

THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE

B.Sc. BIOTECHNOLOGY

UNDER CBCS

(With effect from 2020 - 2021)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		Course Title					CIA	Uni. Exam	Total
SEMESTER I									
1	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2	II	English (CE)	Paper-1	6	4	Communicative English I	25	75	100
3	III	Core Theory	Paper-1	6	4	Cell Biology & Evolution	25	75	100
4	III	Core Practical	Practical-1	4	0	Lab in Cell Biology & Evolution	0	0	0
5	III	Allied -1	Paper-1	4	3	Biodiversity	25	75	100
6	III	Allied- 1	Practical-1	2	0	Lab in Biodiversity	0	0	0
7	III	PE	Paper 1	6	3	Professional English I	25	75	100
8	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		36	20		150	450	600
SEMESTER II									
8	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
9	II	English (CE)	Paper-2	6	4	Communicative English II	25	75	100
10	III	Core Theory	Paper-2	5	4	Biochemistry	25	75	100
11	III	Core Practical	Practical-1	3	2	Lab in Cell Biology & Evolution and Biochemistry	25	75	100
12	III	Allied-1	Paper-2	4	3	Food & Nutrition	25	75	100
13	III	Allied Practical - 1	Practical-1	2	2	Lab in Biodiversity and Food & Nutrition	25	75	100
14	III	PE	Paper 1	6	3	Professional English II	25	75	100
15	IV	Value Education		2	2	Value Education	25	75	100
16	IV	Soft Skill		2	1	Soft Skill	25	75	100
		Sem. Total		36	25		225	675	900

SEMESTER I
CORE PAPER I
CELL AND EVOLUTION BIOLOGY

Course Objectives

1. To impart the basic knowledge of cell design and its components, tools and techniques.
2. To impart the theory of evolution
3. To understand the evolutionary process of animals and plants.

Unit-1

Cell and membrane structure – Historical review, Discovery of cell, Cell theory. Ultra structure of Prokaryotic cell and Eukaryotic cell. Structure and functions of Plasma membrane. Structure and functions of Cytoskeleton. Plant and animal cell.

Unit-2

Structure and function of intracellular organelles, nucleus, nucleolus, chromosome, golgi complex, mitochondria, plastids, ribosome, endoplasmic reticulum.

Unit-3

Cell division and cell death and cell renewal. mitosis, meiosis, cell wall, plasma membrane.

Unit-4

Theories of evolution, Lamarkism, Darwinism, evidence of evolution, micro evolution, macro evolution. patterns of evolution species and speciation.

Unit-5

Natural selection, modes of natural selection. Molecular phylogeny, phylogenetic tree. Construction of phylogenetic tree.

References / Text Books:

1. Cell and Molecular Biology: Concepts and Experiments by Gerald Karp
2. Essential Cell Biology by Bruce Alberts,
3. Cell Biology, Genetics, Molecular Biology: Evolution And Ecology by P.S. Verma
4. The underlying pathway structure of biochemical reaction networks. Christopher H. Schilling et. al. 1998. PNAS. 95:4193-8
5. Cluster Analysis and Display of Genome – wide expression patterns. Michael B. Eisen et. al. 1998, Proc. Natl. Acad. Sci. USA. 95: 14863 – 14868.
6. Molecular Classification of Cancer: Class Discovery and Class prediction by Gene Expression Monitoring. Golub TR. et. al. 1999. . Science, 286: 531 – 537.
7. The Escherichia coli MG. 1655 in silico metabolic genotype: its definition, characteristics and capabilities. Jeremy S. Edwards et. al. 2000. PNAS. 97:5528-33.
8. <https://www.livescience.com/474-controversy-evolution-works.html>
9. <https://www.britannica.com/science/evolution-scientific-theory>

Course Outcomes

1. The student will be able to learn cell structure and function
2. The student will be able to understand cell organelles
3. The student will be able to learn cell division
4. The student will be able to understand evolution
5. The student will be able to understand evolutionary process of plant and animal

ALLIED 1

PAPER 1

BIODIVERSITY

Course Objective:

To introduce the students to the essential basics of plants, animals, biodiversity hotspots and their conservation.

Unit 1

Introduction to Biodiversity -Biodiversity- components of biodiversity (Genetic, Species and Ecosystem diversity). History of biodiversity, Biodiversity Hotspots-Criteria for selection of hotspots, Indian hotspots. Keystone species and their significance-scope and application of biodiversity

Unit 2

Plant Diversity-Kingdom- Plantae, Structure and reproduction (No developmental studies) Algae (Ectocarpus), Fungi (Puccinia), Bryophytes (Funaria) ,Pteridophytes (Selaginella), Gymnosperms (Cycas). Economic importance of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.

Unit 3

Animal Diversity-Kingdom – Animalia Structure, organization and life history of Entamoeba histolytica, Taeniasolium, Ascaris, Penaeus indicus, Pila globosa, Star fish and Calotes.

Unit 4

Biodiversity values and threats -Direct use value (Food, Medicine, Biological control, Industrial materials, Recreational harvesting, Ecotourism)-Indirect use values (Ecosystem services) –Non-use value (Option value, Bequest value, Existence value, Intrinsic value). Threats to biodiversity - Direct exploitation- Habitat loss, fragmentation and degradation-Introduced species- Extinction cascade- Red data Book.

Unit 5

Biodiversity Conservation-Biodiversity Conservation- in situ conservation- objectives -National Parks- Wildlifereserves and Sanctuaries-Biosphere reserves. Ex situ conservation principle-Botanical garden. Germplasm collection- Seed banks Cryopreservation.

References / Textbooks

1. Gangulee & Khar, 1980. College Botany, Vol. II Tata McGraw Hill, New Delhi.
2. Ekambaranatha Ayyar and T.N.Ananthakrishnan, 2008. A manual of Zoology Vol.I& II (Part 1,2) S.Viswanathan, Chennai.
3. Barnes,R.D 2001. Invertebrate Zoology, W.B.Saunders.
4. Prabodh K. Maiti and Mait, P., 2011. Biodiversity: Perception, peril and preservation. Learning Private Limited, New Delhi.
5. Asthana, D. K. and Meera Asthana, 2006. Environment, Problems and solutions. S.Chand & Company Ltd. New Delhi.
6. Longman, K.A. and Jenik, J., 1987. Tropical forest and its Environment: ELBS, 2ndedn. London.
7. Odum E. P. 1983. Basic Ecology, Holt Saunders International Editions

Course Outcomes:

1. The students will gain knowledge on the diversity of plant, animal and their importance.
2. The students can comprehend the structure and function of various ecosystems and hotspots.
3. The students can understand and differentiate the various plant ecological adaptations.
4. The students will be able to distinguish plant distribution, vegetation pattern of world, continental, state level, forest biodiversity management and its conservation strategies.
5. The students will gain knowledge on the importance of bioresources in human welfare

SEMESTER II
CORE PAPER 2
BIOCHEMISTRY

Course Objectives

1. To understand the structure of various bio molecules, their interactions, synthesis and structural relationship
2. To understand the structure of various bio molecules and their interactions
3. To understand synthesis of biomolecules

Unit-1:

Carbohydrates - Classification, occurrence, structure and functions of monosaccharide, disaccharides, oligosaccharides & polysaccharides. Carbohydrate metabolism - Introduction, digestion, absorption, glycolysis, gluconeogenesis, glycogenolysis, Glycogenesis, Citric acid cycle, Bioenergetics.

Unit-2:

Proteins - Classification, structure and biological function. Amino acids –Classification based on structure and polarity. Essential and non-essential amino acids. Amino acid metabolism-Introduction, digestion and absorption, amino acid degradation reactions, urea cycle, linking to TCA cycle.

Unit-3:

Lipids-Classification, structure and biological function—essential and non-essential fatty acids. Lipid metabolism-Introduction, digestion and absorption. β -oxidation. Cholesterol biosynthesis -pathway, importance and regulation.

Unit-4:

Nucleic acids - Structure of purines and pyrimidines. Structure of DNA-Types of DNA. Enzyme: Classification, Nomenclature, Mechanism of enzyme action.

Unit-5:

Vitamins & Hormones- Classification, physiological functions & deficiency disorders of vitamins-A,D,E,K,B complex and C.Hormones - thyroxin, insulin, growth hormones. Separation technique – Chromatography – paper and thin layer. Electrophoresis - AGE, SDS-PAGE.

References / Text Books

1. Text Book of Biochemistry – U. Sathyanarayana
2. Text Book of Biochemistry - Kumaresan
3. Text Book of Biochemistry- Ambika Shanmugam
4. Text Book of Biochemistry – J. L. Jain
1. Lehninger, Cox and Nelson: Biochemistry
2. Voet & Voet: Biochemistry.
3. Stryer K. Biochemistry1995.W.H.Freeman & Company, New York.
4. Mathews, H.R.Freedland R.Miesfeld,R.L.1997. Biochemistry a short course. Wiley - LissInc.
5. Neal, A.C., Chemistry & Biochemistry: A Comprehensive Introduction. McGraw Hill Book Company.

6. Donald Voet, Judith G.Voet, Biochemistry, Second edition.
7. David L. Nelson, Michael M.Cox, Lehninger. Principles of Biochemistry, third edition.
8. Plummer, D.T.1988. An Introduction to Practical Biochemistry, Tata McGraw Hill Co., New Delhi.

Course Outcomes

1. The student will be able to identify and interpret the structure, classification, of carbohydrates
2. The student will be able to identify and interpret the structure, classification, of proteins
3. The student will be able to identify and interpret the structure, classification, of lipids
4. The student will be able to identify and interpret the structure, classification, of nucleic acid
5. The student will be able to identify and interpret the structure, classification, of vitamins

ALLIED 1
PAPER 2
FOOD AND NUTRITION

Course Objectives

1. To know the importance of food and meaning of nutrition
2. To know about the role of nutrition in human life
3. Increase the ability to overcome deficiency
4. To enable the students, gain knowledge about basics in nutrition.
5. To develop knowledge of food and nutritional value.

Unit-1

Food and its Importance: Definition-food, nutrition, optimum nutrition. Functions of foods-physiological, psychological and social functions. Basic five food groups. Balanced diet- definition and objectives, food guide pyramid and its uses.

Unit-2

Nutrition: Nutrients, Nutritional Status, Health. Carbohydrates –Nutritional classification, Function, Digestion and Absorption, effects of deficiency, sources and requirements Fibre- Definition, Types, and Role of fibre in health.

Unit-3

Protein: Protein- Nutritional value, Functions, Digestion and Absorption, Sources and Requirements, Deficiency. Lipids value, Functions, Digestion and Absorption, Sources and Requirements, Deficiency. Essential fatty acids – Functions, Sources.

Unit-4

Energy: Energy - Units of energy - Calorie, Joule, Determination of energy content of foods: Basal Metabolic rate (BMR), Determination of BMR (Benedict's oxy calorimeter), Factors affecting BMR. Thermic effect of food, Factors affecting Thermic effects of food.

Unit-5

Vitamins and Minerals - Vitamins – Fat Soluble Vitamins (A, D, E, K): Functions, Sources, Requirements, Deficiency and Excess. Water Soluble Vitamins (B1, B2, B3, B4, B6, B12 & C)

References / Textbooks

1. B. Srilakshmi, Nutrition Science, Fifth Edition, New Age International (P) Ltd, New Delhi (2008).
2. Ambika Shanmugam, Fundamentals of Biochemistry for Medical Students, Seventh Edition, New Age Publishing Pvt.Ltd., New Delhi (1986).
3. Gopalan, C.et. al, Nutritive value of Indian Foods, ICMR(1991).
4. Swaminathan, M. ,Essentials of Food & Nutrition. Vols I & II Ganesh & Co., Madras(1985).
5. Robinson, C.H., et. al (1986) Normal & Therapeutic Nutrition, 17th ed. MacMillan Publishing Co., (1986)
6. Williams. S.R. Basic Nutrition & Diet Therapy, 11th ed., Mosby, Inc. St. Louis(2001).

Course Outcomes

1. The students will be able to understand different functions of food and learn about balanced diet.
2. The students will be able to understand the importance of carbohydrates and fibre
3. The students will understand the nutritional value of proteins, lipids and fatty acids
4. The students will be able to gain knowledge on food energy intake
5. The students will be able to learn how vitamins are vital to our body.

Core Practical 1

Lab in Cell and Evolution Biology

1. Mitosis in onion root tip
2. Meiosis in flower buds of *Allium cepa* (onion) or grass hopper testis
3. Observation of buccal cells
4. Separation of cellular organelles by differential centrifuge
5. Separation of cell membrane components from leaves
6. Microscopy and calibration
7. Measurement size of various cells using micrometry (Optional)

Lab in Biodiversity

1. Study of the field collection, preservation and identification of plants
2. Study of the field collection, preservation and identification of animals
3. Identify biodiversity of pond ecosystem (using charts only)
4. Identify biodiversity of grassland ecosystem (using charts only)
5. Identify biodiversity of marine ecosystem (using charts only)
6. List out Plant diversity in the campus
7. List out Animal diversity in the campus
8. Preparation of Herbarium
9. Preparation of Insect Box
10. Field visit to any one Hotspot and submission of field report. Field based Viva–Voce.

Lab in Biochemistry

1. Qualitative test for carbohydrates (Glucose, Fructose & Starch)
2. Qualitative test for proteins
3. Qualitative test for lipids
4. Amino acid separation by paper chromatography
5. Amino acid separation by TLC

ALLIED PRACTICAL-1

Lab in Food and Nutrition

Practical for Food

1. Factor affecting the quality of pulses- Use of hard water, soft water, sodium bicarbonate, vinegar; pressure cooking and preparation of few pulse based recipes.
2. Effect of heat and pH on vegetable pigments like: chlorophyll, carotenoids, anthocyanin, anthoxanthin.
3. Smoking temperature of different fats and oils (safflower oil, groundnut oil & palm oil)

Practical for Nutrition

Qualitative tests for Carbohydrates, Proteins and Minerals.

1. Qualitative analysis for Carbohydrates in gives food samples. a) Monosaccharide – Glucose (commercial Glucose), Fructose (fruit juice) b) Disaccharide - Lactose (milk)
2. Qualitative analysis for protein in given food samples a) Albumin (egg) b) Casein (milk)
3. Qualitative analysis for minerals in given food samples. a) Calcium (Ragi) b) Iron (Red rice flakes) c) Phosphorus (Ragi) d) Magnesium (Agathi)
