spectroscopy **Unit-III:** Flame Emission Spectroscopy **Unit IV:** Qualitative Analysis

Semester IV

Code	Name of Course	Units
BDCT-401	**Biochemistry** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:** Carbohydrate Metabolism **Unit II:** Lipid **Unit III:** Lipid Metabolism **Unit IV:** Vitamins and Minerals
BDC -402	**Analysis Techniques-II** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:**Conductometric and Potentiometric Titration **Unit II:** Nephelometry and Turbidimetry **Unit III:** Complexometric Titration **Unit IV:** Acid Base Titration
BDCT-403	**Spectroscopic Techniques-I** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:** Introduction to Spectroscopy **Unit II:** UV Spectroscopy **Unit III:** IR Spectroscopy **Unit IV:** NMR Spectroscopy
BDCT-404	**Bio-instruments-II** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:** X-ray diffraction **Unit II:** Nuclear Chemistry **Unit III:** Magnetic Resonance Imaging **Unit IV:** Polymer and its applications in drug
BDCT-405	**Physical Chemistry** (CREDITS:02; TOTAL HOURS : 45)	**Unit I:** Electrochemistry part I: Electrolytic Conductance and Transference

		Unit II: Electrochemistry Part II: Electromotive Force **Unit III:** Phase Equilibrium **Unit IV:** Physical properties of liquids
BDCT-406	**Inorganic Chemistry** (CREDITS:02; TOTAL HOURS : 45)	**Unit I: Study of periodic properties of elements** **Unit II:** Co-ordination Chemistry **Unit III:** Bio Inorganic Chemistry **Unit IV:** Chelation

Semester – III

BDCT-301 Elemental Drug Chemistry-I [45 Lectures]

Course Objectives: Student will able to

1. Understand the basic concepts in medicinal chemistry.
2. Introduce different Indian system of medicine
3. Learn the interrelationship among absorption distribution and metabolism of drugs.
4. Know the drug metabolism.

Credits (Total Credits 2)	**SEMESTER-III BDCT 301 Elemental Drug Chemistry-I**	**No. of Lectures per unit/credits**
UNIT - I	**Unit I: Introduction to Medicinal Chemistry**	**(14)**
	History, Drugs and medicinal chemist, Why should drugs work? Where do drugs work? Cell structure, Drug targets at molecular level, intermolecular bonding forces, electrostatic bonds, Hydrogen bonds, Van der Waal's interaction, dipoledipole and ion dipole interaction, Repulsive interactions, Role of water and hydrophobic interactions, Drug targets, Lipid as drug target, Carbohydrates a drug target, Protein and nucleic as a drug target	
UNIT - II	**Indian System of Medicine and Homoeopathy**	**(16)**
	Introduction to Indian System of Medicine and Homoeopathy (ISH&M)- Ayurveda, Siddha (Classification), Unani and Homoeopathy, and therapies such as Yoga and Naturopathy. Ayurveda- Definition, Concept, classification of Ayurvedic Drugs, diagnosis, treatment, Dietics in Ayurveda (2 examples)	

	Siddha- Definition, Concept, Basic Human Principals-Three humours, 5 Sheaths (Koshan), Ten Pranic Air (Vayus) ((2 examples) Unani – Definition, Concept, Principles of unani medicine (2 examples) Homoeopathy –Defination, Concept, Homoeopathy in india, Benefits of homoeopathy (2 examples)	
UNIT - III	**Drug Absorption and Distribution**	**(14)**
	Absorption- Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug through intra muscular routes, **Distribution** Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs	
UNIT - IV	**Drug Metabolism**	**(16)**
	Drug metabolism and basic understanding metabolic pathways, renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs and ,heterofermentative pathways)	

Course outcomes: Student should be able to

1. Recollect the fundamentals concepts of medicinal chemistry
2. Analyze different Indian systems of medicine and can choose appropriate one
3. Acquire knowledge of absorption metabolism and distribution of drugs
4. Elustrate drug metabolism

References-

1. Graham L. Patrick's , An Introduction to Medicinal Chemistry (Unit I)
2. Dr. K. M. Nadkarni's, Indian Materia Medica, Bombay Popular Prakashan, (1982) (Volume-I Unit II)
3. Alka L Gupta, Medicinal Chemistry, Pragati Prakashan (2019) (page no 112, 113, 124-137 Unit IV)
4. V. K. Ahluwalia & Madhu Chopra, Medicinal chemistry, (page no 73-94 Unit IV)

5 N. K. Jain, Textbook of Professional Pharmacy, Vallabh Prakash, Delhi (Unit III & Unit IV)

6. B. N. Ladu, H. G. Mandel and E. L. Way, Fundamentals of Drug Metabolism and Disposition by William and Welkins Co. 428 E, Preston Street. Baltimore. (Unit III & Unit IV)

7. J. R. Robinson & V. Lee, Controlled Drug Delivery: Fundamentals & Applications, Marcel Dekker Inc., NY. (Unit III & Unit IV)

BDCT 302 Bio-instruments - I

Course Objectives: Student will be able to

1. Understand the basic concepts of Bio-instruments
2. Understand Centrifugation process and its types
3. Learn different chromatographic Techniques
4. Introduce Advanced chromatographic Techniques

Credits (Total Credits 2)	**SEMESTER-III BDCT 302 Bio-instruments - I**	**No. of Lectures per unit/credits**
UNIT - I	**Introduction to Bio-instruments -I**	**(16)**
	Concepts- Analytical techniques, analyte, method, procedure and protocol. Principle construction, working and applications for analysis of biomolecules of following instruments. pH meter, Centrifuge (RCF, sedimentation concept), different types of centrifuges. Mass spectroscopy (Bainbridge mass spectrometer). Atomic absorption spectrometer (AAS). 0	
UNIT - II	**Centrifugation and its Types**	**(16)**
	Basic principles, RCF, Sedimentation coefficient, Svedberg's constant, Types of centrifuge: High speed and Ultracentrifuge, Differential and density gradient centrifugation, application of preparative & analytical centrifuges, gradient centrifuge	
UNIT - III	**Basic Chromatographic Techniques**	**(16)**
	Introduction, Theory, Principle and applications of Thin layer chromatography, Paper chromatography, Column chromatography, Adsorption column chromatography, Size exclusion chromatography, Ion exchange chromatography, Affinity chromatography	
UNIT - IV	**Advanced Chromatographic Techniques**	**(12)**
	Theory, Principle of HPLC, construction and working of HPLC , Applications of HPLC Theory, Principle of GLC , construction and working of GLC, Application of GLC	

Course outcomes-Students should be able to

1. Explain basics of Bio instruments
2. Compute and explain Centrifugation and its types
3. Apply different chromatographic Techniques for sepatration and Purification.
4. Evaluate Advanced chromatographic Techniques

References

1. J. K. Nigel, Simpson's Solid phase extraction, Principles, techniques and applications (Unit II, Unit III)
2. C.V. S. Subrahmanyam, Physical pharmaceutics (Unit I, Unit II)
3. C.V. S Subrahmanyam et al., Pharmaceutical engineering principles and practices (unit IV) 4. S. M. Khopkar, Basic Concepts of Analytical Chemistry (Unit III)

BDCP-307 Drug Chemistry Practical

Course Objectives: Student will be able to

1. Understand sedimentation technique
2. Introduce to isolate bio-molecules from natural sources
3. Introduce to prepare ayurvedic dosage
4. Study the synthesis of different compounds

Credits (Total Credit 04)	**SEMESTER-III BDCP 307 Drug Chemistry Practical**	**No. of Lectures per unit/credits**
	1. Preparation of 7-hydroxy-4-methyl coumarin 2. Preparation of cinnamic acid from benzaldehyde and malonic acid 3. Preparation of Anthraquinone from anthracene 4. Isolation of pectin from fruits 5. Separation of compounds by column chromatoghraphy 6. Sedimentation of milk or curd 7. Chromatographic Separation of lipid, amino acids and carbohydrates 8. Preparation of ayurvedic dosage form. (any 2 example) 9. Preparation of phthalamide from phthalianhydride 10. Viva voce 11. Practical record Note- Any other relevant practical may be added	

Course outcomes-Students should be able to

1. Synthesize organic pharmaceutical compounds
2. Separate out compounds by chromatographic techniques
3. Prepare ayurvedic dosage form
4. Analyze different compounds by using advanced chromatographic techniques

Practical references-

1. A. J. Hannaford, P. W. G. Smith and A. R. Tatehell, Practical Organic Chemistry, The ELBS/Longman, London.
2. F. C. Mann, and B. C. Saunders, Practical Organic Chemistry, The English Language Book Society and logman Group limited, London.
3. A. H. Beckett and J. B. Stenlake, Practical Pharmaceutical Chemistry Vol. I and II., The Athlone Press of the University of London.
4. Dr. K. M. Nadkarni, Indian Materia Medica, Bombay Popular Prakashan, 1982 (Volume-I)

BDCT-303 Physiochemical Properties

Course Objectives: Student will be able to

1. Understand thermoregulation in body
2. Learn electrophoresis technique
3. Study the mechanism of absorption
4. Gain knowledge of electromotive force

Credits (Total Credits 2)	**SEMESTER-III BDCT 303 Physiochemical Properties**	**No. of Lectures per unit/credits**
UNIT - I	**Thermoregulation**	**(14)**
	Thermometric properties and types of thermometers with construction and working (clinical, thermocouple, bimetallic, platinum resistance, thermistor - thermometers). Body temperature and its regulation.	
UNIT - II	**Electrophoresis**	**(16)**
	Introduction, Principle, theory and applications of paper electrophoresis, Agarose gel. Electrophoresis, SDS PAGE, Pulse field electrophoresis, 2D PAGE	
UNIT - III	**Electromotive Force**	**(14)**

	Galvanic cells, Concept of EMF of a cell. Measurement of EMF of a cell. Standard electrode potential, Nernst equation and its importance, Types of electrode (Metal-Metal ion electrode, Amalgam electrode, Gas electrode, Metal), insoluble salt electrode, Oxidation-reduction electrode, Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data, Calculation of equilibrium constant from EMF data, pH determination using hydrogen electrode and quinhydrone electrode, Numerical problems**.**	
UNIT - IV	**Surface Chemistry**	**(16)**
	Introduction: Adsorption, Mechanism of adsorption, Factors affecting adsorption. Types of adsorption: Physical and Chemical Adsorption. Types of adsorption isotherms. Freundlich adsorption isotherm, Langmuir adsorption isotherm with derivation. BET equation and determination of surface area of adsorbent by BET equation. Applications of adsorption.	

Course outcomes-Students should be able to

1. Explain Thermoregulation in body
2. Differentiate and evaluate different electrophoresis Technique
3. Illustrate the mechanism of adsorption
4. Calculate equilibrium constant from electromotive force

References:

1. A. S. Negi and S. C. Anand, A Text Book of physical Chemistry, New Age International publ, 2nd Ed. (Unit I, IV)
2. Dr. Robin Martin, Gel Electrophoresis : Nucleic acids (Unit II)
3. S. Glasstone. (Mac Millan.) An introduction to electrochemistry (Unit III)
4. Gurdeep Raj, Advanced Physical Chemistry (Unit I, III)
5. K. L. Kapoor, Text Book Of Physical Chemistry (Thermodynamics and chemical Equilibrium) (Unit I)
6. R. A. Alberty, Physical Chemistry (Wiley Eastern Ltd.) (Unit I, III)
7. Gurdeep Raj, Surface chemistry (Adsorption) (Unit IV)

BDCT-304 Fundamentals of Pharmaceutics

Course Objectives: Student will be able to

1. Introduce mixing and homogenization Techniques
2. Understand Distillation Process
3. Study clarification and filtration.
4. Learn extraction process

Credits (Total Credits 2)	**SEMESTER-III BDCT- 304 Fundamentals of Pharmaceutics**	**No. of Lectures per unit/credits**
UNIT - I	**Mixing and Homogenization**	**(16)**
	Liquid mixing and powder mixing, Mixing of semisolids. Study of silverson Mixer-Homogenizer, planetary Mixer; Agitated powder mixer; Triple Roller Mill; Propeller Mixer, colloid Mill and Hand Homogeniser. Double cone mixer.	
UNIT - II	**Clarification and Filtration**	**(14)**
	Theory of filtration, Filter media; Filter aids and selection of filters. Study of the following filtration equipments-Filter Press, sintered filters, Filter candles, Meta filter.	
UNIT - III	**Extraction of Galenicals**	**(16)**
	Extraction techniques: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction Extraction and isolation of plant drugs: conventional and modern techniques used in extraction and separation of phytoconstituents. **Extraction of GalenicalsProducts**: Principle of extraction and methods of extraction (Infusion, Decoction, Maceration), Preparation of tinctures, dry and soft liquid extracts.	
UNIT - IV	**Distillation**	**(14)**
	Simple distillation and Fractional distillation, steam distillation and vacuum distillation. Study of vacuum still, preparation of purified water I.P. and water for Injection I.P. construction and working of the still used for the same.	

Course outcomes-Students should be able to

1. Explain Mixing and Homogenization process

2. Handle different filtration equipments.
3. Analyze extraction methods for galenical product and able to select appropriate method
4. Differentiate distillation methods and select suitable distillation method

References:

1. J.S. Jellinek, John Wiley & Sons, NY. Formulation and Function of Cosmetics (Unit I)
2. G. R. Chatwal, Pharmaceutical Analytical Chemistry, (Unit II)
3. Indian pharmacopoeia. (Unit IV)
4. S. M. Khopkar, Basic concepts of analytical chemistry (Unit IV)
5. Dr. N. M. Choudhuri, A study on MateriaMedica (Unit III)
6. P. J. Cullen's Pharmaceutical Blending and Mixing (Unit I)
7. M.W. Jornitz, Toyler & Francis LTD , Filtration and Purification in the biopharmaceutical industry (Unit II)

BDCP-308 Drug Chemistry Practical Course

Objectives: Student will be able to

1. Introduce preparation of syrup.
2. Learn preparation of Elixirs.
3. Understand preparation of various solutions.
4. Know the synthesis of creams.

Credits (Total Credit 04)	SEMESTER-III BDCP 307 Drug Chemistry Practical	No. of Lectures per unit/credits
	1 . Preparation of Syrups a) Syrup IP'66 b) Compound syrup of Ferrous Phosphate BPC'68 2. Preparation of Elixirs a) Piperazine citrate elixir b) Paracetamolpediatric elixir 4. Preparation of Solutions a) Strong solution of ammonium acetate b) Cresol with soap solution c) Lugol's solution (strong iodine solution) 5. Preparation of Suspensions 6. Separation of two organic compounds by fractional distillation 7. Seperation of two compounds by Steam distillation 8. Preparation of water for injection 9. Gel electrophoresis 10. Extraction of volatile oils and their chromatographic profiles 11. viva 12. Practical record Note- Any other relevant practical may be added	

Course outcomes-Students should be able to

1. Develope preparative skill in syrup preparation
2. Prepare Elixirs
3. Prepare various solutions
4. Synthesize different types of creams

Practical references-

1. D. M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
2. A. H. Beckett & J. B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
3. M. Paye, A. O. Barel, H. Maibach, Handbook of Cosmetic Science and Technology.
4. G. R. Chatwal, PharmaceuticalInorganic Chemistry
5. H. C. Ansel, Introduction to Pharmaceutical Dosage Forms, K M Varghese & Co., Bombay.

BDCT-305 Organic Chemistry

Course Objectives: Student will able to

1. Learn the concepts of synthetic organic chemistry
2. Understand reaction mechanism

3. Understand basics in reactions of amino acids, proteins etc.
4. Enhance knowledge about dye industry.

Credits (Total Credits 2)	**SEMESTER-III BDCT- 305 Organic Chemistry**	**No. of Lectures per unit/credits**
UNIT - I	**Amine and Diazonium Salt**	**(09)**
	Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, HofmannBromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation. Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes.	
UNIT - II	**Chemistry of bio-molecules**	**(20)**
	a) Carbohydrates Classification based on chemical constitution with suitable example- Sources – open chain and ring structure of carbohydrate containing five and six carbon atom, determination of configuration of glucose and fructose, Mutarotatation, reaction of glucose and fructose, acetylation, osazone, methylation, reduction and oxidation , chain lengthening and shortening reaction . **Amino acid, Protein and Nucleic acid** General structure of α amino acid, isoelectric point, synthesis of an amino acid ammination of halo acid, azalactone, Cirtius method, Gabriel method. Synthesis of polypeptide - Bergmann method, Fischer method, solid phase synthesis, structure of protein, Nucleic acid – Classification, structure of nucleosides & nucleotides.	**(10)** **(10)**
UNIT - III	**Organic Name Reactions and Synthetic Reagents**	**(10)**
	Perkin reaction, Reformatsky Reaction, Knovengel Condensation , Claisen condensation, Mannich Reaction, Pinacole – Pinacolone Reaction, Clammensen Reduction, Reimer – Tiemann reaction. Synthetic Reagent- Aceto Acetic ester (Ethyl aceto acetate)and Grignard Reagent	
UNIT-IV	**Stereochemistry**	**(06)**

	Nomenclature of Conformational isomers, Conformational analysis of Ethane and Butane, threo and erythreo isomerism	

Course outcomes-Students should be able to

1. Recapitulate the knowledge about amine, diazonium salts
2. Explain reaction and synthesis of amino acid, nucleic acid and protein.
3. Explain applications of various name reactions
4. Discuss nomenclature of conformational isomers

References: -

1) R.L. Madan's Chemistry for Degree student (Unit-I,II.)
2) T.W. Graham Solman& Craig B. Fryhle's Organic chemistry– 9th Edition. (Unit-I,II.)
3) Morrison & Boyd's Organic Chemistry– 6th Edition. (Unit-I,II,V)
4) Clayden, Greeves& Warren's Organic Chemistry– 2nd Edition. (Unit-I)
5) V. K. Ahluwalia, RakeshParuskar's Organic reaction mechanism– 4th Edition. (Unit-IV)
6) P.S. Kalsi, D.Nasipuri,elien's Stereochemistry –(Unit-V.)
7) Elile's Stereochemistry of organic compounds –(Unit-V.)
8)Nasipuri's Stereochemistry –(Unit-V.)

BDCT-306 Analytical Chemistry

Course Objectives: Student will be able to

1. Learn basic principle of spectroscopy
2. Know the principle and working of dropping mercury electrode
3. Enhance knowledge about qualitative and quantitative analysis
4. Understand various steps in analysis of the materials by using gravimetric analysis.

Credits (Total Credits 2)	**SEMESTER-III BDCT- 306 Analytical Chemistry**	**No. of Lectures per unit/credits**
UNIT - I	**Optical methods of analysis**	**(14)**
	Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. ***UV-Visible Spectrometry:*** Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument	

	Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator& detector) for single and double beam instrument; sampling techniques.	
UNIT - II	**Polarography**	**(16)**
	Introduction to voltammetric methods of analysis, principle of polarographic analysis, dropping mercury electrode, instrument and working of polarographic apparatus, ilkovic equation and quantitative analysis, polarogram and chemical analysis, analysis of mixture of cations, factors affecting polarographic wave, quantitative applications, numerical problems	
UNIT - III	**Flame Emission Spectroscopy**	**(14)**
	Introduction and theory of atomic emission spectroscopy, Principle- Measurement of emission of atomic species, advantages and disadvantages of FES, Instrumentation of single beam FES, Inferences in emission spectroscopy, method of analysis-calibration curve method, standard addition method and internal standard method, qualitative and quantitative applications of FES, Numerical problems	
UNIT - IV	**Qualitative Analysis**	**(16)**
	Principal of qualitative and quantitative analysis, Classifaction of organic and inorganic qualitative analysis, Identification of compounds, the functional group analysis, Application of solubility product and common ion effect, seperation of cation into groups, Application of complex	
	formation, Application of oxidation – reduction in inorganic qualitative analysis, Choice of groups reagents & Group analysis. Inter faring anions (Flurate, borate, oxalate & phosphate)	

Course outcomes-Students should be able to

1. Explain basic terms related to spectrophotometer.
2. Illustrate electro analytical methods and its principle
3. Predict analysis method for various materials.
4. Compare the various analysis techniques

References:

1. G.H. Jeffery, J. Bassett, J. Mendham, & R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989. (Unit-V)
2. H. H. Willard, L. L. Merritt, J. Dean & F. A. Settoe, Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA,1988. 27.(Unit-II,III).
3. G. D. Christian, Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004. (Unit-I)
4. D. C. Harris, Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. S. M. Khopkar, Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009. Unit- (V,IV)
6. D. A. Skoog, F. J. Holler & T. A. Nieman, Principles of Instrumental Analysis, Cengage Learning India Ed. (Unit-I)
7. O. Mikes, Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979. (Unit- I)
8. R. V. Ditts, Analytical Chemistry; Methods of Separation, Van Nostrand, 1974.
9. Shreves chemical processes industries. (Unit-V)
10. B.K.Sharma, Industrial chemistry (Unit-V)
11. J. Mendham, Vogels A Text books of Quantitative Chemical Analysis. (Unit-V)
12. W. E. Haris, An Introduction to Chemical Analysis.(Unit-V)
13. D. A. Skoog, Fundamentals of Analytical Chemistry. (Unit-IV,V)
14. G. Svehla, Vogels Qualitative Inorganic Analysis, Pearson. (Unit- IV)
15. R. M. Verma, Analytical Chemistry Theory & Practice.(Unit-IV)
16. W. Bernagrd King, Experiments in General Chemistry.(Unit-IV)

BDCP-309 Chemistry Practical

Course Objectives: Student will be able to

1. Study the analytical technique for structure determination of organic compound. .
2. Learn to find out the amount of different compound.
3. Understand chromatographic techniques for separation and purification of compound.
4. Understand different instrumental methods to analyze compounds

Credits (Total Credit 04)	**SEMESTER-III BDCP 308 Chemistry Practical**	**No. of Lectures per unit/credits**

	1) Organic qualitative analysis: (Minimum 8 compounds) Acids: Salicylic acid, pthalic acid, aspirin, cinnamic acid, Succinic acid, Oxalic acid, Phenol: β napthol, P Nitro phenol, O Nitro phenol. Base: P nitro aniline, O Nitro aniline, M Nitro aniline, diphenyl amine. Neutrals: Acetomide, ethyl methyl Ketone , Acetophenone, Benzophenone, Benzaldehyde, ethyl acetate, Chloro benzene, bromo benzene, Nitrobenzene, M-dinitrobenzene, naphthalene, thiourea. **2) Organic Estimation:** a) Estimation of Acetone b) Estimation of glycine c) Estimation of Vitamin C **3) Organic Preparations: (any three)** a) Preparation of Benzoic acid b) Preparation of P – nitro acetanilide c) Preparation of Benzamide d) Preparation of Dihydropyrimidone e) Preparation of Dibenzalacetone (Green synthesis) **4) Colorimetry:** a) Determination of unknown concentration of potasium permanganate solution. **5) Conductometry:** a) Determination of strength of strong acid by titrating aganist strong alkali **6) pH Metry:** a) Determination of PH of given soil samples 7) Determination of percentage purity of boric acid using supplied sodium hydroxide 8) Determination of titrable acidity in the given sample of milk or lassi of alkali content of antacid tablet using HCl 9) Determination of percentage of nitrogen present in the given sample of nitrogenous fertilizer 10) Preparation of azo dye 12) Estimation of ester 12) Determination COD in water samples	

Course outcomes-Students should be able to

1. Identify organic compound by qualitative analysis
2. Standardize and estimate quantity of acetone, glycine etc
3. Determines normality by titrations of strong acid Vs strong base
4. Synthesize organic compounds and Calculate percent practical yield of various organic compounds

Practical references-

1. Vogel's text book of Qualitative Chemical Analysis (Longman ELBS Edition)

2. S. M. Khopkar, Basic concepts in Analytical Chemistry
3. J. N. Gurtu & R. Kapoor Advanced experimental Chemistry Vol. I. Physical (S. Chand &Co.)
4. S. W. Rajbhoj, Chondhekar ,Systematic Experimental Physical Chemistry – by. *(Anjali Publ.)*
5. H. N. Patel, S. R. Jakali, H. P. Subhedar, Miss. S.P. Turakhia, College Practical Chemistry *(Himalaya Publishing House, Mumbai.)*

SEMESTER- IV

BDCT-401 Biochemistry

Course Objectives: Student will be able to

1. Learn basic carbohydrate metabolism
2. Gain knowledge about lipids
3. Understand fundamentals of lipid metabolism
4. Learn about vitamins and minerals

Credits (Total Credits 2)	**SEMESTER-IV BDCT-401 Biochemistry**	**No. of Lectures per unit/credits**
UNIT - I	**Carbohydrate Metabolism**	**(14)**
	Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency ; Glycogen metabolism Pathways and glycogen storage diseases (GSD); Gluconeogenesis- Pathway and its significance	
UNIT - II	**Lipid**	**(16)**
	Definition and classification of lipids with two examples of each class, Structure and functions of i) Simple lipids: triglyceride and fatty acids ii) Compound lipids: Phospholipids, viz. lecithin, cephalin iii) Derived lipids: steroids (cholesterol). Fatty acids – properties, classification, essential & nonessential fatty acids Lipid bilayer and Fluid mosaic model of membrane	
UNIT - III	**Lipid Metabolism**	**(14)**
	ß- Oxidation of fatty acid (Palmetic acid): activation of fatty acid, carnitine transport system, ß oxidation cycle, significance, energetic; Biosynthesis of fatty acid (Palmetic acid) & significance, Structure of Fatty acid synthatase complex (Eukaryotes).	

UNIT - IV	**Vitamins and Minerals**	**(16)**
	Definition, classification of vitamins; Sources, structure, RDA value, coenzyme form, biochemical functions & deficiency symptoms of water soluble vitamins viz. Vitamin C, Thiamine, Riboflavin, Niacin, Pyridoxine and fat soluble vitamins viz. Vitamin A, D, E, K. Classification of minerals; Sources, RDA value, cofactor form, biochemical functions & disease states of minerals.	

Course outcomes: Student should be able to

1. Explain carbohydrate metabolism
2. Interpret knowledge about lipids
3. Illustrate fundamentals of lipid metabolism
4. Recite the knowledge about vitamins and minerals

References

1. A. L. Lehniger, David L. Nelson & Cox. W. H. Freeman & company. Lehniger's Principles of Biochemistry, Fourth edition (2005) & Fifth edition (2008). (Unit I, II, III, IV)
2. Jermy M. Berg, John L. Tymoczko, LubertStryer, W.H. Freeman, Biochemistry-Sixth edition, 2006. (Unit I, II, III, IV)
3.Voet, Voet & Pratt, John Wiley & sons, Fundamentals of Biochemistry- Fifth edition, 2016.(Unit I, II, III, IV)
4. J. L. Jain, Nitin Jain & Sunjay Jain, Fundamental of Biochemistry- S. Chand Publishing, First Edition, 1979.(Unit I, II, III, IV)
5. U. Satyanarayan, Elsevier India, A Textbook of Biochemistry- Fifth edition, 2017. (Unit I, II, III, IV)
6.A. C. Deb, Fundamentals of Biochemistry, New Central Book Agency, Seventh edition, 2001.(Unit I, II, III, IV)

BDCT-402 Analysis Techniques- II

Course Objectives: Student will be able to

1. Enhance knowledge about fundamentals of titrations.
2. Learn complexometric titrations .
3. Undrstand about conductometric and potentiometric titration.
4. Understand the concept of nephelometric and turbidimetric analysis.

Credits (Total	**SEMESTER-IV BDCT-402**	**No. of hours per unit/credits**

Credits 2)	**Analysis Techniques- II**	
UNIT - I	**Conductometric and Potentiometric titration**	**(16)**
	Conductometry- Introduction, Definitions, Conductivity cell, measurement of conductance by Wheatstone Bridge method, Conductometric titrations, applications. **Potentiometry -** Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.	
UNIT - II	**Nephelometry and Turbidimetry**	**(14)**
	Introduction, Principles and instrumentation of Nephelometric and Turbidimetric analysis, Difference between Nephelometric and turbidimetric measurements, Choice between Nephelometry and Turbidimetry, Factors affecting nephelometric and Turbidimetric measurements, Quantitative Applications, Numerical Problems.	
UNIT - III	**Complexometric Titration**	**(14)**
	Introduction, Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.	
UNIT - IV	**Acid base titration**	**(16)**
	Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves **Non aqueous titration**: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	

Course outcomes: Student should be able to

1. Recite the knowledge about titration and know about its type
2. explain various applications of various titrations in different fields
3. Interpret the importance of different analytical techniques
4. Compute basic terms realated to turbidometric analysis

Reference Books-

1. A. H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A. I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry (Unit III)
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry (Unit IV)
5. J. H. Kennedy, Analytical chemistry principles (unit I, II)
6. S. M. Khopakar, Concepts in analytical chemistry
7. A. I. Vogel's Textbook of Quantitative chemical analysis 3rd edition, (Unit II)
8. Chatwal and Anand'sInstrumental methods of chemical analysis (Unit III)

BDCP-407 Drug Chemistry Practicals

Course objectives: Student will be able to

1. Know identification tests for inorganic compounds (drugs).
2. Learn to find out TDS of water.
3. Aquire skilled to do various types of titrations.
4. Understand about various titration methods.

Credits (Total Credit 04)	**SEMESTER-IV BDCP-407 Drug Chemistry Practicals**	**No. of hours per unit/credits**
	1. Identification tests for inorganic compounds particularly drugs and pharmaceuticals- Limit test for chloride, Sulfate, Arsenic, Iron and Heavy metals 2. Acid-Base titrations (at least 3) 3. Redox titrations (one each of permanganometry and iodimetry). 4. Precipitation titrations (at least 2) 5. Complexometric titration (Calcium and Magnesium). 6. Determination of Turbidity present in water sample by using nephelometer 7. To carry out coductometric titration 8. To carry out potentiometric titration 9. Viva voce 10. Practical record	

Course outcomes-Students should be able to

1. Remember limit tests for inorganic compounds in drugs and Pharmaceuticals
2. Determine amount of substance Present in given sample by precipitation titrations
3. Analyze the acidity or alkalinity of various samples
4. Calculate TDS of water **Practical references:**

1. A. H. Beckett & J. B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. E. J. Schellard, Practical Plant Chemistry for Pharmacy Students, Pitman Medical, London.
4. A. H. Beckett and J. B. Stenlake, Practical Pharmaceutical Chemistry Vol. I and II., The Athlone Press of the University of London.

BDCT-403 Spectroscopic Techniques-I

Course Objectives: student will be able to

1. Remember basic principles of Spectroscopy techniques.
2. Understand the types of spectroscopy.
3. Differentiate between absorption and emission spectroscopy.
4. Interpret spectral data

Credits (Total Credits 2)	**SEMESTER-IV BDCT- 403 Spectroscopic Techniques-I**	**No. of hours per unit/credits**
UNIT - I	**Introduction to Spectroscopy**	**(16)**
	Meaning of spectroscopy, Nature of electromagnetic radiation: wavelength, frequency, energy, amplitude, wave number and their relationship, Different units of measurement of wavelength and frequency, Different regions of electromagnetic radiations. Interaction of radiation with matter: absorption, emission, fluorescence and scattering. Types of spectroscopy and advantages of spectroscopic methods. Energy types and energy levels of atoms and molecules	
UNIT - II	**UV-Visible Spectroscopy**	**(14)**
	Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect onabsorption spectra, Beer and Lambert‘s law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors-Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications Spectrophotometric titrations, Single component and multi componentanalysis	
UNIT - III	**IR Spectroscopy**	**(15)**

	Introduction, fundamental modes of vibrations in polyatomic molecule Introduction, Principle of IR Spectroscopy, IR Instrumentation, schematic diagram- Fundamental modes of vibrations types and calculation – Condition for absorption of IR radiations Regions of IR Spectrum, fundamental group region, finger print region, Hooks Law for Calculation of vibrational frequency, Factors affecting on IR absorption frequency, Characteristic of IR absorption of following functional groups a] Alkanes, alkenes, alkynes b] Alcohol and phenols c] Ethers d] Carbonyl compounds e] Amines f] Nitro compounds g] Aromatic Compounds	
UNIT - IV	**Nuclear Magnetic Resonance Spectroscopy**	**(15)**
	Introduction, Principles of PMR Spectroscopy, NMR - Instrumentation, Schematic diagram, Magnetic and nonmagnetic nuclei, Chemical shift- definition, measurement, calculation, Factors affecting Chemical shift , Shielding &deshielding, Peak Integration, Merits of TMS as PMR reference compounds , Coupling Constant, Types of Coupling Constant, Spin-spin splitting (n +1 rule), Applications	

Course outcomes: Student should be able to

1. Recapitulate basic knowledge about Spectroscopy.
2. Explain basic concepts of UV-Visible Spectroscopy
3. Illustrate fundamentals of IR Spectroscopy
4. Discuss importance of Nuclear Magnetic Resonance Spectroscopy

References

1. R. Ananthnarayan , Ananthnarayanand Paniker's Textbook of Microbiology, Orient Blackswan publications 2006 (Unit I , Unit II Unit III, Unit IV)
2. Microbiology : An Introduction : Tortora, Funke, Case : 8th Edi. Pearson Education publication (Unit I, Unit II, Unit III, Unit IV)
3. Jacquelyn G. Black, Microbiology , 8th Edi. International student version, Wiley Publication (Unit I, Unit II, Unit III)
4. Wolfagang K. Joklik, Zinsser's Microbiology (1995) McGraw-Hill Co. (Unit I, Unit III)
5. N.C. Dey and T. K. Dey, Medical Microbiology by (Unit II)
6. K. Park, Textbook of Preventive and social medicine, Bhanot publications (Unit II)
7. Ronald Atlas, Robert Brown, Bonus Miller, Basic experimental microbiology by (1986) – Pren- Tice Hall (Unit II)
8. Immunology by Fatima, Saras publication (Unit I, Unit III)

BDCT-404 Bioinstruments-II

Course Objectives: student will be able to

1. Study fundamentals of X-ray diffraction, 2.
Understand Nuclear chemistry
3. Learn about MRI.
4. Understand applications of Polymer.

Credits (Total Credits 2)	**SEMESTER-IV BDCT- 404 Bioinstruments-II**	**No. of Lectures per unit/credits**
UNIT - I	**X- ray Diffraction**	**(14)**
	Origin of X-rays, basic aspects of crystals, Bragg's equation, DyebySherreer equation, X ray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.	
UNIT - II	**Nuclear Chemistry**	**(16)**
	Nucleons and nuclear forces , parameters of nucleus , factors affecting stability of nucleus , Radioactivity, radioactive radiations, radioactive disintegrations , methods of radioactive disintegration, rate of disintegration , half life period $t_{1/2}$, Average life, Activity of radioactive substance, units of radioactivity, disintegration series, Artificial radioactivity, Artificial transmutation, nuclear reactions, types of Nuclear reactions , nuclear reactors, breeder reactor, fertile and fissile materials, nuclear fusion, hydrogen bomb, Aplicatios of Radioactivity- Estimation of Age, medicinal uses.	
UNIT - III	**Magnetic Resonance Imaging**	**(15)**
	Construction, function and operation of superconducting MRI scanner, Permanent and Resistive magnets, Radio frequency receiver coils, spin echo pulse sequence, special localization of the signal, k- space, image acquisition and image reconstruction , multi-echo imaging –basic spoiled and non- spoiled techniques , Applications	
UNIT - IV	**Polymer and its Applications in Drug Chemistry**	**(15)**

	Introduction, definition, classification, properties and application Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy.	

Course outcomes: Student should be able to

1. Interpret crystal structure by X-ray diffraction.
2. Describe the importance of Magnetic Resonance Imaging 3. Explain Applications of radioactive elements in medicines.
4. Elaborate customized drug delivery system

Reference Books:

1. Dr. B. K. Sharma, Instrumental Methods of Chemical Analysis (Unit I)
2. B. Harrow and A. Mazur, Textbdok of Biochemistry, W. B. Saunders Co., Philadelphia36.
3. A.L. Lehninger, Biochemistry, Worth Publisher, Inc., (Unit III,IV)
4. A. L. Lehninger, Principles of Biochemistry, CBS Publishers and Distributors.(Unit III,IV)
5. S.M. Khopakar , Basic concepts of Analytical chemistry, (Unit I)
6. Stewart Carlyle Bushong Geoffrey Clarke's Magnetic Resonance Imaging Physical and Biological Principles 2014 (Unit III)
7. B.D. Cullity, S.R. Stock's Elements of X-Ray Diffraction2014 (Unit I)
8. H.J. Arnikar's Essentials of Nuclear Chemistry (Unit II)
9. Ambikanandan Misra, Alisagarshahiwala's Applications of Polymers in Drug Delivery (Unit IV)

BDCP-408 Drug Chemistry Practicals

Course objectives: Student will able to

1. Learn instrument handling skill and related calculation 2.
Learn to find out structure by X- ray crystallography
3. Enhance skill to Interpretation of IR graph.
4. Study Structure interpretation by H^1 NMR

Credits (Total Credit 04)	**SEMESTER-IV BDCP-408 Drug Chemistry Practicals**	**No. of hours per unit/credits**

	1. To measure absorbance of $KMnO_4$ by using colorimeter (UV spectrophotometer) 2. To measure absorbance of $CuSO_4$ by using colorimeter (UV spectrophotometer) 3. Structural illustration Alcohol by IR (Any two) 4. Structural illustration Phenols by IR (Any two) 5. Structural illustration Amines by IR (Any two) 5. Find out the structure of NaCl and KCl by X-ray diffraction 6. Structure illustration by ^1H NMR 7. Viva voce 8. Practical record Note- Any other relevant practical may be added	

Coures outcomes-Students should be able to

1. Find out absorbance of different compounds by using colorimetry.
2. Trained to find out structure by X-ray crystallography.
3. Become skill to interpret IR graph
4. Explain and evaluate structural interpretation of compounds by H^1 NMR.

Practical references:

1. D. M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker,INC, New York.
2. A. H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
3. M. Paye, A. O. Barel, H. Maibach, Handbook of Cosmetic Science and Technology.
4. Dr. S. Naskar, A Handbook of Practical Pharmaceutical Chemistry, Pharmamedix India Publication Pvt. Ltd.; I edition (1 January 2014)
5. Dr. P. Mondal and Dr. S. Mondal, Handbook of Practical Pharmaceutical Organic, Inorganic and Pharmaceutical Chemistry, EDUCREATION PUBLISHING, RZ 94, Sector - 6, Dwarka, New Delhi - 110075

BDCT-405 Physical Chemistry

Course Objectives: student will be able to

1. Understand the basic concepts of electrochemistry.
2. Enhance the problem solving skills and make them familiar with simple calculation in chemistry
3. Learn phase diagram of one and two component system
4. Recognize the physical properties of liquids

Credits (Total Credits 2)	SEMESTER-IV BDCT- 405 Physical Chemistry	No. of Lectures per unit/credits
UNIT - I	**Electrochemistry Part-I : Electrolytic Conductance and Transference**	**(15)**
	Electrolysis and Faraday's laws of Electrolysis, Conduction of electricity, Types of conductors: Electronic and Electrolytic. Explanation of the terms: Specific, equivalent and molar conductance, relation between specific and equivalent conductance, variation of conductance with dilution, equivalent conductance at infinite dilution. Migration of ions, Hittorf's rule, Transport number, Determination of transport number by Moving boundary method, Factors influencing transport number: Nature of electrolyte, Concentration, Temperature, Complex formation, Abnormal transport number, Degree of hydration Kohlrausch law and application of conductance measurement: (i) Relationship between ionic conductance, ionic mobility and transport number. (ii) Determination of equivalent / molar conductance at infinite dilution for weak electrolytes. (iii) Determination of degree of dissociation. (iv) Determination of ionic product of water. (v) Determination of solubility and solubility product of sparingly soluble salts. (vi) Determination of hydrolysis constant of salt Numerical problems.	
UNIT - II	**Electrochemistry Part II: Electromotive Force**	**(15)**
	Galvanic cells. Concept of EMF of a cell. Measurement of EMF of a cell. Standard electrode potential Nernst equation and its importance. Types of electrodes: Metal-Metal ion electrode, Amalgam electrode, Gas electrode, Metal insoluble salt electrode, Oxidation-reduction electrode, Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data. Calculation of equilibrium constant from EMF data pH determination using hydrogen electrode and quinhydrone electrode. Numerical problems	
UNIT - III	**Phase Equilibrium**	**(16)**

	Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Phase diagrams of one-component systems (water and sulphur) Two component systems involving eutectic point (lead silver, KI-Water, $FeCl_3$-water). Derivation of Clapeyron and Clausius –Clapeyron equation and its importance in phase equilibria	
UNIT - IV	**Physical properties of liquids**	**(14)**
	Classification of physical properties. Viscosity, coefficient of viscosity, determination of viscosity by Ostwald's Viscometer. Refractive index, measurement of refractive index by Abbe's refractometer, specific and molecular refraction, molecular refractivity. Numerical problems.	

Course outcomes: Student should be able to

1. Recapitulate the knowledge about Electrochemistry and conductance measurement. Derive of relation between various types of conductance, ionic mobility and understands Kohlrausch law and solve numerical
2. Revise of the concept about galvanic cells, construct and derives equation for emf of Cells.
3. Compute basic terms related to Phase rule and solutions and derivation of equations
4. Interpret molecular structure of liquid using physical properties

Reference Books-

1. Puri and Sharma's Principles of Chemistry (Vishal Publishing Company,4th edition). (UnitI, II, III, IV.)
2. B. S. Bahl and G. D. Tuli. (S.Chand.) Essentials of Physical Chemistry (Unit-I, II, III, IV.)
3. Soni-Dharmarha's Text Book of Physical Chemistry. (Unit-I,IV.)
4. P. W. Atkin's Elements of Physical Chemistry (Oxford University Press.)
5. S. K. Dogra, D. Dogra's Physical Chemistry through problems (Wiley Eastern Ltd.)
6. A. J. Mee's Physical Chemistry ELBS & Heinemann Educational Books Ltd.)
7. S. Glasstone. (Mac Millan.), An introduction to electrochemistry
8. A. S. Negi and S. C. Anand's A Text Book of physical Chemistry, New Age International publication, 2nd Ed.
9. Gurdeep Raj's Advanced Physical Chemistry
10. K.L. Kapoor's Text Book Of Physical Chemistry

BDCT-406 Inorganic Chemistry

Course Objectives: student will be able to

1. Enhance knowledge about Periodic Table thoroughly and understand the meaning of transition
2. Understand co-ordinate bond, double salt and complex salt
3. Understand about the metallo-prophyrin with spatial reference to hemoglobin and myoglobin
5. Understand the importance of elements in biological proess.

Credits (Total Credits 2)	**SEMESTER-IV BDCT- 406 Inorganic Chemistry**	**No. of Lectures per unit/credits**
UNIT - I	**Study of periodic properties of elements**	**(18)**
	a) P- Block elements (Group 13, 14 and 15) Position of elements in periodic table, Characteristics of p-block elements with special reference to Electronic configuration and Periodic properties, Compounds of group 13,14 and 15, Boron-Diborane method of preparation and nature of bonding (structure), Borazine method of separation and nature of bonding (structure), Allotropes of carbon and phosphorus, Oxyacids of nitrogen – HNO_2 , HNO_3, Hydrides of Nitrogen- NH_3 and N_2H_4 **b) Chemistry of elements of first transition series** Position of elements in periodic table Characteristics of d-block elements with special reference to i) Electronic structure ii) Oxidation states, stability of oxidation states of Fe with respect to Latimer diagram iii) Magnetic character iv) Colored ions v) Complex formation.	**(12)** **(06)**
UNIT - II	**Co-ordination chemistry**	**(14)**
	Introduction-Definition and formation of co-ordinate covalent bond in BF_3 -NH_3,$[NH_4]^+$ and H_2O. Distinguish between double salt and complex salt, Werner's theoryPostulates. The theory as applied to cobalt amines viz. $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl_3.4NH_3$, $CoCl_3.3NH_3$.Description of the terms- ligand, co-ordination number, co-ordination sphere, Effective atomic number IUPAC nomenclature of coordination compounds. Isomerism in complexes with C.N. 4 and 6- Geometrical Isomerism, Optical Isomerism, Structural IsomerismIonisation Isomerism, Hydrate Isomerism, Coordination, Isomerism, Linkage Isomerism and Co-ordination position Isomerism Valance bond theory of transition metal complex with respect to, C.N. 4, complexes of Cu and Ni, C.N. 6 complexes of Fe and Co	

UNIT - III	**Bio Inorganic Chemistry**	**(07)**
	Introduction, Essential and trace elements in biological process, Metalloporphyrins with special reference to heamoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Na^+& K^+.	
UNIT - IV	**Chelation**	**(06)**
	A brief introduction with respect to ligands, chelating agent, chelation and metal chelates. Structural requirements of chelate formation, Difference between metal chelate and metal complex Classification of chelating agents (with specific illustration of bidentate chelating agents) Application of chelation with respect to chelating agents - EDTA and DMG	

Course outcomes: Student should be able to

1.Recall the position of element in periodic table and write their properties summarize the characteristic properties with respect to electronic configuration, lanthanide contraction oxidation state.
2.Explin co-ordinate bond, double salts and complex salt on the basis of co-ordination.
3. Discuss the metallo-prophyrin with spetial reference to hemoglobin and myoglobin
4. Explain coordination chemistry with reference to chelation. Elaborate application of corrosion

Reference Books-

1. R. H. Petrucci, General Chemistry, 5th Ed. Macmillan Publishing Co.: New York (1985). (Unit-I, II)
2. F. A. Cotton, G. Wilkinson, Basic Inorganic Chemistry, Wiley. (Unit-I, II, III, IV)
3. Puri, Sharma, Kalia. Inorganic Chemistry. (Unit-I,II,III,IV, V)
4. J.D.Lee, Concise Inorganic Chemistry. (Unit-III,IV, V)
5. H. Kaur, Instrumental Methods of Chemical Analysis. (Unit-V)
6. S.K.Jain, R.S. Thakure , Chemistry for engineers (Unit-V)
7. B. K. Sharma, Industrial chemistry. 5th Ed. (Unit –V)

Additional Reading:

1. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
2. B. H. Mahan, University Chemistry 3rd Ed. Narosa (1998).
3. D. F. Shriver, & P.W. Atkins, Inorganic Chemistry, Oxford University Press.
4. G. Wulfsberg, Inorganic Chemistry, Viva Books Pvt. Ltd.
5. G. E. Rodgers, Inorganic & Solid State Chemistry, Cengage Learning India Ltd 2008.

6. Puri & Sharma, Principles of Physical chemistry.

BDCP-409 Chemistry Practicals

Course objectives: Student will be able to

1. Learn instrument handling skills and related calculation
2. Study the reaction rate and other parameter .
3. Understand Quanlitative Analysis techniques such as gravimetric and volumetric analysis.
4. Aquire the qualitative analysis techniques including organic and inorganic semi-micro analysis.

Credits (Total Credit 04)	**SEMESTER-IV BDCP-409 Chemistry Practicals**	**No. of hours per unit/credits**
	1. Viscosity : To determine the percentage composition of a given liquid mixture by viscosity method. (Density data to be given). **2. Refractometry :** To determine the specific and molar refractions of benzene, toluene and xylene by Abbe'srefractometer and hence determination of the refraction of -CH_2- group (Methylene group). (Densities should be determined by students.) **3. Conductometry:** 1) Determination of cell constant of a conductivity cell using standard KCl (N/10 or N/50) solutions 2) To determine degree of dissociation and dissociation constant of acetic acid avarious dilutions and to verify Ostwald's dilution law conductometrically. 3) To determine the normality of the given strong acid by titrating it against strong alkali conductometrically. 4) To determine the normality of the given weak acid by titrating it against strong alkali conductometrically. **Part [B]: Non - Instrumental**	

	4. Chemical Kinetics 1) To study the hydrolysis of methyl acetate in presence of HCl and H_2SO_4 and to determine the relative strength of acids. 2) To study the effect of acid strength (0.5 M and 0.25 M HCl) on hydrolysis of an ester. 3) To study the kinetics of the reaction between $K_2S_2O_8$ and KI in solution with unequal initial concentration of the reactants 4) To study the reaction between potassium bromated and potassium iodide ($KBrO_3$ KI) in solution and hence to determine the order of the reaction. **5. Gravimetric Analysis:** a) Gravimetric estimation of iron as ferric oxide from the given solution of frrrous ammonium sulphate and free sulphuric acid b) Gravimetric estimation of barium as barium sulphate from the given solution containing barium chloride and free hydrochloric acid **6. Inorganic Preparations:** a) Preparation of ferrous ammonium sulphate (Mohr's salt) b) Preparation of tetrammonium copper (II) sulphate c) Preparation of chloropentammine cobalt (III) chloride **7. TitrimeticEstimatios:** a) Determination of percentage purity of given sample of soda ash b) Determination of total hardness of water using 0.01M EDTA solution c) Determination on Percentage purity of tetramine copper (II) sulphate **8. Inorganic Semi-micro Qualitative Analysis :** Analysis of Inorganic binary mixture : Anions: Cl^-, Br^-, NO_3^-, NO_2^-, SO_4^{--}, CO_3^{--} Cations: Cd^{++}, Fe^{++}, Al^{+++}, Cr^{+++}, Zn^{++}, Mn^{++}, Co^{++} Mg^{++}, K^+, NH_4^+, Ba^{++}, Cu^{++} **9.** Viva voce **10.** Practical record Note- Any other relevant practical may be added	

Coures outcomes-Students should be able to

1. Identify unknown samples/compounds using qualitative and quantitative analysis.
2. Recall theoretical concepts and interpret rxperimentl results using conductometer.
3.Calculate rate constant of the reaction.
4. Synthesize/Prepare organic derives and inorganic complexes determine purity of samples.

Practical References:

1. D.V. Jahagirdar Experiments in chemistry- Himalya publishing house
2. Vogel's text book of Qualitative Chemical Analysis (Longman ELBS Edition)
3. Vogel's text book of Quantitative Analysis (Longman ELBS Edition)
4. A. I. Vogel's A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis: (Third Ed.) (ELBS)
5. Goyal and Trivedi's Practical Maual in Water Analysis
6. S. M. Khopkar's Basic concepts in Analytical chemistry
7. Pass G's, Practical Inorganic Chemistry
8. A. Findlay's Experimental Physical Chemistry (Longman.)
9. J. B. Yadav's Advanced Practical Physical Chemistry. (Goel Publishing house, Meerut.)
10. R. C. Das and B. Behra's Experiments in Physical Chemistry (Tata McGraw Hill.)
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