



Government of Karnataka

Model Curriculum

Program Name	B.Sc. Discipline	Total Credits for the Program	176
Core	Biotechnology	Starting year of implementation	2021-22

Program Outcomes: At the end of the program the student should be able to:

(Refer to literature on outcome-based education (OBE) for details on Program Outcomes)

- PO1. Understanding concepts of Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology
- PO2. Demonstrating the Laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects
- PO3. Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, animal biotechnology and microbial technology in pharma, food, agriculture, beverages, herbal and nutraceutical industries.
- PO4. Critically analyse the environmental issues and apply the biotechnology knowledge gained for conserving the environment and resolving the problems.
- PO5. Demonstrate comprehensive innovations and skills in the fields of biomolecules, cell and organelles, molecular biology, bioprocess engineering and genetic engineering of plants, microbes, and animals with respect to applications for human welfare.
- PO6. Apply knowledge and skills of immunology, bioinformatics, computational modelling of proteins, drug design and simulations to test the models and aid in drug discovery.
- PO7. Critically analyse, interpret data, and apply tools of bioinformatics and multi omics in various sectors of biotechnology including health and Food.
- PO8. Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of biotechnology.
- PO9. Learning and practicing professional skills in handling microbes, animals and plants and demonstrate the ability to identify ethical issues related to recombinant DNA technology, genetic engineering, animals handling, intellectual property rights, biosafety, and biohazards.
- PO10. Exploring the biotechnological practices and demonstrating innovative thinking in addressing the current day and future challenges with respect to food, health, and environment.
- PO11. Thorough knowledge and application of good laboratory and good manufacturing practices in biotech industries.
- PO12. Understanding and application of molecular biology techniques and principles in forensic and clinical biotechnology.
- PO13. Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises or CROs.

Assessment:

Weightage for assessments (in percentage)

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	40	60
Practical	25	25
Projects	-	-
Experiential Learning (Internships etc.)	-	-

Contents of Courses for B.Sc. Biotechnology as Major Model II A

Semester	Course code	Course Category	Theory/Practical	Credits	Paper Title	Marks	
						S.A	I.A
3.	BTC: 103	DSC- 7	Theory	3	Biomolecules	60	40
			Practical	2	Biomolecules	25	25
		OE- 3	Theory	3	Nutrition and Health	60	40
4.	BTC:104	DSC- 8	Theory	3	Molecular Biology	25	25
			Practical	2	Molecular Biology	60	40
		OE- 4	Theory	3	Intellectual Property Rights	25	25

60 40



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Program Name	BSc Biotechnology		Semester	Third Sem
Course Title	Biomolecules			
Course No.	BTC: 103	DCS -3T	No. of Theory Credits	4
Contact hours	56 hrs		Duration of ESA/Exam	2.30 Hours
Formative Assessment Marks	40		Summative Assessment Marks	60

Course Pre-requisite (s):

Course Outcomes (COs): At the end of the course the student should be able to:

1. Acquire knowledge about types of biomolecules, structure, and their functions
2. Will be able to demonstrate the skills to perform bioanalytical techniques
3. Apply comprehensive innovations and skills of biomolecules to biotechnology field

Content	Hrs
<p>Unit-I – a) Carbohydrates: Introduction, sources, classification of carbohydrates. Structure,function and properties of carbohydrates. Monosaccharides – Isomerism and ring structure, Sugar derivatives – amino sugars and ascorbic acid Oligosaccharides – Sucrose and Fructose Polysaccharides – Classification as homo and heteropolysaccharides, Homopolysaccharides - storage polysaccharides (starch and glycogen- structure, reaction, properties), structural polysaccharides (cellulose and chitin-structure,properties),Heteropolysaccharides - glycoproteins and proteoglycans (Brief study). Metabolism:Glycolysis and gluconeogenesis, Kreb's cycle, oxidative phosphorylation.</p> <p>b) Amino Acids, Peptides and Proteins Introduction, classification and structure of amino acids. Concept of – Zwitterion, isoelectric point, pK values. Essential and nonessential amino acids. Peptide bond and peptide, classification of proteins based on structure and function, Structural organization of proteins[primary, secondary (α, β), tertiary and quaternary]. Fibrous and globular proteins, Denaturation and renaturation of proteins General aspects of amino acid metabolism:Transamination, deamination, decarboxylation and urea cycle.</p>	14

<p>Unit -II a) Lipids Classification and function of lipids, properties (saponification value, acid value, iodine number, rancidity), Hydrogenation of fats and oils Saturated and unsaturated fatty acids. General structure and biological functions of - phospholipids, sphingolipids, glycolipids, lipoproteins, prostaglandins, cholesterol, ergosterol. Metabolism: Beta oxidation of fatty acids. Biosynthesis of cholesterol.</p> <p>b) Enzymes Introduction, nomenclature and classification, enzyme kinetics, factors influencing enzyme activity,metalloenzymes, activation energy and transition state, enzyme activity, specific activity. Coenzymes and their functions (one reaction involving FMN, FAD, NAD). Enzyme inhibition- Irreversible and reversible (competitive, non-competitive and uncompetitive inhibitionwith an example each) Zymogens (trypsinogen, chymotrypsinogen and pepsinogen), Isozymes (LDH. Creatine kinase. Alkaline phosphatase and their clinical significance).</p>	14
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<p>Unit -III -a. Vitamins Water and fat soluble vitamins, dietary source and biological role of vitamins Deficiency manifestation of vitamin A, B, C, D, E and K</p> <p>a) Nucleic acids Structures of purines and pyrimidines, nucleosides, nucleotides in DNA Denovo and salvage pathway of purine and pyrimidine synthesis.</p> <p>b) Hormones Classification of hormones based on chemical nature and mechanism of action. Chemical structure and functions of the following hormones: Glucagon, Cortisone, Epinephrine, Testosterone and Estradiol.</p>	14
<p>Unit -IV - Bioanalytical tools :</p> <p>a) Chromatography : Principle, procedure and applications of - paper chromatography, thin layer chromatography, adsorption chromatography, ion exchange chromatography, gel filtration chromatography, affinity chromatography, gas liquid chromatography and high performance liquid chromatography.</p> <p>b) Electrophoresis: Principle, procedure and applications of electrophoresis (paper electrophoresis, gel electrophoresis -PAGE, SDS- PAGE & agarose electrophoresis) and isoelectric focusing.</p> <p>c) Spectroscopy: UV-Vis spectrophotometry; mass spectroscopy, atomic absorption spectroscopy.</p>	14

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs) / Program Outcomes (POs)	Program Outcomes (POs)												
	1	2	3	4	5	6	7	8	9	10	11	12	
Acquire knowledge about types of biomolecules, structure, and their functions	✓				✓								✓
Will be able to demonstrate the skills to perform bioanalytical techniques			✓									✓	✓
Apply comprehensive innovations and skills of biomolecules to biotechnology field	✓				✓								✓

Pedagogy: Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

Summative Assessment = 60 Marks	
Formative Assessment Occasion / type	Weightage in Marks (40)
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
Total	60 marks + 40 marks = 100 marks

Course Title	Biomolecules		Practical Credits	2
Course No.	BTC:103	DSC-3P	Contact hours	
Content				
<ol style="list-style-type: none"> 1. Introduction to basic instruments (Principle, standard operating procedure) with demonstration. 2. Definitions and calculations: Molarity, Molality, Normality, Mass percent % (w/w), Percent by volume (% v/v), parts per million (ppm), parts per billion (ppb), Dilution of concentrated solutions. Standard solutions, stock solution, solution of acids. Reagent bottle label reading and precautions. 3. Preparation of standard buffers by Hendersen-Hasselbach equation – Acetate, phosphate, Tris and determination of pH of solution using pH meter. 4. Estimation of maltose by DNS method 5. Determination of α-amylase activity by DNS method 6. Estimation of proteins by Bradford method 7. Estimation of amino acid by Ninhydrin method 8. Extraction of protein from soaked/sprouted green gram by salting out method 9. Separation of plant pigments by circular paper chromatography 10. Separation of amino acids by thin layer chromatography 11. Native PAGE 12. Determination of iodine number of lipids 				

Practical assessment

Assessment			
Formative assessment		Summative Assessment	Total Marks
Assessment Occasion / type	Weightage in Marks	Practical Exam	
Record	5	25	50
Test	10		
Attendance	5		
Performance	5		
Total	25	25	

References

1	An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India
2	Biochemical Methods, 1st Edition, (1995), S.Sadashivam, A.Manickam; New Age International Publishers, India
3	Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing. House, New Delhi, ISBN 81-7319-302-9
4	Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande (ed). I.K International Pvt. LTD, New Delhi. ISBN 81-88237-41-8
5	Standard Methods of Biochemical Analysis, S. K. Thimmaiah (ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067



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Program Name	BSc Biotechnology		Semester	Third Sem
Course Title	Nutrition and Health			
Course Code		OE-3	No. of Theory Credits	3
Contact hours	Lecture		Duration of ESA/Exam	Hours
	Practical			
Formative Assessment Marks			Summative Assessment Marks	

Course Pre-requisite(s):

Course Outcomes (COs): At the end of the course the student should be able to:

1. Study the concepts of food, nutrition, diet and health
2. To apply the best practices of food intake and dietary requirements
3. Acquire knowledge about various sources of nutrients and good cooking practices

H2 H2

Content

45 Hrs

Unit-I - Introduction

14 Hrs

Concepts of nutrition and health. Definition of Food, Diet and nutrition, Food groups. Food pyramids. Functions of food. Balanced diet. Meal planning. Eat right concept. Functional foods, Prebiotics, Probiotics, and antioxidants

Unit -II - Nutrients

14 Hrs

Macro and Micronutrients - Sources, functions and deficiency. Carbohydrates, Proteins, Fats - Sources and calories. Minerals - Calcium, Iron, Iodine.

Vitamins - Fat soluble vitamins - A, D, E & K. Water soluble vitamins - vitamin C Thiamine, Riboflavin, Niacin. Water - Functions and water balance. Fibre - Functions and sources. Recommended Dietary Allowance, Body Mass Index and Basal Metabolic Rate.

Unit -III - Nutrition and Health

14 Hrs

Methods of cooking affecting nutritional value. Advantages and 'disadvantages. Boiling, steaming, pressure cooking. Oil/Fat - Shallow frying, deep frying. Baking. Nutrition through lifecycle. Nutritional requirement, dietary guidelines: Adulthood, Pregnancy, Lactation, Infancy- Complementary feeding, Pre-school, Adolescence, geriatric. Nutrition related metabolic disorders- diabetes and cardiovascular disease.

Pedagogy: Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

Summative Assessment = 60 Marks	
Formative Assessment Occasion / type	Weightage in Marks <i>(40)</i>
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
Total	60 marks + 40 marks = 100 marks

References

1	Sri Lakshmi B, (2007), Dietetics. New Age International publishers. New Delhi
2	Sri Lakshmi B, (2002), Nutrition Science. New Age International publishers. New Delhi
3	Swaminathan M. (2002), Advanced text book on food and Nutrition. Volume I. Bappco
4	Gopalan.C., RamaSastry B.V., and S.C.Balasubramanian (2009), Nutritive value of Indian Foods. NIN. ICMR. Hyderabad.
5	Mudambi S R and Rajagopal M V, (2008), Fundamentals of Foods, Nutrition & diet therapy by New Age International Publishers, New Delhi