



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

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

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण-२०२० नुसार पदवी तृतीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६-२७ पासून लागू करण्याबाबत.

परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २२ एप्रिल २०२६ रोजी संपन्न झालेल्या मा.विद्यापरिषद बैठकीतील विषय क्र.०८/६४-२०२६ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण-२०२० नुसार पदवी तृतीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६-२७ पासून लागू करण्यास मा.विद्यापरिषदेने मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील बी.एस्सी. तृतीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६-२७ पासून लागू करण्यात येत आहे.

01	B.Sc. III Year Botany	10	B.Sc. III Year Biochemistry
02	B.Sc. III Year Chemistry	11	B.Sc. III Year Agriculture Microbiology
03	B.Sc. III Year Mathematics	12	B.Sc. III Year Electronics
04	B.Sc. III Year Zoology	13	B.Sc. III Year Seed Technology
05	B.Sc. III Year Microbiology	14	B.Sc. III Year Horticulture
06	B.Sc. III Year Geology	15	B.Sc. III Year Analytical Chemistry
07	B.Sc. III Year Environment & Earth Science	16	B.Sc. III Year Agrochemical & Fertilizers
08	B.Sc. III Year Statistics	17	B.Sc. III Year Industrial Chemistry
09	B.Sc. III Year Dairy Science	18	B.Sc. III Year Industrial Microbiology

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.

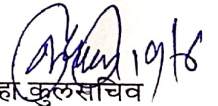
'ज्ञानतीर्थ' परिसर,

विष्णुपुरी, नांदेड - ४३१ ६०६.

जा.क्र.:शे-१ / परिपत्रक / पदवी / बीएस्सी / २०२६-२७ / 60

दिनांक : १९.०६.२०२६




सहा कुलसचिव

शैक्षणिक (१-अभ्यासमंडळे) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :-

- १) मा. कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
- २) मा. प्र.कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ
- ३) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
- ४) मा. संचालक, परिक्षा व मुल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
- ५) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.



COURSE STRUCTURE

As Per National Education Policy- 2020

B. Sc. Third Year

Subject: Biochemistry

- ❖ Teaching scheme
- ❖ Examination Scheme
- ❖ Syllabus

To be Implemented from
Academic Year 2026-2027



B. Sc. Third Year Semester V (Level 5.5)

Sub. Code: BCH

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs./ week)	
			Theory	Practical	Total	Theory	Practical
Optional 1	SBCHCT1301	Diagnostic Biochemistry	03	--	12	03	--
	SBCHCT1302	Plant Biochemistry	03	-		03	-
	SBCHIK1303	Indian Knowledge System & tradition	02	--		02	--
	SBCHCP1301	Practical Based on SBCHCT1301	-	02			04
	SBCHCP1302	Practical Based on SBCHCT1302		02			04
Optional 2	SBCHET1301	Human Anatomy and physiology OR Developmental Biology	03	--	04	03	--
	SBCHEP1302	Practical Based on SBCHET1301	-	01			04
Vocational Course (related to Major)	SBCHVC1301	Blood Sample Collection and Processing	--	02	02	--	04
Community Engagement Services (CES)	SBCH FP1301	Field Project	-	04	04	--	04
Total Credits			11	11	22	11	20



B. Sc. Third Year Semester V (Level 5.5) Sub. Code: BCH

Examination Scheme

[40% Continuous Assessment (CA) and 60% End Semester Assessment (ESA)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject(1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA	CA (8)	ESA (9)	
			Test I (4)	Test II (5)	T1 & T2 (6)	Total (7)			
Optional 1	SBCHCT1301	Diagnostic Biochemistry	15	15	30	45	--	--	75
	SBCHCT1302	Plant Biochemistry	15	15	30	45			75
	SBCHIK1303	Indian Knowledge System & tradition	10	10	20	30	-	-	50
	SBCHCP1304	Practical Based on SBCHMT1301	-	-	-	-	20	30	50
	SBCHCP1305	Practical Based on SBCHMT1302	-	-	-	-	20	30	50
Optional 2	SBCHET1301	Human Anatomy and physiology OR Developmental Biology	15	15	30	45	--	--	75
	SBCHEP1302	Practical Based on SBCHET1301	--	--	--	--	10	15	25
Vocational Course (related to Major)	SBCHVC1301	Blood Sample Collection and Processing	-	-	-	-	20	30	50
Community Engagement Services (CC)	SBCH FP1301	Field Project	--	--	--	--	40	60	100



B. Sc. Third Year Semester VI (Level 5.5)

Sub. Code: BCH

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs./ week)	
			Theory	Practical	Total	Theory	Practical
Optional 1	SBCHCT1351	Endocrinology	03	--	12	03	--
	SBCHCT1352	Genetic Engineering	03	-		03	-
	SBCHCT1353	Proteomic	02			02	
	SBCHCP1351	Practical Based on SBCHCT 1351		02			02
	SBCHCP1352	Practical Based on SBCHCT 1152		02			02
Optional 2	SBCHET1351	Clinical Pathology OR Evolutionary Biology	03	--	04	02	--
	SBCHEP1352	Practical Based on SBCHET 1351	-	01			1
Vocational Course (related to Major)	SBCHVC1351	Biomedical Waste Management	--	02	02	--	02
Community Engagement Services (CES)	SBCHOJ1351	On Job Training	-	04	04	--	04
Total Credits			11	11	22	12	11



B. Sc. Third Year Semester VI (Level 5.5) Sub. Code: BCH

Examination Scheme

[40% Continuous Assessment (CA) and 60% End Semester Assessment (ESA)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject (1)	Course Code (2)	CourseName (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA	CA (8)	ESA (9)	
			Test I (4)	Test II (5)	T1 & T2 (6)	Total (7)			
Optional 1	SBCHCT1351	Endocrinology	15	15	30	45	--	--	75
	SBCHCT1352	Genetic Engineering	15	15	30	45	-	-	75
	SBCHCT1353	Proteomic	10	10	20	30	-	-	50
	SBCHCP1354	Practical Based on SBCHCT 1152	-	-	-	-	20	30	50
	SBCHCP1355	Practical Based on SBCHCT 1153	-	-	-	-	20	30	50
Optional 2	SBCHET1351	Clinical Pathology OR Evolutionary Biology	15	15	30	45	--	--	75
	SBCHET1352	Practical Based on SBCHET 1351	--	--	--	--	10	15	25
Skill Based Course	SBCHVC1351	Biomedical Waste Management	--	--	--	--	20	30	50
Community Engagement Services (CC)	SBCHOJ1351	On Job Training	--	--	--	--	40	60	100

Syllabus for B. Sc. Third Year

Subject: Biochemistry

Semester –V

As Per National Education Policy- 2020

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - V)
Major Core Theory Course
Course Code – **SBCHCT1301**

Title of the Course: **DIAGONASTIC BIOCHEMISTRY**

[Credits: 3 (Marks: 75)]

(Total Periods: 45 Hours)

1. Course Objectives

1. To understand the principles and diagnostic importance of renal, gastric, and liver function tests.
2. To study biochemical methods used for thyroid function tests and lipid profile analysis.
3. To explain the biochemical basis and clinical interpretation of various diagnostic tests used in disease detection.
4. To introduce the biochemistry of cancer cells, carcinogenesis, oncogenes, and tumor markers.

3. Course Outcomes (COs)

After completion of the course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Explain the biochemical principles and clinical significance of renal and gastric function tests	PO1, PO2, PO9	PSO1, PSO3	Understand (U), Analyze (An)
CO2	Describe and interpret different liver function tests used in diagnosis of liver diseases	PO1, PO2, PO3	PSO1, PSO2, PSO3	Understand (U), Analyze (An)
CO3	Analyze results of thyroid function tests and lipid profile parameters such as cholesterol and triglycerides	PO2, PO3, PO5	PSO2, PSO3	Analyze (An)
CO4	Understand the biochemical basis of cancer development, including carcinogens, oncogenes, and tumor markers	PO1, PO6, PO8	PSO1, PSO3	Understand (U), Analyze (An)

CURRICULUM DETAILS: SBCHCT1301: DIAGNOSTIC BIOCHEMISTRY

Module No.	Unit No.	Topic	Hrs.
1.0		Renal and Gastric Function Test	
	1.1	Introduction Renal function test, Glomerular Filtration Test,	12
	1.2	Test for Renal Blood Flow, Tests of Tubular Function. Other Miscellaneous tests to asses' renal function.	
	1.3	Examination of Resting Content, Functional gastric analysis using test meal,	
	1.4	Achyliagastica, Stimulation test, Serum Pepsinogen, tubeless Gastric analysis	
2.0		Liver Function Test	
	2.1	Function of liver, Test based on abnormalities of bile pigment metabolism. Test based on livers' part in carbohydrate metabolism.	12
	2.2	Tests based on changes in plasma protein. Test based on abnormalities of lipid.	
	2.3	Test based on detoxicating function of liver. Test based on excretory function of liver formation of prothrombin by liver test based on amino acid catabolism test based on drug metabolism.	
	2.4	Value of serum enzymes in liver diseases	
3.0		Thyroid and Lipid Profile Test	
	3.1	Test based on primary function of thyroid, Test Measuring blood level of thyroid hormone,	11
	3.2	Test based on metabolic effect of thyroid hormone. Thyroid Scanning, Immunological test for thyroid hormone	
	3.3	Total serum cholesterol, Serum triglyceride, HDL Cholesterol, LDL Cholesterol,	
	3.4	Enzymatic method for estimation. Normal value and Clinical interpretation.	
4.0		Biochemistry of Cancer cell	
	4.1	Characteristic of cancer cell.	10
	4.2	Carcinogenesis and carcinogen,	
	4.3	proto-oncogene and oncogene, tumor Suppressor Gene.	
	4.4	Tumar Markers, Cancer and Diet	
		Total	45

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Textbook of Biochemistry for Medical Students	D. M. Vasudevan, Sreekumari S., Kannan Vaidyanathan	Jaypee Brothers Medical Publishers
2	Harper's Illustrated Biochemistry	Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly	McGraw-Hill Education
3	Biochemistry	Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer	W.H. Freeman / Macmillan
4	Lehninger Principles of Biochemistry	David L. Nelson, Michael M. Cox	W.H. Freeman and Company
5	Lippincott Illustrated Reviews: Biochemistry	Denise R. Ferrier	Wolters Kluwer / Lippincott Williams & Wilkins

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - V)
Major Practical Course
Course Code – SBCHCP1301
Title of the Course: Practical based on SBCHCT1301

[Credits: 2 (Marks: 50)]

(Total Periods: 60 Hours)

CURRICULUM DETAILS: SBCHCP1301: Practical based on SBCHCT1301

Sr. No	Practical Exercises	Hr s.
1.	Estimate blood sugar by GOD/POD Method.	4
2.	Estimate blood urea by enzymatic / diacetyl monoxime method.	4
3.	Estimate serum creatinine by Jaffe's method.	4
4.	Estimate serum bilirubin (total, direct, indirect).	4
5.	Detect qualitatively bile pigments and bile salts in urine.	4
6.	Estimate serum AST (SGOT) activity.	4
7.	Estimate serum ALT (SGPT) activity.	4
8.	Estimate serum alkaline phosphatase activity.	4
9.	Estimate total protein and albumin in serum.	4
10.	Estimate serum inorganic Phosphorus.	4
11.	Detect and interpret thyroid autoantibodies by immunological methods.	4
12.	Estimate quantitatively total serum cholesterol by enzymatic method.	4
13.	Estimate quantitatively serum triglycerides by enzymatic method.	4
14.	Estimate quantitatively HDL cholesterol and calculate LDL cholesterol.	4
15.	Interpret lipid profile results with cardiovascular risk assessment.	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Biochemistry Practical Manual	Soundravally Rajendiran, Pooja Dhiman	Elsevier
2	Practical Manual of Biochemistry	Neha Sharma, Ruchi Jindal, Sabira Dabeer, G. G. Kaushik	CBS Publishers & Distributors
3	Manual of Practical Biochemistry	Evangeline Jones	Jaypee Brothers Medical Publishers
4	Clinical Biochemistry: A Laboratory Guide	Rooma Devi, Aman Chauhan, Simmi Kharb, C. S. Pundir	Jenny Stanford Publishing
5	Laboratory Manual for Practical Biochemistry	Shivaraja Shankara, M. K. Ganesh, A. R. Shivashankara	Jaypee Brothers Medical Publishers

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - V)
Major Core Theory Course
Course Code – SBCHCT1302
Title of the Course: Plant Biochemistry

[Credits: 3 (Marks: 75)]

(Total Periods: 45 Hours)

1. Course Objectives

1. To introduce the basic principles of plant biochemistry and the chemical composition of plant cells.
2. To explain the structure, classification, and functions of plant biomolecules such as carbohydrates, lipids, proteins, and enzymes.
3. To understand plant metabolic pathways, including photosynthesis, respiration, and nitrogen metabolism.
4. To study secondary metabolites and plant growth regulators and their role in plant development and stress responses.
5. To develop an understanding of the biochemical mechanisms involved in plant growth, productivity, and stress tolerance.

2. Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Describe the chemical composition and explain structure and functions of plant biomolecules	PO1, PO6, PO9	PSO1	Remember (R), Understand (U)
CO2	Explain the role of enzymes and metabolic pathways involved in plant respiration	PO1, PO2	PSO1, PSO2	Understand (U), Analyze (An)
CO3	Illustrate the biochemical processes of photosynthesis and nitrogen metabolism in plants	PO1, PO2, PO3	PSO1, PSO2	Understand (U), Analyze (An)
CO4	Understand the biosynthesis and functions of secondary metabolites and plant hormones	PO1, PO2, PO6	PSO1, PSO3	Understand (U), Analyze (An)

CURRICULUM DETAILS: SBCHET1302: Plant Biochemistry

Module No.	Unit No.	Topic	Hrs.
1.0		Introduction of Plant Biochemistry	
	1.1	Scope and importance of plant biochemistry in agriculture, medicine, and industry	12
	1.2	Chemical composition of plant cells: water, minerals, and organic constituents	
	1.3	Carbohydrates in plants: structure, classification, and biological role	
	1.4	Lipids and proteins in plants: types, properties, and functions	
2.0		Plant Enzyme and Metabolism	
	2.1	Enzymes in plants: classification, properties, and mechanism of action	12
	2.2	Factors affecting enzyme activity (pH, temperature, inhibitors)	
	2.3	Carbohydrate metabolism: photosynthetic carbon reduction cycle (Calvin cycle)	
	2.4	Respiration in plants: glycolysis, TCA cycle, and electron transport chain	
3.0		Photosynthesis and Nitrogen Metabolism	
	3.1	Photosynthesis: light reactions and photophosphorylation	11
	3.2	Dark reactions and regulation of photosynthesis	
	3.3	Nitrogen metabolism: nitrogen fixation and nitrate reduction	
	3.4	Amino acid and protein biosynthesis in plants	
4.0		Secondary Metabolite and plant Hormone	
	4.1	Secondary metabolites: alkaloids, phenolics, terpenoids – biosynthesis and role	10
	4.2	Plant pigments: chlorophylls, carotenoids, anthocyanins	
	4.3	Plant growth regulators: auxins, gibberellins, cytokinins, ethylene, ABA	
	4.4	Biochemical basis of plant stress responses (biotic and abiotic stress)	
		Total	45

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Biochemistry and Molecular Biology of Plants	Bob B. Buchanan, Wilhelm Gruissem, Russell L. Jones	Wiley-Blackwell
2	Plant Biochemistry	Hans-Walter Heldt, Birgit Piechulla	Academic Press / Elsevier
3	Plant Physiology and Development	Lincoln Taiz, Eduardo Zeiger, Ian M. Møller, Angus Murphy	Sinauer Associates / Oxford
4	Introduction to Plant Biochemistry	Trevor W. Goodwin, E. I. Mercer	Pergamon Press
5	Plant Biochemistry and Biotechnology	B. J. Mifflin	Oxford University Press
6	Lehninger Principles of Biochemistry	David L. Nelson, Michael M. Cox	W.H. Freeman
7	Biochemistry	Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer	W.H. Freeman / Macmillan

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - V)
Major Practical Course
Course Code – SBCHCP1302
Title of the Course: Plant Biochemistry

[Credits: 2 (Marks: 50)]

(Total Periods: 60 Hours)

CURRICULUM DETAILS: SBCHMP1301: Practical based on SBCHMT1301

Sr. No	Practical Exercises	Hrs
1.	Qualitative tests for carbohydrates in plant extracts	4
2.	Estimation of reducing sugars by DNS method	4
3.	Estimation of total carbohydrates by Anthrone method	4
4.	Qualitative tests for proteins and amino acids	4
5.	Estimation of protein by Lowry / Biuret method	4
6.	Estimation of chlorophyll a, b and total chlorophyll	4
7.	Separation of plant pigments by paper chromatography	4
8.	Assay of catalase activity in plant tissues	4
9.	Assay of peroxidase activity in plant tissues	4
10.	Effect of pH and temperature on enzyme activity	4
11.	Estimation of free amino acids by ninhydrin method	4
12.	Estimation of starch content in plant material	4
13.	Determination of respiration rate in germinating seeds	4
14.	Detection of secondary metabolites in plants (alkaloids, phenols)	4
15.	Visit / demonstration: Photosynthesis or enzyme lab techniques	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Experiments in Plant Biochemistry	Sadasivam S., Manickam A	New Age International Publishers
2	Practical Plant Biochemistry	S. K. Sawhney, Randhir Singh	Narosa Publishing House
3	Plant Biochemistry Laboratory Manual	N. K. Jain	CBS Publishers & Distributors
4	Experiments in Plant Physiology and Biochemistry	D. P. Singh	New Age International
5	Practical Plant Physiology	S. K. Sawhney, Randhir Singh	Narosa Publishing House
6	Laboratory Manual in Plant Physiology and Biochemistry	S. K. Sawhney	IK International Publishing
7	Experimental Plant Physiology	S. K. Sawhney	New Age International

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - V)
Minor Core Theory Course
Course Code – SBCHIK1303
Title of the Course: Indian knowledge System in
Biochemistry

[Credits: 2 (Marks: 50)]

(Total Periods: 30 Hours)

1. Course Objectives

1. To introduce the principles of the **Indian Knowledge System** and its contribution to biochemical sciences.
2. To understand the biochemical basis of traditional Indian medicinal practices.
3. To study plant-based bioactive compounds used in traditional healthcare systems.
4. To explore the relevance of ancient Indian scientific knowledge in modern biotechnology, medicine, and agriculture.

2. Course Outcomes (COs)

After completion of the course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Explain the historical development and principles of the Indian knowledge system related to biological sciences	PO1, PO6, PO8, PO9	PSO1	Understand (U)
CO2	Describe the biochemical basis of traditional medicinal practices and herbal formulations	PO1, PO2, PO6	PSO1, PSO3	Understand (U), Analyze (An)
CO3	Understand the role of plant secondary metabolites and natural products in traditional Indian medicine	PO1, PO2	PSO1, PSO3	Understand (U), Analyze (An)
CO4	Evaluate the relevance of ancient Indian scientific knowledge in modern biochemistry and healthcare	PO2, PO6, PO8, PO9	PSO1, PSO3	Analyze (An), Evaluate (E)

CURRICULUM DETAILS: SBCHMT1303: IKS in Biochemistry

Module No.	Unit No.	Topic	Hrs.
1.0		Foundations of Indian Knowledge System	
	1.1	Introduction to Indian Knowledge System and its scientific heritage	07
	1.2	Contributions of ancient Indian scholars to life sciences	
	1.3	Concepts of health and nutrition in traditional Indian systems	
	1.4	Relationship between traditional knowledge and modern biochemical science	
2.0		Biochemistry in Ayurveda and Traditional Medicine	
	2.1	Fundamental concepts of Tridosha Theory (Vata, Pitta, Kapha)	08
	2.2	Biochemical significance of traditional herbal medicines	
	2.3	Role of medicinal plants and phytochemicals in disease prevention	
	2.4	Traditional fermentation processes and biochemical transformations	
3.0		Plant-Based Biochemistry in Indian Tradition	
	3.1	Biochemistry of medicinal plants used in Indian systems	07
	3.2	Secondary metabolites (alkaloids, phenolics, terpenoids) in herbal medicines	
	3.3	Nutritional and therapeutic value of traditional Indian foods and spices	
	3.4	Biochemical aspects of plant-based natural products and antioxidants	
4.0		Modern Relevance of Indian Knowledge System	
	4.1	Integration of traditional knowledge with modern biochemistry	08
	4.2	Biochemical basis of herbal drug development	
	4.3	Role of traditional knowledge in sustainable agriculture and environment	
	4.4	Scientific validation and global importance of Indian traditional medicine	
		Total	30

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Indian Knowledge System	Kapil Kapoor, Avadhesh Kumar Singh	Indian Institute of Advanced Study
2	Ayurveda: The Science of Self-Healing	Vasant Lad	Lotus Press
3	Medicinal Plants: Chemistry and Properties	M. Daniel	Oxford & IBH Publishing
4	Pharmacognosy and Phytochemistry	Vinod D. Rangari	Career Publications
5	Textbook of Pharmacognosy and Phytochemistry	Biren Shah, A. K. Seth	Elsevier
6	Biochemistry	Jeremy M. Berg, John L. Tymoczko, Lubert Stryer	W. H. Freeman
7	Biochemistry and Molecular Biology of Plants	Bob B. Buchanan, Wilhelm Gruissem, Russell L. Jones	Wiley
8	Traditional Knowledge Systems of India	Amit Jha	Atlantic Publishers
9	Herbal Medicine: Biomolecular and Clinical Aspects	Iris F. F. Benzie, Sissi Wachtel-Galor	CRC Press
10	Indian Medicinal Plants	K. R. Kirtikar, B. D. Basu	International Book Distributors

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - V)
Minor Core Theory Course
Course Code – SBCHET1301

Title of the Course: Human Anatomy and physiology

[Credits: 3 (Marks: 75)]

(Total Periods: 45 Hours)

1. Course Objectives

1. To understand the structure and function of cells, tissues, and organelles in the human body.
2. To study the organization and functions of major body systems such as circulatory, digestive, respiratory, and excretory systems.
3. To explain the structure and physiological functions of the nervous and endocrine systems.
4. To understand the structure and functions of the reproductive system and hormonal regulation.
5. To develop the ability to interpret physiological processes such as blood circulation, digestion, respiration, and urine formation.

2. Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Describe the structure of cell, cell organelles, and types of tissues and explain their functions in the human body	PO1, PO6, PO9	PSO1	Remember (R), Understand (U)
CO2	Explain the structure and physiological functions of blood, lymphatic system, heart, and skeletal system	PO1, PO2	PSO1, PSO3	Understand (U), Analyze (An)
CO3	Illustrate the structure and function of digestive, respiratory, and excretory systems, including the mechanism	PO1, PO2, PO3	PSO1, PSO2	Understand (U), Analyze (An)
CO4	Describe the organization and functions of nervous, endocrine, and reproductive systems	PO1, PO6, PO8	PSO1, PSO3	Remember (R), Understand (U)

**CURRICULUM DETAILS: SBCHET1301: Human
Anatomy and Physiology**

Module No.	Unit No.	Topic	Hrs.
1.0		Structure of Cell and Tissue	
	1.1	Cell, Structure of cell. Nucleus, Cell membrane, Nucleolus, Mitochondrion, Gogi bodies, Ribosomes, Centriole, Cilia.	12
	1.2	Mitosis and Meiosis Gene Structure.	
	1.3	Type of Tissue, Epithelial Tissue, Structure and function, Connective tissue structure and function.	
	1.4	Muscular tissue structure and function. Nerve tissue, Structure and function.	
2.0		Lymph, Bone and Skeleton	
	2.1	Lymph and Lymphatic System. Structure and function of heart. Arterial and venous System.	12
	2.2	The Blood component, Composition of Blood plasma and Corpuscles. Mechanism of Blood Coagulation. Blood group ABO System. Blood group Antigen (Rhesus factor), Bombay Blood Group. Blood pressure and its recording Physiology of blood circulation.	
	2.3	Bone-Formation and growth. Skeleton- Structure, function and types.	
	2.4	Axial skeleton, the skull and vertebral column. Appendicular Skeleton- limbs and gridles. Joints.	
3.0		Digestive Respiratory and Excretory System	
	3.1	Digestion- definition. Well labelled diagram of digestive system. Structure and function of - oral cavity, oesophagus, stomach, small and large intestine, rectum and anus. Physiology of digestion of food.	11
	3.2	Respiration- Defination, diagram of respiratory system. Organs of respiratory system -nasal cavity, larynx, pharynx, trachea, bronchi, lungs.Physiology of respiration- Inspiration and expiration	
	3.3	Excretion-Definition, diagram of excretory system. Organs of excretory system- Kidney, ureter, urinary bladder, urethra.	
	3.4	Physiology of urine formation- structure of nephron, mechanism of urine formation..	
4.0		Nervous, Endocrine and Reproductive System	
	4.1	Nervous system- Definition. Structure and functions of neuron. Structure and functions of Brain . Structure and functions of spinal cord. Twelve pairs of cranial nerves. Sympathetic nervous system. Parasympathetic nervous system	10
	4.2	Hormone- definition, Different types of endocrine glands Structure of - Pituitary gland, Thyroid gland, Thymus gland, Adrenal gland,	

	Pancreas,	
4.3	Sex glands Function of- Pituitary gland, Thyroid gland, Thymus gland, Adrenal gland, Pancreas, Sex glands Abnormalities of- Pituitary gland, Thyroid gland, Thymus gland, Adrenal gland, Pancreas, Sex glands	
4.4	Reproduction - Definition Organs of Male reproductive system- Scrotum, Testes, Seminal vesicle, Ejaculatory duct, Vas Deference, Sperm Organs of Female reproductive system-Vagina, Cervix, Uterus, Fallopian tube, Ovaries Menstrual Cycle- Definition, Phases Menopause- Definition Hormonal Imbalance- PCOD, PCOS	
Total		45

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Human Anatomy and Physiology	Human Anatomy and Physiology	Human Anatomy and Physiology
2	Textbook of Medical Physiology	Textbook of Medical Physiology	Textbook of Medical Physiology
3	Human Physiology	Human Physiology	Human Physiology
4	Principles of Anatomy and Physiology	Principles of Anatomy and Physiology	Principles of Anatomy and Physiology
5	Ross and Wilson Anatomy and Physiology in Health and Illness	Anne Waugh, Allison Grant	Elsevier
6	Essentials of Human Anatomy and Physiology	Elaine N. Marieb	Pearson
7	Human Physiology: From Cells to Systems	Lauralee Sherwood	Cengage Learning

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - V)
Minor Practical Course
Course Code – SBCHEP1302
Title of the Course: Human Anatomy and physiology

[Credits: 1 (Marks: 25)]

(Total Periods: 60 Hours)

CURRICULUM DETAILS: SBCHCP1302: Practical based on SBCHCT1302

Sr. No	Practical Exercises	Hrs.
1.	Examine permanent slide under compound microscope.	4
2.	Perform blood smear and record observations about different cells	4
3.	Examine different tissues.	4
4.	Prepare slide for T.S. of stomach, Intestine, Skeletal muscle.	4
5.	Examine bones of Human Skull.	4
6.	Examine bones of Axial skeleton.	4
7.	Examine bones of Appendicular skeleton.	4
8.	Examine bones of girdles.	4
9.	Examine bones of joints.	4
10.	Test Blood group of individuals.	4
11.	Observe the permanent slide of Transverse section of salivary gland & tongue.	4
12.	Observe permanent slide of Transverse section. of Stomach & Pancreas.	4
13.	Observe permanent slide of Transverse section of Small intestine & Large Intestine.	4
14.	Observe the permanent slide of transverse section of Skin.	4
15.	Observe the permanent slide of transverse section of Lung.	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Practical Workbook for Human Physiology	Stuart Ira Fox	McGraw-Hill
2	Laboratory Manual for Anatomy and Physiology	Elaine N. Marieb, Lori A. Smith	Pearson
3	Experimental Physiology	Robert R. Switzer, Liam F. Garrity	W. H. Freeman
4	Manual of Practical Physiology	C. L. Ghai	Jaypee Brothers Medical Publishers
5	Practical Physiology	G. K. Pal, Pravati Pal	Universities Press
6	Textbook of Practical Physiology	C. L. Ghai	Jaypee Brothers
7	Laboratory Manual of Human Anatomy and Physiolog	Elaine N. Marieb	Pearson

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - V)
Minor Core Theory Course
Course Code – SBCHET1301
Title of the Course: Developmental Biology

[Credits: 3 (Marks: 75)]

(Total Periods: 45 Hours)

1. Course Objectives

1. To understand fundamental principles of animal development.
2. To study cellular and molecular mechanisms of embryogenesis.
3. To explain gene regulation and signaling pathways in development.
4. To analyze organogenesis and developmental abnormalities.

2. Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Explain basic concepts and stages of development.	PO1, PO6, PO9	PSO1	Remember (R), Understand (U)
CO2	Describe molecular mechanisms controlling development.	PO1, PO2	PSO1, PSO3	Understand (U), Analyze (An)
CO3	Analyze embryonic development processes and pattern formation.	PO1, PO2, PO3	PSO1, PSO2	Understand (U), Analyze (An)
CO4	Interpret experimental data related to developmental biology.	PO1, PO6, PO8	PSO1, PSO3	Remember (R), Understand (U)

CURRICULUM DETAILS: SBCHET1301: Developmental Biology

Module No.	Unit No.	Topic	Hrs.
1.0		Basic Concepts of Development	
	1.1	Introduction to developmental biology and model organisms	12
	1.2	Gametogenesis and fertilization	
	1.3	Cleavage and blastulation	
	1.4	Gastrulation and germ layer formation	
2.0		Molecular Basis of Development	
	2.1	Gene expression and regulation during development	12
	2.2	Cell signaling pathways (Notch, Wnt, Hedgehog)	
	2.3	Morphogens and pattern formation	
	2.4	Stem cells and differentiation	
3.0		Organogenesis and Differentiation	
	3.1	Neurulation and nervous system development	10
	3.2	Organ formation (heart, limb development)	
	3.3	Cell migration and apoptosis	
	3.4	Regeneration and aging	
4.0		Applied Developmental Biology	
	4.1	Developmental genetics and mutations	11
	4.2	Cloning and transgenic animals	
	4.3	Assisted reproductive technologies (IVF, embryo transfer)	
	4.4	Developmental disorders and teratogenesis	
		Total	45

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Developmental Biology	Scott F. Gilbert	Oxford University Press
2	Principles of Development	Lewis Wolpert, Cheryll Tickle	Oxford University Press
3	Essential Developmental Biology	Jonathan M. W. Slack	Wiley-Blackwell
4	Human Embryology and Developmental Biology	Bruce M. Carlson	Elsevier
5	Langman's Medical Embryology	T. W. Sadler	Wolters Kluwer
6	Molecular Developmental Biology	T. Subramoniam	Alpha Science International
7	Developmental Biology	Werner A. Müller	Springer
8	Concepts of Developmental Biology	Amrita Singh	Anvi Books & Publishers
9	Ecological Developmental Biology	Scott F. Gilbert & David Epel	Sinauer Associates
10	The Science of Stem Cells	Jonathan M. W. Slack	Oxford University Press

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - V)
Minor Practical Course
Course Code – SBCHEP1302
Title of the Course: Developmental Biology

[Credits: 1 (Marks: 25)]

(Total Periods: 60 Hours)

CURRICULUM DETAILS: SBCHCP1302: Practical based on SBCHCT1302

Sr. No	Practical Exercises	Hrs.
1.	Study of different stages of frog embryonic development	4
2.	Observation of chick embryo development (slides/models)	4
3.	Identification of cleavage stages using prepared slides	4
4.	Study of gastrulation stages in amphibians	4
5.	Microscopic observation of sperm and ovum	4
6.	Study of mitotic cell division in early embryos	4
7.	Demonstration of gene expression using staining techniques	4
8.	Analysis of developmental mutants (case studies)	4
9.	Study of limb development models	4
10.	Observation of stem cell cultures (demonstration)	4
11.	Study of apoptosis using staining methods	4
12.	Experimental study of regeneration (planaria/hydra)	4
13.	Embryo mounting and slide preparation techniques	4
14.	Study of teratogenic effects (case study approach)	4
15.	Bioinformatics analysis of developmental genes	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Practical Workbook for Human Physiology	Stuart Ira Fox	McGraw-Hill
2	Laboratory Manual for Anatomy and Physiology	Elaine N. Marieb, Lori A. Smith	Pearson
3	Experimental Physiology	Robert R. Switzer, Liam F. Garrity	W. H. Freeman
4	Manual of Practical Physiology	C. L. Ghai	Jaypee Brothers Medical Publishers
5	Practical Physiology	G. K. Pal, Pravati Pal	Universities Press
6	Textbook of Practical Physiology	C. L. Ghai	Jaypee Brothers
7	Laboratory Manual of Human Anatomy and Physiolog	Elaine N. Marieb	Pearson

National Education Policy 2020
B.Sc. Biochemistry III Year (Semester - V)

Vocational Course

Course Code – SBCHVC1301

Title of the Course: Blood Sample collection And Processing

[No. of Credits: 2 Credit (Marks: 50)]

[Total: 60 Hours]

CURRICULUM DETAILS: SBCHSC 1301: Blood Sample Collection and Processing

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1	Study of laboratory safety rules and precautions in blood sample collection	4
2	Identification and use of equipment for blood collection (syringe, needle, vacutainer system)	4
3	Preparation of patient for blood sample collection and ethical considerations	4
4	Demonstration of venipuncture technique for blood collection	4
5	Collection of capillary blood sample using finger prick method	4
6	Collection of blood using vacutainer tubes and identification of color-coded tubes	4
7	Labeling, documentation, and transportation of blood samples	4
8	Separation of serum and plasma from whole blood by centrifugation	4
9	Preparation of blood smear on glass slide	4
10	Staining of blood smear using Leishman/Wright stain	4
11	Determination of blood group by slide agglutination method (ABO system)	4
12	Determination of Rh factor by agglutination test	4
13	Estimation of hemoglobin concentration in blood	4
14	Study of anticoagulants used in blood collection (EDTA, heparin, citrate) and their uses	4
15	Proper storage and preservation of blood samples for biochemical analysis	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Practical Clinical Biochemistry	Harold Varley, Alan H. Gowenlock, Maurice Bell	CBS Publishers & Distributors
2	Medical Laboratory Technology: Methods and Interpretations (Vol. 1)	Ramnik Sood	Jaypee Brothers Medical Publishers
3	Textbook of Practical Physiology	C. L. Ghai	Jaypee Brothers Medical Publishers
4	Manual of Practical Biochemistry	Evangeline Jones	Jaypee Brothers Medical Publishers
5	Competency-Based Practical Manual for Clinical Biochemistry	Kapila Gaikwad	Jaypee Brothers Medical Publishers
6	Laboratory Manual of Biochemistry	R. K. Sharma	CBS Publishers & Distributors
7	Clinical Biochemistry: A Laboratory Guide	Rooma Devi, Aman Chauhan, Simmi Kharb, C. S. Pundir	Jenny Stanford Publishing
8	Basic Concepts in Clinical Biochemistry: A Practical Guide	Vijay Kumar, Kiran Dip Gill	Springer
9	Laboratory Techniques in Biochemistry and Molecular Biology	T. S. Work, E. Work	North-Holland Publishing
10	Practical Hematology	John V. Dacie, S. M. Lewis	Churchill Livingstone / Elsevier

Syllabus for B. Sc. Biochemistry,
Third Year
Semester – VI
As Per National Education Policy- 2020

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - VI)
Major Core Theory Course
Course Code – SBCHCT 1351
Title of the Course: ENDOCRINOLOGY

[Credits: 3 (Marks: 75)]

(Total Periods: 45 Hours)

1. Course Objectives

1. To introduce the structure, classification, and mechanism of action of hormones.
2. To study the structure and function of endocrine glands and their hormonal regulation.
3. To understand the biochemical role of hormones in metabolism, growth, and reproduction.
4. To explain the pathophysiology of endocrine disorders and their clinical significance.

2. Course Outcomes (COs)

After successful completion of the course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Explain the structure, classification, and mechanism of hormone action in endocrine regulation	PO1, PO2, PO6	PSO1, PSO2	Understand (U), Analyze (An)
CO2	Describe the structure and functions of major endocrine glands and their hormones	PO1, PO6, PO9	PSO1	Remember (R), Understand (U)
CO3	Understand the biochemical role of hormones in metabolism, growth, and homeostasis	PO1, PO2	PSO1, PSO3	Understand (U), Analyze (An)
CO4	Analyze the causes and biochemical basis of endocrine disorders and their physiological effects	PO2, PO3, PO5, PO8	PSO2, PSO3	Analyze (An), Evaluate (E)

CURRICULUM DETAILS: SBCHCT 1351: ENDOCRINOLOGY

Module No.	Unit No.	Topic	Hrs. Required
1.0		Introduction to Endocrinology	
	1.1	Introduction to endocrine system and hormonal regulation	12
	1.2	Classification and chemical nature of hormones	
	1.3	Mechanism of hormone action and hormone receptors	
	1.4	Feedback regulation and endocrine control mechanisms	
2.0		Hypothalamus, Pituitary and Thyroid Glands	
	2.1	Structure and function of hypothalamus and pituitary gland	12
	2.2	Hormones of anterior and posterior pituitary	
	2.3	Structure and function of thyroid gland	
	2.4	Thyroid hormones and their role in metabolism	
3.0		Adrenal, Pancreatic and Parathyroid Hormones	
	3.1	Structure and hormones of adrenal cortex and adrenal medulla	11
	3.2	Pancreatic hormones: insulin and glucagon	
	3.3	Parathyroid hormone and regulation of calcium metabolism	
	3.4	Hormonal control of carbohydrate, lipid, and protein metabolism	
4.0		Reproductive and Other Endocrine Glands	
	4.1	Hormones of male and female reproductive systems	10
	4.2	Hormonal regulation of reproductive cycle	
	4.3	Pineal gland and thymus hormones	
	4.4	Endocrine disorders: diabetes mellitus, hypothyroidism, hyperthyroidism, and hormonal imbalance	
		Total	45

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Endocrinology	Mac E. Hadley, Jon E. Levine	Pearson
2	Williams Textbook of Endocrinology	Shlomo Melmed, Kenneth S. Polonsky, P. Reed Larsen	Elsevier
3	Vertebrate Endocrinology	David O. Norris, James A. Carr	Academic Press
4	Textbook of Medical Physiology	Arthur C. Guyton, John E. Hall	Elsevier
5	Harper's Illustrated Biochemistry	Victor W. Rodwell, David A. Bender, Kathleen Botham	McGraw-Hill
6	Lehninger Principles of Biochemistry	David L. Nelson, Michael M. Cox	W.H. Freeman
7	Human Physiology	Stuart Ira Fox	McGraw-Hill
8	Principles of Anatomy and Physiology	Gerard J. Tortora, Bryan Derrickson	Wiley

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester -VI)
Major Practical Course
Course Code – SBCHCP 1351
Title of the Course: Practical based on SBCHCT 1351

[No. of Credits: 2 Credit]

[Total: 60 Hours]

CURRICULUM DETAILS: SBCHCP 1351: Practical based on SBCHCT 1351

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1	Study of endocrine glands using charts, models, or preserved specimens	4
2	Demonstration of hormone classification and endocrine gland functions.	4
3	Estimation of blood glucose by enzymatic method (related to pancreatic hormone activity).	4
4	Estimation of serum cholesterol level.	4
5	Estimation of serum triglycerides	4
6	Determination of serum calcium level (related to parathyroid hormone function)	4
7	Determination of serum phosphorus level	4
8	Demonstration of thyroid function test (T3, T4, TSH) using immunoassay principle.	4
9	Study of ELISA technique for hormone estimation.	4
10	Determination of insulin level using immunoassay (demonstration)	4
11	Estimation of cortisol level in serum (demonstration)	4
12	Study of menstrual cycle stages using charts and hormonal changes	4
13	Study of hormonal regulation of metabolism using case studies	4
14	Demonstration of pregnancy test (hCG hormone detection)	4
15	Interpretation of endocrine laboratory reports (thyroid, diabetes, reproductive hormones)	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Practical Clinical Biochemistry	Harold Varley, Alan H. Gowenlock, Maurice Bell	CBS Publishers & Distributors
2	Medical Laboratory Technology: Methods and Interpretations (Vol. 1 & 2)	Ramnik Sood	Jaypee Brothers Medical Publishers
3	Manual of Practical Biochemistry	Evangeline Jones	Jaypee Brothers Medical Publishers
4	Competency-Based Practical Manual for Clinical Biochemistry	Kapila Gaikwad	Jaypee Brothers Medical Publishers
5	Clinical Biochemistry: A Laboratory Guide	Rooma Devi, Aman Chauhan, Simmi Kharb, C. S. Pundir	Jenny Stanford Publishing
6	Basic Concepts in Clinical Biochemistry: A Practical Guide	Vijay Kumar, Kiran Dip Gil	Springer
7	Laboratory Manual of Biochemistry	R. K. Sharma	CBS Publishers & Distributors
8	Practical Hematology	John V. Dacie, S. M. Lewis	Churchill Livingstone / Elsevier
9	Textbook of Practical Physiology	C. L. Ghai	Jaypee Brothers Medical Publishers
10	Experimental Biochemistry	Robert R. Switzer, Liam F. Garrity	W. H. Freeman & Company

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - VI)
Minor Core Theory Course
Course Code – SBCHCT 1352
Title of the Course: GENETIC ENGINEERING

[Credits: 3 (Marks: 75)]

(Total Periods: 45 Hours)

1. Course Objectives

The objectives of this course are:

1. To understand the principles and tools of genetic engineering.
2. To study gene cloning, recombinant DNA technology, and gene expression systems.
3. To explore applications of genetic engineering in medicine, agriculture, and industry.
4. To develop knowledge about modern genome editing technologies and bioethical issues.

2. Course Outcomes

After completion of the course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Explain the basic concepts and techniques of recombinant DNA technology	PO1, PO2, PO5	PSO1, PSO2	Understand (U), Analyze (An)
CO2	Demonstrate understanding of gene cloning, vectors, and host systems	PO1, PO3, PO5	PSO1, PSO2	Understand (U), Apply (Ap)
CO3	Apply genetic engineering techniques in biotechnology, medicine, and agriculture	PO2, PO3, PO5, PO6	PSO2, PSO3	Apply (Ap), Analyze (An)
CO4	Analyze the advantages, limitations, and ethical aspects of genetic manipulation	PO2, PO6, PO8, PO9	PSO3	Analyze (An), Evaluate (E)

CURRICULUM DETAILS: **SBCHCT 1352: GENETIC ENGINEERING**

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to Genetic Engineering	
	1.1	Definition, scope and history of genetic engineering.	12
	1.2	Recombinant DNA technology: concept and principles.	
	1.3	Structure and function of DNA and gene organization.	
	1.4	Restriction enzymes, ligases and other DNA modifying enzymes.	
2.0		Cloning Vectors and Gene Cloning	
	2.1	Cloning vectors: plasmids, bacteriophages, cosmids and BACs	12
	2.2	Host systems for cloning: bacteria, yeast, plant and animal cells	
	2.3	Gene cloning techniques and steps in cloning	
	2.4	Screening and selection of recombinant clones	
3.0		Gene Expression and Gene Transfer Techniques	
	3.1	Polymerase Chain Reaction (PCR) and its types	11
	3.2	DNA sequencing methods	
	3.3	Gene transfer methods: transformation, transduction, conjugation, electroporation, microinjection.	
	3.4	Expression vectors and protein expression systems	
4.0		Applications of Genetic Engineering	
	4.1	Genetic engineering in medicine: gene therapy, recombinant vaccines and insulin production.	10
	4.2	Genetic engineering in agriculture: transgenic plants and GM crops	
	4.3	Industrial applications: enzyme production, biofuels, and pharmaceuticals.	
	4.4	CRISPR-Cas technology and ethical issues in genetic engineering	
		Total	45

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Principles of Gene Manipulation and Genomics	Sandy B. Primrose & Richard Twyman	Blackwell Publishing.
2	Molecular Biotechnology: Principles and Applications of Recombinant DNA	Bernard R. Glick & Jack J. Pasternak	ASM Press.
3	Gene Cloning and DNA Analysis	T.A. Brown	Wiley-Blackwell.
4	Recombinant DNA: Genes and Genomes	James D. Watson	W.H. Freeman and Company.
5	Molecular Biology of the Gene	James D. Watson	Pearson Education
6	Molecular Cloning: A Laboratory Manual –	Sambrook & Russell	W.H. Freeman
7	Current Protocols in Molecular Biology	Frederick M. Ausubel et al.	McGraw-Hill
8	Experimental Molecular Biology	Robert F. Weaver	Wiley
9	Principles and Techniques of Biochemistry and Molecular Biology	Keith Wilson & John Walker	McGraw-Hill

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester -VI)
Major Practical Course
Course Code – SBCHCP 1352
Title of the Course: Practical based on SBCHCT 1352

[No. of Credits: 2 Credit]

[Total: 60 Hours]

CURRICULUM DETAILS: SBCHCP 1252: Practical based on SBCHCT 1252

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1	Isolation of genomic DNA from bacteria.	4
2	Isolation of genomic DNA from plant.	4
3	Prepare Module of Agarose gel electrophoresis.	4
4	Perform Agarose gel electrophoresis of DNA.	4
5	Isolation of plasmid DNA (alkaline lysis method).	4
6	Estimation of RNA using spectrophotometer.	4
7	Estimation of DNA using spectrophotometer.	4
8	Prepare Module of SDS-PAGE electrophoresis	4
9	Prepare Module of PCR	4
10	Prepare Module of DNA	4
11	Demonstration of DNA sequencing technique.	4
12	Demonstration of CRISPR gene editing (computer simulation).	4
13	Gene sequence analysis using bioinformatics tools.	4
14	Preparation of competent bacterial cells.	4
15	Transformation of bacteria with plasmid DNA.	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Principles of Gene Manipulation and Genomics	Sandy B. Primrose & Richard Twyman	Blackwell Publishing.
2	Molecular Biotechnology: Principles and Applications of Recombinant DNA	Bernard R. Glick & Jack J. Pasternak	ASM Press.
3	Gene Cloning and DNA Analysis	T.A. Brown	Wiley-Blackwell.
4	Recombinant DNA: Genes and Genomes	James D. Watson	W.H. Freeman and Company.
5	Molecular Biology of the Gene	James D. Watson	Pearson Education
6	Molecular Cloning: A Laboratory Manual –	Sambrook & Russell	W.H. Freeman
7	Current Protocols in Molecular Biology	Frederick M. Ausubel et al.	McGraw-Hill
8	Experimental Molecular Biology	Robert F. Weaver	Wiley
9	Principles and Techniques of Biochemistry and Molecular Biology	Keith Wilson & John Walker	McGraw-Hill

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - VI)
Minor Core Theory Course
Course Code – SBCHMT 1353
Title of the Course: PROTEOMIC

[Credits: 2 (Marks: 50)]

(Total Periods: 30 Hours)

1. Course Objectives

The objectives of this course are:

1. To understand the concept and importance of proteomics in modern biology.
2. To study techniques used for protein separation, identification, and characterization.
3. To learn mass spectrometry and bioinformatics tools used in proteomics.
4. To explore applications of proteomics in medicine, biotechnology, and drug discovery.

2. Course Outcomes

After completion of the course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Explain the principles and scope of proteomics in biological research	PO1, PO5, PO6	PSO1	Understand (U)
CO2	Understand various methods for protein isolation, separation, and analysis	PO1, PO3, PO5	PSO1, PSO2	Understand (U), Apply (Ap)
CO3	Interpret proteomic data using bioinformatics tools and databases	PO2, PO5	PSO2, PSO3	Analyze (An)
CO4	Evaluate the applications of proteomics in disease diagnosis, biomarker discovery, and pharmaceutical research	PO2, PO6, PO8, PO9	PSO3	Analyze (An), Evaluate (E)

CURRICULUM DETAILS: SBCHCT 1351: PROTEOMIC

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to Proteomics	
	1.1	Definition, scope, and history of proteomics.	07
	1.2	Proteome vs genome and importance of proteomic studies.	
	1.3	Types of proteomics: structural, functional, and expression proteomics	
	1.4	Organization and complexity of the proteome	
2.0		Protein Separation and Analysis Techniques	
	2.1	Protein extraction and purification methods.	08
	2.2	Gel-based techniques: SDS-PAGE and two-dimensional gel electrophoresis (2D-PAGE)	
	2.3	Chromatographic techniques in proteomics.	
	2.4	Protein staining, visualization, and quantification methods	
3.0		Protein Identification and Characterization	
	3.1	Mass spectrometry in proteomics (MALDI-TOF, ESI-MS)	08
	3.2	Peptide mass fingerprinting and protein sequencing	
	3.3	Post-translational modifications and their analysis	
	3.4	Post-translational modifications and their analysis	
4.0		Bioinformatics and Applications of Proteomics	
	4.1	Proteomic databases and bioinformatics tools	07
	4.2	Biomarker discovery and clinical proteomics	
	4.3	Proteomics in drug discovery and development.	
	4.4	Applications of proteomics in disease diagnosis and biotechnology	
		Total	30

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Introduction to Proteomics: Principles and Applications	Nawin C. Mishra	Wiley-Interscience.
2	Proteomics: From Protein Sequence to Function	S.R. Pennington & M.J. Dunn	Springer
3	Principles of Proteomics	Richard Twyman	Garland Science (Taylor & Francis Group).
4	Proteomics: A Cold Spring Harbor Laboratory Course Manual	Andrew J. Link	Cold Spring Harbor Laboratory Press..
5	Proteome Research: Mass Spectrometry	Peter James	Springer
6	Proteomics in Practice	Reiner Westermeier & Tom Naven	Wiley-VCH.
7	Proteomics for Biological Discovery	Timothy D. Veenstra & John R. Yates III	Wiley-Liss.
8	Mass Spectrometry for Proteomics	Caroline A. Evans	Wiley
9	Functional Proteomics: Methods and Protocols	Michael P. Washburn	Humana Press (Springer).
10	Bioinformatics and Functional Genomics	Jonathan Pevsner	Wiley-Blackwell.

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - VI)
Minor Core Theory Course
Course Code – SBCHET 1351
Title of the Course: CLINICAL PATHOLOGY

[Credits: 3 (Marks: 75)]

(Total Periods: 45 Hours)

1. Course Objectives

The objectives of this course are:

1. To understand the basic principles and importance of clinical pathology in disease diagnosis.
2. To study laboratory examination of blood, urine, and other body fluids.
3. To learn microscopic and biochemical diagnostic techniques used in clinical laboratories.
4. To develop skills in interpretation of laboratory results for clinical diagnosis.

2. Course Outcomes

After successful completion of the course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Explain the role of clinical pathology in diagnosis and monitoring of diseases	PO1, PO2, PO6	PSO1, PSO3	Understand (U), Analyze (An)
CO2	Perform routine laboratory tests on blood, urine, and body fluids	PO3, PO5	PSO2	Apply (Ap)
CO3	Identify abnormal cellular and biochemical changes associated with diseases	PO1, PO2, PO3	PSO1, PSO2, PSO3	Understand (U), Analyze (An)
CO4	Interpret laboratory findings for clinical and diagnostic purposes	PO2, PO3, PO5, PO9	PSO2, PSO3	Analyze (An), Evaluate (E)

CURRICULUM DETAILS: SBCHET 1351: CLINICAL PATHOLOGY

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to Clinical Pathology	
	1.1	Definition, scope, and importance of clinical pathology	12
	1.2	Organization and functions of clinical laboratories	
	1.3	Collection, handling, and preservation of clinical specimens.	
	1.4	Safety procedures and quality control in clinical laboratories	
2.0		Hematological Examination	
	2.1	Composition and functions of blood.	12
	2.2	Hemoglobin estimation and RBC, WBC count	
	2.3	Differential leukocyte count (DLC) and peripheral blood smear examination.	
	2.4	Erythrocyte sedimentation rate (ESR) and hematological disorders	
3.0		Urine and Body Fluid Analysis	
	3.1	Physical examination of urine	11
	3.2	Chemical examination of urine (glucose, protein, ketone bodies, bile pigments)	
	3.3	Microscopic examination of urine sediments	
	3.4	Examination of other body fluids: cerebrospinal fluid (CSF), pleural and synovial fluids	
4.0		Clinical Diagnostic Techniques	
	4.1	Blood glucose estimation and glucose tolerance test	10
	4.2	Liver function tests and kidney function tests	
	4.3	Detection of infectious agents and parasites in clinical samples	
	4.4	Role of automated analyzers and modern diagnostic techniques	
		Total	45

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Clinical Diagnosis and Management by Laboratory Methods	John B. Henry	Elsevier Saunders.
2	Practical Clinical Biochemistry	Harold Varley	CBS Publishers & Distributors.
3	Textbook of Medical Laboratory Technology	Praful B. Godkar & Darshan P. Godkar	Bhalani Publishing House
4	Clinical Hematology	Shirlyn B. McKenzie & Lynne M. Williams	Pearson Education.
5	Medical Laboratory Technology Methods and Interpretations	Ramnrik Sood	Jaypee Brothers Medical Publishers.
6	Clinical Pathology and Laboratory Techniques	S.P. Gupta,	CBS Publishers & Distributors.
7	Essentials of Medical Laboratory Practice	Betty L. Theriot	Cengage Learning
8	Clinical Chemistry: Principles, Techniques and Correlations	Michael L. Bishop et al	Wolters Kluwer.
9	Medical Parasitology	K.D. Chatterjee,	CBS Publishers & Distributors.
10	Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics	Carl A. Burtis & David E. Bruns	Elsevier.

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester -VI)
Minor Practical Course
Course Code – SBCHEP 1352
Title of the Course: Practical based on SBCHMT 1351

[No. of Credits: 1 Credit]

[Total: 60 Hours]

CURRICULUM DETAILS: SBCHMP 1351: Practical based on SBCHMT 1351

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1	Collection and handling of clinical specimens	4
2	Preparation of blood smear and staining	4
3	Hemoglobin estimation (Sahli's or Cyanmethemoglobin method)	4
4	Total RBC count using hemocytometer	4
5	Total WBC count using hemocytometer	4
6	Differential leukocyte count (DLC)	4
7	Determination of erythrocyte sedimentation rate (ESR)	4
8	Determination of packed cell volume (PCV)	4
9	Physical examination of urine	4
10	Chemical examination of urine (sugar and protein tests)	4
11	Microscopic examination of urine sediments	4
12	Blood glucose estimation	4
13	Detection of parasites in stool sample	4
14	Examination of cerebrospinal fluid (demonstration)	4
15	Demonstration of automated clinical analyzer	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Clinical Diagnosis and Management by Laboratory Methods	John B. Henry	Elsevier Saunders.
2	Practical Clinical Biochemistry	Harold Varley	CBS Publishers & Distributors.
3	Textbook of Medical Laboratory Technology	Praful B. Godkar & Darshan P. Godkar	Bhalani Publishing House
4	Clinical Hematology	Shirlyn B. McKenzie & Lynne M. Williams	Pearson Education.
5	Medical Laboratory Technology Methods and Interpretations	Ramnrik Sood	Jaypee Brothers Medical Publishers.
6	Clinical Pathology and Laboratory Techniques	S.P. Gupta,	CBS Publishers & Distributors.
7	Essentials of Medical Laboratory Practice	Betty L. Theriot	Cengage Learning
8	Clinical Chemistry: Principles, Techniques and Correlations	Michael L. Bishop et al	Wolters Kluwer.
9	Medical Parasitology	K.D. Chatterjee,	CBS Publishers & Distributors.
10	Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics	Carl A. Burtis & David E. Bruns	Elsevier.

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - VI)
Minor Core Theory Course
Course Code – SBCHET 1351
Title of the Course: Evolutionary Biology

[Credits: 3 (Marks: 75)]

(Total Periods: 45 Hours)

1. Course Objectives

The objectives of this course are:

1. To understand the principles and mechanisms of biological evolution.
2. To explain genetic variation and natural selection in populations.
3. To study speciation and evolutionary patterns.
4. To analyze molecular evolution and phylogenetics.

2. Course Outcomes

After successful completion of the course, students will be able to:

CO No.	Course Outcome (CO)	Mapped POs	Mapped PSOs	Bloom's Level
CO1	Explain basic concepts and theories of evolution.	PO1, PO2, PO6	PSO1, PSO3	Understand (U), Analyze (An)
CO2	Analyze mechanisms of evolutionary change (mutation, selection, drift).	PO3, PO5	PSO2	Apply (Ap)
CO3	Interpret speciation and adaptation processes.	PO1, PO2, PO3	PSO1, PSO2, PSO3	Understand (U), Analyze (An)
CO4	Construct and analyze phylogenetic relationships.	PO2, PO3, PO5, PO9	PSO2, PSO3	Analyze (An), Evaluate (E)

CURRICULUM DETAILS: **SBCHET 1351: Evolutionary Biology**

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Origin and Theories of Evolution	
	1.1	Origin of life – chemical evolution (Oparin-Haldane theory)	12
	1.2	Early theories: Lamarckism and Darwinism	
	1.3	Modern Synthetic Theory of Evolution	
	1.4	Evidence of evolution – fossil, anatomical, embryological, molecular	
2.0		Genetic Basis of Evolution	
	2.1	Population genetics – Hardy-Weinberg equilibrium	12
	2.2	Sources of variation – mutation and recombination	
	2.3	Natural selection and its types (directional, stabilizing, disruptive)	
	2.4	Genetic drift and gene flow	
3.0		Speciation and Adaptation	
	3.1	Concept of species and isolating mechanisms	11
	3.2	Types of speciation – allopatric, sympatric, parapatric	
	3.3	Adaptive radiation and convergent evolution	
	3.4	Co-evolution and evolutionary fitness	
4.0		Molecular Evolution and Phylogeny	
	4.1	Molecular evolution – DNA and protein evolution	10
	4.2	Molecular clocks and neutral theory	
	4.3	Phylogenetic tree construction methods	
	4.4	Evolutionary genomics and applications	
		Total	45

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Evolutionary Biology	Douglas J. Futuyma	Oxford University Press
2	Evolution	Douglas J. Futuyma	Oxford University Press
3	Evolutionary Analysis	Scott Freeman & Jon C. Herron	Pearson Education
4	Evolution	Mark Ridley	Blackwell Publishing
5	Principles of Population Genetics	Daniel L. Hartl & Andrew G. Clark	Sinauer Associates
6	Molecular Evolution and Phylogenetics	Masatoshi Nei & Sudhir Kumar	Oxford University Press
7	Evolutionary Biology	Eli C. Minkoff	Addison-Wesley
8	Evolution in Four Dimensions	Eva Jablonka & Marion J. Lamb	MIT Press
9	The Selfish Gene	Richard Dawkins	Oxford University Press
10	On the Origin of Species	Charles Darwin	John Murray (original publication)

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester -VI)
Minor Practical Course
Course Code – SBCHEP 1352
Title of the Course: Practical based on SBCHMT 1351

[No. of Credits: 1 Credit]

[Total: 60 Hours]

CURRICULUM DETAILS: SBCHMP 1351: Practical based on SBCHMT 1351

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1	Study of homologous and analogous structures	4
2	Hardy-Weinberg equilibrium calculation	4
3	Simulation of genetic drift (bottle experiment)	4
4	Study of fossil records (models/images)	4
5	Phylogenetic tree construction using morphological data	4
6	DNA sequence alignment (basic bioinformatics tools)	4
7	Study of variation in natural populations	4
8	Case study on adaptive radiation (Darwin's finches)	4
9	Analysis of mutation rates	4
10	Comparative study of vertebrate limbs	4
11	Simulation of natural selection using colored beads	4
12	Molecular phylogeny using software (MEGA or similar)	4
13	Study of evolutionary trends in plants/animals	4
14	Population genetics problems solving	4
15	Case study on antibiotic resistance evolution	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Evolutionary Biology	Douglas J. Futuyma	Oxford University Press
2	Evolution	Douglas J. Futuyma	Oxford University Press
3	Evolutionary Analysis	Scott Freeman & Jon C. Herron	Pearson Education
4	Evolution	Mark Ridley	Blackwell Publishing
5	Principles of Population Genetics	Daniel L. Hartl & Andrew G. Clark	Sinauer Associates
6	Molecular Evolution and Phylogenetics	Masatoshi Nei & Sudhir Kumar	Oxford University Press
7	Evolutionary Biology	Eli C. Minkoff	Addison-Wesley
8	Evolution in Four Dimensions	Eva Jablonka & Marion J. Lamb	MIT Press
9	The Selfish Gene	Richard Dawkins	Oxford University Press
10	On the Origin of Species	Charles Darwin	John Murray (original publication)

National Education Policy 2020
B.Sc. Biochemistry, III Year (Semester - VI)
Skill Enhancement Course
Course Code – SBCHVC 1351

Title of the Course: Biomedical Waste Management

[No. of Credits: 2 Credit]

[Total: 60 Hours]

CURRICULUM DETAILS: SBCHVC 1351: Biomedical Waste Management

Sr. No	Practical Exercises	Hrs. Required to cover the contents
1.	Identification and classification of biomedical waste according to categories.	4
2.	Demonstration of color-coded segregation system for biomedical waste (yellow, red, white, blue bins).	4
3.	Collection and segregation of biomedical waste in a laboratory setting.	4
4.	Demonstration of safe handling and disposal of sharps (needles, blades, syringes).	4
5.	Study of biomedical waste treatment methods: incineration, autoclaving, and microwaving.	4
6.	Demonstration of autoclave sterilization for biomedical waste treatment.	4
7.	Preparation and use of disinfectant solutions for biomedical waste treatment.	4
8.	Demonstration of chemical disinfection of contaminated laboratory materials.	4
9.	Study of transport and storage methods of biomedical waste.	4
10.	Demonstration of personal protective equipment (PPE) used in biomedical waste handling.	4
11.	Preparation of biomedical waste management flow chart for hospitals/laboratories.	4
12.	Study of Biomedical Waste Management Rules and regulations (India).	4
13.	Risk assessment and safety measures in biomedical waste handling.	4
14.	Demonstration of record keeping and labeling of biomedical waste containers.	4
15.	Field visit/report preparation on biomedical waste management system in a hospital or laboratory.	4
	Total	60

Text Books and Reference Books:

Sr. No.	Book Title	Author(s)	Publisher
1	Biomedical Waste Management and Handling Rules	Government of India,	Ministry of Environment, Forest and Climate Change..
2	Biomedical Waste Management	P. Sharma	CBS Publishers & Distributors.
3	Hospital Waste Management	P.K. Gupta,	Jaypee Brothers Medical Publishers.
4	Biomedical Waste Management: Principles and Practice	S. K. Sharma	Wiley India Pvt. Ltd.
5	Environmental Health and Safety in Laboratories	D. A. Crowl & J. F. Louvar	Prentice Hall.
6	Hospital and Healthcare Waste Management	A. K. Bansal,	CBS Publishers & Distributors.
7	Waste Management in Healthcare Facilities	WHO Guideline	World Health Organization Press.
8	Environmental Pollution and Control	P. Aarne Vesilind & Susan M. Morgan	Cengage Learning.
9	Handbook of Environmental Health and Safety	Herman Koren & Michael Bisesi	CRC Press..
10	Environmental Biotechnology	Alan Scragg	Oxford University Press.

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B.Sc. Biochemistry, III Year (Semester - VI)

Community Engagement Services

Course Code – **SBCHOJ 1351**

Title of the Course: **On Job Training**

[No. of Credits: 4 Credit]

[Total: 120 Hours]