॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड – ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

Established on 17th September, 1994. Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

Fax : (02462) 215572

Phone: (02462)215542

Academic-1 (BOS) Section

website: srtmun.ac.

E-mail: bos@srtmun.ac.

विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० नुसार पदव्यूत्तर द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२४–२५ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, या विद्यापीठा अंतर्गत येणा–या सर्व संलग्नित महाविद्यालयामध्ये शैक्षणिक वर्ष २०२४–२५ पासून राष्ट्रीय शैक्षणिक धोरणानुसार पदव्यूत्तर द्वितीय वर्षाचे अभ्यासक्रम लागू करण्याच्या दृष्टीकोनातून विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत येणा–या अभ्यासमंडळांनी तयार केलेल्या पदव्यूत्तर द्वितीय वर्षाच्या अभ्यासक्रमांना मा. विद्यापरिषदेने दिनांक १५ मे २०२४ रोजी संपन्न झालेल्या बैठकीतील विषय क्रमांक १५/५९–२०२४ च्या ठरावाअन्वये मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील खालील एम. एस्सी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) लागू करण्यात येत आहेत.

1) M. Sc. II year - Analytical Chemistry (Affiliated College)
2) M. Sc. II year - Biochemistry (Affiliated College)
3) M. Sc. II year - Organic Chemistry (Affiliated College)
4) M. Sc. II year - Physical Chemistry (Affiliated College)
5) M. Sc. II year - Inorganic Chemistry (Affiliated College)
6) M. Sc. II year - Analytical Chemistry (Campus)
7) M. Sc. II year - Industrial Chemistry (Campus)
8) M. Sc. II year - Medicinal Chemistry (Campus)
9) M. Sc. II year - Organic Chemistry (Campus)
10) M. Sc. II year - Physical Chemistry (Campus)
11) M. Sc. II year - Polymer Chemistry (Campus)
12) M. Sc. II year - Computer Management (Affiliated College)
13) M. Sc. II year - Computer Sciene (Affiliated College)
14) M. Sc. II year - Software Engineering (Affiliated College)
15) M. Sc. II year - System Administration & Networking (Affiliated College)
16) M. Sc. II year - Computer Application (Campus)
17) M. Sc. II year - Computer Network (Campus)
18) M. Sc. II year - Computer Science (Campus)
19) M. Sc. II year - Zoology (Campus)
20) M. Sc. II year - Zoology (Affiliated College)
21) M. Sc. II year - Physics (Campus)
22) M. Sc. II year – Physics (Affiliated College)

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शै–१/एनइपी/विवत्रंविपदवी/२०२४–२५/993
दिनांक १३.०६.२०२४

डॉ. सरिता लोसरवार
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत : १) मा. आधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मुल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
३) मा. प्राचार्य, सर्व संबधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) मा. संचालक, सर्व संकुले परिसर व उपपरिसर, प्रस्तुत विद्यापीठ
५) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, सदर परिपत्रक संकेतस्थळावर प्रसिध्द करण्यात यावे.

COURSE STRUCTURE

As Per National Education Policy- 2020

M. Sc. Second Year

Subject: Biochemistry

- **Teaching scheme**
- **Examination Scheme**
- **Syllabus**

To be Implemented from

Academic Year 2024-2025

M. Sc. Second Year Semester III

Sub. Code: BCH

Teaching Scheme

	CourseCode	Course Name	Credits Assigned			Teaching Scheme (Hrs./ week)	
			Theory	Practical	Total	Theory	Practical
Major (DSC)	SDSCCBCH 501	**Pharmaceutical Biochemistry**	04	--	**04**	**04**	--
	SDSCCBCH 502	**Genetic Engineering**	04	-	**04**	**04**	-
	SDSCCBCH 503	**Drug Design**	04	-	04	04	-
Elective (DSE)	SDSCEBCH 501 SDSCEBCH 503	**Study of Natural Plant Product OR Study of Plant tissue culture**	04	--	**04**	**04**	-
Research Project	SDSCR 551	**Research Project**	-	04	04	-	04
DSC Practical	SDSCPBCH-501	**Lab Course in Pharma. Biochemistry**	-	01	01	-	02
	SDSCEBCH-502	**Lab Curse in Genetic Engineering**	-	**01**	**01**		02
Total Credits			**16**	**06**	**22**	**16**	**08**

M. Sc. Second Year Semester III

Sub. Code: BCH

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	Total (7)	CA (8)	ESA (9)	
Major (DSC)	SDSCCBCH 501	**Pharmaceutical Biochemistry**	20	20	20	80	--	--	100
	SDSCCBCH 502	**Genetic Engineering**	20	20	20	80	--	--	100
	SDSCCBCH 503	**Drug Design**	20	20	20	80	--	--	100
Elective (DSE)	SDSCEBCH 501 SDSCEBCH 503	**Study of Natural Plant Product** **OR** **Study of Plant tissue culture**	20	20	20	80	--	--	100
Research Project	SDSCR 551	**Research Project**	-	-	-		20	80	100
DSC Practical	SDSCPBCH-501	**Lab Course in Pharma. Biochemistry**	-	-	-	-	5	20	25
	SDSCEBCH-502	**Lab Curse in Genetic Engineering**	--	--	--	--	5	20	25

M. Sc. Second Year Semester IV *(Level 4.5)*
Sub. Code: BCH
Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs./ week)	
			Theory	Practical	Total	Theory	Practical
Major (DSC)	SDSCCBCH 551	**Industrial Biochemistry**	04	--	**04**	**04**	--
	SDSCCBCH 552	**Drug Metabolism**	04	-	**04**	**04**	-
Elective (DSE)	SDSCEBCH 551 SDSCEBCH 503	**Diagnostic Virology** **OR** **Diagnostic Biochemistry**	04	--	**04**	**04**	-
Value Education Course	SVECP 551	**Publication Ethics**	2		**2**	**02**	
Research Project	SDSCR 551	**Research Project**	-	06	06	-	06
DSC Practical	SDSCPBCH-501	**Lab Course in Ind. Biochemistry**	-	01	01	-	02
	SDSCEBCH-502	**Lab Curse in Drug Metabolism**	-	**01**	**01**		02
Total Credits			**14**	**08**	**22**	**14**	**10**

M. Sc. Second Year Semester IV *(Level 4.5)*

Sub. Code: BCH

Examination Scheme

[20% Continuous Assessment (***CA)*** and 80% End Semester Assessment (***ESA***)]

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	Total (7)	CA (8)	ESA (9)	
Major (DSC)	SDSCCBCH 551	**Industrial Biochemistry**	20	20	20	80	--	--	100
	SDSCCBCH 552	**Drug Metabolism**	20	20	20	80	--	--	100
Elective (DSE)	SDSCEBCH 551 SDSCEBCH 503	**Diagnostic Virology OR Diagnostic Biochemistry**	20	20	20	80	--	--	100
Value Education Course	SVECP 551	**Publication Ethics**	10	10	10	40			50
Research Project	SDSCR 551	**Research Project**	-	-	-		30	120	150
DSC Practical	SDSCPBCH-501	**Lab Course in Ind. Biochemistry**	-	-	-	-	5	20	25
	SDSCEBCH-502	**Lab Curse in Drug Metabolism**	--	--	--	--	5	20	25

Syllabus for M. Sc. Second Year

Subject: Biochemistry

Semester – III

As Per National Education Policy- 2020

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - III)

Major Core Theory Course

Course Code – SBCHCT1501

Title of the Course: Pharmaceutical Biochemistry

[Credits: 4 (Marks: 100)] **(Total Periods: 60 Hours)**

Course objectives:

- To understand the structure and function of key biomolecules.
- To gain insights into metabolic pathways and their regulation.
- To explore the biochemical mechanisms of drug action and metabolism.
- To learn about the role of enzymes in drug interactions and metabolic processes.
- To develop skills in laboratory techniques and data analysis in biochemistry.

Course outcomes: The student will be able to

1. Analyze Enzyme Mechanisms and Kinetics:
2. Explain Drug Action and Metabolism:
3. Apply Pharmacogenomics:
4. Evaluate Drug-Induced Toxicity**:**

CURRICULUM DETAILS: SBCHC1501: PHARMACEUTICAL BIOCHEMISTRY

Module No.	Unit No.	Topic	Hrs.
1.0		**Introduction to Pharma. Biochemistry**	**15**
	1.1	Overview of biochemistry and its relevance to pharmacy	
	1.2	Structure and properties of water	
	1.3	pH and buffers in biological systems	
	1.4	Enzyme kinetics and inhibition	
2.0		**Biochemical Basis of Drug Action**	**15**
	2.1	Drug-receptor interactions	
	2.2	Signal transduction pathways	
	2.3	Mechanisms of drug action: agonists and antagonists	
	2.4	Allosteric regulation of enzymes	
3.0		**Pharmacogenomics and Biochemical Genetics**	**15**
	3.1	Genetic variation and its impact on drug response	
	3.2	Personalized medicine and pharmacogenomics	
	3.3	Biochemical basis of genetic disorders and their treatment	
	3.4	Role of enzymes in drug metabolism	
4.0		**Drug Metabolism and Toxicology**	**15**
	4.1	Phase I and Phase II drug metabolism	
	4.2	Cytochrome P450 enzyme system	
	4.3	Biotransformation and elimination of drugs	
	4.4	Mechanisms of drug-induced toxicity	
		Total	**60**

Text Books and Reference Books:

1. Harper's Illustrated Biochemistry" by Robert K. Murray, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, and P. Anthony Weil
2. Lehninger Principles of Biochemistry" by David L. Nelson and Michael M. Cox
3. Biochemistry" by Jeremy M. Berg, John L. Tymoczko, and Lubert Stryer
4. Textbook of Biochemistry with Clinical Correlations" by Thomas M. Devlin
5. Biochemical Pharmacology" by Michael Palmer
6. Goodman & Gilman's: The Pharmacological Basis of Therapeutics" by Laurence L. Brunton, Randa Hilal-Dandan, and Bjorn Knollmann
7. Lippincott Illustrated Reviews: Biochemistry" by Denise R. Ferrier
8. Pharmaceutical Biochemistry" by Jayaveera K.N., Vrushabendra Swamy B.M.
9. Essentials of Medical Biochemistry: With Clinical Cases" by Chung Eun Ha and N. V. Bhagavan
10. Clinical Biochemistry and Metabolic Medicine" by Martin Crook
11. Principles of Biochemistry" by H. Robert Horton, Laurence A. Moran, Gray Scrimgeour, Marc Perry, and David Rawn
12. Medical Biochemistry: An Illustrated Review" by Sankhavaram R. Panini

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - III)

Major Core Theory Course

Course Code – SBCHCT1502

Title of the Course: Genetic Engineering

[Credits: 4 (Marks: 100)] **(Total Periods: 60 Hours)**

Course objectives:

- To understand the fundamental principles of genetic engineering.
- To learn about the tools and techniques used in gene cloning and genetic manipulation.
- To explore the applications of genetic engineering in medicine, agriculture, and industry.
- To discuss the ethical, legal, and social issues related to genetic engineering.

Course outcomes: The student will be able to

1. Understand Fundamental Principles.
2. Utilize Molecular Tools and Techniques.
3. Conduct Gene Cloning and Expression.
4. Apply Recombinant DNA Technology.
5. Implement Gene Editing Techniques.

CURRICULUM DETAILS: SBCHC1502: GENETIC ENGINEERING

Module No.	Unit No.	Topic	Hrs.
1.0		**Introduction to Genetic Engineering**	**15**
	1.1	Overview of genetic engineering	
	1.2	Historical developments and milestones	
	1.3	Applications and significance in various fields	
	1.4	DNA isolation and purification	
2.0		**Molecular Tools and Techniques**	**15**
	2.1	Restriction enzymes and DNA ligases	
	2.2	Gel electrophoresis	
	2.3	Polymerase chain reaction (PCR) and its variants	
	2.4	DNA sequencing technologies	
3.0		**Gene Cloning and Expression**	**15**
	3.1	Cloning vectors: plasmids, phages, cosmids, and artificial chromosomes.	
	3.2	Insertion of DNA into vectors: transformation, transfection, and electroporation.	
	3.3	Selection and screening of recombinant clones.	
	3.4	Expression systems: bacterial, yeast, insect, and mammalian cells.	
4.0		**Gene Editing Technologies**	**15**
	4.1	Introduction to gene editing.	
	4.2	CRISPR-Cas9: mechanism, design, and applications.	
	4.3	Other gene editing tools: TALENs and ZFNs.	
	4.4	Gene therapy and its clinical applications.	
		Total	**60**

Text Books and Reference Books:

1. Molecular Cloning: A Laboratory Manual" by Michael R. Green and Joseph Sambrook
2. Principles of Gene Manipulation and Genomics" by Sandy B. Primrose and Richard Twyman
3. Gene Cloning and DNA Analysis: An Introduction" by T.A. Brown
4. Molecular Biotechnology: Principles and Applications of Recombinant DNA" by Bernard R. Glick, Jack J. Pasternak, and Cheryl L. Patten
5. Essential Genetics and Genomics" by Daniel L. Hartl
6. Genome Editing: A Practical Guide to Research and Clinical Applications" by Kursad Turksen
7. Genetic Engineering: Principles and Methods" edited by Jane K. Setlow
8. Molecular Genetics of Bacteria" by Larry Snyder and Wendy Champness
9. From Genes to Genomes: Concepts and Applications of DNA Technology" by Jeremy W. Dale and Malcolm von Schantz
10. Biotechnology: A Laboratory Course" by Becky Sue Coleman and Karen Wilson
11. Modern Genetic Analysis" by Anthony J.F. Griffiths, Susan R. Wessler, Richard C. Lewontin, and Sean B. Carroll
12. Genetics: Analysis and Principles" by Robert J. Brooker
13. Recombinant DNA: Genes and Genomes - A Short Course" by James D. Watson, Amy A. Caudy, Richard M. Myers, and Jan A. Witkowski
14. Genomics: The Science and Technology Behind the Human Genome Project" by Charles R. Cantor and Cassandra L. Smith

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - III)

Major Core Theory Course

Course Code – SBCHCT1503

Title of the Course: Drug Design

[Credits: 4 (Marks: 100)] **(Total Periods: 60 Hours)**

Course objectives:

- To understand the fundamental principles of drug design and discovery.
- To learn about the various strategies and tools used in drug design.
- To explore the role of computational methods in modern drug design.
- To understand the process of lead optimization and preclinical development.

Course outcomes: The student will be able to

1. Understand Drug Discovery and Development Processes.
2. Identify and Validate Biological Targets.
3. Apply Lead Discovery Techniques.
4. Utilize Computational Methods in Drug Design.
5. Conduct Preclinical Development Studies.

CURRICULUM DETAILS: SBCHC1503: DRUG DESIGN

Module No.	Unit No.	Topic	Hrs.
1.0		**Introduction to Drug Design**	**15**
	1.1	Overview of drug design and discovery	
	1.2	Historical perspectives and milestones	
	1.3	Key concepts in pharmacodynamics and pharmacokinetics	
	1.4	Stages of drug development	
2.0		**Target Identification and Validation**	**15**
	2.1	Biological targets: enzymes, receptors, and nucleic acids	
	2.2	Methods for target identification: genomics, proteomics, and bioinformatics	
	2.3	Target validation techniques: genetic, biochemical, and pharmacological approaches	
	2.4	Fragment-based drug discovery, Natural products in drug discovery	
3.0		**Computational Methods in Drug Design**	**15**
	3.1	Introduction to computational chemistry	
	3.2	Molecular modeling and docking studies	
	3.3	Quantitative structure-activity relationship (QSAR) modeling	
	3.4	Pharmacophore modeling and virtual screening, Structure-based drug design (SBDD) and ligand-based drug design (LBDD)	
4.0		**Preclinical Development**	**15**
	4.1	In vitro and in vivo pharmacology	
	4.2	Toxicology studies and safety assessment	
	4.3	Pharmacokinetics and pharmacodynamics (PK/PD) studies	
	4.4	Biomarker development and validation	
		Total	**60**

Text Books and Reference Books:

1. Drug Design: Structure- and Ligand-Based Approaches" by Kenneth M. Merz, Dagmar Ringe, and Charles H. Reynolds
2. The Organic Chemistry of Drug Design and Drug Action" by Richard B. Silverman and Mark W. Holladay
3. Drug Discovery and Development: Technology in Transition" by Raymond G. Hill and Humphrey P. Rang
4. Molecular Modelling: Principles and Applications" by Andrew R. Leach
5. Principles of Medicinal Chemistry" by Thomas L. Lemke, David A. Williams, Victoria F. Roche, and S. William Zito
6. Computational Drug Design: A Guide for Computational and Medicinal Chemists" by David C. Young
7. An Introduction to Medicinal Chemistry" by Graham L. Patrick
8. Medicinal Chemistry: A Molecular and Biochemical Approach" by Thomas Nogrady and Donald F. Weaver
9. Structure-Based Drug Discovery" edited by Harren Jhoti and Marko J. Zvelebil
10. Handbook of Drug Design, Discovery, and Development" edited by Ronald E. Borchardt, Peter J. Kerns, Mark J. Stillman, and Jeffrey A. Burger
11. Pharmacokinetics and Metabolism in Drug Design" edited by Dennis A. Smith, Han van de Waterbeemd, and Don K. Walker
12. The Practice of Medicinal Chemistry" by Camille G. Wermuth.

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - III)

Generic Elective Course

Course Code – SBCHGE 1501

Title of the Course: Study of Natural Plant Product

[No. of Credits: 4 Credit] **[Total: 60 Hours]**

Course objectives:

- To understand the diversity and classification of natural plant products.
- To learn the methods of extraction, isolation, and characterization of plant-derived compounds.
- To study the biosynthetic pathways of major classes of natural products.
- To explore the biological activities and therapeutic potentials of plant natural products.

Course outcomes: The student will be able to

1. Understand the Diversity and Classification of Natural Plant Products.
2. Apply Extraction and Isolation Techniques.
3. Analyze Chemical Composition and Characterization.
4. Explore Biosynthetic Pathways.
5. Evaluate Biological Activities and Therapeutic Potentials.

CURRICULUM DETAILS: SBCHGE 1501: Study of Natural Plant Product

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Introduction to Natural Plant Products**	**15**
	1.1	Definition and significance of natural plant products	
	1.2	Historical perspectives and traditional uses of plant products	
	1.3	Overview of primary and secondary metabolites	
	1.4	Classification of Natural Plant Product.	
2.0		**Extraction and Isolation Techniques**	**15**
	2.1	Methods of extraction: maceration, percolation, Soxhlet extraction, and supercritical fluid extraction	
	2.2	Purification techniques: chromatography (TLC, HPLC, GC), crystallization, and distillation	
	2.3	Characterization methods: spectroscopy (UV-Vis, IR, NMR, MS), and bioassays	
	2.4	Use of plant cell cultures for production of natural products	
3.0		**Biosynthesis of Natural Plant Products**	**15**
	3.1	Primary metabolism and secondary metabolism	
	3.2	Biosynthetic pathways: shikimic acid pathway, mevalonic acid pathway, and acetate pathway	
	3.3	Regulation of secondary metabolite biosynthesis	
	3.4	Genetic engineering and metabolic engineering of plant pathways	
4.0		**Biological Activities of Plant Natural Products**	**15**
	4.1	Antimicrobial, antifungal, and antiviral activities	
	4.2	Antioxidant and anti-inflammatory properties	
	4.3	Anticancer and cytotoxic effects	
	4.4	Role in plant defense mechanisms	

Text Books and Reference Books:

1. Natural Products: A Laboratory Guide" by Raphael Ikan
2. Introduction to Natural Products Chemistry" by Rensheng Xu and Yi Wang
3. The Chemistry of Natural Products" by R. H. Thomson
4. Natural Products from Plants" by Leland J. Cseke, Ara Kirakosyan, Peter B. Kaufman, Sara Warber, James A. Duke, and Harry L. Brielmann
5. Biochemistry of Plant Secondary Metabolism" edited by Michael Wink
6. Medicinal Natural Products: A Biosynthetic Approach" by Paul M. Dewick
7. Handbook of Natural Plant Products" by Mallappa Kumara Swamy
8. Plant Biochemistry" by Hans-Walter Heldt and Fiona Heldt
9. Natural Product Chemistry: A Mechanistic and Biosynthetic Approach to Secondary Metabolism" by Stephen Hanessian
10. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis" edited by Jeffrey B. Harborne and Herbert Baxter
11. Medicinal Plants: Chemistry and Properties" by Marcello Iriti and Michael Heinrich
12. Natural Product Isolation" edited by Richard J. P. Cannell and Joseph R. Johnes

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - III)

Generic Elective Course

Course Code – SBCHGE 1501

Title of the Course: Study of Plant tissue culture

[No. of Credits: 4 Credit] **[Total: 60 Hours]**

Course objectives:

- To understand the principles and techniques of plant tissue culture.
- To learn the steps involved in establishing and maintaining plant tissue cultures.
- To explore the applications of plant tissue culture in plant propagation, conservation, and genetic improvement.
- To develop practical skills in media preparation, sterilization, and manipulation of plant tissues in vitro.

Course outcomes: The student will be able to

1. Understand the Principles and Techniques of Plant Tissue Culture.
2. Apply Plant Tissue Culture Techniques.
3. Analyze and Interpret Plant Tissue Culture Data.
4. Demonstrate Practical Skills in Plant Tissue Culture.
5. Explore Applications of Plant Tissue Culture.

CURRICULUM DETAILS: SBCHGE 1501: Study of Plant Tissue Culture

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Introduction to Plant Tissue Culture**	**15**
	1.1	Definition and significance of plant tissue culture	
	1.2	Historical development and milestones	
	1.3	Applications in agriculture, horticulture, forestry, and biotechnology	
	1.4	Definition of Health, Nutrition and Malnutrition.	
2.0		**Basic Techniques in Plant Tissue Culture**	**15**
	2.1	Culture media preparation: solid and liquid media	
	2.2	Sterilization techniques: surface sterilization, autoclaving, and filtration	
	2.3	Explant selection and preparation	
	2.4	Inoculation and establishment of plant tissue cultures	
3.0		**Micropropagation Techniques**	**15**
	3.1	Micropropagation: principles and applications	
	3.2	Single-node culture, shoot tip culture, and meristem culture	
	3.3	Rooting and acclimatization of micropropagated plants	
	3.4	Organogenesis: induction and development of shoots from callus or explants	
4.0		**Secondary Metabolite Production**	**15**
	4.1	Role of plant tissue culture in secondary metabolite production	
	4.2	Elicitation and optimization of secondary metabolite production	
	4.3	Bioreactor culture and scaling up for commercial production	
	4.4	Cryopreservation and Germplasm Conservation	

Text Books and Reference Books:

1. Plant Tissue Culture: Theory and Practice" by S. S. Bhojwani and M. K. Razdan
2. Plant Tissue Culture: Techniques and Experiments" by Roberta H. Smith
3. Plant Propagation by Tissue Culture: Volume 1. The Background" by Edwin F. George and Michael A. Hall
4. Plant Propagation by Tissue Culture: Volume 2. In Practice" by Edwin F. George and Michael A. Hall
5. Principles of Plant Biotechnology: An Introduction to Genetic Engineering in Plants" by Arun Kumar Sharma and Ashwani Kumar
6. Plant Cell and Tissue Culture" by J. Reinert and Y. Bajaj
7. Introduction to Plant Tissue Culture" by M. K. Razdan
8. Plant Tissue Culture: Development and Biotechnology" by Paul Michael Anderson
9. Practical Plant Tissue Culture" by Trigiano and Gray
10. Plant Tissue Culture and Its Agricultural Applications" by Lyndsey A. Withers and Peter G. Alderson

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - III)

Major Practical Course

Course Code – SBCHCP1501

Title of the Course: Practical based on SBCHCT1501

[Credits: 1 (Marks: 25)] **(Total Periods: 15Hours)**

CURRICULUM DETAILS: SBCHCP1501: Practical based on SBCHCT1501

Sr. No	Practical Exercises	Hrs.
1.	Determination of drug solubility in various solvents and pH conditions.	2
2.	Evaluation of drug dissolution rates using dissolution apparatus.	2
3.	Study of enzyme kinetics using spectrophotometric or fluorometric assays.	2
4.	Evaluation of drug dissolution profiles using dissolution apparatus.	2
5.	Cell viability assays (e.g., MTT assay) to evaluate drug cytotoxicity and cell proliferation.	2
6.	Metabolite identification and characterization using TLC	2
7.	Determination of the absorption spectra of pharmaceutical compounds.	2
8.	Quantification of the concentration of a compound using Beer-Lambert's law.	2
9.	Analysis of protein and nucleic acid concentrations using absorbance measurements.	2
10.	Separation and quantification of pharmaceutical compounds in a mixture.	2
11.	Determination of the purity and content of active ingredients in pharmaceutical formulations.	2
12.	Measurement of enzyme activity using spectrophotometric assays.	2
13.	Determination of Michaelis-Menten kinetics parameters such as Vmax and Km.	2
14.	Analysis of enzyme inhibition using reversible and irreversible inhibitors.	2
15.	Determination of protein concentration using Bradford or Lowry assays.	2
	Total	**30**

Text Books and Reference Books:

1. Experimental Biochemistry" by Sanjay Sharma
2. Experiments in Pharmaceutical Biochemistry" by C. N. Ratledge and R. G. Lan
3. Practical Pharmaceutical Biochemistry" by A. Ramachandran and A. R. Gomes
4. Experimental Techniques in Pharmaceutical Biochemistry" by A. R. Gomes and C. K. Kokate
5. Laboratory Experiments in Pharmaceutical Biochemistry" by N. Rama Rao
6. Practical Manual of Pharmaceutical Biochemistry" by V. G. Bhagwat
7. Experimental Methods in Pharmaceutical Biochemistry" by K. Jayaraman and P. K. Mukherjee
8. Laboratory Manual of Pharmaceutical Biochemistry" by S. N. Pandeya and A. K. Das

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - III)

Major Practical Course

Course Code – SBCHCP1502

Title of the Course: Practical based on SBCHCT1502

[Credits: 1 (Marks: 25)] **(Total Periods: 15Hours)**

CURRICULUM DETAILS: SBCHCP1502: Practical based on SBCHCT1502

Sr. No	Practical Exercises	Hrs.
1.	Isolation of plasmid DNA from bacterial cultures using alkaline lysis or commercial kits.	2
2.	Digestion of plasmid DNA with restriction enzymes to generate DNA fragments of interest.	2
3.	Preparation of agarose gels and loading of digested DNA samples.	2
4.	Electrophoresis of DNA fragments to separate them based on size.	2
5.	Visualization of DNA bands using ethidium bromide or other DNA stains.	2
6.	Ligation of DNA fragments into plasmid vectors using DNA ligase enzyme.	2
7.	Transformation of ligated plasmids into competent bacterial cells.	2
8.	Preparation of competent bacterial cells and transformation with recombinant plasmids.	2
9.	Selection of transformed cells on agar plates containing antibiotic resistance markers.	2
10.	Amplification of specific DNA sequences using PCR primers, DNA template, and DNA polymerase enzyme.	2
11.	Optimization of PCR conditions including annealing temperature, extension time, and primer concentration.	2
12.	Cloning of PCR-amplified DNA fragments into plasmid vectors.	2
13.	Screening of recombinant clones using blue-white screening or colony PCR.	2
14.	Induction of gene expression in bacterial or yeast expression systems.	2
15.	Analysis of recombinant protein expression using SDS-PAGE and Western blotting.	2
	Total	**30**

Text Books and Reference Books:

1. Experimental Methods in Molecular Biology" by Fredrick M. Ausubel et al.
2. Experimental Approaches to Understanding the Genetic Basis of Complex Biological Traits" edited by Sergey V. Nuzhdin
3. Methods in Molecular Biotechnology: Genomic Approaches" edited by Adelio R. Matos and Viswanathan Chinnusamy
4. Laboratory Techniques in Biochemistry and Molecular Biology: Genetic Engineering" by S. N. Chakrabarti and K. A. R. Kennedy
5. Experimental Techniques in Bioinformatics and Computational Biology: Genetic Engineering" by S. C. Rastogi and N. D. Sharma
6. Basic Laboratory Methods for Biotechnology: Genetic Engineering" by Lisa A. Seidman
7. Experimental Molecular Genetics" by Sue Carson
8. Advanced Methods in Molecular Biology and Biotechnology: Genetic Engineering" edited by P. K. Gupta
9. Experimental Techniques in Microbial Genetics and Genetic Engineering" by P. V. Agarwal and V. P. Singh
10. Genetic Engineering: Principles and Methods" edited by J. K. Setlow

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - III)

Minor Core Theory Course

Course Code – SBCHR 551

Title of the Course: Research Project

[Credits: 4 (Marks: 100)] **(Total Periods: 60 Hours)**

Course objectives:

1. To train the students with different experimental and analytical skills considering opportunities in academic and industrial research.
2. To gain the knowledge of referring research journals, writing research articles and submit the dissertation report.

SBCHR 551: Research Project

Note:

1. External and Internal Examiners will examine this project jointly at the time of Practical examination.
2. The students will have to give at least one seminar in each semester in their subject of specialization is compulsory.
3. Project work must be carried out only in specialized branch.
4. The project work carried out during the year should be presented in power point presentation in presence of University Examiners.

Syllabus for M. Sc. Biochemistry,

Second Year

Semester – IV

As Per National Education Policy- 2020

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - IV)

Major Core Theory Course

Course Code – SBCHCT551

Title of the Course: Industrial Biochemistry

[Credits: 4 (Marks: 100)] **(Total Periods: 60 Hours)**

Course objectives:

- To understand the principles and applications of biochemical processes in industrial settings.
- To learn about industrial enzymes, fermentation technology, and biocatalysis.
- To explore the production of biofuels, pharmaceuticals, and other bioproducts.
- To develop practical skills in industrial biochemistry techniques through laboratory experiments.

Course outcomes: The student will be able to

1. Understand the Principles and Applications of Industrial Biotechnology.
2. Analyze Industrial Enzymes and Biocatalysts.
3. Explore Fermentation Technology and Bioreactors.
4. Examine Biopolymers and Bio-based Materials.
5. Evaluate Biofuels and Bioenergy Production.
6. Understand Pharmaceutical Biotechnology.

CURRICULUM DETAILS: SBCHC551: INDUSTRIAL BIOCHEMISTRY

Module No.	Unit No.	Topic	Hrs.
1.0		**Introduction to Industrial Biochemistry**	**15**
	1.1	Overview of industrial biotechnology and its applications.	
	1.2	Historical development and milestones in industrial biochemistry.	
	1.3	Role of enzymes, microorganisms, and bioreactors in industrial processes.	
	1.4	Biopharmaceuticals: production of recombinant proteins, antibodies, and vaccines.	
2.0		**Industrial Enzymes**	**15**
	2.1	Sources of industrial enzymes: microbial, plant, and animal sources.	
	2.2	Production, purification, and immobilization of enzymes.	
	2.3	Applications of enzymes in food processing, detergent industry, and biocatalysis.	
	2.4	Wastewater treatment using biological methods: activated sludge process, anaerobic digestion, and phytoremediation.	
3.0		**Fermentation Technology**	**15**
	3.1	Principles of fermentation: aerobic and anaerobic processes.	
	3.2	Microbial fermentation: production of ethanol, organic acids, and amino acids.	
	3.3	Industrial-scale fermentation: bioreactor design, operation, and optimization.	
	3.4	Bioremediation of pollutants: microbial degradation of organic pollutants, heavy metals, and xenobiotics.	
4.0		**Biopolymers and Bio-based Materials**	**15**
	4.1	Production of biopolymers: polysaccharides, proteins, and polyhydroxyalkanoates (PHA).	
	4.2	Biopolymer modification and functionalization for industrial applications.	
	4.3	Biodegradable plastics, biomaterials, and their environmental impact.	
	4.4	Production of biofuels: biodiesel, bioethanol, and biogas.	
		Total	**60**

Text Books and Reference Books:

1. Industrial Biotechnology: Principles and Applications" by Larry Erickson
2. Industrial Enzymes: Structure, Function, and Applications" edited by Julio Polaina and Andrew P. MacCabe
3. Bioprocess Engineering: Basic Concepts" by Michael L. Shuler and Fikret Kargi
4. Biopolymers: Applications and Trends" edited by Michael Niaounakis
5. Biofuels: Production, Application, and Development" edited by Marco Aurelio Dos Santos Bernardes
6. Industrial Microbiology: An Introduction" by Michael J. Waites, Neil L. Morgan, and John S. Rockey
7. Pharmaceutical Biotechnology: Fundamentals and Applications" edited by Daan J. A. Crommelin, Robert D. Sindelar, and Bernd Meibohm
8. Bioremediation: Principles and Applications" edited by Ronald L. Crawford and Don L. Crawford
9. Food Biotechnology" edited by Kalidas Shetty and Gopinadhan Paliyath
10. Handbook of Industrial Chemistry: Organic Chemicals" edited by Michael Ash and Irene Ash

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - IV)

Major Core Theory Course

Course Code – SBCHCT552

Title of the Course: Drugs Metabolism

[Credits: 4 (Marks: 100)] **(Total Periods: 60 Hours)**

Course objectives:

- Explain the structure and function of the four major classes of biomolecules: proteins, nucleic acids, carbohydrates, and lipids.
- Understand the chemical properties and biological roles of amino acids, nucleotides, monosaccharides, and fatty acids.
- Describe the structure and function of nucleic acids (DNA and RNA) and their role in the storage, transmission, and expression of genetic information.

Course outcomes: The student will be able to

1. Understanding of Drug Metabolism Pathways.
2. Knowledge of Factors Influencing Drug Metabolism.
3. Ability to Evaluate Drug-Drug Interactions.
4. Comprehension of Pharmacogenomics and Personalized Medicine.
5. Analysis of Drug Efficacy and Toxicity**.**

CURRICULUM DETAILS: SBCHC552: DRUG METAMOLISM

Module No.	Unit No.	Topic	Hrs.
1.0		**Introduction to Drug Metabolism**	**15**
	1.1	Overview of drug metabolism: phases, enzymes, and pathways.	
	1.2	Role of drug metabolism in pharmacokinetics and pharmacodynamics.	
	1.3	Genetic factors: pharmacogenomics, genetic polymorphisms, and drug metabolism phenotyping.	
	1.4	Physiological factors: age, gender, ethnicity, and disease states.	
2.0		**Phase I Metabolism**	**15**
	2.1	Oxidation, reduction, and hydrolysis reactions catalyzed by cytochrome P450 enzymes.	
	2.2	Other Phase I reactions: dealkylation, deamination, and ring oxidation.	
	2.3	Factors influencing Phase I metabolism: genetic polymorphisms, enzyme induction/inhibition, and environmental factors.	
	2.4	Impact of drug metabolism on drug efficacy, toxicity, and therapeutic drug monitoring.	
3.0		**Phase II Metabolism**	**15**
	3.1	Conjugation reactions: glucuronidation, sulfation, methylation, acetylation, and glutathione conjugation.	
	3.2	Enzymes involved in Phase II metabolism: UDP-glucuronosyltransferases (UGTs), sulfotransferases (SULTs), methyltransferases, and others.	
	3.3	Role of Phase II metabolism in drug elimination and detoxification.	
	3.4	Relationship between drug metabolism and pharmacokinetics/pharmacodynamics.	
4.0		**Factors Influencing Drug Metabolism**	**15**
	4.1	Genetic factors: pharmacogenomics, genetic polymorphisms, and drug metabolism phenotyping.	
	4.2	Physiological factors: age, gender, ethnicity, and disease states.	
	4.3	Environmental factors: diet, smoking, alcohol, and drug interactions.	
	4.4	Mechanisms of drug-drug interactions: enzyme induction, inhibition, and competition	
		Total	**60**

Text Books and Reference Books:

1. Drug Metabolism: Chemical and Enzymatic Aspects" by Bernard Testa and Urs A. Meyer
2. Introduction to Drug Metabolism" by G. Gordon Gibson and Paul Skett
3. Principles of Drug Metabolism" edited by Emilio Díaz and Michael J. Mulvihill
4. Drug Metabolism and Pharmacokinetics Quick Guide" by Johannes Kirchmair and Maike Windshügel
5. Handbook of Drug Metabolism" edited by Paul G. Pearson and Larry C. Wienkers
6. Drug Metabolism in Pharmaceuticals" edited by Abd El-Galil E. Amr
7. Drug Metabolism Handbook: Concepts and Applications" edited by John W. Harlow and Rodney R. Dietert
8. Practical Pharmacology for the Pharmaceutical Sciences" by K. D. Tripathi
9. Pharmacogenomics and Precision Medicine: An Issue of the Clinics in Laboratory Medicine" edited by Issam Makhoul and Daniel J. Weisenberger
10. Clinical Pharmacokinetics: Concepts and Applications" by Malcolm Rowland and Thomas N. Tozer

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - IV)

Generic Elective Course

Course Code – SBCHGE 551

Title of the Course: Diagnostic Virology

[No. of Credits: 4 Credit] **[Total: 60 Hours]**

Course Objectives:

- To understand the principles and methodologies used in the laboratory diagnosis of viral infections.
- To learn about the various techniques and assays employed in the detection and characterization of viral pathogens.
- To explore the clinical significance of diagnostic virology in the management of viral diseases.
- To develop practical skills in performing and interpreting virological tests.

Course Outcomes:

1. Understanding of Diagnostic Virology Principles
2. Knowledge of Viral Detection Methods
3. Proficiency in Laboratory Techniques
4. Ability to Interpret Virological Test Results
5. Application of Diagnostic Virology in Clinical Practice

CURRICULUM DETAILS: SBCHGE 551: Diagnostic Virology

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Introduction to Diagnostic Virology**	**15**
	1.1	Overview of diagnostic virology: history, scope, and significance.	
	1.2	Principles of viral diagnosis: detection, identification, and characterization of viral pathogens.	
	1.3	Laboratory safety and quality assurance in diagnostic virology.	
	1.4	Principles of POCT: rapid diagnostic tests for viral infections.	
2.0		**Viral Detection Techniques**	**15**
	2.1	Serological assays: ELISA, immunofluorescence, neutralization assays.	
	2.2	Molecular diagnostics: PCR, RT-PCR, nucleic acid sequencing.	
	2.3	Antigen detection methods: immunochromatography, immunohistochemistry.	
	2.4	Interpretation of virological test results: sensitivity, specificity, predictive values.	
3.0		**Viral Culture and Isolation**	**15**
	3.1	Principles of viral culture: cell culture systems, viral growth kinetics.	
	3.2	Techniques for viral isolation: cell culture, shell vial culture, tissue culture.	
	3.3	Identification of viral isolates: cytopathic effects, immunofluorescence, molecular methods.	
	3.4	Novel approaches in viral diagnosis: metagenomics, microarrays, mass spectrometry.	
4.0		**Molecular Typing and Characterization**	**15**
	4.1	Nucleic acid sequencing: Sanger sequencing, next-generation sequencing (NGS).	
	4.2	Genomic analysis: phylogenetic analysis, sequence alignment, genotype determination.	
	4.3	Applications of molecular typing in epidemiology and viral surveillance.	
	4.4	Applications of nanotechnology and biosensors in viral detection and monitoring.	

Text Books and Reference Books:

1. Diagnostic Virology: Protocols and Methods" edited by Amir Steinbuch
2. Clinical Virology Manual" edited by Benjamin N. Rosenthal and Michael A. Pfaller
3. Molecular Virology: A Laboratory Manual" edited by A. E. Campbell and J. M. Gatherer
4. Viral Pathogenesis and Immunology" by Neal Nathanson, Diane E. Griffin, and Robert T. Schooley
5. Diagnostic Microbiology" by Bailey and Scott's
6. Manual of Diagnostic Antibodies for Immunohistology" edited by Anthony S-Y Leong
7. Molecular Diagnostics: Techniques and Applications for the Clinical Laboratory" by Wayne W. Grody, Robert M. Nakamura, and Frederick L. Kiechle
8. Principles and Practice of Clinical Virology" edited by Arie J. Zuckerman, John R. Pattison, and David J. M. Lewis
9. Viral Infections of Humans: Epidemiology and Control" by Richard A. Kaslow, Lawrence R. Stanberry, and James W. LeDuc
10. Medical Virology" edited by G. Van der Groen and G. C. Marks

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - IV)

Generic Elective Course

Course Code – SBCHGE 551

Title of the Course: Diagnostic Biochemistry

[No. of Credits: 4 Credit] **[Total: 60 Hours]**

Course Objectives:

- To understand the biochemical basis of disease and the role of diagnostic biochemistry in disease diagnosis.
- To learn laboratory techniques and methodologies used in the analysis of biochemical markers.
- To develop practical skills in performing biochemical tests and interpreting results.
- To explore the clinical applications of diagnostic biochemistry in various medical specialties.
- To understand quality assurance and quality control in diagnostic biochemistry laboratories.

Course Outcomes:

1. Comprehensive Understanding of Biochemical Principles.
2. Proficiency in Laboratory Techniques.
3. Ability to Interpret Biochemical Data.
4. Knowledge of Disease Biomarkers.

CURRICULUM DETAILS: SBCHGE 1501: DIAGNOSTIC BIOCHEMISTRY

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Introduction to Diagnostic Biochemistry**	**15**
	1.1	Overview of diagnostic biochemistry: principles, scope, and significance in clinical practice.	
	1.2	Biochemical markers of disease: enzymes, proteins, lipids, carbohydrates, hormones, and metabolites.	
	1.3	Role of food in the maintenance of good health	
	1.4	Tumor-associated antigens and biomarkers: AFP, CA 19-9, CA 125, PSA, CEA.	
2.0		**Laboratory Techniques in Diagnostic Biochemistry**	**15**
	2.1	Specimen collection and processing: blood, urine, cerebrospinal fluid, and other body fluids.	
	2.2	Analytical techniques: spectrophotometry, chromatography, immunoassays, electrophoresis, and molecular diagnostics.	
	2.3	Automation and instrumentation in diagnostic biochemistry laboratories.	
	2.4	Molecular diagnostics in cancer: PCR, gene expression profiling, next-generation sequencing (NGS).	
3.0		**Biochemical Markers of Organ Function and Injury**	**15**
	3.1	Liver function tests: enzymes (ALT, AST), bilirubin, albumin, and coagulation factors.	
	3.2	Kidney function tests: creatinine, urea, electrolytes, and urinary biomarkers.	
	3.3	Cardiac biomarkers: troponin, creatine kinase (CK), CK-MB, and B-type natriuretic peptide (BNP).	
	3.4	Monitoring response to cancer therapy: chemotherapy, targeted therapy, immunotherapy.	
4.0		**Endocrine and Metabolic Disorders**	**15**
	4.1	Thyroid function tests: TSH, T3, T4, thyroid antibodies.	
	4.2	Diabetes mellitus: glucose, glycated hemoglobin (HbA1c), insulin, C-peptide.	
	4.3	Lipid profile: total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides.	
	4.4	Infectious disease markers: HIV, hepatitis viruses, syphilis, tuberculosis, and other infectious agents	

Text Books and Reference Books:

1. Clinical Biochemistry: Techniques and Instrumentation - A Practical Approach" by Lynne S. M. Donald and Stuart A. Hunt
2. Practical Clinical Biochemistry: Methods and Interpretations" by Ranjna Chawla
3. Clinical Biochemistry: An Illustrated Colour Text" by Allan Gaw, Michael Murphy, Rajeev Srivastava, and Dennis R. St. J. O'Reilly
4. Clinical Chemistry: Principles, Techniques, and Correlations" by Michael L. Bishop, Edward P. Fody, and Larry E. Schoeff
5. Laboratory Guide to Clinical Biochemistry" by S. P. Kumar and K. S. Jiji
6. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics" edited by Carl A. Burtis and David E. Bruns
7. Manual of Practical Medical Biochemistry" by Vidya Ratan
8. Clinical Laboratory Chemistry" by Robert L. Sunheimer and Linda Graves
9. Laboratory Techniques in Biochemistry and Molecular Biology" edited by Thomas Spence Work and E. Work
10. Practical Biochemistry: Principles and Techniques" by Keith Wilson and John Walker

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M.Sc. Biochemistry, II Year (Semester - IV)

Value Education Course

Course Code – SVECP 551

Title of the Course: Publication Ethic

[No. of Credits: 2 Credit] **[Total: 30 Hours]**

CURRICULUM DETAILS: SVECP551: Publication Ethic

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Philosophy and Ethics**	**08**
	1.1	Introduction to philosophy: definition,	
	1.2	Nature and scope, concept, branches	
	1.3	Ethics: Definition, moral philosophy	
	1.4	Nature of moral judgements and reactions	
2.0		Scientific Conduct	**07**
	2.1	Ethics with respect to science and research, Intellectual honesty and research integrity	
	2.2	Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP) Redundant publications,	
	2.3	Duplicate and overlapping publications, salami slicing	
	2.4	Selective reporting and misrepresentation of data	
3.0		**Publication Ethics**	**07**
	3.1	Publication ethics: definition, introduction and importance 2.	
	3.2	Best practices/ Standards setting initiatives and guidelines: COPE, WAME, etc.	
	3.3	Conflicts of interest	
	3.4	Publication misconduct: Definition, concept, problems that lead to unethical behaviour and vice versa, types	
4.0		**Publication Ethics**	**08**
	4.1	Violation of publication ethics, authorship and contributorship.	
	4.2	Identification of publication misconduct,	
	4.3	Complaints and appeals	
	4.4	Predatory publishers and Journals	

Text Books and Reference Books:

1. Bird, A., Philosophy of Sciencs, Routledge, 2006.
2. Mac Intyre, Alasdair., A Short History of Ethics, London, 1967.
3. Chaddah, P., Ethics in competitive Research: Do not get scooped: do not get plagiarized, ISBN:978-938748086, 2018.
4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine.
5. On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition National Academies Press, 2009.
6. Resnik, D.B., What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10., 2011., Retrieved from Https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm.
7. Beall, J., Predatory Publishers are corrupting open access. Nature, 489(7415), 179-179, 2012., https://doi.org/10.1038/489179a
8. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance, ISBN:978-81-939482-1-7, 2019.

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M.Sc. Biochemistry, II Year (Semester - III)

Major Practical Course

Course Code – SBCHCP551

Title of the Course: Practical based on SBCHCT551

[Credits: 1 (Marks: 25)] **(Total Periods: 15Hours)**

CURRICULUM DETAILS: SBCHCP551: Practical based on SBCHCT551

Sr. No	Practical Exercises	Hrs.
1.	Extraction of enzymes from microbial, plant, or animal sources.	2
2.	Purification techniques such as ammonium sulfate precipitation, dialysis, and chromatography (e.g., ion exchange, gel filtration).	2
3.	Quantitative measurement of enzyme activity using spectrophotometric methods.	2
4.	Determination of kinetic parameters (Km and Vmax) using Michaelis-Menten kinetics.	2
5.	Techniques for immobilizing enzymes on various supports (e.g., agarose, alginate beads).	2
6.	Analysis of the stability and activity of immobilized enzymes.	2
7.	Investigation of competitive, non-competitive, and uncompetitive inhibition.	2
8.	Cultivation of microorganisms (e.g., bacteria, yeast) in batch, fed-batch, and continuous modes.	2
9.	Monitoring of growth parameters (e.g., optical density, dry cell weight).	2
10.	Fermentative production of ethanol, lactic acid, citric acid, or antibiotics.	2
11.	Downstream processing for product recovery and purification.	2
12.	Production of biodiesel from vegetable oils or animal fats using transesterification.	2
13.	Synthesis of biodegradable plastics (e.g., polyhydroxyalkanoates) from microbial sources.	2
14.	Use of microorganisms or enzymes to degrade environmental pollutants.	2
15.	Agarose gel electrophoresis for nucleic acid analysis.	2
	Total	**30**

Text Books and Reference Books:

1. Biochemical Engineering Fundamentals" by James E. Bailey and David F. Ollis
2. Bioprocess Engineering: Basic Concepts" by Michael L. Shuler and Fikret Kargi
3. Principles of Fermentation Technology" by Peter F. Stanbury, Allan Whitaker, and Stephen J. Hall
4. Industrial Microbiology and Biotechnology" by Michael J. Waites, Neil L. Morgan, John S. Rockey, and Gary Higton
5. Biochemical Engineering and Biotechnology" by Ghasem D. Najafpour
6. Biotechnology: A Laboratory Course" by Becker, Caldwell, and Zachgo
7. Methods in Industrial Biotechnology" edited by Michael Wink
8. Practical Fermentation Technology" edited by Brian McNeil and Linda M. Harvey
9. Fundamentals of Biochemical Engineering" by Rajiv Dutta
10. Manual of Industrial Microbiology and Biotechnology" edited by Richard H. Baltz, Julian E. Davies, and Arnold L. Demain
11. Practical Enzymology" by Hans Bisswanger
12. Fermentation and Biochemical Engineering Handbook" edited by Henry C. Vogel and Celeste L. T
13. Practical Biochemistry: Principles and Techniques" by Keith Wilson and John Walker
14. Biotechnology Procedures and Experiments Handbook" by S. Harisha

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M.Sc. Biochemistry, II Year (Semester - IV)

Major Practical Course

Course Code – SBCHCP552

Title of the Course: Practical based on SBCHCT552

[Credits: 1 (Marks: 25)] **(Total Periods: 15Hours)**

CURRICULUM DETAILS: SBCHCP1502: Practical based on SBCHCT1502

Sr. No	Practical Exercises	Hrs.
1.	Measuring the activity of specific cytochrome P450 enzymes (e.g., CYP3A4, CYP2D6) using substrate-specific reactions.	2
2.	Determination of kinetic parameters (Km and Vmax) for drug metabolism.	2
3.	Investigating the effects of potential inducers (e.g., rifampicin) or inhibitors (e.g., ketoconazole) on cytochrome P450 enzyme activity.	2
4.	Quantification of induction/inhibition effects using enzyme assays.	2
5.	Assays for conjugation reactions, such as glucuronidation (using UDP-glucuronosyltransferases) and sulfation (using sulfotransferases).	2
6.	Measuring the formation of conjugated drug metabolites.	2
7.	Quantitative and qualitative analysis of drug metabolites in biological samples (e.g., blood, urine).	2
8.	Evaluating the inhibitory effects of drugs on specific metabolic enzymes.	2
9.	IC50 determination using competitive, non-competitive, or mixed inhibition models.	2
10.	Development and validation of LC-MS methods for the detection and quantification of drugs and their metabolites.	2
11.	Application of LC-MS in metabolite identification and pharmacokinetic studies.	2
12.	Use of HPLC for the separation and quantification of drug metabolites.	2
13.	Optimization of HPLC conditions (e.g., mobile phase, column selection) for specific drugs and metabolites.	2
14.	Analysis of volatile and semi-volatile metabolites using GC-MS.	2
15.	Sample preparation techniques (e.g., derivatization) for GC-MS analysis.	2
	Total	**30**

Text Books and Reference Books:

1. Drug Metabolism: Current Concepts" by Corina Ionescu and Mino R. Caira
2. Handbook of Drug Metabolism" edited by Paul G. Pearson and Larry C. Wienkers
3. Drug Metabolism: Chemical and Enzymatic Aspects" by Jack P. Uetrecht and William Trager
4. Enzyme Kinetics in Drug Metabolism: Fundamentals and Applications" by Swati Nagar, Upendra Argikar, and Donald Tweedie
5. Drug Metabolism and Pharmacokinetics Quick Guide" by Siamak Cyrus Khojasteh, Harvey Wong, and Camilo A. García
6. Drug Metabolism Handbook: Concepts and Applications" edited by Ala F. Nassar
7. Metabolic Profiling: Methods and Protocols" edited by Shen Hu
8. Practical Handbook of Biochemistry and Molecular Biology" edited by Gerald D. Fasman
9. Drug Metabolism in Drug Design and Development: Basic Concepts and Practice" edited by Donglu Zhang and Mingshe Zhu
10. Practical Pharmacokinetics" by John G. Wagner
11. Practical LC-MS for Biotechnology and Pharmaceutical Research" by Gary Siuzdak

National Education Policy 2020

M.Sc. Biochemistry, II Year (Semester - III)

Minor Core Theory Course

Course Code – SBCHR 551

Title of the Course: Research Project

[Credits: 6 (Marks: 150)] **(Total Periods: 120 Hours)**

Course objectives:

3. To train the students with different experimental and analytical skills considering opportunities in academic and industrial research.
4. To gain the knowledge of referring research journals, writing research articles and submit the dissertation report.

SBCHR 551: Research Project

Note:

5. External and Internal Examiners will examine this project jointly at the time of Practical examination.
6. The students will have to give at least one seminar in each semester in their subject of specialization is compulsory.
7. Project work must be carried out only in specialized branch.
8. The project work carried out during the year should be presented in power point presentation in presence of University Examiners.