

DEPARTMENT OF BIOCHEMISTRY

PREAMBLE

UG: Programme Profile & the Syllabi of Courses offered in the Semester V along with III & IV Evaluation Components (With Effect from 2021- 2024 Batch Onwards).

PROGRAMME PROFILE OF B.Sc., BIOCHEMISTRY

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO No.	Upon completion of these courses the students would be able to
PSO-1	Recognize their Own Ability to improve their Competence in Using the Language through Professional English for Life Science Course.
PSO-2	Understand the Various Biological Components Present in Living Cells, Functions and their Clinical Significance.
PSO-3	Inculcate the Basic Concepts of Biochemistry Including an Understanding of the Fundamental Biochemical Principles and their Applications in a Systematic, Methodical and Scientific, Evidence - Based Process.
PSO-4	Develop Problem Solving and Analytical Skills through Case Studies, Research Projects, Experimentation, Internship, Experiential Learning and Hands-on-Experience.
PSO-5	Analyze the Applications of Biochemistry in the Fields of Clinical Biochemistry, Biochemical Techniques, Molecular Biology, Biotechnology, Microbiology Etc.,
PSO-6	Relate the Biochemistry Oriented Theoretical and Practical Knowledge in securing a Successful Career and Pursue Higher Studies.

Semester	Part	Category	Course Code	Course Title	Previous course code	Hours per week	Credit
							Min /Max
I	I	Language/ AECC- II / Tamil (2Levels) Hindi / French	UTAL107/ UTAL108/ UHIL102/ UFRL102	Basic Tamil I / Advanced Tamil I / Hindi I / French I	UTAL105/ UTAL106/ UHIL101/ UFRL101	5	3/4
	II	Communicative English I/ AECC-I (2Levels)	UCEL101/ UCEL102	Communicative English I / Effective Communicative English I	--	5	3/4
	III	Core I/ DSC-I	UBCM108	Basics of Biochemistry	UBCM106	3	2
		Core II/DSC -II	UBCM107	Cellular Biology	UBCM105	6	6
		Core Practical I	UBCR103	Cellular Biology Practical	UBCR102	3	3
		Allied I / GEI	UCHA102	Allied Chemistry	UCHA101	3	2
		Allied Practical	UCHR103 / UCHR403	Allied Chemistry Practical	--	3	2
		PE-I	UPEM101	Professional English I	--	6	4
	IV	Value Education/ SEC			--	2	1
	TOTAL						36
							26/28

Semester	Part	Category	Course Code	Course Title	Previous course code	Hours per week	Credit
							Min /Max
II	I	Language / AECC -II /Tamil (2Levels) Hindi/ French	UTAL207/ UTAL208/ UHIL202/ UFRL202	Basic Tamil II / Advanced Tamil II/ Hindi II/ French II	UTAL205/ UTAL206/ UHIL201/ UFRL201	5	3/4
	II	Communicative English / AECC-II(2Levels)	UCEL201/ UCEL202	Communicative English II / Effective Communicative English II	--	5	3/4
	III	Core III/ DSC-III	UBCM203	Biomolecules	UBCM202	6	6
		Core practical II	UBCR202	Qualitative analysis of Biomolecules Practical	--	5	5
		Allied II/ GE-II	UMBA202	Microbiology	UMBA201	3	2
		Allied II practical	UMBR202	Microbiology Practical	UMBR201	3	2
		PE-II	UPEM201	Professional English II	--	6	4
		Internship	UBCI201	Internship/ Field Work / Field Project	-	-	-/1
	IV	Non Major elective/ SEC			--	3	2
	V	Extension activity/ Physical Education/NCC	--	--	--	-	1/2
TOTAL						36	28/32
III	I	Language / AECC- II / Tamil (2Levels) Hindi / French	UTAL307/ UTAL308/ UHIL302/ UFRL302	Basic Tamil III/ Advanced Tamil III / Hindi III / French III	UTAL305/ UTAL306/ UHIL301/ UFRL301	5	3/4
	II	Communicative English / AECC-I (2Levels)	UENL309/ UENL310	General English I/Advanced English I	UENL307/ UENL308	5	3/4
	III	Core IV/DSC - IV	UBCM305	Biochemical Techniques	UBCM304	6	6
		Core Practical III	UBCR302	Biochemical Techniques practical I	UBCR301	3	3
		Allied III/ GE-III	UMAA305	Biostatistics	UMAA405	6	4
		Online Course		NPTEL		3	1/2
	IV	Value Education/ SEC				2	1
TOTAL						30	21/24

IV	I	Language/ AECC-II / Tamil (2Levels) Hindi/French	UTAL407/ UTAL408/ UHIL402/ UFRL402	Basic Tamil IV/ Advanced Tamil IV/Hindi IV/ French IV	UTAL405/ UTAL406/ UHIL401/ UFRL401	5	3/4
	II	English /AECC-I (2Levels)	UENL409 / UENL410	General English II/ Advanced English II	UENL407/ UENL408	5	3/4
	III	Core V/DSC-V	UBCM404	Immunology	UBCO603/ UBCM403	5	4
		Core VI /DSC -VI	UIDM402	Pharmaceutical Biochemistry	UIDM401	4	4
		Allied IV/ GE-IV	UBIA401	Basics of Bioinformatics	UBCM506	3	2
		Core practical IV	UBCR402	Biochemical Techniques Practical II	UBCR401	3	3
		Internship	UBCI401	Internship/ Field Work/ FieldProject	-	-	-/1
	IV	Non Major Elective			--	3	2
		Soft Skill/SEC			--	2	1
V	Extension Activity/ Physical Education/NCC			--	-	-/2	
TOTAL						30	22/27
V	III	Core VII/DSC-VII	UBCM507	Enzymology	--	5	5
		Core VIII/DSC-VIII	UBCM508	Intermediary Metabolism	UBCM504	5	5
		Core IX /DSC-IX	UBCM509	Human Physiology	UBCM502	5	5
		Core Elective - I / DSE-I	UBCO501	Nutritional Biochemistry	--	5	4
			UBCO502	Stem Cell Biology	UBCO604		
		Core practical V	UBCR501	Enzymology Practical	-	4	3
		Major Core X / DSC-X	UBCP501	Project	UBCP601	4	4
		Value Education/SEC				2	1
TOTAL						30	27
VI	III	Core XI/ DSC-XI	UBCM605	Introduction to Biotechnology	UBCM601	5	5
		Core XII/DSC-XII	UBCM606	Clinical Biochemistry	UBCM602	5	4
		Core XIII/DSC - XIII	UBCM607	Molecular Biology	UBCM603	5	4
		Core XIV/DSC- XIV	UBCM604	Comprehensive Viva voce	--	-	1
		Core Practical VI	UBCR601	Clinical Biochemistry practical	--	5	3
		Core Practical VII	UBCR602	Hematology & Urineanalysis	--	3	2
		Major Elective– II/ DSE -II	UBCO607	Molecular Endocrinology	UBCO605	5	4
			UBCO606	Pathobiology of Human Diseases and Disorders	--		
			UIDM601	Nanotechnology in medicine	--		
		Internship	UBCI601	Internship/ Field Work/ Field Project	-	-	-/1

VI	IV	Soft Skill/SEC				2	1
	V	Extension activity/ Physical Education/NCC				-	-/2
		Extension Programme	UROX601	Rural Outreach Programme		30	-/1
TOTAL						30	24/28
GRAND TOTAL						192	148/166

COURSES OFFERED TO OTHER DEPARTMENTS

NON MAJOR ELECTIVES (NME)

Semester	Part	Category	Course code	Course Title	Previous course code	Contact Hour/ Week	Credit
							Min/ Max
II	IV	Non Major Elective	UBCE202	Biomedical Techniques	--	3	2
			UBCE204	Nutrition & Health	UBCE401		
			UBCE204/ UBCE502	Women's Health, Nutrition & Disorders	--		
			UBCE208/ UBCE304	Mushroom Cultivation	--		
			UBCE209	Clinical Diagnostics	--		
			UBCE210	Reproductive Biology	--		
IV	IV	Non Major Elective	UBCE403/ UBCE301	Hormonal Biochemistry	--	3	2
			UBCE404/ UBCE302	Food Microbiology	--		
			UBCE402/ UBCE303	Clinical Nutrition	--		
			UBCE401/ UBCE304	Mushroom Cultivation	--		

EXTRA CREDIT EARNING PROVISION (ONLY FOR INTERESTED STUDENTS)

Semester	Part	Category	Course Code	Course Title	Credit
II	III	Internship	UBCI201	Summer Internship	1
IV	III	Internship	UBCI401	Summer Internship	1
VI	III	Self-Study paper	UBCS601	Experimentation	2

EXPERIENTIAL LEARNING OFFERED IN SEMESTER VI

Course Mapping				Collaborating Agency –MSME & E.S. Hospital		
Semester	Course Code	Course Title	Assessment	Course Title	Hours/ Days/ Month	Mode of Evaluation
VI	UBCM606	Clinical Biochemistry	Component III	Clinical Biochemistry	5 days	Reflection
VI	UBCM605	Introduction to Biotechnology	Component IV	Organic Farming	2 days	Reflection

ENZYMOLGY UBCM507

Semester	: V	Credits	5
Category	: Core VII/ DSC-VII	Hours/Week	5
Class & Major	: III B.Sc Biochemistry	Total Hours	65

Course Objectives:

CO No.	To enable the students to
CO -1	Understand the classification, nomenclature, activity of enzymes and its action in biochemical reactions.
CO -2	Acquire knowledge on the role of co-factors and co-enzymes in enzyme catalyzing reactions.
CO -3	Integrate the practical aspects of enzymology with the kinetic theories.
CO -4	Gain knowledge on types of enzyme inhibitions.
CO -5	Interpret the role of enzymes in Industries, disease diagnosis and therapeutic measures.

UNIT I: BASIC CONCEPTS OF ENZYMES

13 Hours

Classification and nomenclature of enzymes, isoenzymes, multi-enzyme complexes. Enzyme specificity, Active site. Measurement and expression of enzyme activity – Definition of IU, Enzyme turnover number and nature of non-enzymatic and enzymatic catalysis, enzyme assays.

UNIT II: ENZYMES CATALYSIS & ROLE OF COFACTORS IN ENZYME CATALYSIS

13 Hours

Theories of enzyme catalysis – Lock and key model and Koshland's induced fit model. Role of co-factors in enzyme catalysis - NAD/NADP⁺, FMN/FAD, coenzyme A, biotin, TPP, pyridoxal phosphate, tetrahydrofolate and metal ions with special emphasis on coenzyme functions.

UNIT III: ENZYME KINETICS & FACTORS AFFECTING ENZYME ACTIVITY

15 Hours

Factors affecting rate of enzyme catalyse reaction - enzyme concentration, substrate concentration, pH and temperature. Derivation of Michaelis - Menten equation for uni-substrate reactions. K_m and its significance. Line Weaver Burk plot and its limitations. Importance of K_{cat} / K_m .

UNIT IV: ENZYME INHIBITION

12 Hours

Reversible and irreversible inhibition, competitive, non-competitive and uncompetitive inhibitions, determination of K_m & V_{max} in presence and absence of inhibitor, Allosteric enzymes.

UNIT V: APPLICATIONS OF ENZYME

12 Hours

Industrial Enzymes – Cellulase, Amylase, Lipase, Invertase & Zymase; Marker Enzymes – AST, ALT; Therapeutic Enzymes –Asparaginase, Streptokinase, Collagenase.

Text Books

- Trevor Palmer, Philip Bonner (2007) *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry*, (2nd Ed.), Horwood Publishing Limited,
- Dixon and Webb, (2000) *Enzymes*, (3rd Ed.), Academic Press, New York.
- Meenakshi Meena D.C (2009). *Fundamentals of Enzymology*, Aavinshankar Publisher – ISBN – 10:8179102807/ISBN – 13:978 – 8179102800.

Reference Books

- Donald Voet.C.W (2012). *Principles of Biochemistry* (4th Ed.), Wiley – ISBN 10:1118092449/ISBN 13:9781118092446.
- Sathyanarayana. (2017) *Biochemistry*, Elsevier – ISBN:9788-131236017.
- David L. Nelson Michael M. (2008) *Cox Lehninger Principles of Biochemistry*, W. H. Freeman; (5th Ed.)

e-Resources

- <https://storeiyta.firebaseio.com/.../enzymes-biochemistry-biotechnology-clinical-che>.
- <https://quacktradition4ahz.files.wordpress.com/.../fundamentals-of-enzymology-the-ce>.
- <https://www.kobo.com/us/en/ebook/enzymes-6>
- <https://www.elsevier.com/books/the-enzymes/dalbey/978-0-12-373916-2>

Course Outcomes:

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Summarize the fundamental concept of enzymes and their importance in biological reactions.	K2
CO-2	Explain the factors that affect enzyme activity and the rate of Biochemical reaction.	K4
CO-3	Differentiate the chemical catalyst and the biocatalyst.	K1
CO-4	Classify the different types of inhibitors and its role.	K2
CO-5	Integrate the applications of enzymes in disease, diagnosis and therapeutic measures.	K5

INTERMEDIARY METABOLISM

UBCM508

Semester : V
Category : Core VIII/ DSC-VIII
Class & Major : III B.Sc Biochemistry

Credits : 5
Hours/Week : 5
Total Hours 65

Course Objectives

CO No.	To enable the students to
CO -1	Study the transformation of energy within living organisms and between living organisms and their environment.
CO -2	Elucidate the anabolic and catabolic pathways of carbohydrate metabolism.
CO -3	Familiar with importance of biochemical metabolic pathways of lipids.
CO -4	Understand how amino acids are converted into specialized products.
CO -5	Connect how the denovo and salvage pathways form purine and pyrimidine nucleotides.

UNIT - I BIOENERGETICS

15 Hours

The electron transport chain – organization and role in electron capture. Oxidative phosphorylation - electron transfer reactions in mitochondria. F1F0 ATPase - structure and mechanism of action. The chemiosmotic theory. Inhibitors of respiratory chain and oxidative phosphorylation - uncouplers, ionophores. Regulation of oxidative phosphorylation. Mitochondrial transport systems - ATP/ADP exchange, malate / glycerophosphate shuttle.

UNIT-II CARBOHYDRATE METABOLISM

13 Hours

Glycolysis - Aerobic and anaerobic pathway, Oxidation of Pyruvate, TCA cycle and its energetics - Anaplerotic reactions; Regulation, Gluconeogenesis, Glycogenesis, Glycogenolysis – pathway and Regulation. Pentose phosphate pathway.

UNIT-III LIPID METABOLISM

12 Hours

Biosynthesis of Fatty acid. Oxidation of Fatty acids - α , β and γ oxidation; Biosynthesis and Degradation of Lecithin, Cephalin, Phosphatidyl Inositol, Phosphatidyl Serine, Sphingomyelin and Plasmalogen. Biosynthesis and Degradation of Cholesterol.

UNIT-IV PROTEIN METABOLISM

12 Hours

Fate of Dietary Proteins. Catabolism of Aminoacids –Transamination, Oxidative and Non - Oxidative Deamination, Transdeamination, Decarboxylation, Urea cycle and its Regulation and Biosynthesis of Creatinine.

UNIT-V NUCLEICACID METABOLISM

13 Hours

Metabolism of Purines - Biomedical importance. Biosynthesis of Purine Nucleotides by De novo and Salvage Pathway, Regulation and Degradation, Metabolism of Pyrimidines – Biosynthesis of Pyrimidine Nucleotides by De novo and Salvage pathway and Degradation.

Text Books

- David L. Nelson, Michael M.Cox (2017), *Lehninger-Principles of Biochemistry* (7th Ed.), W.H.Freeman and company Newyork
- Robert k.Murray.et.al., (2015), *Harpers Biochemistry*, (30th Ed.), Prentices Hall international

Reference Books

- Voet & Voet, John Wiley & Sons (2018), *Biochemistry*, (5th Ed., Prentices Hall International,
- Champe P.C and Richard A Harvey (2017), *Lippincotts Biochemistry*, (7th Ed.), Williams & Wilkins Publishers.

e-Resources

- <https://www.kobo.com/us/en/ebook/metabolic-regulation>
- <https://www.kobo.com/us/en/ebook/hepatic-de-novo-lipogenesis-and-regulation-of-metabolism>.
- <https://www.elsevier.com/books/metabolic-regulation/vogel/978-0-12-299255-1>

Course Outcomes:

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Describe the importance of high energy compounds, electron transport chain and synthesis of ATP under aerobic and anaerobic conditions.	K1
CO-2	Summarize the various metabolic pathways of carbohydrate.	K2
CO-3	Illustrate the anabolic and catabolic pathways of lipids.	K3
CO-4	Explain the catabolism of amino acids into specialized products and the reactions of urea cycle.	K4
CO-5	Differentiate the biosynthesis and degradation of nucleic acids.	K4

HUMAN PHYSIOLOGY

UBCM509

Semester	: V	Credits	5
Category	: Core VIII/ DSC-IX	Hours/Week	5
Class & Major	: III B.Sc Biochemistry	Total Hours	65

Course Objectives

CO No.	To enable the students to
CO -1	Understand the physical structure and functioning of human body.
CO -2	Recognize the importance of human organs (Heart, Lungs & Kidneys).
CO -3	Learn about the body fluids and its importance.
CO -4	Understand the different parts of nervous and muscular system.
CO -5	Illustrate the blood coagulation and blood grouping.

UNIT - I BLOOD AND CIRCULATORY SYSTEM

13 Hours

Blood and Body fluids - Composition and Functions; Types of Blood Cells-Morphology and Function; Blood coagulation; Blood groups– ABO, Rhesus System and h. Blood pressure, Sphygmomanometer.

Circulation - Structure and functions of Heart and Blood Vessels, Cardiac Cycles, Cardiac Factors Controlling Blood Pressure, Electrocardiogram.

UNIT - II DIGESTION AND EXCRETORY SYSTEM

13 Hours

Digestive System - Structure and Function of different components of Digestive System, Mechanism of Digestion and Absorption of Carbohydrates, Lipids and Proteins, Gastric Secretion - Mechanism of HCl formation in Stomach.

Excretory system - Kidney structure and its organization, Mechanism of Urine Formation- Glomerular Filtration Rate (GFR), Selective Reabsorption (active and passive) of substances and Secretion.

UNIT –III RESPIRATION

12 Hours

Respiration – Types, Components of the respiratory system; **Structure and functions of Lungs:** Diffusion of gases in Lungs- Transport of oxygen from Lungs to Tissues, Transport of CO₂ from Tissues to Lungs.

UNIT – IV NERVOUS SYSTEM

13 Hours

Central Nervous System- General organization. Functional Units. Resting and Action potential- Conduction of Nerve Impulse, Structure of Synapses, Synaptic transmission; Structure of Neuromuscular Junction and Mechanism of Neuromuscular transmission; Neurotransmitters. Biochemical aspects of learning and memory. Enkephalin and Endorphins.

UNIT – V MUSCULAR SYSTEM

14 Hours

Types of Muscles and their Functions; Structure of Skeletal Muscle, Myosin, Actin and Regulatory proteins, Sarcomere unit, Mechanism of Contraction and Relaxation of Skeletal Muscles; Chemical changes during Muscle Contraction, Source of energy for Muscle Contraction.

Text Books

- C.C. Chatterjee (2018), *Human Physiology*, Vol I & II, (12th Ed.).
- Sembulingam.K and PremaSembulingam (2019), *Essentials of Medical Physiology*, (8th Ed.), Jaypee Brothers, New Delhi.

Reference Books

- Guyton & Hall (2020), *Textbook of Medical Physiology*, (14th Ed.), Reed Elsevier India Private Limited, New Delhi.
- Murray et al, (2012), *Harper's Physiological Biochemistry*, (29th Ed.), Tata McGraw Hill Publication. Co. Limited, New Delhi.
- Chaudhri, K. (2016) *Concise Medical Physiology*, 7th Edition, New Central BookAgency (Parental) Ltd., Calcutta Fox.

e-Resources

- <https://openstax.org/details/books/anatomy-and-physiology>
- <https://open.umn.edu/opentextbooks/textbooks/anatomy-and-physiology>
- <https://oer.galileo.usg.edu/cgi/viewcontent.cgi?article=1004&context=biology-collections>
- <https://opentextbc.ca/anatomyandphysiology/>
- <https://libguides.com.edu/c.php?g=649894&p=4556867>

Course Outcomes

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Explain the components of blood, blood grouping & cardio vascular system.	K2
CO-2	Illustrate the mechanism of digestion, absorption of macromolecules and explain urine formation.	K3
CO-3	Describe the process of gaseous exchange in tissues and lungs, respiratory adaption to high altitude.	K1
CO-4	Measure and give results for identifying the physiological functions.	K5
CO-5	Determine the mechanism of contraction and relaxation of muscles.	K5

NUTRITIONAL BIOCHEMISTRY UBCO501

Semester : V

Credits :4

Category : Core Elective

Hours/Week : 5

Class & Major : III B.Sc Biochemistry

Total Hours : 65

Course Objectives:

CO No.	To enable the students to
CO -1	Understand the basic concepts of food and RDA.
CO -2	Evaluate the roles and nutritive significance of carbohydrates, lipids and proteins.
CO -3	Study the role of vitamins and minerals for good health.
CO -4	Understand the differential functions of nutritional food constituents and deficiency states.
CO -5	Understand the categorization and assessment of nutritional foods status and national nutrition institutions roles.

UNIT-I CONCEPTS OF FOOD AND NUTRITION

12 Hours

Principle food components, Diet, Balanced diet, Nutritional Requirement, Recommended dietary allowances (RDA), Definition of Calorie and joule, Measurement of Calorific values of foods, Physical, Physiological fuel value. Basal metabolism – (BMR), Factors affecting BMR, specific dynamic action of foods, Energy needs of the body measurement of energy balance of the body. Direct and indirect calorimetry. Calculation of energy requirement, the ideal proportion of calories from protein, carbohydrates and fats. Respiratory quotient (RQ) of nutrients and factors affecting the RQ.

UNIT-II MAJOR FOOD CONSTITUENTS / MACRO NUTRIENTS

15 Hours

Carbohydrates - Dietary requirements, source and functions of carbohydrates, Dietary fiber, and its fiber in lipid metabolism.

Proteins - Sources, RDA & Nutritional Significance. Essential and Nonessential amino acids. NPU, Biological Value, Nitrogen balance.

Lipids - Essential Fatty Acids; Functions of EFA, RDA, – excess and deficiency of EFA. Lipotropic factors, role of saturated fat, cholesterol, lipoprotein and triglycerides.

UNIT-III MINOR FOOD CONSTITUENTS / MICRO NUTRIENTS

13 Hours

Vitamins - definition and types of vitamins. Sources, requirement, biological functions, deficiency symptoms of fat soluble and water soluble vitamins.

Minerals - sources, requirement, physiological functions, deficiency of Calcium, Sodium, Potassium, Iron, Phosphorous, Chloride, Magnesium, Chromium.

Water - Sources, Requirements, Functions, Mechanism of water balance Electrolyte and acid base balance

UNIT IV NUTRITIONAL DISORDERS & ASSESSMENT OF NUTRITIONAL STATUS

13 Hours

Role of nutrition in Obesity, Cardiovascular disease, diabetes, Gastrointestinal disorders other than cancer, Marasmus and Kwashiorkor, Night blindness, Iron deficiency anemia, Osteomalacia, PCOD.

Anthropometric measurements; Z scores, BMI, skinfold, circumference ratios. Basal metabolic panel, Comprehensive metabolic panel, CBC, Urine Analysis, Assessment of Anemia, ROS assessment, GTT and Glycosylated Hb, Differential diagnosis of B12 and folate.

UNIT-V COMMUNITY NUTRITION & NUTRACEUTICALS

12 Hours

Assessment of Nutritional Status – Anthropometry, Malnutrition – Definition causes of Malnutrition. International organizations, National agencies in community nutrition - FAO, WHO, UNICEF and CARE, ICDS, Midday meal programme, Role of National Institutions ICMR, CSIR, NIN, CFTRI. Nutraceuticals – Definition, Benefits and Importance of fortified dairy products (e.g., milk) and citrus fruits (e.g., orange juice).

Text Books

- M.Swaminathan, (2005), *Advanced Text book of Food and Nutrition*, Bappco Press. Bappco.
- Sathyanarayana, (2017), *Biochemistry*, Elsevier – ISBN: 9788-131236017.
- Srilakshmi.B, (2019), *Dietetics – (Multi Colour Edition Ed)*, New age International Publisher – ISBN 10: 93866492091, ISBN 13: 9789386649201.

References

- Andreas M. Papas, *Antioxidant Status, Diet, Nutrition, and Health*, CRC Press.
- Margaret Mc Williams (2012), *Food Fundamentals (10th Ed)*, Prentice Hall.
- Tom Brody, *Nutritional Biochemistry*, Academic Press, USA. Aravind Kumar (1999), *Human rights and social movements*, Anmol publisher.
- Krause's (2013), *Food, Nutrition & diet therapy (11th Ed.,)*, W.B Saunders – ISBN – 10 : 0721697844; ISBN – 13: 9780721697840.

e-Resources

- <https://www.amazon.in/Nutritional-Biochemistry-Tom-Brody-ebook/dp/B0087GZCUW>
- [amazon.in/Nutritional-Biochemistry-D-C-Sharma-ebook/dp/B08FR1MHD8](https://www.amazon.in/Nutritional-Biochemistry-D-C-Sharma-ebook/dp/B08FR1MHD8)
- <https://www.elsevier.com/books/nutritional-biochemistry/brody/978-0-12-134836-6>

Course Outcomes

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Define the fundamental concept in food and nutrition.	K1
CO-2	Summarize the nutritional significance of macromolecule.	K2
CO-3	Illustrate the importance of Vitamin & Minerals in day to day life.	K3
CO-4	Analyze nutrition-related conditions and prepare balanced diet.	K4
CO-5	Express the community nutrition and role of national institutions.	K2

STEM CELL BIOLOGY UBCO502

Semester : V
Category : Core Elective
Class & Major: III B.Sc Biochemistry

Credits : 4
Hours/Week : 5
Total Hours : 65

Course Objectives:

CO No.	To enable the students to
CO -1	Understand physiology of stem cells at cellular level.
CO -2	Study the role of growth factors in cell development.
CO -3	Understand the culture of stem cells.
CO -4	Illustrate the methods to produce differentiated cells.
CO -5	Identify the diagnosis and management of diseases and disorders with stem cells

UNIT –I INTRODUCTION TO STEM CELLS**15 Hours**

Stem cell definition, kinds of stem cells - Embryonic and adult stem cells. Characteristics of stem cells. Totipotent, Unipotent, oligopotent and pluripotent cells.

UNIT- II GROWTH INDUCING AGENTS**10 Hours**

Role of bone marrow in cell synthesis, Growth factors – Types and their role in cell development.

UNIT- III CELL LINES**12 Hours**

Cell lines – Types, Commonly used cell lines and selection of cell lines; maintenance of cell culture; Sub culture – Mono layer culture, Criteria for sub culture of mono layer, technique; Suspension cultures.

UNIT- IV EMBRYONIC STEM CELLS**13 Hours**

Stem cell culture – Embryonic stem cell, methods to produce differentiated cells, maintenance of stem cells. Stem cell bank.

UNIT- V APPLICATIONS OF STEM CELLS**15 Hours**

Human embryonic stem cell research- Parkinson's Diseases, Diabetes, Heart muscle repair. Applications of stem cells in study of tissue differentiation, molecular signals and testing of new drugs.

Text Books

- U. Sathiyararayanan, (2007). *Biotechnology*. Books & Allied (P) Ltd.
- V. Kumaresan, (2009). *Biotechnology*. Saras publication. Nagercoil revised edition.

Reference Books

- Old R.W, Primrose S.B, (2003). *An introduction to Genetic Engineering*. Blackwell Science.
- Sasidhara ,(2006). *Animal Biotechnology*. MJP publishers.

Course Outcomes

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Define the characterizes of a stem cell	K1
CO-2	List and compare the different types of stem cells	K2
CO-3	explain stem cell differentiation in vivo and in vitro	K3
CO-4	Describe the methods of stem cell culture	K4
CO-5	Enumerate the role of human embryonic stem cell research.	K2

ENZYMOLGY PRACTICAL UBCR501

Semester : V
Category : Core Practical V
Class & Major : III B.Sc Biochemistry

Credits : 3
Hours/Week : 4
Total Hours : 52

Course Objectives:

CO No.	To enable the students to
CO -1	Plan and execute an enzyme assay & Understand enzyme activity.
CO -2	Develop technical competence with respect to kinetics of specific enzymes.
CO -3	Inculcate the ability to engage in critical enquiry.
CO -4	Analyse kinetic inhibition data and to determine the mechanism of inhibition.
CO -5	Describe the factors affecting enzymatic reactions & Experimental approach to enzyme action.

Experiments

1. Assay of Salivary Amylase activity.
2. Effect of pH on Salivary Amylase activity.
3. Effect of Temperature on Salivary Amylase activity.
4. Effect of Substrate Concentration on Salivary Amylase activity.
5. Assay of Urease activity.
6. Effect of pH on Urease activity.
7. Effect of Temperature on Urease activity.
8. Effect of Substrate Concentration on Urease activity.
9. Assay of Serum Alanine Transaminase activity.
10. Assay of Serum Alkaline Phosphatase activity.
11. Assay of Serum Aspartate Transaminase activity.

Text Books

- David T. Plummer (1999), *An Introduction to practical Biochemistry*, (3rd revised edition).
- J. Jayaraman (2011), *Laboratory Manual in Biochemistry*, New Age international limited publication.

Reference Books

- Pattabiraman (2015), *Laboratory Manual in Biochemistry* (4th Ed.).
- Singh .S.P. (2013), *Practical Mannual of Biochemistry*, (6th Ed.), CBS Publication

e-Resources

- <https://www.worldcat.org/title/practical-enzymology/oclc/827358447>
- <https://onlinelibrary.wiley.com/doi/book/10.1002/9783527659227>
- <https://www.kobo.com/us/en/ebook/practical-enzymology>
- https://books.google.co.in/books/about/Practical_enzymology.html?id=dxZrAAAAMAAJ&redir_esc=y
- <https://www.amazon.in/Practical-Enzymology-Hans-Bisswanger-ebook/dp/B00DOX8ESA>

Course Outcomes

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Identify the influence of enzyme structure on catalytic properties.	K1
CO-2	Explain the factors influencing the enzyme activity.	K2
CO-3	Analyze the action of enzymes as biocatalysts and in factors that influence enzyme activity.	K4
CO-4	Estimate the activity of enzymes of salivary amylase, urease, ALT, AST and ALP	K5
CO5	Produce the results on enzyme activity for their own biological specimens.	K6

PROJECT UBCP501

Semester : V
Category : Core X
Class & Major: III B.Sc. Biochemistry

Credit: 4
Hours/Week: 4
Total Hours:52

Course Objectives:

CO No.	To enable the students to
CO -1	Acquire knowledge in biological science and interdisciplinary research
CO -2	Develop problem solving and decision making skills
CO -3	Articulate a clear research question or problem and formulate a hypothesis
CO -4	Identify and demonstrate appropriate research methodologies and know when to use them
CO -5	Reflect on their own research, identifying lessons learned, strengths, and ways to improve

Guidelines:

- Project is offered for final year B.Sc Biochemistry students in semester V.
- Project can be done according to area of interest
- Project should do either as individual or as group with maximum of three /four students.
- Project can be field study, survey, experimentation, extraction of components from medicinal plants and waste water treatment.
- Project proposal and final project report are to be presented in power point presentation.
- Evaluation scheme for the project will be Internal 60 and External 40.

Course Outcomes

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Acquire effective knowledge in experiential learning for the students which plays a key role in bridging the gap between industry and academia.	K1
CO-2	Identify practical problem solve using the laboratory techniques and biochemistry underpinning the set experiment.	K1
CO-3	Apply fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study	K3
CO-4	Demonstrate an awareness and application of appropriate personal, societal, and professional ethical standards.	K4
CO-5	Design, perform, and analyze results from the area of study.	K6

Assessment:

S. No	Internal	Evaluation	
	Component	CIA (Valuation by Faculty Guide)	ESE (Average of Internal & External Marks)
1	Research Proposal – Statement of the problem, Research methodology	10	-
2	Analysis of data / Implementation, Results & Findings, Conclusion	10	-
3	Report Preparation	10	-
4	Research publications	30	-
5	Project report	-	30
6	Viva Voce	-	10
	Total	60	40

III & IV EVALUATION COMPONENTS OF CIA

Semester	Category	Course Code	Course Title	Component III	Component IV
V	Core VII / DSC-VII	UBCM507	Enzymology	Assignment	Seminar
	Core VIII / DSC-VIII	UBCM508	Intermediary Metabolism	Assignment	Seminar
	Core IX/ DSC - IX	UBCM509	Human Physiology	Model presentation	Seminar
	CORE PRACTICAL-V	UBCR501	Enzymology Practical	DPA	Viva
	MAJOR ELECTIVE-I / DSE - I	UBCO501	Nutritional Biochemistry	Balanced diet chart	Case study
		UBCO502	Stem Cell Biology	Culture preparation	Seminar