COURSES IN BIOCHEMISTRY

Syllabus for

Undergraduate Programme (Honours)

Under Credit Semester System

(Outcome Based Education with Effect from 2024 Admissions)

St Berchmans College
Founded 1922
AUTONOMOUS | College with Potential for Excellence | A+ in the Fifth Cycle of Reaccreditation by NAAC
Changanassery, Kerala, India 686101 | Affiliated to Mahatma Gandhi University, Kottayam

ACKNOWLEDGEMENT

We extend our sincere appreciation to the esteemed members of our syllabus development team, whose collective expertise and dedication have been instrumental in shaping the curriculum for the courses in Biochemistry.

As the Dean and Professor (Retired) at the School of Bioscience, Mahatma Gandhi University, Dr. Latha M S has provided invaluable leadership and scholarly insights throughout the syllabus development process. Her wealth of experience and profound understanding of academic frameworks have greatly enriched the content of our syllabus.

We express our gratitude to Dr. Ambili S, Assistant Professor at S N College, for her meticulous attention to detail and unwavering commitment to academic excellence. Her expertise in the field of Biochemistry has significantly contributed to the comprehensive nature of the syllabus.

Our heartfelt thanks to Dr. Latha B, Assistant Professor at TKM College, for her scholarly contributions and thoughtful inputs. Her dedication to pedagogical innovation and student-centered learning has been invaluable in shaping the syllabus content to meet the diverse needs of our learners.

We would like to acknowledge Dr. Lekshmi Sundar M S, our esteemed alumni representative, for providing invaluable insights from a student's perspective. Her feedback and recommendations have been instrumental in ensuring that the syllabus remains relevant and engaging for current and future students.

Special thanks to Dr. Abhilash S, representative from Industry, for his invaluable contributions in bridging the academia-industry gap. His practical insights and industry perspective have helped ensure that our syllabus aligns with the evolving needs of the job market and equips students with the skills and knowledge required for professional success.

Last but not least, we express our heartfelt gratitude to our Head of Department, Dr. Jiji Jacob, for her unwavering support, guidance, and mentorship throughout the syllabus development process. Her visionary leadership and commitment to academic excellence have been instrumental in guiding our team towards the successful completion of this endeavour.

Together, the collective efforts of these esteemed individuals have culminated in the creation of a syllabus that reflects the highest standards of academic rigor, relevance, and innovation. We are confident that it will serve as a cornerstone for the intellectual and professional development of our students for years to come.

BOARD OF STUDIES

CHAIRMAN

Name	Official Address
Dr. Jiji Jacob	Head of the Department Department of Microbiology and Biochemistry SB College, Changanassery.

SUBJECT EXPERTS NOMINATED BY THE COLLEGE ACADEMIC COUNCIL

Name	Official Address
Dr. Ambili S	Assistant Professor Department of Biochemistry SN College, Kollam
Dr. Latha B	Assistant Professor Department of Biochemistry TKM College, Kollam

EXPERT NOMINATED BY THE VICE-CHANCELLOR

Name	Official Address
Dr. Latha M S	Dean & Professor (Retired) School of Bioscience Mahatma Gandhi University, Kottayam

ALUMNI REPRESENTATIVE

Name	Official Address
Dr. Lekshmi Sundar M S	Research Scientist Prayaga Scientific Laboratory KRIBS-BIONEST, KINFRA Hi-Tech Park North Kalamassery Kochi, Kerala

REPRESENTATIVE FROM MEDIA/INDUSTRY AND ALLIED AREAS

Name	Official Address
Dr. Abhilash S	Senior Biochemist & Quality Officer Dept. of Laboratory Medicine Ananthapuri Hospital & Research Institute Trivandrum.

TEACHERS FROM THE DEPARTMENT NOMINATED BY THE PRINCIPAL TO THE BOARD OF STUDIES

Name
Ms. Biby Sara John
Ms. Ramlath Beegam L
Ms. Shema Jacob
Ms. Neena Krishnan

PROGRAMME OUTCOMES

PO1: Develop in-depth conceptual knowledge and skills in the discipline for vertical growth and scholarly pursuits

PO2: Integrate and apply interdisciplinary knowledge incorporating historical, theoretical, scientific, technological, economic, philosophical, cultural, aesthetic and ethical perspectives to address complex challenges in diverse settings

PO3: Demonstrate communication skills promoting adaptability, collaboration and resilience in global and local contexts

PO4: Develop problem solving skills to transfer the knowledge of methods and systems of different disciplines for a sustainable and egalitarian world order

PO5: Cultivate research skills and innovative and critical thinking to contribute to societal development through the creation of sustainable solutions and advancements in the respective fields

OUTLINE OF DISCIPLINE SPECIFIC COURSES

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
Semester I (Course Level: 100 - 199)					
SBU24BC1DSC100	Minor	Fundamentals of Biochemistry	5	75	4
Semester II (Course Level: 100 - 199)					
SBU24BC2DSC100	Minor	Biomolecules	5	75	4
Semester III (Course Level: 200 - 299)					
SBU24BC3DSC200	Minor	Metabolism and Bioenergetics - I	5	75	4
Semester IV (Course Level: 200 - 299)					
SBU24BC4DSC200	Minor	Metabolism and Bioenergetics - II	5	75	4
Semester V (Course Level: 300 – 399)					
SBU24BC5DSC300	Minor	Nutritional Biochemistry	4	60	4
Semester VII (Course Level: 400 - 499)					
SBU24BC7DSC400	Minor	Enzymology	4	60	4
SBU24BC7DSC401	Minor	Techniques in Biochemistry	4	60	4
SBU24BC7DSC402	Minor	Biochemistry of Cancer	4	60	4

OUTLINE OF MULTIDISCIPLINARY COURSES (MDC)

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
Semester I (Course Level: 100 - 199)					
SBU24BC1MDC100	MDC	Life Style Diseases	4	60	3
Semester II (Course Level: 100 - 199)					
SBU24BC2MDC100	MDC	Nutrition and Dietetics	4	60	3
Semester III (Course Level: 200 - 299)					
SBU24BC3MDC200	MDC	Sports Biochemistry	3	45	3

SEMESTER I

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BC1DSC100	Minor	Fundamentals of Biochemistry	5	75	4
SBU24BC1MDC100	MDC	Life Style Diseases	4	60	3

SBU24BC1DSC100: FUNDAMENTALS OF BIOCHEMISTRY

Type of Course	Minor		
Course Level	100-199		
Credit	4		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand water properties, pH concepts, buffer systems, and their biological relevance,enabling them to analyze and solve problems in diverse scientific contexts.	Understand
CO2	Understand the mechanisms governing the movement of molecules across cellular membranes and their implications for cellular function and homeostasis.	Remember
CO3	Understand the diverse classes of biomolecules, their structures, functions, and roles in cellular processes.	Understand
CO4	Acquire knowledge on the structural diversity and bonding principles within biomolecules, enabling them to analyse andpredict the three-dimensional arrangements of molecules crucial to biological processes.	Understand
CO5	Acquire skill in preparing solutions, determine concentrations through colorimetric analysis, andproficiently utilize pH meters for precise pH measurements in laboratory settings.	Apply

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	-	2	1
CO2	-	-	-	-	-	2	2	-	1	1
CO3	-	-	-	-	-	2	2	-	-	-
CO4	-	-	-	-	-	2	2	-	-	-
CO5	-	-	-	-	-	2	2	-	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	MCQ	Exam 1	Exam 2	
CO1	-	x	x	x	-	x
CO2	x	x	x	x	-	x
CO3	-	x	-	-	x	x
CO4	-	x	x	-	x	x
CO5	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment	ESE
	Practical Assignment	Observation of practical skills	Laboratory report	Lab Test	
CO1	-	-	-	-	-
CO2	-	-	-	-	-
CO3	-	-	-	-	-
CO4	-	-	-	-	-
CO5	x	x	x	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Water, Acids, Bases and buffers (13 Hrs)				
Structure of water, Ionisation of water.	1.1	1	2	Lecture/Powerpoint Presentation
Definition of acids and bases, Bronsted theory of acids and bases	1.2	1	2	Lecture/Powerpoint Presentation
Dissociation of acids and bases, Meaning of Ka and pKa values	1.3	1	2	Lecture/Powerpoint Presentation
pH, pOH, Significance of pH Scale	1.4	1	2	Lecture/Powerpoint Presentation
Determination of pH using indicators and pH meter. Solutions: Molarity, molality, normality, percentage solution, Parts per million	1.5	1	2	Lecture/Powerpoint Presentation, Lab work
Buffers, Biological Buffers, Henderson Hasselbach Equation	1.6	1	3	Lecture/Powerpoint Presentation
Module 2: Membrane Transport (8 Hrs)				
Solute transport across membranes (passive transport - simple diffusion and facilitated diffusion)	2.1	2	2	Lecture/Powerpoint Presentation Animated Video
Active transport- primary and secondary, uniport, symport, antiport	2.2	2	2	Lecture/ Powerpoint Presentation, Animated Video
Osmosis, Biological significance of Osmosis, Solute Potential: Hypertonic, Hypotonic, Isotonic and isosmotic, colloids	2.3	2	4	Lecture/ Powerpoint Presentation, Animated Video
Module 3: Introduction to Biomolecules (18 Hrs)				
Introduction to functional groups in biomolecules.	3.1	3	1	Lecture/ Powerpoint Presentation
Carbohydrate: Definition, classification with examples (ribose, glucose, fructose, sucrose, maltose,starch).	3.2	3	3	Lecture/ Powerpoint Presentation
Lipid: Definition, classification with example	3.2	3	4	Lecture/ Powerpoint Presentation
Basics of Amino acids: Definition, Classification with examples	3.3	3	4	Lecture/ Powerpoint Presentation
Protein: Definition, classification with examples.	3.4	3	3	Lecture/ Powerpoint Presentation

Nucleic acids: Definition, examples	3.5	3	3	Lecture/ Powerpoint Presentation
Module 4: Isomerism and Bonding in Biomolecules (6 Hrs)				
Isomerism of Biomolecules: Classification with examples	4.1	4	2	Lecture/ Powerpoint Presentation
Bonding in Biomolecules: Covalent Bonds, glycosidic bond, peptide bond, disulphide bond, phophodiester linkage, hydrophobic bond, Hydrogen bond (in DNA andprotein), Ionic bond, Vander waal's interaction (outline study)	4.2	4	4	Lecture/ Powerpoint Presentation, Seminars, Assignments
Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbooks

1. R N Roy, A Text Book of Biophysics (2005) Publisher: New Central Book Agency(P) Ltd., Calcutta, India, ISBN: 81738114
2. Avinash Upadhyay and Kakoli Upadhyay and Nirmal Nath, Biophysical Chemistry: Principles and techniques (2010), Himalaya Publishing House, ISBN Number: 978-93-5142-227-3

Reference

1. E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen, A Text Book of Biochemistry (2017) Oxford and IBH Publishing Co., New Delhi.
2. Puri Br, Sharma Lr, Madan S Pathania Vishal, Principles of Physical Chemistry (2008) by Publishing Co, India ISBN: 8188646008ISBN-13: 9788188646005, 978- 8188646005
3. Hiram. F. Gilbert, Biochemistry: A Students Survival Guide (2002) Publishers, McGrawHill ISBN 0-07-135657-6
4. Reginald H. Garrett and Charles M. Grisham, Biochemistry (2012), Publisher: 5th Edition, Cengage Learning, ISBN-13: 978-1133106296 ISBN-10: 1133106293.
5. David L. Nelson, Cox, Lehninger Principles of Biochemistry, Fourth Edition (2004); Publisher: W. H. Freeman; ISBN-10: 0716743396

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 6: Preparation of solution (17 Hrs)				
Preparation of solutions- Normal solutions, Molar solutions, percentage solution. Preparation of stock standard solutions, Dilution of stock solutions	6.1	5	17	Demonstrations, hands on training
Module 7: Instrumentation (13 Hrs)				
Determination of the concentration of solutions using colorimeter. (Beer Lambert's Law)	7.1	5	10	Demonstrations, hands on training
Demonstration of pH meter	7.2	5	3	Demonstrations, hands on training

Textbooks

1. S. Sadasivam and A. Manickam, Biochemical Methods (2008), New Age International (P) Limited, ISBN-8122421407, 9788122421408

2. Beedu Sasidhar Rao & Vijay Deshpande (ed), Experimental Biochemistry: A Student Companion (2005), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41- 8.

Reference

1. P.B. Hawk (Author), B.L. Oser, (Editor), Hawk's Physiological Chemistry (2015), 14th Edition McGRAW Hill Book Company LTD, New York. ISBN-10: 0070478007, ISBN13: 978-0070478008.

Course designed by: Biby Sara John

SBU24BC1MDC100: LIFE STYLE DISEASE

Type of Course	MDC		
Course Level	100-199		
Credit	3		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	30	30	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the factors influencing lifestyle-related health conditions, analyse their impact on public health, and formulate strategies for prevention and management.	Understand
CO2	Understand the pathophysiology, management strategies, and preventive measures related to diabetes.	Understand
CO3	Acquire knowledge about molecular basis, diagnostic approaches, treatment modalities, and socio-economic impact of cancer.	Understand
CO4	Understand the pathophysiology, risk factors, diagnostic approaches, management and prevention of cardiovascular diseases	Understand
CO5	Understand the significance and methods of assessing cardiovascular health.	Apply

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	1	1	1
CO2	-	-	-	-	-	2	2	1	1	1
CO3	-	-	-	-	-	2	2	1	2	2
CO4	-	-	-	-	-	2	2	1	1	1
CO5	-	-	-	-	-	2	1	2	-	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	MCQ	Exam 1	Exam 2	
CO1	x	x	x	x	-	x
CO2	-	-	x	x	-	x
CO3	-	x	x	-	x	x
CO4	-	x	x	-	x	x
CO5	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment	ESE
	Practical Assignment	Observationof practical skills	Viva	Laboratory report	
CO1	-	-	-	-	-
CO2	-	-	-	-	-
CO3	-	-	-	-	-
CO4	-	-	-	-	-
CO5	x	x	x	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Concept of Life Style Diseases (8 Hrs)				
Lifestyle diseases- definition and types	1.1	1	2	Lecture/Powerpoint Presentation
Risk factors in developing disease – diet, sedentary lifestyle, smoking, alcohol.	1.2	1	2	Lecture/Powerpoint Presentation
Genetic predisposition and family history, mental health, depression, meditational yoga	1.3	1	2	Lecture/Powerpoint Presentation, Library work
Socioeconomic factors contributing to lifestyle disease	1.4	1	2	Lecture/Powerpoint Presentation, Library work
Module 2: Diabetes Mellitus (7 Hrs)				
Classification of diabetes mellitus-type 1 and type 2	2.1	2	2	Lecture/ Powerpoint Presentation
Symptoms, causes, diagnosis, HbA1c, GTT	2.2	2	3	Lecture/ Powerpoint Presentation, Lab work
Prevention and Management of diabetes	2.3	2	2	Lecture/ Powerpoint Presentation
Module 3: Cancer (7 Hrs)				
Characteristics, causes and diagnosis of cancer.	3.1	3	3	Lecture/ Powerpoint Presentation
Prevention and management of cancer.	3.2	3	2	Lecture/ Powerpoint Presentation
Methods for treatment of cancer	3.3	3	2	Lecture/ Powerpoint Presentation
Module 4: Atherosclerosis and Cardiovascular diseases (8 Hrs)				
Atherosclerosis and cardiovascular diseases definition and distinction	4.1	4	2	Lecture/ Powerpoint Presentation
Myocardial infarction	4.2	4	2	Lecture/ Powerpoint Presentation
Progression of atherosclerosis: Factors influencing plaque stability and rupture	4.3	4	2	Lecture/ Powerpoint Presentation
Prevention and management of hyper tension.	4.4	4	2	Lecture/ Powerpoint Presentation
Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbook

1 Vasudevan, D. M., & Sreekumari, S, Textbook of Medical Biochemistry for Medical Students (5th ed.). Jaypee Brothers, Medical Publishers, (2019).

Reference

1. Kumar, M. N., & Kumar, R. Guide to Prevention of Lifestyle Diseases. Deep and Deep Publication (2004).
2. Satyanarayana, U., & Chakrapani, U. Essentials of Biochemistry (3rd ed.) (2021)
3. Vasudevan, D. M., & Sreekumari, S. Textbook of Medical Biochemistry for Medical Students (5th ed.). Jaypee Brothers, Medical Publishers (2019)
4. Karp, G. Cell and Molecular Biology (9th edition). John Wiley & Sons. (2019).
5. Guyton, A., & Hall, J. E, Textbook of Medical Physiology (9th edition). Prism Saunders. (1996).

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 6: Diabetes Monitoring Techniques				
Estimation of sugar (Nelson Somogyi/ Benedict's method/ Phenol sulphuric acid method) 2. Perform Glucose Tolerance Test	1.1	5	15	Laboratory sessions including demonstrations, hands on training
Module 7: Vital Health Measurements: Monitoring Cardiovascular and Metabolic Health (15 Hrs)				
Estimation of cholesterol by Zak's method Blood pressure monitoring Determination of haemoglobin by Sahli's method	2.1	5	15	Laboratory sessions including demonstrations, hands on training

Textbooks

1. S. Sadasivam and A. Manickam, Biochemical Methods (2008), New Age International (P) Limited, ISBN-8122421407, 9788122421408
2. Beedu Sasidhar Rao & Vijay Deshpande (ed), Experimental Biochemistry: A Student Companion (2005), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41- 8.

Reference

1. P.B. Hawk (Author), B.L. Oser, (Editor), Hawk's Physiological Chemistry (2015), 14th Edition Mc Graw Hill Book Company LTD, New York. ISBN-10: 0070478007, ISBN13: 978-0070478008.

Course designed by: Mrs. Biby Sara John

SEMESTER II

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BC2DSC100	Minor	Biomolecules	5	75	4
SBU24BC2MDC100	MDC	Nutrition and Dietetics	4	60	3

SBU24BC2DSC100: BIOMOLECULES

Type of Course	Minor		
Course Level	100-199		
Credit	4		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the structures, functions,and significance of carbohydrates in biological systems.	Understand
CO2	Understand the diverse structures, functions, and biological roles of lipids.	Understand
CO3	Acquire knowledge of protein structure, function and crucial role in various biological processes	Remember
CO4	Understand the structures and functions of DNA and RNA and their pivotal roles in genetic information storage	Understand
CO5	Proficiency in employing various chemical tests and techniques to identify the presence of specific types of carbohydrates.	Apply

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	-	-	1
CO2	-	-	-	-	-	2	2	-	-	1
CO3	-	-	-	-	-	2	2	-	-	1
CO4	-	-	-	-	-	2	2	-	-	1
CO5	-	-	-	-	-	2	2	-	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	MCQ	Exam 1	Exam 2	
CO1	-	x	x	x	-	x
CO2	-	x	x	x	-	x
CO3	x	x	-	-	x	x
CO4	-	x	x	-	x	x
CO5	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment	ESE
	Practical Assignment	Observation of practical skills	Laboratory report	Lab Test	
CO1	-	-	-	-	-
CO2	-	-	-	-	-
CO3	-	-	-	-	-
CO4	-	-	-	-	-
CO5	x	x	x	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Carbohydrates (13 Hrs)				
Classification of Carbohydrates. Monosaccharides: D andL forms of glyceraldehyde, Isomerism of carbohydrates. Structure (linear and cyclic structures) of glucose, galactose, mannose and fructose	1.1	1	3	Lecture/Powerpoint Presentation
Epimers and anomers with examples, mutarotation and its explanation by ring structures	1.2	1	2	Lecture/Powerpoint Presentation
Reactions of sugars- oxidation, reduction & osazone. Reducing actions of sugars.	1.3	1	2	Lecture/Powerpoint Presentation
Structure and biological importance of disaccharides- sucrose, lactose, maltose.	1.4	1	2	Lecture/Powerpoint Presentation
Homopolysaccharides -Structural(cellulose) and storage polysaccharides (starch).	1.5	1	3	Lecture/Powerpoint Presentation
Heteropolysaccharides (GAG)- Structure and function of heparin and hyaluronic acid.	1.6	1	1	Lecture/Powerpoint Presentation
Module 2: Lipids (9 Hrs)				
Fatty acids: Classification, Physical and chemical properties. Essential and non-essential fatty acids with examples.	2.1	2	2	Lecture/Powerpoint Presentation
Structure of the following fatty acids- stearic acid and oleic acid, omega-3- fatty acid, Saponification number, acid number and iodine number of fats.	2.2	2	2	Lecture/Powerpoint Presentation
Lipids: Classification of lipids with examples. Structure of triacylglycerol.	2.3	2	2	Lecture/Powerpoint Presentation
Phospholipids (phosphatidyl choline and phosphatidyl ethanolamine and Glycolipids)	2.4	2	2	Lecture/Powerpoint Presentation
Steroids: Structure and functions of cholesterol. Phytosterol	2.5	2	1	Lecture/ Powerpoint Presentation
Module 3: Proteins (13 Hrs)				
Structure of 20 standard amino acids – single letter abbreviations of amino acids, non-standard amino acids	3.1	3	2	Lecture/ Powerpoint Presentation
Classification of amino acids based on charge and polarity. Essential and non-essential amino acids.	3.2	3	1	Lecture/Powerpoint Presentation
Ionization of amino acids- zwitter ions.	3.3	3	1	Lecture/Powerpoint Presentation
Elementary study of primary, secondary, tertiary and quaternary structure of proteins. Forces stabilizing the structure of protein.	3.4	3	2	Lecture/ Powerpoint Presentation
Classification of proteins.	3.5	3	2	Lecture/ Powerpoint Presentation
General properties of proteins. Denaturation of proteinsand precipitation reactions of proteins.	3.6	3	2	Lecture/Powerpoint Presentation
Introduction to enzymes	3.7	3	3	Lecture/ Powerpoint Presentation

Module 4: Nucleic Acids (10 Hrs)				
Nature of nucleic acids: Structure of purines and pyrimidines. Nucleosides, nucleotides.	4.1	4	2	Lecture/Powerpoint Presentation
Structure of Nucleic acids- Watson-Crick DNA doublehelix structure	4.2	4	3	Lecture/ Powerpoint Presentation
Types of RNA. Types of DNA	4.3	4	3	Lecture/Powerpoint Presentation
High energy compounds (ATP, GTP)	4.4	4	2	Lecture/ Powerpoint Presentation
Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbooks

1. J. L. Jain, Sunjay Jain and Nitin Jain, Fundamentals of Biochemistry Publishers: S. Chand & Co Ltd (2008)
2. U Sathyanarayana, U Chakrapani, Biochemistry, Fourth Edition, Elsevier Publication, (2013)

Reference

1. David L. Nelson, Cox, Lehninger Principles of Biochemistry Fourth Edition, Publisher: W. H. Freeman (2004)
2. E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen, A Text Book of Biochemistry Oxford and IBH Publishing Co., New Delhi., (2017)
3. Donald Voet, Judith G. Voet Publisher: John Wiley & Sons Inc, Biochemistry (2004)
4. Robert Horton H, Laurence A Moran, Gray Scrimgeour K, Principles of Biochemistry Publisher: Pearson, (2006)
5. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Biochemistry, Publisher: 6th Edition B.I. Publications Pvt. Ltd, (2007)
6. J. L. Jain, Sunjay Jain and Nitin Jain, Fundamentals of Biochemistry Publishers: S. Chand & Co Ltd (2008)
7. Reginald H. Garrett and Charles M. Grisham, Biochemistry 5th Edition Publisher: Cengage Learning, (2012)
8. Robert Murray, David Bender, Kathleen M. Botham, Peter J. Kennelly, Victor Rodwell and P. Anthony Weil, Harpers Illustrated Biochemistry (2012), 29th Edition (LANGE Basic Science); 10: 007176576X; ISBN-13: 9780071765763

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 6: Reactions of Carbohydrates (15 Hrs)				
Reactions of carbohydrate: (Molisch's test, Iodine test, Test for reducing sugars (Fehling's test, Benedict's test, Barfoed's test), Seliwanoff's test, Osazone test (only demonstration) for Glucose, Fructose, Lactose, Maltose, xylulose. Polysaccharides-iodine test Starch Dextrin, full saturation and half saturation	6.1	5	15	Demonstrations, hands on training

Module 7: Unknown Analysis (15 Hrs)				
Identification of monosaccharides, disaccharides, polysaccharides, following systematic scheme of analysis	7.1	5	15	Demonstrations, hands on training

Textbooks

1. S. Sadasivam and A. Manickam, Biochemical Methods (2008), New Age International (P) Limited, ISBN-8122421407, 9788122421408
2. Beedu Sasidhar Rao & Vijay Deshpande (ed), Experimental Biochemistry: A Student Companion (2005), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41- 8.

Reference

1. P.B. Hawk (Author), B.L. Oser, (Editor), Hawk's Physiological Chemistry (2015), 14th Edition McGRAW Hill Book Company LTD, New York. ISBN-10: 0070478007, ISBN13: 978-0070478008.

Course designed by: Mrs. Ramlath Beegam L

SBU24BC2MDC100: NUTRITION AND DIETETICS

Type of Course	MDC		
Course Level	100-199		
Credit	3		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	30	30	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the fundamental principles underlying the relationships between dietary choices, nutritional components, and their impact on individual and public health.	Understand
CO2	Acquire the knowledge in science, development, and potential health benefits of functional foods	Understand
CO3	Perceive the knowledge to use proven nutritional guidelines, assess diets, and create personalized diet plans to improve health.	Understand
CO4	To implement specialized nutritional plans to mitigate the impact of various medical conditions and promote overall health.	Understand
CO5	Acquire foundational skills in dietary assessment, meal planning, grocery shopping, and recipe modification.	Apply

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	1	1	1
CO2	-	-	-	-	-	2	2	1	1	1
CO3	-	-	-	-	-	2	2	1	1	-
CO4	-	-	-	-	-	2	2	1	1	1
CO5	-	-	-	-	-	2	2	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	MCQ	Exam 1	Exam 2	
CO1	x	x	x	x	-	x
CO2	-	-	x	x	-	x
CO3	-	x	x	-	x	x
CO4	-	x	x	-	x	x
CO5	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment	ESE
	Practical Assignment	Observation of practical skills	Viva	Laboratory report	
CO1	-	-	-	-	-
CO2	-	-	-	-	-
CO3	-	-	-	-	-
CO4	-	-	-	-	-
CO5	x	x	x	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Nutrition and Health (7 Hrs)				
Introduction to Nutrition, BMR	1.1	1	1	Lecture/PowerPoint Presentation, Library work
Carbohydrates, Proteins, Fats, Lipids and fibres	1.2	1	2	Lecture/Powerpoint Presentation, Library work
Vitamins: Fat soluble and Water soluble vitamins	1.3	1	2	Lecture/Powerpoint Presentation, Library work
Minerals: Microminerals and Macrominerals	1.4	1	2	Lecture/Powerpoint Presentation, Library work
Module 2: Functional foods (7 Hrs)				
Functional food of plant and animal origin	2.1	2	2	Lecture/Powerpoint Presentation, Library work
Probiotics, prebiotics, nutraceuticals, antioxidants	2.2	2	3	Lecture/Powerpoint Presentation, Library work
Overview of phytochemicals	2.3	2	2	Lecture/Powerpoint Presentation, Library work
Module 3: Dietetics and Diet Therapy (6 Hrs)				
Objective of diet therapy; Principles of diet preparation and counselling.	3.1	3	3	Lecture/Powerpoint Presentation, Library work
Therapeutic diets for disorders; Nutritional status assessment of the critically ill patients	3.2	3	3	Lecture/Powerpoint Presentation, Library work
Module 4: Dietary management and prevention of diseases (10 Hrs)				
Dietary Management - Obesity, Diabetes	4.1	4	2	Lecture/Powerpoint Presentation, Library work
Dietary Management -Cardiovascular Diseases, Hypertension, Gastrointestinal Disorders	4.2	4	3	Lecture/Powerpoint Presentation, Library work
Dietary Management - Cancer, Liver Diseases	4.3	4	3	Lecture/Powerpoint Presentation, Library work
Nutrition and mental health	4.4	4	2	Lecture/Powerpoint Presentation, Library work

Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**

Textbooks

1. Swaminathan, M. (Ed.). (2007). Essentials of food & nutrition (Vol. II). Bappco.
2. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (2009). Textbook of HumanNutrition (3rd ed.). Oxford and IBH Publishing Co. Pvt. Ltd.

Reference

1. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (2009). Textbook of HumanNutrition (3rd ed.). Oxford and IBH Publishing Co. Pvt. Ltd.
2. Ghosh, D., et al. (2012). Innovations in Healthy and Functional Foods. CRC Press.
3. Krause, L., & Mahan, S. (Eds.). (1992). Food, nutrition, and diet therapy (6th ed.). W.B. Saunders Company.
4. Madhavi, D. L., Deshpande, S. S., & Salunkhe. (1995). Food Antioxidants:Technological, Toxicological and Health Perspective. CRC Press.
5. Shakuntalamanay, N., & Shadaksharaswam, M. (2008). Food Facts and Principles (3rded.). New Age International.
6. Sizer, F., & Whitney, E. (2000). Nutrition concepts and controversies (8th ed.).
7. Srilakshmi. (2002). Dietetics (4th ed.). New Age International (P) Limited, Publishers.
8. Swaminathan, M. (Ed.). (2007). Essentials of food & nutrition (Vol. II). Bappco.
9. Whitney, P. N., & Roes, S. R. (1996). Understanding nutrition. West Publication Co.
10. Wildman, R. E. C. (2001). Handbook of Nutraceutical and Functional Foods. CRC Press.

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 6: Dietary Assessment and Meal Planning (15 Hrs)				
Prepare dietary assessment data. Prepare meal plan based on theassessment data	1.1	5	15	Laboratory sessions (data collection)
Module 7: Nutrition Education, Cooking Demo and Recipe Modification (15 Hrs)				
Practical Application through Grocery StoreExploration and Label Interpretation Prepare a nutritious recipe for a healthier diet	2.1	5	15	Laboratory sessions including demonstrations, hands on training

Textbooks

1. Shubhangini A Joshi, Nutrition and Dietetics (with Indian Case Studies) (2021), 5th Edition, Mc Graw Hill, ISBN-13: 978-9390727827 ISBN-10: 9390727820
2. S. Sadasivam and A. Manickam, Biochemical Methods (2008), New Age International (P) Limited, ISBN-8122421407, 9788122421408
3. Beedu Sasidhar Rao & Vijay Deshpande (ed), Experimental Biochemistry: A Student Companion (2005), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41- 8.

Reference

1. P.B. Hawk (Author), B.L. Oser, (Editor), Hawk's Physiological Chemistry (2015), 14th Edition McGRAW Hill Book Company LTD, New York. ISBN-10: 0070478007, ISBN13: 978-0070478008.

Course designed by: Mrs. Ramlath Beegam L

SEMESTER III

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BC3DSC200	Minor	Metabolism and Bioenergetics - I	5	75	4
SBU24BC3MDC200	MDC	Sports Biochemistry	3	45	3

SBU24BC3DSC200: METABOLISM AND BIOENERGETICS - I

Type of Course	Minor		
Course Level	200-299		
Credit	4		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the biochemical processes involvedin the synthesis, breakdown, and regulation of carbohydrates	Understand
CO2	Understand the biochemical mechanisms underlying various disorders, diagnose and differentiate between different conditions.	Understand
CO3	Understand the molecular processes involved in lipid synthesis, breakdown, and regulation of lipid metabolism.	Understand
CO4	Analyse and comprehend the diverse spectrum of disorders in lipid metabolism, including their clinical manifestations, and therapeutic approaches.	Understand
CO5	Demonstrate proficiency in employing colorimetric techniques to qualitatively assess and estimate concentrations of substances	Analyse

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	-	1	1
CO2	-	-	-	-	-	2	2	-	-	1
CO3	-	-	-	-	-	2	2	-	1	1
CO4	-	-	-	-	-	2	2	-	-	1
CO5	-	-	-	-	-	2	2	-	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	Seminar	Exam 1	Exam 2	
CO1	-	x	x	x	-	x
CO2	x	x	x	-	x	x
CO3	-	x	x	x	-	x
CO4	-	x	x	-	x	x
CO5	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment	ESE
	Practical Assignment	Observation of practical skills	Laboratory report	Lab Test	
CO1	-	-	-	-	-
CO2	-	-	-	-	-
CO3	-	-	-	-	-
CO4	-	-	-	-	-
CO5	x	x	x	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Carbohydrate Metabolism (16 Hrs)				
Pathway of glycolysis, Energetics and its Regulation. Gluconeogenesis.	1.1	1	4	Lecture/Powerpoint Presentation
Fates of Pyruvate. TCA Cycle and energetics	1.2	1	3	Lecture/Powerpoint Presentation
Electron Transport Chain	1.3	1	2	Lecture/Powerpoint Presentation
Oxidative Phosphorylation	1.4	1	2	Lecture/Powerpoint Presentation
HMP Shunt Pathway	1.5	1	2	Lecture/Powerpoint Presentation
Glycogen Metabolism	1.6	1	3	Lecture/Powerpoint Presentation
Module 2: Disorders of carbohydrate metabolism (7 Hrs)				
Glycogen Storage Diseases (GSDs)	2.1	2	3	Lecture/Powerpoint Presentation
Pyruvate Carboxylase Deficiency,	2.2	2	1	Lecture/Powerpoint Presentation
Phosphoglucomutase Deficiency, Lactic acidosis and Lactose Intolerance	2.3	2	3	Lecture/Powerpoint Presentation
Module 3: Lipid Metabolism (14 Hrs)				
Fatty acid oxidation: α oxidation, β-oxidation and ω-oxidation.	2.1	3	3	Lecture/Powerpoint Presentation
Biosynthesis of fatty acid	2.2	3	3	Lecture/Powerpoint Presentation
Synthesis of Triacylglycerol, phospholipids (phosphtidyl choline and ethanolamine)	2.3	3	2	Lecture/Powerpoint Presentation
Outline study of cholesterol synthesis (without structure).	2.4	3	3	Lecture/Powerpoint Presentation
Ketogenesis	2.5	3	3	Lecture/Powerpoint Presentation
Module 4: Disorders of lipid metabolism (8 Hrs)				
Carnitine deficiency, Carnitine Palmitoyl Transferase Deficiency (CPT), SIDS, Jamaican VomittingDiseases, Refsum's disease	3.1	4	2	Lecture/Powerpoint Presentation
Fatty acid synthase deficiency, Hypertriglyceridemia, Glycerol kinase deficiency, Fatty liver,	3.2	4	3	Lecture/Powerpoint Presentation
Hypercholesterolemia-Atherosclerosis, Hypocholesterolemia, Atherosclerosis, Ketonemia,Ketonuria	3.3	4	3	Lecture/Powerpoint Presentation
Note: structure not necessary for the metabolic pathways.				
Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbooks

1. Voet, D., Voet, J. G., & Pratt, C. W. (2018). Voet's Principles of Biochemistry. Wiley.
2. U Sathyanarayana, U Chakrapani, Biochemistry, Fourth Edition, Elsevier Publication, (2013)

Reference

1. Botham, K., Mc Guinness, O., Weil, P. A., Kennelly, P., & Rodwell, V. (2022). Harper's Illustrated Biochemistry. McGraw-Hill Education.
2. Grisham, C., & Garrett, R. (2016). Biochemistry. Brooks/Cole.
3. Jain, J. L., Jain S., & Jain, N. (2016). Fundamentals of Biochemistry. S Chand.
4. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., & Bretscher, A. (2021). Molecular Cell Biology. W H Freeman & Co
5. Nelson, L., & Cox, M. M. (2017). Lehninger Principles of Biochemistry 7th edition. W H Freeman & Co.
6. Rao, B. S., & Deshpande, V. (2013). Experimental Biochemistry: A Student Companion. I K International Publishing House Pvt. Ltd.
7. Sawhney, S. K., & Singh, R. (2005). Introductory Practical Biochemistry. Alpha Science International Ltd.
8. Thimmaiah, S. K. (2016). Standard Methods of Biochemical Analysis. Kalyani Publishers.
9. Voet, D., Voet, J. G., & Pratt, C. W. (2018). Voet's Principles of Biochemistry. Wiley.

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 5: Estimation of Carbohydrates (20 Hrs)				
Quantitation of glucose by Anthrone method	5.1	5	10	Demonstrations, hands on training
Quantitation of maltose by DNS method	5.2	5	10	Demonstrations, hands on training
Module 6: Estimation of Lipid (10 Hrs)				
Quantitation of Cholesterol by Zak's method	6.1	5	10	Demonstrations, hands on training

Textbooks

1. S. Sadasivam and A. Manickam, Biochemical Methods (2008), New Age International (P) Limited, ISBN-8122421407, 9788122421408
2. Beedu Sasidhar Rao & Vijay Deshpande (ed), Experimental Biochemistry: A Student Companion (2005), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41- 8.

Reference

1. P.B. Hawk (Author), B.L. Oser, (Editor), Hawk's Physiological Chemistry (2015), 14th Edition McGRAW Hill Book Company LTD, New York. ISBN-10: 0070478007, ISBN13: 978-0070478008.

Course designed by: Mrs. Shema Jacob

SBU24BC3MDC200: SPORTS BIOCHEMISTRY

Type of Course	MDC		
Course Level	200-299		
Credit	3		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	45	-	45
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand fundamentals of muscular activity and its energetics, the principles of muscle contraction, energy metabolism, and their interplay in various physiological contexts	Understand
CO2	Acquire knowledge of sport and exercise biochemistry, includingthe biochemical principles governing energy metabolism.	Understand
CO3	Understand the fundamentals of various diseases affecting athletes and the diet management.	Understand
CO4	Understand the strategies to optimize energy balance and body composition for peak athletic performance.	Understand

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	-	1	-
CO2	-	-	-	-	-	2	2	-	1	-
CO3	-	-	-	-	-	2	2	-	1	-
CO4	-	-	-	-	-	2	2	1	1	-
CO5	-	-	-	-	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	Seminar	Exam 1	Exam 2	
CO1	x	x	x	x	-	x
CO2	-	x	x	x	-	x
CO3	-		x	-	x	x
CO4	-	x	x	-	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Basics of muscular activity and its energetics (9 Hrs)				
Energy sources for muscular activity: Adenosine triphosphate: the energy currency, Energy supply formuscle contraction	1.1	1	3	Lecture/Powerpoint Presentation, Library work
Skeletal muscle contraction, Muscles inaction: twitch, tension, tone, fatigue, Tetanus	1.2	1	3	

Role of hormones in exercise-adrenaline, testosterone,insulin, cortisol	1.3	1	3	Lecture/Powerpoint Presentation, Library work
Module 2: Nutritional Essentials (12 Hrs)				
Introduction to Nutrition	2.1	2	3	Lecture/Powerpoint Presentation, Library work
Proteins: sources, functions, types	2.2	2	3	Lecture/Powerpoint Presentation, Library work
Carbohydrate: sources, functions, types	2.3	2	3	Lecture/Powerpoint Presentation, Library work
Lipid: sources, functions, types	2.4	2	3	Lecture/Powerpoint Presentation, Library work
Module 3: Diet management (12 Hrs)				
Principle foods for Athletes	3.1	3	2	Lecture/Powerpoint Presentation, Library work
Basal Metabolic Rate (BMR) -definition, measurement,Factors	3.2	3	5	Lecture/Powerpoint Presentation, Library work
Diet for Athletes.	3.3	3	5	Lecture/Powerpoint Presentation, Library work
Module 4: Energy Balance and Body Composition (12 Hrs)				
Energy balance and body composition: The Kcalories of foods provide, body weight, body composition andhealth,	4.1	4	5	Lecture/Powerpoint Presentation, Library work
weight management, Causes of obesity, Treatments forobesity.	4.2	4	4	Lecture/Powerpoint Presentation, Library work
Respiratory quotient (RQ)-definition	4.3	4	3	Lecture/Powerpoint Presentation, Library work
Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbooks

1. MacLaren, D., & Morton, J. (2012). Biochemistry for Sport and Exercise Metabolism, John Wiley & Sons, Ltd. UK.

Reference

1. Anshel, M. H., et al. (1991). Dictionary of the Sport and Exercise Sciences, Human Kinetics, USA
2. Beashel, P., & Taylor, N. (1996). Advanced Studies in Physical Education and Sport. Thomas Nelson & Sons Ltd. U.K.

3. Blakey, P. (1998). The Muscle Book (2nd ed.). Stafford: Bibliotek Books.
4. Davis, B., Bull, R., Roscoe, J., & Roscoe, D. (2000). Physical Education and the Study of Sport (5th ed.). London: Harcourt.
5. Honeybourne, J., Hill, M., & Moors, H. (2006). Advanced Physical Education & Sport for A Level (3rd ed.). Cheltenham: Nelson Thornes.
6. MacLaren, D., & Morton, J. (2012). Biochemistry for Sport and Exercise Metabolism, John Wiley & Sons, Ltd. UK.
7. McArdle, D., Katch, V., & Katch, F. (2011). Essentials of Exercise Physiology (4th ed.). Lippincott: Williams & Wilkins, Baltimore
8. Schmidt, R., & Wrisberg, C. (2000). Motor Learning and Performance: A Problem-Based Learning Approach (2nd ed.). Human Kinetics, USA
9. Sharp, B. (1992). Acquiring Skill in Sport. Sports Dynamics, UK
10. Webster, S. (1996). Sport Psychology: An A Level Guide for Teachers and Students. Widnes: Roscoe Publications.

Course designed by: Mrs. Shema Jacob

SEMESTER IV

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BC4DSC200	Minor	Metabolism and Bioenergetics - II	5	75	4

SBU24BC4DSC200: METABOLISM AND BIOENERGETICS - II

Type of Course	Minor		
Course Level	200-299		
Credit	4		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the biochemical pathwaysinvolved, including synthesis and catabolism related to amino acid metabolism.	Understand
CO2	Identify, and describe the biochemical basis, clinical manifestations, associated with variousdisorders affecting amino acid metabolism.	Understand
CO3	Understand the biochemical pathways of nucleotide synthesis and catabolism, identifying and evaluating disorders related to nucleotide metabolism.	Understand
CO4	Understand the molecular mechanisms underlying light harvesting, electron transport, and carbon fixation processes of photosynthesis at the biochemical level.	Understand
CO5	Proficient in employing colorimetric techniques for accurate determination of protein and nucleic acid concentrations in biological samples.	Analyse

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	-	1	1
CO2	-	-	-	-	-	2	2	-	-	1
CO3	-	-	-	-	-	2	2	-	1	2
CO4	-	-	-	-	-	2	2	-	1	1
CO5	-	-	-	-	-	2	2	-	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	Seminar	Exam 1	Exam 2	
CO1	-	x	x	x	-	x
CO2	-	x	x	-	x	x
CO3	-	x	x	x	-	x
CO4	x	x	x	-	x	x
CO5	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment	ESE
	Practical Assignment	Observation of practical skills	Laboratory report	Lab Test	
CO1	-	-	-	-	-
CO2	-	-	-	-	-
CO3	-	-	-	-	-
CO4	-	-	-	-	-
CO5	x	x	x	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Amino Acid and Protein Metabolism (13 Hrs)				
Decarboxylation, Transamination, Deamination	1.1	1	3	Lecture/Powerpoint Presentation
Metabolism of aromatic amino acids phenyl alanine and Tyrosine	1.2	1	4	Lecture/Powerpoint Presentation
Urea Cycle	1.3	1	3	Lecture/Powerpoint Presentation
Fate of carbon skeleton of amino acids- Glucogenic and ketogenic amino acids.	1.4	1	3	Lecture/Powerpoint Presentation
Module 2: Disorders of amino acids and Protein metabolism (7 Hrs)				
Parkinson's Disease, Phenylketonuria, Tyrosinemia, Alkaptonuria, Albinism	2.2	2	3	Lecture/Powerpoint Presentation
Hartnup's Disease	2.3	2	1	Lecture/Powerpoint Presentation
Hyperammonemia, Hyperornithinemia - hyperammonemia- homocitrullinuria (HHH Syndrome)	2.4	2	3	Lecture/Powerpoint Presentation
Module 3: Nucleic acid metabolism and its disorders (14 Hrs)				
Purine metabolism: De novo synthesis and Salvage pathway and its degradation	3.1	3	5	Lecture/Powerpoint Presentation
Hyperuricemia and Hypouricemia, Gout, Lesch Nyhan Syndrome	3.2	3	4	Lecture/Powerpoint Presentation
Biosynthesis and Degradation of pyrimidine ribonucleotides.	3.3	3	4	Lecture/Powerpoint Presentation
Orotic aciduria	3.4	3	1	Lecture/Powerpoint Presentation
Module 4: **Photosynthesis (11 Hrs)**				
Light reactions: cyclic and non-cyclic electron transport and photophosphorylation.	4.1	4	5	Lecture/Powerpoint Presentation
Dark reactions: the path of carbon- C3, C4, & CAM Pathways.	4.2	4	5	Lecture/Powerpoint Presentation
Glyoxylate cycle and its significance.	4.3	4	1	Lecture/Powerpoint Presentation
Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbooks

1. Voet, D., Voet, J. G., & Pratt, C. W. (2018). Voet's Principles of Biochemistry. Wiley.
2. Sathyanarayana, U Chakrapani, Biochemistry, Fourth Edition, Elsevier Publication, (2013)

Reference

1. Botham, K., Mc Guinness, O., Weil, P. A., Kennelly, P., & Rodwell, V. (2022). Harper's Illustrated Biochemistry. McGraw-Hill Education.
2. Grisham, C., & Garrett, R. (2016). Biochemistry. Brooks/Cole.

3. Jain, J. L., Jain S., & Jain, N. (2016). Fundamentals of Biochemistry. S Chand.
4. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., & Bretscher, A. (2021). Molecular Cell Biology. W H Freeman & Co
5. Nelson, L., & Cox, M. M. (2017). Lehninger Principles of Biochemistry 7th edition. W H Freeman & Co.
6. Rao, B. S., & Deshpande, V. (2013). Experimental Biochemistry: A Student Companion. I K International Publishing House Pvt. Ltd.
7. Sawhney, S. K., & Singh, R. (2005). Introductory Practical Biochemistry. Alpha Science International Ltd.
8. Thimmaiah, S. K. (2016). Standard Methods of Biochemical Analysis. Kalyani Publishers.
9. Voet, D., Voet, J. G., & Pratt, C. W. (2018). Voet's Principles of Biochemistry. Wiley.

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 6: Estimation of Proteins: (Colorimetric) (15 Hours)				
Estimation of protein by Lowry's method	6.1	5	8	Demonstrations, hands ontraining
Determination of protein by Biuret method	6.2	5	7	Demonstrations, hands ontraining
Module 7: Estimation of Nucleic acids: (Colorimetric) (15 Hours)				
Estimation of DNA by Diphenylaminemethod	7.1	5	8	Demonstrations, hands ontraining
Determination of RNA by orcinol method	7.2	5	7	Demonstrations, hands ontraining

Textbooks

1. S. Sadasivam and A. Manickam, Biochemical Methods (2008), New Age International (P) Limited, ISBN-8122421407, 9788122421408
2. Beedu Sasidhar Rao & Vijay Deshpande (ed), Experimental Biochemistry: A Student Companion (2005), I.K International Pvt. LTD, New Delhi ISBN 81-88237-41- 8.

Reference

1. P.B. Hawk (Author), B.L. Oser, (Editor), Hawk's Physiological Chemistry (2015), 14th Edition McGRAW Hill Book Company LTD, New York. ISBN-10: 0070478007, ISBN13: 978-0070478008.

Course designed by: Mrs. Neena Krishnan

SEMESTER V

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BC5DSC300	Minor	Nutritional Biochemistry	4	60	4

SBU24BC5DSC300: NUTRITIONAL BIOCHEMISTRY

Type of Course	Minor		
Course Level	300-399		
Credit	4		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understanding of fundamental nutritional principles, including the roles of macronutrients and micronutrients, dietary sources, and their impact on overall health.	Understand
CO2	Equipped to analyse, interpret, and apply principles related to energy expenditure, intake, and body composition, facilitating informed strategies for weight management and overall health.	Understand
CO3	Understand the nutritional needs and considerationsacross various life stages, integrating evidence-based knowledge to develop appropriate dietary recommendations for individuals at different life cycle phases	Understand
CO4	Adept at applying nutritional knowledge to design therapeutic diets, demonstrating the ability to manage and prevent various health conditions through dietary interventions	Understand

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	1	-	1
CO2	-	-	-	-	-	2	2	1	1	1
CO3	-	-	-	-	-	2	2	1	1	1
CO4	-	-	-	-	-	2	2	1	1	1
CO5	-	-	-	-	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	Seminar	Exam 1	Exam 2	
CO1	x	x	x	x	-	x
CO2	-	x	x	-	x	x
CO3	-	x	x	x	-	x
CO4	-	x	x	-	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Basic concepts of nutrition (15 Hrs)				
Introduction to Nutrition, Principal foods, Basal Metabolic Rate (BMR) -definition, measurement, Respiratory quotient (RQ)-definition, Factors	1.1	1	3	Lecture/Powerpoint Presentation,

Functions, requirements, digestion and absorption of macronutrients -Carbohydrates, Lipids, Proteins,	1.2	1	4	Lecture/ Powerpoint Presentation
Minerals-outline study	1.3	1	3	Lecture/ Powerpoint Presentation
Vitamins-outline study	1.4	1	5	Lecture/ Powerpoint Presentation
Module 2: Energy Balance and Body Composition (15 Hrs)				
Energy balance and body composition: The Energy value of foods provide, body weight, body composition andhealth	2.1	2	4	Lecture/ Powerpoint Presentation,
weight management, Causes of obesity, Treatments for obesity.	2.2	2	4	Lecture/ Powerpoint Presentation,
Mental health.	2.3	2	4	Library work and Discussion
Antioxidant nutrients and phytochemicals in disease prevention.	2.4	2	3	Lecture/ Powerpoint Presentation
Module 3: Life Cycle Nutrition (15 Hrs)				
Pregnancy and lactation: nutrition during pregnancy and lactation, maternal health, practices incompatible with pregnancy	3.1	3	4	Lecture/ Powerpoint Presentation
Nutrition in infancy and childhood.	3.2	3	4	Lecture/ Powerpoint Presentation
Nutrition in adolescence.	3.3	3	4	Lecture/ Powerpoint Presentation
Nutrition in adulthood and later years.	3.4	3	3	Lecture/ Powerpoint Presentation
Module 4: Dietary management and prevention of diseases (15 Hrs)				
Dietary Management - Obesity, Diabetes,	4.1	4	5	Library work and Discussion
Dietary Management -Cardiovascular Diseases, Hypertension, Gastrointestinal Disorders	4.2	4	5	Library work and Discussion
Dietary Management - Cancer, Liver Diseases	4.3	4	5	Library work and Discussion
Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbooks

1. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (2009). Textbook of Human Nutrition (3rd ed.). Oxford and IBH Publishing Co. Pvt. Ltd.
2. Swaminathan, M. (Ed.). (2007). Essentials of food & nutrition (Vol. II). Bappco

Reference

1. Ghosh, D., et al. (2012). Innovations in Healthy and Functional Foods. CRC Press.
2. Krause, L., & Mahan, S. (Eds.). (1992). Food, nutrition, and diet therapy (6th ed.). W.B. Saunders Company.
3. Madhavi, D. L., Deshpande, S. S., & Salunkhe. (1995). Food Antioxidants: Technological, Toxicological and Health Perspective. CRC Press.

4. Shakuntalamanay, N., & Shadaksharaswam, M. (2008). Food Facts and Principles (3rd ed.). New Age International.
5. Sizer, F., & Whitney, E. (2000). Nutrition concepts and controversies (8th ed.).
6. Srilakshmi. (2002). Dietetics (4th ed.). New Age International (P) Limited, Publishers.
7. Swaminathan, M. (Ed.). (2007). Essentials of food & nutrition (Vol. II). Bappco.
8. Whitney, P. N., & Roes, S. R. (1996). Understanding nutrition. West Publication Co.
9. Wildman, R. E. C. (2001). Handbook of Nutraceutical and Functional Foods. CRC Press.

Course designed by: Mrs Biby Sara John

SEMESTER VII

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BC7DSC400	Minor	Enzymology	4	60	4
SBU24BC7DSC401	Minor	Techniques in Biochemistry	4	60	4
SBU24BC7DSC402	Minor	Biochemistry of Cancer	4	60	4

SBU24BC7DSC400: ENZYMOLOGY

Type of Course	Minor		
Course Level	400-499		
Credit	4		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand enzyme function, kinetics, and their diverse roles in biological systems, and interpret enzymatic reactions in various contexts.	Understand
CO2	Analyze and interpret the quantitative aspects of enzyme-catalyzed reactions, including understanding the Michaelis-Menten equation, enzyme inhibition, and kinetic parameters.	Understand
CO3	Understand the diverse mechanisms by which enzymes are inhibited or regulated and design strategies for modulating enzyme activity.	Understand
CO4	Understand the regulatory mechanisms governing enzyme activity, the coordination of enzymatic reactions within cellular pathways	Understand
CO5	Demonstrate a comprehensive understanding of how enzymes function as catalysts in various industrial, medical, and biotechnological processes	Understand

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	-	1	1
CO2	-	-	-	-	-	2	2	-	1	1
CO3	-	-	-	-	-	2	2	-	1	1
CO4	-	-	-	-	-	2	2	-	1	1
CO5	-	-	-	-	-	2	2	-	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	Seminar	Exam 1	Exam 2	
CO1	-	x	x	x	-	x
CO2	-	-	x	-	x	x
CO3	-	x	x	x	-	x
CO4	-	x	x	-	x	x
CO5	x	x	-	-	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Enzymes (16 Hrs)				
Classification and nomenclature of enzymes.	1.1	1	4	Lecture/ Powerpoint Presentation

Activation energy, Transition state stabilization, Features of the active site.	1.2	1	3	Lecture/ Powerpoint Presentation
Interaction between enzyme and substrate-Lockand Key model, induced fit model. enzyme specificity	1.3	1	3	Lecture/ Powerpoint Presentation
Coenzymes and their functions- NAD, FAD, FMN, TPP, PLP, CoA	1.4	1	4	Lecture/ Powerpoint Presentation
Definition of IU, katal, enzyme turnover number and specific activity.	1.5	1	2	Lecture/ Powerpoint Presentation
Module 2: Enzyme Kinetics (10 Hrs)				
Factors affecting the velocity of enzyme-catalysed reaction (explanation with graphical representation)	2.1	2	3	Lecture/ Powerpoint Presentation
Derivation of Michaelis- Menten equation, Vmax, Km value, and its significance.	2.2	2	4	Lecture/ Powerpoint Presentation
Lineweaver - Burk double reciprocal plot	2.3	2	3	Lecture/ Powerpoint Presentation
Module 3: Enzyme Inhibition and Regulation (12 Hrs)				
Enzyme inhibition- Introduction, Reversible and irreversible, Reversible- Competitive, non-competitive anduncompetitive, Feedback inhibition.	3.1	3	7	Lecture/ Powerpoint Presentation
Covalent modification – Adenylation and Phosphorylation (in brief)	3.2	3	3	Lecture/ Powerpoint Presentation
Zymogen form of enzymes and zymogen activation.	3.3	3	2	Lecture/ Powerpoint Presentation
Module 4: Allosteric Enzymes, Multienzyme System and Isoenzymes (12 Hrs)				
Allosteric enzymes: concerted and sequential models for allosteric enzymes; significance of sigmoidal behaviour, allosteric regulation: example of aspartate transcarbamoylase.	4.1	4	5	Lecture/ Powerpoint Presentation
Multienzyme system – mechanism of action of pyruvate dehydrogenase and fatty acid synthase complexes and theirrole in regulation of metabolic pathways.	4.2	4	4	Lecture/ Powerpoint Presentation
Isoenzymes- lactate dehydrogenase and creatine phosphokinase	4.4	4	3	Lecture/ Powerpoint Presentation
Module 5: Application of enzymes (10 Hrs)				
Immobilized enzymes.	5.1	5	2	Lecture/ Powerpoint Presentation
Industrial uses of enzymes.	5.2	5	2	Lecture/ Powerpoint Presentation
Diagnostic and therapeutic enzymes, marker enzymes (brief study of name of enzyme and rolein diagnosis and therapy). Abzymes.	5.3	5	3	Lecture/ Powerpoint Presentation
Purification and characterisation of enzymes	5.4	5	3	Lecture/ Powerpoint Presentation
Module 6: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbooks

1. T. Devasena, Enzymology Textbook, Fourth Edition, Oxford University Press, (2019)
2. Palmer, T., & Bonner, P. (Year of Publication). Enzymes: Biotechnology, Clinical Chemistry (2nd ed.). Horwood Publishing Limited.

Reference

1. Palmer, T., & Bonner, P. (Year of Publication). Enzymes: Biotechnology, Clinical Chemistry (2nd ed.). Horwood Publishing Limited.
2. Price, N. C., & Stevens, L. (Year of Publication). Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins. Oxford University Press.
3. Voet, D., & Voet, J. G. (Year of Publication). Biochemistry. John Wiley & Sons Inc
4. Nelson, D. L., & Cox, M. M. (2017). Lehninger Principles of Biochemistry. W. H. Freeman

Course designed by: Ms. Ramlath Beegam L

SBU24BC7DSC401: TECHNIQUES IN BIOCHEMISTRY

Type of Course	Minor		
Course Level	400-499		
Credit	4		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understanding of various chromatographic methods, their principles, and applications.	Understand
CO2	Understanding the principles, methodologies, and applications of electrophoretic separation and blotting technologies in molecular biology, enables them to analyse and interpret complex biomolecular patterns and contribute to diverse research areas.	Understand
CO3	Understanding of analytical techniques for characterizing substances based on their spectral properties, colour attributes, and separation through centrifugal forces.	Understand
CO4	Demonstrate proficiency in the principles and techniques of microscopy, enabling them to effectively utilize various microscopic instruments for scientific observation and analysis.	Understand

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	-	2	2
CO2	-	-	-	-	-	2	2	-	1	2
CO3	-	-	-	-	-	2	2	-	1	2
CO4	-	-	-	-	-	2	2	-	1	2
CO5	-	-	-	-	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	Seminar	Exam 1	Exam 2	
CO1	-	x	x	x	-	x
CO2	x	-	X	-	x	x
CO3	-	x	x	x	-	x
CO4	--	x	x	-	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Chromatography Techniques (18 Hrs)				
Introduction to Biochemical Techniques.	1.1	1	2	Lecture/Powerpoint Presentation

Chromatography- classification based on principle and type of chromatographic bed used,and the physical state of the mobile phase.	1.2	1	4	Lecture/Powerpoint Presentation
Planar chromatography -Principle, procedure & applications of paper chromatography and TLC,	1.3	1	6	Lecture/Powerpoint Presentation
Principle, procedure & applications of HPLC, Affinity Chromatography and Gel filtration Chromatography.	1.4	1	6	Lecture/Powerpoint Presentation
Module 2: Electrophoresis and Blotting Technique (12 Hrs)				
Electrophoretic techniques-Introduction, principle, procedure and applications of AGE and PAGE.	2.1	2	7	Lecture/Powerpoint Presentation
Blotting techniques- Southern, Northern and Western.	2.2	2	5	Lecture/Powerpoint Presentation
Module 3: Spectroscopy, Colorimetery, Centrifugation (12 Hrs)				
Spectroscopy- Types of spectroscopy (an outline study)	3.1	3	4	Lecture/Powerpoint Presentation
Colorimetry-Beer Lambert's law	3.2	3	2	Lecture/Powerpoint Presentation
Instrumentation and applications of colorimeter and UV-Visible Spectrophotometer.	3.3	3	2	Lecture/Powerpoint Presentation
Centrifugation-Principle and types	3.4	3	4	Lecture/Powerpoint Presentation
Module 4: Microscopy (18 Hrs)				
Introduction to microscopy, Classification	4.1	4	2	Lecture/Powerpoint Presentation
Microscopy: Light, phase contrast. polarization, confocal and interference microscopy, fluorescence microscopy. Introduction to Atomic force microscopy.	4.2	4	9	Lecture/Powerpoint Presentation
Electron Microscopy: SEM, TEM	4.3	4	4	Lecture/Powerpoint Presentation
Principle, methods and applications of polarimetry, cytometry, flow cytometry	4.4	4	3	Lecture/Powerpoint Presentation
Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbooks

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). Molecular Biology of the Cell (6th ed.). Garland Science.
2. Wilson, K., & Walker, J. (2009). Principles and Techniques of Biochemistry and Molecular Biology (7th ed.). Cambridge University Press

Reference

1. Voet, D., & Voet, J. (2010). Biochemistry (4th ed.). John Wiley and Sons.
2. Wilson, K., & Walker, J. (2009). Principles and Techniques of Biochemistry and Molecular Biology (7th ed.). Cambridge University Press.
3. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). Molecular Biology of the Cell (6th ed.). Garland Science.
4. Banwell, C. N., & McCash, E. M. (1994). Fundamentals of Molecular Spectroscopy (4th ed.). McGraw-Hill.

5. Berg, J. M., Tymoczko, J. L., & Gatto, G. J. (2015). Stryer's Biochemistry (8th edition) W.H. Freeman and Company.
6. Creighton, T. E. (1993). Proteins: Structures and Molecular Properties (2nd ed.). W.H. Freeman and Company.
7. Engel, T., & Reid, P. (2006). Physical Chemistry (Pearson International Edition). Pearson Education.
8. Hofmann, A. F. (2010). Chromatography: A Science of Discovery (1st ed.). Wiley.
9. Maniatis, T., Fritsch, E. F., & Sambrook, J. (1982). Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Laboratory Press.
10. Simpson, R. J., & Vaughn, J. L. (Eds.). (2009). Capillary Electrophoresis of Proteins and Peptides (Methods in Molecular Biology). Humana Press

Course designed by: Mrs. Shema Jacob

SBU24BC7DSC402: BIOCHEMISTRY OF CANCER

Type of Course	Minor		
Course Level	400-499		
Credit	4		
Course Delivery Duration	**Theory (Hrs)**	**Practical (Hrs)**	**Total (Hrs)**
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Comprehensive understanding of the molecular and cellular mechanisms underlying cancer initiation, progression, and treatment strategies.	Understand
CO2	To understand the molecular mechanisms underlying cancer initiation, progression, and therapeutic interventions	Understand
CO3	Understanding of the fundamental concepts and approaches in cancer treatment, including the principles of surgery, chemotherapy, radiation therapy, immunotherapy, and targeted therapies.	Understand
CO4	Understanding of the interplay between the immune system and cancer development ultimately contributing to advancements in prevention and treatment strategies.	Understand

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	-	1	2
CO2	-	-	-	-	-	2	2	-	1	1
CO3	-	-	-	-	-	2	2	1	1	1
CO4	-	-	-	-	-	2	2	1	1	1
CO5	-	-	-	-	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Quiz	Seminar	Exam 1	Exam 2	
CO1	-	x	x	x	-	x
CO2	-	x	x	x	-	x
CO3	x	x	x	-	x	x
CO4	-	x	x	-	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Fundamentals of Cancer Biology (15 Hrs)				
Properties of cancer cells, metamorphogenesis, clonal expansion.	1.1	1	6	Lecture/ Powerpoint Presentation, Seminar
Benign tumour and malignant tumour type ofcancer	1.2	1	4	Lecture/ Powerpoint Presentation, Seminar

Tumor Microenvironment, Cancer Invasion and Metastasis	1.3	1	5	Lecture/ Powerpoint Presentation, Seminar
Module 2: Molecular Biology of Cancer Development (20 Hrs)				
Genetic Basis of Cancer, Oncogenes andTumor Suppressor genes.	2.1	2	4	Lecture/ Powerpoint Presentation, Seminar
Cell Signaling Pathways in Cancer, Activationof growth factor signaling pathways. PI3K-AKT-mTOR and MAPK pathways in cancer.	2.2	2	12	Lecture/ Powerpoint Presentation, Seminar
Mechanism of Genomic Instability and DNARepair.	2.3	2	4	Lecture/ Powerpoint Presentation, Seminar
Module 3: Principles of Cancer Therapy (15 Hrs)				
Imaging Techniques, Biomarkers, PathologicalStaging.	3.1	3	6	Lecture/ Powerpoint Presentation, Seminar
Chemotherapy – basic principles.	3.2	3	3	Lecture/ Powerpoint Presentation, Seminar
Phytochemicals in cancer therapy	3.3	3	3	Lecture/ Powerpoint Presentation, Seminar
Clinical Trials and Translational Research, Palliative and Supportive Care.	3.4	3	3	Lecture/ Powerpoint Presentation, Seminar
Module 4: Cancer Immunology and Epidemiology (10 Hrs)				
Descriptive, analytical Epidemiology of Cancer and Emerging Topics in Cancer Epidemiology	4.1	4	5	Lecture/ Powerpoint Presentation, Seminar
Cancer Vaccines and Adoptive Cell Therapies, Combination Therapies.	4.2	4	5	Lecture/ Powerpoint Presentation, Seminar
Module 5: Teacher Specific Content *(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)* **This content will be evaluated internally**				

Textbook

1. Lodish, H. F., Berk, A., Kaiser, C., Krieger, M., Bretscher, A., Ploegh, H. L., Martin, K.C., Yaffe, M.B. & Amon, A. (2021). Molecular cell biology. New York: WH Freeman

Reference

1. Hayes A W (1988) Principles and methods of toxicology, II nd edition, Raven press New York.
2. Lodish, H. F., Berk, A., Kaiser, C., Krieger, M., Bretscher, A., Ploegh, H. L., Martin, K.C., Yaffe, M.B. & Amon, A. (2021). Molecular cell biology. New York: WH Freeman
3. Klaassen C D, Amdur M O &Doull J (1986) Casarett and Doull's Toxicology, III rd edition, Macmillan publishing company, New York. 26
4. Stewart C P&Stolman A (1960) Toxicology, vol I, Academic press, New York.
5. Weinberg, R. A., & Weinberg, R. A. (2006). The biology of cancer. WW Norton & Company
6. Williams P L &Burson J L (1985) Industrial Toxicology, Van- Nostrand Reinhold, New York.
7. Burch, P. R. (2012). The biology of cancer: A new approach. Springer Science & Business Media.
8. Chabner, B. A., & Longo, D. L. (2011). Cancer chemotherapy and biotherapy: principles and practice. Lippincott Williams & Wilkins.
9. DeVita Jr, V. T., Rosenberg, S. A., & Lawrence, T. S. (2022). DeVita, Hellman, and Rosenberg's Cancer: Principles and Practice of Oncology. Lippincott Williams & Wilkins.
10. Dudley, A. C., & Griffioen, A. W. (2023). Pathological angiogenesis: mechanisms and therapeutic strategies. Angiogenesis, 1-35.

Course designed by: Ms. Neena Krishnan

Rubrics for Assessment Tools

Each course contains specific assessment tools. However, the faculty teaching the course has the freedom to alter these tools according to the course requirements, with prior permission from the respective Board of Studies.

Rubrics for Assignment

Criteria	Level 1	Level 2	Level 3
Level of Content	Many relevant aspects regarding the topic are missing	Some aspects are missing	All aspects regarding the topic are covered
Organization	Writing lacks logical organization. It shows some coherence but ideas lack unity.	Writing is impartially coherent and medium level of logical organization.	Writing is coherent and logically organized. Overall unity of ideas is present.
Reference	Lack clarity of sources and are unauthentic	Sources are listed properly but many are unauthentic	Enough reference and all the sources are authentic

Rubrics for Assignment - Phycology

Criteria	Level 1	Level 2	Level 3
Level of Content	Many relevant aspects of economic and ecological importance of algae and algal culturing is missing	Some aspects of economic and ecological relevance of algae and algal culturing is missing	All aspects of economic and ecological relevance of algae and its culturing is covered
Organization	Writing lacks logical organization. It shows some coherence but ideas lack unity.	Writing is impartially coherent and medium level of logical organization.	Writing is coherent and logically organized. Overall unity of ideas is present.
Reference	Lack clarity of sources and are unauthentic	Sources are listed properly but many are unauthentic	Enough reference and all the sources are authentic

Rubrics for Viva

Criteria	Level 1	Level 2	Level 3
Clarity in the understanding concepts	Only superficial knowledge in most of the topics	Adequate understanding in most of the topics, but fails to elaborate	Good understanding with explanation ability
Communication skills	Struggle to communicate the concepts	Limitations in concept clarity, proper vocabulary and articulation	Concept clarity, proper vocabulary and perfect articulation

Rubrics for Lab involvement

Criteria	Level 1	Level 2	Level 3
General Lab Practice	Unaware of general lab practices	Some laxity in good lab practices	Aware of good lab practice
Plant dissection and identification	Errors in both construction of floral formula and floral diagram and identification	Dissected properly but some errors in floral formula/diagram and identification	Proper dissection followed by construction of floral formula and floral diagram and identification
Lab procedure	Error in lab procedure	Followed the lab procedure with minimum errors	Well followed the lab procedure

Rubrics for Lab involvement

Criteria	Level 1	Level 2	Level 3
General Lab Practice	Unaware of general lab practices	Some laxity in good lab practices	Aware of good lab practice
Use of microscope	Errors in both light setting and microscope handling	Errors in light setting or microscope handling	Light setting and focusing are correct
Specimen Preparation	Error in preparation and mounting	Error in preparation or mounting	Good preparation and proper mounting

Rubrics for Record

Criteria	Level 1	Level 2	Level 3
Diagram	Incomplete records	Complete records but with errors in labelling and captions	Complete record with proper labelling and captions /Legends
Punctuality	Delay in timely submission of record sheets	Submission of records on the ensuing day of lab work	Submission on the day of lab work

Rubrics for Field Report

Criteria	Level 1	Level 2	Level 3	Level 4
Writing Skills	Language is very poor	Able to communicate to a certain extent	Able to communicate but lacks proper usage of terminologies	Able to communicate with proper scientific terminologies
Knowledge/ Understanding about the subject	Knowledge about the subject of presentation is not up to the mark.	Knowledge about the subject is fairly good but not exhibited through report.	Knowledge about the subject is good and tried to exhibit it to a certain extent.	Sound understanding about the subject and communicated it well.
Diagrams/ Photographs	Diagrams/ Photographs lack clarity.	Diagrams without labelling or Photographs without captions	Diagrams with proper labelling or Photographs with captions of any two groups	Diagrams with proper labelling or Photographs with captions of any three or more groups

Rubrics for Field Report

Criteria	Level 1	Level 2	Level 3
Understanding about thallus and habitat	Knowledge about the subject is not up to the mark.	Knowledge about the subject is fairly good.	Knowledge about the subject is good.
Report	Diagrams/ lack clarity.	Diagrams without enough description	Diagrams with proper description

Rubrics for Field Work Phycology

Criteria	Level 1	Level 2	Level 3
Understanding about algal thallus and habitat	Knowledge about the subject is not up to the mark.	Knowledge about the subject is fairly good.	Knowledge about the subject is good.
Report	Diagrams lack clarity.	Diagrams without enough description	Diagrams with proper description
Level of Exploration	Able to explore less than 4 habitats	Able to explore more than 4 habitats	Able to explore more than 8 habitats