Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara

(Autonomous)

(Lead College, Karmaveer Bhaurao Patil University, Satara)

Department of Drug Chemistry

B. Sc. I Syllabus

(Major)

(As per NEP 2020)

w.e.f. June 2023

1. **Title:**B.Sc. Drug Chemistry
2. **Year of implementation:**2023-2024
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 same time 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 withrelevance.

4. General objectives of the course:

1. To develop the content of the syllabus according to the UGC norms.
2. To inculcate fundamentalprinciples 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 theconcepts.
4. To enhance student's sense of enthusiasmfor chemistry and to involve them in an intellectuallystimulatingexperienceoflearninginasupportiveenvironment.

5. **Duration:** One year
6. **Pattern:**Semester
7. **Medium of instruction:** English
8. **Structure of the course:**

Level	Sem.	Subject -1 Major				Subject-2 Minor		Subject-3 Open Elective		VSEC		AEC, VEC, IKS			CC	Total
		DSC		DSE						VSC	SEC	AEC	VEC	IKS		
		T	P	T	P	T	P	T	P							
4.5	I	4	2	-	-	4	2	4	2	-	-	-	-	2	2	22
	II	4	2	-	-	4	2	4	2	-	2	-	2	-	-	22

Subject	Sem.	Name of the major subject (Drug Chemistry)	Name of the minor subject (Drug Chemistry)	Open Elective programs for others (Generic Medicine)
Drug Chemistry	I	1) BDCT-111: Introduction to Drug Chemistry	1) BDCT-114: Basics in Drug Chemistry	1) BDCT-117: Introduction to Generic Medicine
		2) BDCT-112: Fundamentals of Drug	2)BDCT-115:Fundamentals of Drug	2) BDCT-118: Statistical Analysis of Generic Medicine
		3) BDCP-113: Major Lab I	3) BDCP-116: Minor Lab I	3) BDCP-119: Open Elective Lab I
	II	4) BDCT-121: Introduction to Biochemistry	4) BDCT-124: Introduction to Biochemistry	4) BDCT- 127: Generic Drug: The Indian Scenario
		5) BDCT-122: Analysis Techniques	5) BDCT-125:Pharmaceutical Analysis	5) BDCT-128: Clinical Pharmacy
		6) BDCP-123: Major Lab II	6) BDCP-126: Minor Lab II	6) BDCP-129: Open Elective Lab II

Sr. No.	Course	Title of the course	Credits
1	Skill Enhanced Course (SEC-103)	Separation Techniques	2
2	Value Education Course (VEC-104)	Digital Technological Solutions for Society	2
3	Indian Knowledge System (IKS-101)	Indian Health Sciences	2
4	Co-Curricular Course (CC-102)	NCC/ NSS/ sports/ cultural	2

Structure and titles of the B.Sc. I course Major subject: Drug Chemistry			
Semester	**Course no.**	**Name of the course**	**Units**
I	BDCT-111 (Theory)	Introduction to Drug Chemistry	Unit I: Introduction to drug chemistry Unit II: Sources of drug Unit III: Classification of drug Unit IV: Chemical communication
	BDCT-112 (Theory)	Fundamentals of Drug	Unit I: Fundamentals of biological chemistry Unit II: Basic biomolecules Unit III: Amino acids Unit IV: Bioavailability and permeability
	BDCP-113 (Practical)	Major LabI	
II	BDCT-121 (Theory)	Introduction to Biochemistry	Unit I: Hormones Unit II: Vitamins Unit III: Mineral metabolism Unit IV: Body fluid and blood
	BDCT-122(Theory)	Analysis Techniques	Unit I: Acid base titration Unit II: Oxidation reduction titration Unit III: Precipitation titration Unit IV: Theory of gravimetric analysis
	BDCP-123 (Practical)	Major Lab II	

SEMESTER– I Major Course – I BDCT-111: Introduction to Drug Chemistry		
Course Objectives: Students should be able to… 1. Define 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.		
Credits (Total credits 2)	**BDCT-111: Introduction to Drug Chemistry**	**No. of hours per unit (30)**
Unit – I	**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 pharmacopoeias.	**(09)**
Unit – II	**Sources of drugs** 2.1 Biological sources of drugs. 2.2 Marine sources of drugs. 2.3 Mineral sources of drugs. 2.4 Synthetic sources of drugs. 2.5 Plant tissue cultures as sources of drugs.	**(05)**
Unit – III	**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	**(07)**
Unit – IV	**Chemical communication** 4.1 Various types of communication systems 4.2 Endocrine hormones of pituitary gland and their action. 4.3 Endocrine hormones of adrenal gland and their action.	**(09)**
Course Outcomes: After completion of the course students will be able to...		

1. Explain fundamentals of drug chemistry.
2. Discuss natural sources of drugs.
3. Classify drugs according to their actions.
4. Describe chemical communication in human body.

References:

1. Jain J. L., 2016, Fundamentals of Biochemistry; 7th edition S. Chand & Company Ltd. New Delhi.

2. Choudhary N. C. &Gurbani N. K. 2014, Pharmaceutical Chemistry; Vallabh Prakashan, Delhi.

3. Rubin H. H., 2014, Your Life is in Your Glands, Martino fine books.

4. Shah B. N. & Seth A. K., 2010 Textbook of Pharmacognocy and Phytochemistry; Elsevier publication.

5. Algarsamy V., 2010, Textbook of Medicinal Chemistry Vol. I, Elsevier publication.

6. Jain N. K., 2009, Textbook of Professional Pharmacy, 5th edition VallabhPrakashan, Delhi.

7. Gaud R. S. & Gupta G. D., 2007, Practical Pharmaceutics; CBS Publishers and Distributors, New Delhi.

8. Gereth T., 2003, Fundamentals of Medicinal Chemistry, Wiley publication.

9. Barar F. S., 2000, Essentials of Pharmacotherapeutics: S. Chand & Company Ltd. New Delhi.

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Major Course – II BDCT-112: Fundamentals of Drug		
Course Objectives: Students should be able to... 1. Study the fundamentals of biological chemistry. 2. Infer basic biomolecules. 3. Recall amino acids and proteins. 4. Define bioavailability.		
Credits (Total Credits 2)	**BDCT-112:Fundamentals of Drug**	**No. of hours per unit (30)**
Unit – I	**Fundamentals of biological chemistry** 1.1 Drug receptors and interactions 1.2 Configuration and information in 3D structure of biomolecules 1.3 Stereochemistry, chiral interaction, enantiomers etc. 1.4 Interaction between biomolecules, stereo specificity 1.5 Types of bonds in biomolecules, their formation and interactions. Viz. Covalent, glycosidic, peptide, phosphodiester, ionic, hydrogen, Van-der Waals, hydrophobic, coordinate.	**(08)**
Unit – II	**Basic biomolecules** 2.1 Carbohydrates: Introduction and biological importance. 2.2Classification of carbohydrates (glyceraldehyde, simple aldose, simple ketoses, D-glucose, conformation of D-glucose). 2.3 Monosaccharide's other than glucose. 2.4 Polysaccharides (starch, glycogen) peptidoglycan, proteoglycan matrix.	**(08)**
Unit – III	**Amino acids** 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.	**(07)**

Unit – IV	**Bioavailability and permeability** 4.1 Bioavailability: Definition in pharmacology, nutritional science, environmental science. 4.2 Absolute bioavailability, relative bioavailability andbioequivalence. 4.3 Factors influencing on bioavailability, bioavailability of drugs versus dietary supplements. 4.4 Nutritional science: reliable and universal bioavailability. 4.5 Permeability: Diffusion – Definition, significance, mechanism, laws and factors affecting on diffusion.	**(07)**

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. Nelson D. L. & Cox M. M., 2021, Lehninger Principles of Biochemistry; 8th Edition, W. H. Freeman and company NY.
2. Plummer D. T., 2017, An Introduction to Practical Biochemistry; 3rd Edition, McGraw Hill Edu.Pvt.Ltd.
3. Bramhnakar D.M. & Jaiswal S.B., 2015, Biopharmaceutics& Pharmacokinetics -A treatise; VallabhPrakashan.
4. Jeremy B.& Lubert S., 2012, Biochemistry;7th Edition, W. H. Freeman and company
5. Shukla G.S., 2009, Economic Zoology; 4th Edition, Rastogi publications.
6. EricE. C. & Paul K. S. 2006, Outlines of Biochemistry; 5th Edition, John Wiley and Sons USA.
7. Jain J. L., Jain N. & Jain S., 2000, Fundamentals of Biochemistry; S. Chand publishing.
8. Kumar H. D., 1999, Biodiversity and sustainable conservation; Oxford & IBH, New Delhi.

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Credits (Total Credits 2)	BDCP-113: Major Lab- I	No. of hours (60)
Course Objectives: Students will be able to… 1. Identify safety measures in laboratory. 2. Learn purification methods. 3. Detect functional group in the given compound. 4. Know estimation techniques of protein.		
1	Study safety symbols and labels on pack of chemicals with its meaning	
2	Learn details about MSDS and its importance	
3	Purification of organic pharmaceutical compound (Any 2)	
4	Determination of solubility, melting point or boiling point (MP/ BP) of active drug intermediates (Any 4)	
5	Detection of elements and functional group in the given organic compounds (Any 4)	
6	Estimation of tincture iodine.	
7	Spot test for carbohydrates & amino acids	
8	Isolation of starch /Protein/oil from plant source.	
9	Estimation of protein by Biuret method	
10	Estimation of protein by Lowry method	
11	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 by distillation. 3. Isolate starch, protein and oil from respective plant source. 4. Estimate the protein from given sample.		
References: 1. Gupta R. C, 2022, Practical Biochemistry; 6th edition, CBC publication. 2. Parikh D. M., 2018, Handbook of Pharmaceutical Granulation Technology; Marcel Dekker, INC, New York. 3. R. A. Copeland, 2013, Methods of Protein Analysis: A Practical Guide for Laboratory Protocols; Springer publications.		

4. Kulandevalu A.R, Veerswami R., 2012, Basic Principles of Practical Chemistry 2nd edition Sultan Chand and Sons.
5. Pandey O. P. & Bajapai D. N., 2010, Practical Chemistry; S. Chand publication.
6. Gupta B., 2006, Practical Biochemistry; 6th edition, CBS publisher.
7. Paye M., Barel A. O. &Maibach H., 2001 Handbook of Cosmetic Science and Technology; 1st edition CRC Press.
8. Beckett A. H. & Stenlake, J. B., 2000, Practical Pharmaceutical Chemistry Vol. I & II; 4th edition, Stallone Press, University of London.

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SEMESTER – II Major Course – III BDCT-121: Introduction to Biochemistry		
Course Objectives: Students should be able to… 1. Study fundamentals of the endocrine system. 2. Recognize importance of vitamins in our life. 3. Gain knowledge about mineral metabolism. 4. Learn in detail about body fluid and blood.		
Credits (Total Credits 2)	**BDCT- 121: Introduction to Biochemistry**	**No. of hours per unit (30)**
Unit – I	**Hormones** 1.1 Introduction, functions and anatomy of endocrine system. 1.2 Hormones, functions and diseases related to hormones. 1.3 Thyroid hormones and anti-thyroid drugs, parathormone, calcitonin and vitamin D. 1.4 Chemical messengers & feedback mechanism of hormonal action. 1.5 Androgens, anabolic steroids, estrogens& progesterone. 1.6 Oral contraceptives & drugs acting on the uterus.	**(09)**
Unit – II	**Vitamins** 2.1 Concept of vitamins, types of vitamins- fat soluble and water soluble. 2.2 Various vitamins- its solubility, food sources, deficiency diseases, interaction with other nutrients. 2.3 Antagonists and analogues of vitamins.	**(08)**
Unit – III	**Mineral metabolism** 3.1 General definition and history of minerals; causes of macro and micro mineral deficiencies in India. 3.2 Chronology, chemistry, distribution, functions, absorption transport, metabolism, deficiency manifestations. 3.3 Nutritional requirements, methods of assay of all the minerals.	**(06)**
Unit – IV	**Body fluid and blood** 4.1 Introduction to body fluids, composition and functions of blood,	**(07)**

	haemopoeisis, formation of haemoglobin, anaemia, 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.	

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

1. Explain endocrine system and importance of various hormones
1. Draw the structures of vitamins.
2. Explain mineral metabolism.
3. Categories body fluid and blood.

References:

1. Chatterjee. C. C., 2020, Human Physiology Vol. I and II; 13th edition Academic Publishers Kolkata.
2. Rubin H. H., 2014, Your Life is in Your Glands, Martino fine books.
3. Reginald. H. G., Charles M. G., 2012, Biochemistry; 5th edition, cengege learning.
4. Nelson D. L. &Cox M. M., 2008, Lehninger Principles of Biochemistry 5thEdition, W. H. Freeman and company NY.
5. Conn E. E. & Stump P. K., 2006, Outlines of Biochemistry; 5th edition, John Wiley and Sons, New York.
6. Tortora G. J., 2003, Principles of Anatomy and Physiology; 10th edition GA, U.S.A.
7. Hanch C. &Leo A., 1995, Fundamentals and Applications in Chemistry and Biology; 1st edition ACS Book Catlog.American Chemical Society.
8. Kawthalkar S. M., 2015, Essentials of Haematology; 2nd edition, Jaypeebrother's medical publishers.

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Major Course – IV BDCT-122:Analysis Techniques		
Course Objectives: Students should be able to… 1. Study fundamentals of titrations. 2. Tell names of indicators used in acid base titrations. 3. Know about oxidation reduction titration. 4. Define gravimetric analysis.		
Credits (Total Credits 2)	**BDCT-122: Analysis Techniques**	**No. of hours per unit (30)**
Unit - I	**Acid-Base titration** 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-Hesselbach 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 titration** 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 titration** 3.1 Precipitation reactions, solubility products, effect of acids, temperature and solvent upon the solubility of a precipitate.	**(07)**

	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.	
Unit - IV	**Theory of gravimetric analysis** 4.1 Precipitation techniques, 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)**

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

1. Explain different types of titration.
2. Apply knowledge of titrations in analysis.
3. Describe the importance of different analytical techniques.
4. Discussimportance of thermal methods of analysis.

References :

1. Atherden L.M., 2020, Bentley and Driver's Textbook of Pharmaceutical Chemistry; 8th edition Oxford university press.
2. Chatwal G. R., 2013, Pharmaceutical Chemistry- Inorganic vol. I; Himalaya publisher.
3. Vogel A. I., 2012, Text Book of Quantitative Inorganic analysis; 7th edition Pearson education India.
4. Kennedy J. H., 2011,Analytical chemistry principles; 2nd edition Sengage publication
5. Rao G. P., 2007Inorganic Pharmaceutical Chemistry; Vallabh publication.
6. Beckett A. H. &Stenlake J. B., 2005, Practical Pharmaceutical Chemistry Vol. I; 4th edition CBS.
7. Kar A. 2005, Pharmaceutical Drug Analysis; 2nd edition, New age publications.
8. Khopkar S. M, 1984 Concepts in Analytical Chemistry. Halsted press.

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Credits (Total Credits 2)	BDCP- 123: Major Lab - II	No. of hours per Practical (60)
Course Objectives: Students should be able to... 1. Understand neutralisation reactions. 2. Acquire skill in chromatographic separation techniques. 3. Study detection of food adulteration. 4. Define complexometric titrations		
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, vaccumdeciators, 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 fats, oil, milk, milk products 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. Detect adulteration in given sample of food materials. 4. Calculate amount of calcium or magnesium in given sample.		
References: 1. Kaur N. & Dahiya R., 2023, Pharmaceutical Analysis: A Practical Manual; PharmaMed press		

2. Chatwal G. R. & Anand S. K., 2018 Instrumental Methods of Chemical Analysis; Himalaya Publishing house.
3. Jain S. M. & Patel V. B., 2018, A Practical Book of Pharmaceutical Analysis; 1st edition, Niraliprakashan.
4. Naskar S., 2014, A Handbook of Practical Pharmaceutical Chemistry; 1st edition, Pharmamedix India Publication pvt. ltd.
5. Watson D. G., 2012, Pharmaceutical Analysis; 3rd edition, Churchill livingstoneelsever publisher.
6. Parikh M.D, 2009, Handbook of Pharmaceutical Granulation Technology; 3rd edition CRC press.
7. Beckett A. H. & Stenlake J. B., 2005Practical Pharmaceutical Chemistry; Vol. I & II, 4th edition Stahlone press of university of London.
8. Vogel A. I., 1980, Text Book of Quantitative Inorganic Analysis; Longman Sc tech publisher.

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Department of Drug Chemistry

B. Sc. I Syllabus

(Minor)

(As per NEP 2020)

w.e.f. June 2023

Structure and titles of the B.Sc. I Minor Subject: Drug Chemistry			
Semester	**Course no.**	**Name of the course**	**Units**
I	BDCT-114 (Theory)	Basics in Drug Chemistry	Unit I: Introduction to drug chemistry Unit II: Sources of drug Unit III: Classification of drug Unit IV: Chemistry of hydrocarbons
	BDCT-115 (Theory)	Fundamentals of Drug	Unit I: Fundamentals of biological chemistry Unit II: Basic biomolecules Unit III: Amino acids Unit IV: Bioavailability
	BDCP-116 (Practical)	Minor Lab I	
II	BDCT-124 (Theory)	Introduction to Biochemistry	Unit I: Hormones Unit II: Vitamins Unit III: Mineral nutrition Unit IV: Haematology
	BDCT-125 (Theory)	Pharmaceutical Analysis	Unit I: Acid base titration Unit II: Redox titration Unit III: Precipitation titration Unit IV: Gravimetric analysis
	BDCP-126 (Practical)	Minor Lab II	

SEMESTER– I Minor Course – I BDCT-114: Basics in Drug Chemistry		
Course Objectives: Students should be able to… 1. Define basic concepts in drug chemistry. 2. Know different natural sources of drugs. 3. Study the classification of drugs. 4. Learn chemical reactions of hydrocarbons.		
Credits (Total credits 2)	**BDCT-114: Basics in Drug Chemistry**	**No. of hours per unit (30)**
Unit – I	**Introduction to drug chemistry** 1.1. Definition, history & scope 1.2. Definition of drug, ideal properties of drug, prodrug, soft drug, hard drug. 1.3. Pharmacopoeia, history, development of pharmacopoeia.	**(09)**
Unit – II	**Sources of drugs** 2.1 Biological sources of drugs. 2.2 Marine sources of drugs. 2.3 Mineral sources of drugs. 2.4 Plant tissue cultures as sources of drugs.	**(05)**
Unit – III	**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	**(07)**
Unit – IV	**Chemistry of aliphatic hydrocarbons** 4.1 **Alkanes:** General formula, properties**,** preparation, catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis from Grignard reagent, and reactions of alkane 4.2 **Alkenes:** General formula, properties**,** preparation, reactions of alkene addition reaction Saytzeff's rule.	**(09)**

	4.3 **Alkynes:** General formula, properties**,** preparation, preparation of acetylene from calcium carbide, preparation of higher alkynes by dehalogenation of tetra halides, reactions of alkyne addition reaction and cycloalkanes preparation and reactions,	

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

1. Explain fundamentals of drug chemistry.
2. Discuss natural sources of drugs.
3. Classify drugs according to their actions.
4. Describe different chemical reactions of hydrocarbons.

References:

1. Jain J. L., 2016, Fundamentals of Biochemistry; 7th edition S. Chand & Company Ltd. New Delhi.

2. Choudhary N. C. &Gurbani N. K. 2014, Pharmaceutical Chemistry; VallabhPrakashan, Delhi.

3. Rubin H. H., 2014, Your Life is in Your Glands, Martino fine books.

4. Shah B. N. & Seth A. K., 2010 Textbook of Pharmacognocy and Phytochemistry; Elsevier publication.

5. Algarsamy V., 2010, Textbook of Medicinal Chemistry Vol. I, Elsevier publication.

6. Jain N. K., 2009, Textbook of Professional Pharmacy, 5th edition VallabhPrakashan, Delhi.

7. Gaud R. S. & Gupta G. D., 2007, Practical Pharmaceutics; CBS Publishers and Distributors, New Delhi.

8. Gereth T., 2003, Fundamentals of Medicinal Chemistry, Wiley publication.

9. Barar F. S., 2000, Essentials of Pharmacotherapeutics: S. Chand & Company Ltd. New Delhi.

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Minor Course – II BDCT-115: Fundamentals of Drug		
Course Objectives: Students should be able to... 1. Study the fundamentals of biological chemistry. 2. Infer basic biomolecules. 3. Recall amino acids and proteins. 4. Define bioavailability.		
Credits (Total Credits 2)	**BDCT-115: Fundamentals of Drug**	**No. of hours per unit (30)**
Unit – I	**Fundamentals of biological chemistry** 1.1 Drug receptors and interactions 1.2 Configuration and information in 3D structure of biomolecules 1.3 Types of bonds in biomolecules, their formation and interactions. Viz. covalent, glycosidic, peptide, phosphodiester, ionic, hydrogen, Van-der Waals, hydrophobic, coordinate.	**(08)**
Unit – II	**Basic biomolecules** 2.1 Carbohydrates: Introduction and biological importance. 2.2 Classification of carbohydrates (glyceraldehyde, simple aldose, simple ketoses, D-glucose, conformation of D-glucose). 2.3 Monosaccharide's other than glucose.	**(08)**
Unit – III	**Amino acids** 3.1 Introduction to amino acids, classification, structure and properties of amino acids. 3.2 Acid base behaviour of amino acid, analysis, reactions, Zwitter ions 3.3 Structure-peptide bond.	**(07)**

Unit – IV	**Bioavailability** 4.1 Bioavailability: Definition in pharmacology, nutritional science, environmental science. 4.2 Absolute bioavailability, relative bioavailability and bioequivalence. 4.3 Factors influencing on bioavailability, bioavailability of drugs versus dietary supplements. 4.4 Nutritional science: reliable and universal bioavailability.	**(07)**

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.

References:

1. Nelson D. L. & Cox M. M., 2021, Lehninger Principles of Biochemistry; 8th Edition, W. H. Freeman and company NY.
2. Plummer D. T., 2017, An Introduction to Practical Biochemistry; 3rdEdition, McGraw Hill Edu. Pvt. ltd.
3. Bramhnakar D. M. & Jaiswal S. B., 2015, Biopharmaceutics & Pharmacokinetics -A treatise; Vallabhprakashan.
4. Jeremy B. &Lubert S., 2012, Biochemistry; 7th Edition, W. H. Freeman and company
5. Shukla G. S., 2009, Economic Zoology; 4th Edition, Rastogi publications.
6. Eric E. C. & Paul K. S. 2006, Outlines of Biochemistry; 5th Edition, John Wiley and Sons USA.
7. Jain J. L., Jain N. & Jain S. 2000, Fundamentals of Biochemistry; S. Chand publishing.
8. Kumar H. D. 1999, Biodiversity and sustainable conservation; Oxford & IBH, New Delhi.

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Credits (Total Credits 2)	BDCP-116: Minor Lab- I	No. of hours (60)
Course objectives: Students will be able to… 1. Identify safety measures in laboratory. 2. Learn purification methods. 3. Detect functional group in the given compound. 4. Know estimation techniques of protein.		
1	Study safety symbols and labels on pack of chemicals with its meaning	
2	Learn details about MSDS and its importance	
3	Purification of organic pharmaceutical compound (Any 2)	
4	Determination of solubility, melting point or boiling point (MP/ BP) of active drug intermediates (Any 4)	
5	Detection of elements and functional group in the given organic compounds (Any 4)	
6	Spot test for carbohydrates & amino acids	
7	Isolation of starch plant source.	
8	Isolation of eugenol from clove.	
9	Isolation of casein from milk	
10	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 by distillation. 3. Isolate starch, protein and oil from respective plant source. 4. Estimate the protein from given sample.		
References: 1. Gupta R. C, 2022, Practical Biochemistry; 6th edition, CBC publication. 2. Parikh D. M., 2018, Handbook of Pharmaceutical Granulation Technology; Marcel Dekker, INC, New York. 3. R. A. Copeland, 2013, Methods of Protein Analysis: A Practical Guide for Laboratory Protocols; Springer publications. 4. Kulandevalu A.R, Veerswami R., 2012, Basic Principles of Practical Chemistry 2nd edition		

Sultan Chand and Sons.

5. Pandey O. P. &Bajapai D. N., 2010, Practical Chemistry; S. Chand publication.
6. Gupta B., 2006, Practical Biochemistry; 6th edition, CBS publisher.
7. Paye M., Barel A. O. &Maibach H., 2001 Handbook of Cosmetic Science and Technology; 1st edition CRC Press.
8. Beckett A. H. & Stenlake, J. B., 2000, Practical Pharmaceutical Chemistry Vol. I & II; 4th edition, Stallone Press, University of London.

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SEMESTER – II Minor Course – III BDCT-124: Introduction to Biochemistry		
Course Objectives- Students should be able to… 1. Study fundamentals of the endocrine system. 2. Recognise importance of vitamins in our life. 3. Gain knowledge about mineral nutrition. 4. Learn about body fluid and blood.		
Credits (Total Credits 2)	**BDCT- 124: Introduction to Biochemistry**	**No. of hours per unit (30)**
Unit – I	**Hormones** 1.1 Introduction, functions and anatomy of endocrine system. 1.2 Hormones, functions and diseases related to hormones. 1.3 Thyroid hormones and anti-thyroid drugs, parathormone, calcitonin and vitamin D. 1.4 Chemical messengers & feedback mechanism of hormonal action.	**(09)**
Unit – II	**Vitamins** 2.1 Concept of vitamins, types of vitamins- fat soluble and water soluble. 2.2 Various vitamins- its solubility, food sources, deficiency diseases, interaction with other nutrients.	**(08)**
Unit – III	**Mineral nutrition** 3.1 General definition, history and classification of minerals; causes of macro and micro mineral deficiencies among Indians. 3.2 Functions, nutritional requirements of minerals. 3.3 Absorption, transport anddeficiency manifestations of minerals.	**(06)**
Unit – IV	**Haematology** 4.1 Introduction to body fluids, composition and functions of blood, haemopoeisis, formation of haemoglobin, anaemia, mechanisms of coagulation. 4.2 Blood grouping, Rh factors, transfusion, its significance and disorders of blood.	**(07)**

	4.3 Lymphatic system, lymphatic organs and tissues, lymphatic vessels, lymph, circulation and functions of lymphatic system.	

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 vitamin A and B-6.
3. Illustrate mineral nutrition.
4. Categories body fluid and blood.

References:

1. Chatterjee. C. C., 2020, Human Physiology; Vol. I and II; 13th edition Academic Publishers Kolkata.
2. Rubin H. H., 2014, Your Life is in Your Glands; Martino fine books.
3. Reginald. H. G., Charles M. G., 2012, Biochemistry; 5th edition, cengege learning.
4. Nelson D. L. &Cox M. M., 2008, Lehninger Principles of Biochemistry; 5thEdition, W. H. Freeman and company NY.
5. Conn E. E.& Stump P. K., 2006, Outlines of Biochemistry; 5th edition, John Wiley and Sons, New York.
6. Tortora G. J., 2003, Principles of Anatomy and Physiology; 10th edition GA, U.S.A.
7. Hanch C. &Leo A., 1995, Fundamentals and Applications in Chemistry and Biology; 1st edition ACS Book Catlog.American Chemical Society.
8. Kawthalkar S. M., 2015, Essentials of Haematology; 2nd edition, Jaypee brother's medical publishers.

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Minor Course – IV BDCT-125: Pharmaceutical Analysis		
Course Objectives: Students should be able to… 1. Study fundamentals of titrations. 2. Tell names of indicators used in acid base titrations. 3. Know about oxidation reduction titration. 4. Define gravimetric analysis.		
Credits (Total Credits 2)	**BDCT-125: Pharmaceutical Analysis**	**No. of hours per unit (30)**
Unit - I	**Acid-Base titration** 1.1 Acid base concept, relative strengths of acids and bases. 1.2 Law of mass action, common ion effect, ionic product of water 1.3 pH, hydrolysis of salts, Henderson-Hesselbach equation, buffer solutions. 1.4 Neutralization curves, acid-base indicators, theory of indicators, choice of indicators, mixed indicators.	**(08)**
Unit – II	**Redox titration** 2.1 Concepts of oxidation and reduction reactions. 2.2 Theory of redox titrations, redox indicators, cell representations, measurement of electrode potential. 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 titration** 3.1 Definition, concept, precipitation reaction, 3.2 Solubility product, effect of acid, temperature and solvent upon the solubility of a precipitate. 3.2 Argentometric titration and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, indicators.	**(07)**

Unit - IV	**Gravimetric analysis** 4.1 Precipitation techniques, solubility product; 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	**(07)**

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

1. Explain different types of titration.
2. Apply knowledge of titrations in analysis.
3. Describe the importance of different analytical techniques.
4. Discuss importance of thermal methods of analysis.

References :

1. Atherden L.M., 2020, Bentley and Driver's Textbook of Pharmaceutical Chemistry; 8th edition Oxford university press.
2. Chatwal G. R., 2013, Pharmaceutical Chemistry- Inorganic vol. I; Himalaya publisher.
3. Vogel A. I., 2012, Text Book of Quantitative Inorganic analysis; 7th edition Pearson education India.
4. Kennedy J. H., 2011,Analytical chemistry principles; 2nd edition Sengage publication
5. Rao G. P., 2007 Inorganic Pharmaceutical Chemistry; Vallabh publication.
6. Beckett A. H. & Stenlake J. B., 2005, Practical Pharmaceutical Chemistry Vol. I; 4th edition CBS.
7. Kar A. 2005, Pharmaceutical Drug Analysis; 2nd edition, New age publications.
8. Khopkar S. M, 1984 Concepts in Analytical Chemistry. Halsted press

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Credits (Total Credits 2)	BDCP- 126: Minor Lab - II	No. of hours per Practical (60)
Course Objectives: Students should be able to... 1. Understand neutralisation reactions. 2. Acquire skill in chromatographic separation techniques. 3. Study detection of food adulteration. 4. Define complexometric titrations.		
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, vaccumdeciators, and oven.	
5	Determination of strength of strong acid.	
6	Determination of strength of strong base.	
7	Redox titrations (permanganometry)	
8	Redox titration by iodometry method	
9	Precipitation titrations (at least 2)	
10	Complexometric titration (Calcium /Magnesium).	
11	Chromatographic Separation of lipid, amino acids and carbohydrates	
12	Determination of adulteration in fats, oil, milk, milk products sweetening agents and miscellaneous products.	
13	Redox titrations (permanganometry)	
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. Detect adulteration in given sample of food materials. 4. Calculate amount of calcium or magnesium in given sample.		

References:

1. Kaur N. & Dahiya R., 2023, Pharmaceutical Analysis: A Practical Manual; PharmaMed press
2. Chatwal G. R. & Anand S. K., 2018 Instrumental Methods of Chemical Analysis; Himalaya Publishing house.
3. Jain S. M. & Patel V. B., 2018, A Practical Book of Pharmaceutical Analysis; 1st edition, Niraliprakashan.
4. Naskar S., 2014, A Handbook of Practical Pharmaceutical Chemistry; 1st edition, Pharmamedix India Publication pvt. ltd.
5. Watson D. G., 2012, Pharmaceutical Analysis; 3rd edition, Churchill livingstoneelsever publisher.
6. Parikh M.D, 2009, Handbook of Pharmaceutical Granulation Technology; 3rd edition CRC press.
7. Beckett A. H. & Stenlake J. B., 2005 Practical Pharmaceutical Chemistry; Vol. I & II, 4th edition Stahlone press of university of London.
8. Vogel A. I., 1980, Text Book of Quantitative Inorganic Analysis; Longman Sc tech publisher.

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Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara

(Autonomous)

(Lead College, Karmaveer Bhaurao Patil University, Satara)

Department of Drug Chemistry

B. Sc. I Syllabus

(Open Elective Subject: Generic Medicine)

(As per NEP 2020)

w.e.f. June 2023

Structure and titles of the B.Sc. I Course Open Elective Subject: Generic Medicine			
Semester	**Course No.**	**Name of Course**	**Units**
I	BDCT-117 (Theory)	Introduction to Generic Medicine	Unit I: Diseases Unit II: Diagnosis and Medicine Unit III: Generic Medicine Unit IV: Generic medicine Analysis
	BDCT-118 (Theory)	Statistical Analysis of Generic Medicine	Unit I: Basic Statistical Concepts Unit II: Data Collection, Management and Analysis Unit III: Bioequivalence Studies Unit IV: Pharmacovigilance and Post Marketing Surveillance
	BDCP-119 (Practical)	Open Elective Lab-I	
II	BDCT-127 (Theory)	Generic Drug: The Indian Scenario	Unit I: Availability and Accessibility Unit II: Drug Price Control Unit III: Government Initiatives Unit IV: Indian Generic Medicine in the International Market
	BDCT-128 (Theory)	Clinical Pharmacy	Unit I: Introduction to Clinical Pharmacy Unit II: Patient Assessment & Medication Therapy Management Unit III: Drug Information and Literature Evaluation. Unit IV: Communication and Counselling Skills
	BDCP-129 (Practical)	Open Elective Lab-II	

Credits (Total Credits 2)	SEMESTER– I Open Elective Course – I BDCT-117: Introduction to Generic Medicine	No. of hours per unit (30)
Course Objectives: Students Should be able to... 1. Define diseases and its types. 2. Study methods of disease diagnosis. 3. Identify generic medicine. 4. Understand generic medicine analysis.		
Unit - I	**Diseases** 1.1 Concept of disease, 1.2 Types of diseases, Infectious diseases, non-infectious diseases, chronic diseases, acute disease, 1.3 Host, Parasite, pathogens, disease conditions.	**(08)**
Unit - II	**Diagnosis and Medicine** 2.1 History of diagnosis, 2.2 Types of diagnosis, latest methods of diagnosis according to diseases. 2.3 Definition of medicine, early medicine, evolution of medicine, medicines used in diagnosis, 2.4 Combo of instrument and medicine in diagnosis.	**(08)**
Unit – III	**Generic Medicine** 3.1 Concept of generic medicine, 3.2 Comparison between branded and generic medicine. 3.3 Patent and its values. 3.4 Cost effective study.	**(08)**
Unit - IV	**Generic Medicine Analysis** 4.1 Comparative study of generic and branded medicine: 4.2 Paracetamol/acetaminophen is the non-proprietary name (generic name) while Crocin/Metacin/Meftal/Tylenol etc. are brand names. 4.3 Ibuprofen & IBU/ Advil Migraine/Ibren.	**(06)**
Course Outcomes: After completion of the course students should be able to…		

1. Describe types of diseases to society.
2. Explain methods of disease diagnosis
3. Categories generic medicine and branded medicine.
4. Analyze generic medicines and branded medicine.

References:

1. Papadakis M. A., Mcphee S. J., & Rabow M.W., 2021, Current Medical Diagnosis and Treatment; 61st edition, McGraw Hill publication
2. Pawar A., 2017, Generic Medicine Samaj-Gairsamaj (Marathi) Nirali Publication.
3. Bartlett J., 2011. Pocket guide for brand and generic drugs; Jones & Bratlett publishers.
4. Koessler K. K., Hatch A. & Pick A., 2007, Clinical Symptomology: with special reference to life thratening symptoms and their treatment; Kessinger Pub. Co
5. Kanfer I. & Shargel L, 2007 Generic Drug Product Development: Bioequivalence Issues, CRC Press.
6. Crowly L. V., 2006, Student Study Guide; An Introduction to Human Diseases; 7th edition, Jones and Bartlett publisher.
7. Tamparo C. D & Davis F. A., 2000, Diseases of Human Body; 3rd edition F. A. Davis publisher.

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Credits (Total Credits 2)	Open Elective Course – II BDCT-118: Statistical Analysis of Generic Medicine	No. of hours per unit (30)
Course Objectives: Students should be able to… 1. Study the introduction of statistical analysis in the context of generic medicines. 2. Learn about essential statistical concepts, techniques. 3. Define bioequivalence. 4. Understand statistical methods for detecting drug safety		
Unit - I	**Basic Statistical Concepts** 1.1 Descriptive statistics: measures of central tendency and variability. 1.2 Probability distribution: normal distribution &binomial distribution 1.3 Hypothesis testing & p- values. 1.4 Confidence intervals. 1.5 Importance of statistical analysis in generic medicine research.	**(08)**
Unit – II	**Data collection, management & analysis** 2.1 Data collection methods and sources. 2.2 Data quality assurance and validation. 2.3 Data cleaning and transformation. 2.4 Data visualization techniques: histograms, box plots, scatter plots. 2.5 Summery statistics & graphical representation	**(08)**
Unit – III	**Bioequivalence Studies** 3.1 Definition & importance of bioequivalence. 3.2 Study design and statistical analysis in bioequivalence analysis. 3.3 Average bioequivalence & individual bioequivalence. 3.4 Bioequivalence acceptance criteria.	**(08)**
Unit - IV	**Pharmacovigilance and Post- marketing Surveillance** 4.1 Overview of pharmacovigilance and post- marketing Surveillance, 4.2 Statistical methods for detecting and evaluating drug safety signals, 4.3 Risk benefit assessment of generic medicines. 4.4 Reporting and communication of safety findings.	**(06)**
Course Outcomes: After completion of the course students should be able to… 1. Collect and analyze the statistical data of drug.		

2. Interpret results and draw conclusions for statistical analysis of drug.
3. Explain bioequivalence and its importance.
4. Report and discuss safety finding of generic drug.

References

1. Gupta S. K. & Shrivastava S., 2019, Textbook of Pharmacovigilance; 2nd edition, Jaypee brother's medical publishers.
2. Sharma S, Mehata Y., 2018, Essentials of pharmacovigilance; 1st edition Jaypee brother's medical publishers.
3. Pawar A., 2017 Generic Medicine Samaj-Gairsamaj (Marathi); Nirali Publication.
4. Zozus M, 2017, The data book collection and management of research data. 1st edition Chapman & Hall/ CRC press
5. Naizi S. K., 2014, Handbook of Bioequivalence Testing (Drugs and the Pharmaceutical Science), 2nd edition CRC Press.
6. Rani S.2012, Handbook of Basic Statistical Concepts: for Scientist and Pharmacists; Alfa science intenational ltd.
7. Hauschke D, Steinijans V, Pigeot I., 2007, Bioequvalence studies in drug development methods and applications; 1st edition, Wiley Publications.
8. Kanfer I. & Shargel L, 2007 Generic Drug Product Development: Bioequivalence Issues, CRC Press.
9. Bartz A. E., 1988 Basic Statistical Concepts; 3rd edition Macmillan USA

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Credits (Total Credits 2)	BDCP-119: Open Elective Lab- I	No. of hours (60)

Course Objectives: Students Should be able to…

1. Identify generic medicine.
2. Understand brand names, generic names of medicine.
3. Study compositions of medicines.
4. Learn blood groups.

1	To identify generic medicines.	
2	To identify brand name, trade name, manufacturer and marketed by for the drug Rabeprazole	
3	To identify brand name, trade name, manufacturer and marketed by for the drug (Any 6)	
4	To identify brand name, trade name, manufacturer and marketed by for the drug cetirizine	
5	Write the names of chemical ingredients present in the given tablet	
6	Comparing generic and brand- name medicine.	
7	Case study on benefits and limitations of regulatory guidelines for generic medicine.	
8	To identify blood group.	
9	Explore pharmacovigilance databases to identify signals and trends related to generic medicines.	

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

1. Organize brand name, generic name of drug.
2. Distinguish generic and branded drug
3. Analyze medicines to find constituent ingredients in it.
4. Detect blood group.

References:

1. Pawar A., 2017, Generic Medicine Samaj-Gairsamaj (Marathi) Nirali Publication
2. Naizi S. K., 2014, Handbook of Bioequivalence Testing (Drugs and the Pharmaceutical Science), 2nd edition CRC Press.
3. Rani S.2012, Handbook of Basic Statistical Concepts: for Scientist and Pharmacists; Alfa

science intenational ltd.

4. Bartlett J., 2011. Pocket guide for brand and generic drugs; Jones & Bratlett publishers.
5. Kanfer I. & Shargel L, 2007 Generic Drug Product Development: Bioequivalence Issues, CRC Press.
6. Bartz A. E., 1988 Basic Statistical Concepts; 3rd edition Macmillan USA

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Credits (Total Credits 2)	SEMESTER – II Open Elective Course – III BDCT-127: Generic Drugs: The Indian Scenario	No. of hours per unit (30)
Course Objectives: Students should be able to… 1. Recognize the availability of generic medicine. 2. Understand role of government in controlling drug price. 3. Summaries the government initiatives towards generic medicine. 4. Study the importance of international marketing.		
Unit - I	**Availability and Accessibility** 1.1 Availability of generic medicine in India, 1.2 Retail pharmacies, 1.3 Government hospitals, 1.4 Private healthcare facilities across the country.	**(08)**
Unit – II	**Drug Price Control** 2.1 Drug Price Control Chart 2.2 Affordability and cost-effectiveness of generic medicine in India 2.3 Various measures to control the prices of essential medicines, and generic drugs. 2.4 The National Pharmaceutical Pricing Authority (NPPA) in India.	**(08)**
Unit – III	**Government Initiatives** 3.1 Role of government, 3.2 Jan Aushadhi Scheme and its impact on access to affordable generic medicines, 3.3 Distribution channels and retail availability of generic medicines in India, 3.4 Challenges and initiatives in ensuring widespread availability of generic medicines. 3.5 Government subsidies on life saving medicines.	**(07)**
Unit - IV	**Indian Generic Medicines in the International Market** 4.1 Export of Indian generic medicines and its contribution to global healthcare, 4.2 Challenges and opportunities in the international market for Indian generic medicines,	**(08)**

	4.3 Regulations and compliance for exporting generic medicines.	

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

1. Illustrate the availability of generic medicine in India.
2. Discuss role of NPPA in controlling price of medicine.
3. Explain government policies about generic medicine to society
4. Describe challenges and opportunities in the international market for Indian generic medicine.

References:

1. Baig S. M., 2023, Prevention & Social Medicine; 2nd Edition SIA Publisher.
2. Kore P., Bodhankar S., 2022, Principles of Drug discovery, 1st edition Career Publication.
3. Pawar A., 2017, Generic Medicine Samaj-Gairsamaj (Marathi); Nirali Publishation.
4. Lofgren H., 2013, the politics of the pharmaceuticals Industry & Access to Medicines; Orient blackswan private limited-New Delhi.
5. Isadore K, Leon S., 2007, Generic drug product development bioequivalence Issues; 1st edition CRC press.

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Credits (Total Credits 2)	Open Elective Course – IV BDCT-128: Clinical Pharmacy	No. of hours per unit (30)
Course Objectives: Students should be able to… 1. Define clinical pharmacy 2. Collect medication history of patient. 3. Search drug information from different sources. 4. Learn patients counselling techniques.		
Unit - I	**Introduction to Clinical Pharmacy** 1.1 Definition and scope of the clinical pharmacy, 1.2 Role of clinical pharmacist in healthcare teams, 1.3 Legal and ethical considerations in clinical practice.	**(08)**
Unit – II	**Patient Assessment and Medication Therapy Management** 2.1 Collecting patient medication histories, 2.2 Identifying and resolving drug related problems, 2.3 Developing therapeutic plans.	**(08)**
Unit – III	**Drug Information and Literature Evaluation.** 3.1 Searching and evaluating drug information resources, 3.2 Critical appraisal of clinical literature, 3.3 Evidence-based medicine principles.	**(07)**
Unit - IV	**Communication and Counselling Skills** 4.1 Effective communication with healthcare professionals and patients, 4.2 Patients counselling techniques, 4.3 Health literacy and cultural competence.	**(07)**
Course Outcomes: After completion of the course students will be able to… 1. Describe the role of clinical pharmacist. 2. Recognize medication history of patient. 3. Evaluate drug information resources. 4. Value patients counselling.		
References: 1. Arora P. & Kumar B., 2023, A Book of Hospitals And Clinical Pharmacy, VM books 2. Sherrin D., 2020, Authentic Assessment in social studies; 1st Edition, Eye on Education.		

3. Kumar S.S., 2018 Hospital And Clinical Pharmacy; Sathya Publishers.
4. Pawar A., 2017, Generic Medicine Samaj-Gairsamaj (Marathi); Nirali publication.
5. Wiffen P., Mitchell M., Snelling M. & Stoner Nicola, 2017 Oxford Handbook of Clinical Pharmacy, 3rd edition OUP Oxford.
6. Abate M. A., Blommel M. L., 2013, Drug information & literature evaluation; Pharmaceutical press.
7. Silverman J., Kurtz S., Draper J., 2013, Skills and Communicating with patients; 3rd edition CRC press.
8. Partasarathi G. Hansen K. M, Nahata M. C., 2012, A textbook of clinical Pharmacy Practice essential concepts and skills, 2nd edition, Universities press India.

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Credits (Total Credits 2)	BDCP-129: Open Elective Lab - II	No. of hours (60)

Course Objectives: Students should be able to…

1. Understand importance of medication history of patient.
2. Collect drug information and safety data.
3. Enlist drugs used for same therapeutic area.
4. Learn patients counselling techniques.

1	Conduct a cost-effectiveness study comparing generic medicines and branded drugs. (Any 5)	
2	Assess the safety profile of generic medicines by analyzing adverse drug reactions (ADRs) reported in databases or clinical trials. (Any 3)	
3	Select a specific therapeutic area and compare the effectiveness of generic medicines against their branded counterparts. (Any 2)	
4	To collect medication history of patient.	
5	To learn the methods for patient's counselling.	
6	To collect drug information and safety data of Pthallidoamide drug.	
7	To collect drug information and safety data of Ranitidine.	
8	To collect drug information and safety data Atenolol	

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

1. Collect and analyze patient's medication history.
2. Compare different drugs in terms of safety and their effectiveness.
3. Collect the information of drugs used for same therapeutic area.
4. Practice patients counselling.

References:

1. Baig S. M., 2023, Prevention & Social Medicine 2nd Edition SIA publisher.
2. Arora P. & Kumar B., 2023, A Book of Hospitals And Clinical Pharmacy, VM books
3. Kore P., Bodhankar S., 2022, Principles of Drug discovery; 1st edition Carrier publication.
4. Sethi P. D., 2019, Quantitative Analysis of Drugs in Pharmaceutical Formulations; 3rd edition CBS publication.
5. Partasarathi G. Hansen K. M, & Nahata M. C., 2012, A textbook of Clinical Pharmacy Practice essential concepts and skills, 2nd edition, Universities press India.

6. Isadore K., Leon S., 2007; Generic drug product development bioequivalence Issues; 1st edition CRC press.
7. Shah V. P. & Howard I. M, 1993, Topical Drug Biavailability, Bioequivalence and Penetration; Springer publication.

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Structure and titles of the B.Sc. I Course Indian Knowledge System: Indian Health Sciences			
Semester	**Course no.**	**Name of course**	**Units**
I	IKS- 101 (Theory)	Indian Health Sciences	Unit I: Basic Concepts of Ayurveda Unit II: Daily Regimen and Seasonal Regimen Unit III: Introduction to Charaka Samhita Unit IV: Introduction to Sushruta-Samhita

Indian Health Sciences

IKS-101: Indian Knowledge System: Indian Health Sciences Course- I		
Course Objective: Students should be able to… 1. Learn basic concepts of Ayurveda. 2. Study Daily regimen for maintenance of good health. 3. Recall the basics qualities of a Vaidya. 4. Understand importance of digestion in maintenance of good health.		
Credits (Total Credits 2)	**Indian Knowledge System (IKS-101) Indian Health Sciences**	**No. of hours per unit**
Unit I	**Basic concepts of Ayurveda** 1.1 Vedic foundations of Ayurveda, concerne of Ayurveda with maintenance of good health and treatment of disease, 1.2 The three Gunas and three Doshas, Panchamabhuta and Sapta- Dhatu 1.3 The importance of Agni (digestion). Six Rasas and their relation to Doshas. Ayurvedic view of the cause of disease	**8**
Unit II	**Daily regimen and seasonal regimen** 2.1 Dinacharya or daily regimen for the maintenance of good health Ritucharya 2.2 Seasonal regimen.	**8**
Unit III	**Introduction to Charaka- Samhita** 3.1 **A)** Charaka and Sushruta on the qualities of a Vaidya. The whole world is a teacher of the good Vaidya. 3.2 Charaka's description of a hospital. Hospitals in ancient and mediaeval India. 3.3 **B) Flourishment of Ayurveda:** Flourishment of Ayurveda till 18/19th centuries. Surgical practices, inoculation. Current revival of Ayurveda and Yoga	**8**

Unit IV	**Introduction to Sushruta- Samhita** 4.1 Introduction of Susruta- Samhita, sections on plastic surgery, cataract surgery and anal fistula. 4.2 The large pharmacopeia of Ayurveda	**6**

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

1. Explain causes of diseases according to Ayurveda.
2. Apply the relationship of daily regimen to maintain good health.
3. Describe ashtanga Ayurveda to society.
4. Discuss characteristics of Vaidya.

References:

1. Krishan S., 2021, Essential Ayurveda; Jaico publishing house.
2. Tiwari M., 2017, Ayurveda: Secrets of Healing: The complete Ayurvedic guide to healing through Pancha Karma seasonal therapies, diet, herbal remedies and memory; Motilal Banarsidass Publishers
3. Lad V., 2017, Ayurveda: The Science of Self Healing; Motilal Banarsidass Publishers.
4. Srikanth Murty K. R., 2012, Illustrated Susrut Samhita Text English Tr; Chaukhamba orientalika publisher
5. Das B., 2009, Charak Samhita: Text with English Translation & Critical Exposion Based on Chakrapani Datta's Ayurveda Dipika; Chaukhamba Sanskrit Pratishtan.
6. Athavale V. B., 2005, Basic Principles of Ayurveda; Chaukhamba Sanskrit Pratishtan.
7. SvobodaR. E., 2004, Ayurveda: Life, Health and Longevity*;* Penguin India.
8. Srikantha Murthy Astangahrdaya, Vol. I, Sutrasthāna and Sarirasthana, 1991.Translated by K. R., Vol. I, Krishnadas Academy, Varanasi.

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Structure and titles of the B.Sc. I Course Skill Enhancement Course			
Semester	**Course No.**	**Name of Course**	**Units**
II	**I (Theory)**	**Separation Techniques**	**Unit I: Separation Techniques**
	Practical	**Practical Course of Separation Techniques**	

Skill Enhancement Course Name: Separation Techniques

Credits (Total Credits 2)	SEMESTER– II Skill Enhancement Course SEC-103: Separation Techniques	No. of hours per unit
1 Credit	**Theory paper**	
Course Objectives: Students should be able to… 1. Understand the importance of separation techniques in practical skill. 2. Recall different methods of separation. 3. Acquire skill to separate binary mixtures. 4. Study functional group detection instrumentally.		
Unit I	**Separation Techniques:** 1.1 Introduction to Separation techniques ,types of separation techniques 1.2 Identification of elements and functional group in the given compounds 1.3 Identification of functional group chemically and instrumental.	**15**
1 Credit	**Practical**	**15**
	1. Isolation of paracetamol from given pharmaceutical tablet 2. Extraction of piperazine from black paper by Soxhlet apparatus. 3. Separation of mixture by simple distillation 4. Separation of mixture by steam distillation 5. Extraction of essential oils from given sample 6. Separation of binary mixture of acid-base 7. Separation of binary mixture of acid-phenol 8. Separation of binary mixture of acid- neutral 9. Separation of binary mixture of base-phenol 10. Isolation of crude drugs from natural sources.	
Course Outcomes: After completing the course student will be able to…		

1. Isolate active pharmaceutical ingredients from given tablet.
2. Extract oil from given natural source.
3. Identify the type of given mixture and separate it.
4. Determine the functional group of given organic compound.

References:

1. Stanley C., 2022, Analytical Chemistry: A Fundamental Approach to Modern Separtion Techniques; independently published.
2. Popat P. R., 2020, Practical Handbook for analytical Chemistry; Nation press.
3. Sundaramurthy S. & Keshav A., 2012, Textbook of Separation Processes; Studium Press India.
4. Leonard J., Lygo B., Procter G., 2018, Advanced Practical Organic Chemistry; Taylor and Francis Books India Pvt. Ltd.
5. Furnis B. S., Hannaford A. J., Tacthell A. R., 2003,Vogel's text book of Practical Organic Chemistry; 5th edition. Pearson India.
6. Okotore R. O., 1998, Basic Separation Techniques in Biochemistry; New are international
7. Melon C. E., 1999, Chemical Separations: Principle, Techniques and Experiments Wiley publication.

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Credits 02	B. Sc. I, Sem II Value Education Course	No. of Hrs. 30
UNIT	**VEC 104: Digital Technological Solutions for Society**	
	Course Objective: Students should be able to… 1. Gain familiarity with technology based system and solutions. 2. Provide know how of social media communication system. 3. Understand the emerging technologies. 4. Bring awareness about the impact on society.	
I	**Technology Based System and Solutions for Society:** 1.1 Introduction, Industry 4.0, Society 4.0 1.2 Digital India and e-Governance 2 1.3 Digital Financial Tools: Unified Payment Interface, Aadhar enabled payment System, USSD, Credit/Debit Cards. e-Wallets 1.4 Internet Banking, NEFT/RTGS and IMPS, Online Bill Payments, platform ecology	**6**
II	**Modern Youth and Social Media Communication Systems:** 2.1 Introduction, Internet: concept and applications 2.2 Search Engines, Messaging, E-mail, Social networking Mobilization 2.3 Amplification, new social media ecology, Data ecology	**8**
III	**Emerging Technologies: Case Studies:** 3.1 Disruptive technology, Health care, Space 3.2 Mechanical, and automobile 3.3 AI, Robotics, Chat GPT, and future, Digital Technologies and its use	**8**
IV	**Impact on Society:** 4.1 Introduction, new global ecology 4.2 21st century skills, Opportunities, Threats 4.3 Human and machine co-working and responsibilities	**8**
	Course Outcomes: After completion of the course, the students will be able to… 1. Evaluate the importance of digital technology, digital financial tools, and e- commerce. 2. Apply technological solutions in day today life in effective manner. 3. Analyze the emerging technologies 4. State the impact of technology on society	

	References: 1. Yuval Naoh Harari. 2019. 21 lessons for the 21st century: Vintage Publication. 2. Godbole A. 2023. Industry 4. 0: Madhushree Publication. 3. Chinchure A 2021. The new age organizations: Spotlight publication.	

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