B.Sc., Biotechnology

LOCF SYLLABUS – 2022

WITH CHOICE-BASED CREDIT SYSTEM (CBCS)

DEPARTMENT OF BIOTECHNOLOGY
RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)
Accredited at 'A' Grade by NAAC & DST-FIST Sponsored
College Thanjavur - 613 005, Tamil Nadu,
India

DEPARTMENT OF BIOTECHNOLOGY

VISION
To be one of the leading department in the field of Biotechnology and contribute in generating manpower pharmaceutical industries, academia, diagnostics, bio-entrepreneurship and related areas.
MISSION
1. To create an environment for the students and faculty for personal and professional growth with high moral standards. 2. To continuously upgrade the curriculum and laboratory facilities to train the students in modern biotechnology and related areas for carrying out cutting edge research. 3. To contribution to society through biotechnological approaches/inventions towards fulfillment of regional needs.

PROGRAMME OUTCOMES (POs)

Upon completion of a under Graduate Degree Programme,

PO-1	Students will be able to demonstrate their knowledge of biotechnology concepts
PO-2	Students will possess the technical background knowledge needed to support biotechnology research activity.
PO-3	Students will possess hands-on technical skills necessary for supporting biotechnology research activity.
PO-4	Students describe the structure, classification, staining, culturing and physiology of microorganisms
PO-5	They can restate the various types of gene interactions and genetic recombination
PO-6	Students can explain the basic principles, tools, techniques, applications of Genetic engineering in various fields
PO-7	Students can able to debate on ethical issues concerned with Genetic engineering

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Upon completion of under Graduate Degree Programme Graduates will be able to

PSO – 1	**Cognitive Knowledge:** To provide education that leads to comprehensive understanding of the principles and practices of biotechnology.
PSO – 2	**Experimental Skills:** To provide broad-based training in technical skills in methods of biotechnology
PSO – 3	**Critical Thinking:** To empower students with the ability to think and solve problems in the field of biotechnology.
PSO – 4	**Scientific Communication:** To ensure students are able to effectively communicate with biotech and other interdisciplinary professionals
PSO – 5	**Professional Attitude:** To produce responsible biotechnologists that can work within the interdisciplinary framework of biotechnology and related fields.
PSO – 6	**Information and Computer Literacy:** To educate and make them up to date with the current scientific literature, computer programs and web information

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DEPARTMENT OF BIOTECHNOLOGY
RAJAH SERFOJI GOVERNMENT COLLEGE (Autonomous)
THANJAVUR-613005
BOARD OF STUDIES MEETING

The board of studies meeting for the Department of Biotechnology was conducted on **Thursday (18.08.2022)** at **11:00 pm** during the academic year 2022-2023 in the presence of the following board members under the chairmanship of **Dr. M. SUKUMARAN**

S.No	Name		Address	Signature
1	**Dr. M. SUKUMARAN**	Chairperson	Head, Department of Biotechnology	18.8.22
2	**Dr. S. ACHIRAMAN**	University Representative Nominee	Associate Professor Dept. of Environmental Biotechnology Bharathidasan University Tiruchirappalli-620024	18/8/2022
3	**Dr. P. GANESH**	Subject Expert	Assistant Professor of Microbiology Faculty of Science Annamalai University Chidambaram-608003	18.08.22
4	**Dr. P. PONMANICKAM**	Subject Expert	Assistant Professor Dept. of Zoology, Ayya Nadar Janaki Ammal College, Sivakasi	18/8/22
5	**Dr. M. LOGANATHAN**	Industrialist	Associate professor and Head, IIFPT, Thanjavur-613005	ABSENT
6	**Mr. AJITH SIVA SANGAR**	Meritorious Alumnus	Ph.D., scholar, Dept. of Human genetics and Molecular biology, Bharathiar University, Coimbatore	
7	**Dr. J. RAJESH SINGH**	Faculty Member	Assistant Professor, Dept of Biotechnology	18/8/22
8	**Dr. K. GIRIJA**	Faculty Member	Guest Lecturer, Dept of Biotechnology	18/8/22
9	**Dr. A. SATHYA**	Faculty Member	Guest Lecturer, Dept of Biotechnology	18/08/22

The syllabi for B.Sc. Biotechnology (Major) under CBCS system were discussed and necessary corrections/modifications were made in the paper and finalized. The finalized syllabi are approved and appended herewith

CHAIRMAN

(M. SUKUMARAN)

Head, Dept.of Biotechnology
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Thanjavur - 613005 TamilNadu

CONTROLLER OF EXAMINATIONS,
RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS)
THANJAVUR-613 005.

AGENDA OF THE MEETING

The meeting of the Board of Studies in Biotechnology, for the Academic Year 2022-23, will be held on 18.08.2022 at 11:00 am at Department of Biotechnology, Rajah Serfoji Government College, Thanjavur-613 005

The following agenda will be discussed in the meeting:

1) Revamping of the syllabus for the I year

2) To discuss the new additions and changes in the existing curriculum for B.Sc., Programme applicable for the students admitted from 2022-2023 onwards.

3) To discuss the revision of the course outline of this programme incorporating the assessment pattern of these Course.

4) To discuss and approve the Course Outcomes and Learning Outcomes of individual subjects.

5) Panel of Question paper setters and Examiners.

6) Action plan of the Department for 2022-23 including Seminars.

7) Any other proposal with the permission of the chair.

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Dr. M. Sukumaran
Chairperson, BoS and
Head, Department of Biotechnology

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B.Sc., BIOTECHNOLOGY COURSE STRUCTURE

(For the candidate admitted from the academic year 2022-2023 onwards)

semester	Part	Course	Subject Code	Title of the paper	Inst. Hrs.	credit	Exam hrs.	Marks		Total
								Int.	Ext.	
I	I	LT	A1T1	Tamil-I	6	3	3	25	75	100
	II	LE	A1E1	English-I	6	3	3	25	75	100
	III	CC1	A1BT1	General Microbiology	4	4	3	25	75	100
	III	CC2	A1BTP1	Major Practical-I	3	3	3	40	60	100
	III	Allied 1	A1AZO1	Allied Zoology-I	4	3	3	25	75	100
	III	Allied 2	A2AZOP	Allied Practical-I	3	-	-	-	-	
	IV	VE	A1VE	Value Education	2	2	3	25	75	100
	IV	GEC1			2	2	3	25	75	100
				Total	**30**	**20**				**700**
II	I	LT	A2T2	Tamil- II	6	3	3	25	75	100
	II	LE	A2E2	English- II	6	3	3	25	75	100
	III	CC3	A2BT2	Cell Biology & Genetics	4	4	3	25	75	100
	III	CC4	A2BTP2	Major Practical-II	3	3	3	40	60	100
	III	Allied 3	A2AZO2	Allied Zoology-II	4	3	3	25	75	100
	III	Allied 2	A2AZOP	Allied Practical-I	3	4	3	40	60	100
	IV	ES	A2ES	Environmental Studies	2	2	3	25	75	100
	IV	GEC1			2	2	3	25	75	100
				Total	30	**24**				**800**
III	I	LT	A3T3	Tamil- III	6	3	3	25	75	100
	II	LE	A3E3	English- III	6	3	3	25	75	100
	III	CC5	A3BT3	Molecular Biology	4	4	3	25	75	100
	III	CC6	A3BTP3	Major Practical-III	3	3	3	40	60	100
	III	Allied 4	A3ABC1	Allied Biochemistry -I	4	3	3	25	75	100
	III	Allied 5	A4ABCP	Allied Practical-II	3	-	-	-	-	-
	IV	SEC1	A3SB1	Aquaculture	2	2	3	25	75	100
				Total	**30**	**20**				**700**

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IV	I	LT	A4T4	Tamil- IV	6	3	3	25	75	100
	II	LE	A4E4	English- IV	6	3	3	25	75	100
	III	CC1	A4BT4	rDNA Technology	4	4	3	25	75	100
	III	CC2	A4BTP4	Major Practical-IV	3	3	3	40	60	100
	III	Allied 6	A4ABC2	Allied Biochemistry -II	4	3	3	25	75	100
	III	Allied 5	A4ABCP	Allied Practical-II	3	3	3	25	75	100
	IV	SEC2	A4SB2	Biofertilizer	2	2	3	25	75	100
				Total	**30**	**20**				**700**
V	III	CC9	A5BT5	Industrial Biotechnology	7	5	3	75	75	100
	III	CC10	A5BTP5	Major Practical- V	7	5	3	40	60	100
	III	DSE1	A5BTEL1A	Molecular Diagnostics	6	5	3	25	75	100
			A5BTEL1B	Microbial Biotechnology						
			A5BTEL1C	Nanobiotechnology						
	III	DSE2	A5BTEL2A	Immunotechnology	6	5	3	25	75	100
			A5BTEL2B	Developmental biology						
			A5BTEL2C	Computational Biology						
	IV	SSD	A5SSD	Soft Skill Development	2	2	3	25	75	100
	IV	SEC3	A5SB3	Mushroom cultivation	2	2	3	25	75	100
	IV	ECC1		Medical Biotechnology	-	4	3	-	100	100
				Total	30	**24**				**600**
VI	III	CC11	A6BT6	Plant and Animal Biotechnology	7	6	3	25	75	100
	III	CC12	A6BT7	Environmental Biotechnology	7	6	3	25	75	100
	III	CC13	A6BTP6	Major Practical- VI	7	5	3	40	60	100
	III	DSE2	A6BTEL3A	Enzyme technology	3	3	3	25	75	100
			A6BTEL3B	Bioenergetics and Metabolism						
			A6BTEL3C	Virology						
	IV	GS	A6GS	Gender studies	2	2	3	25	75	100
	IV	ECC2		Genomics and proteomics		4	3	-	-	100
	V	Extra activities		NCC/NSS/SPORTS/RCC/YRC/CCC	-	2	-	-	-	-
				Total	**30**	**26**				**500**
GRAND TOTAL						**138**				**3900**

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Credits	5	Hours/Week	6	Sub Code	A1BT1	Semester	I
Medium of Instruction : English						Core Course : 1	

GENERAL MICROBIOLOGY

Objectives:

1. To appreciate the efforts of the scientists for the development of Microbiology and Microscopes.
2. To update the students with the real knowledge of working with different types of Microbes.
3. To understand the variety of microorganisms and to analyse their true potential.

CO No.	Course Outcomes:
	On the successful completion of the course, student will be able to:
CO-1	Remember and recall the historical events which paved the development of different types of microscopes.
CO-2	Understand and differentiate the different types of microbes.
CO-3	Analyze the media composition and grow the desired microbe.
CO-4	Apply the knowledge to enumerate the microorganisms from natural environment.
CO-5	Evaluate the success of understanding the epidemiology of diseases

Unit I: History of Microbiology, classification, and nomenclature of microorganisms. Microscopy:Light and Electron microscopy. Microscopic examination of microorganisms-Staining techniques - principle and types.

Unit II: Sterilization Methods - Principles and applications - Physical and chemical methods. Antimicrobial chemotherapy –Antibiotics –mode of actions –antimicrobial resistance -tests for sensitivityto antimicrobial agents.

Unit III: Morphology and fine structure of bacteria. Growth of bacteria-multiplication - nutritional requirements - factors affecting growth - growth curve –Determination of growth. Media and its types. Culture techniques -Pure culture, anaerobic culture - preservation of cultures.

Unit IV: Water microbiology - Microbes in water, Bacteriological examination of water; sewage and its treatment; purification of drinking water. Soil microbiology- Symbiotic and Non- symbiotic Nitrogen fixing organisms -Rhizosphere. Food microbiology - Microbiology of food borne diseases- Botulism, Salmonellas, Staphylococcal poisoning Perfingeens poisoning and Mycotoxins.

Unit V: Microbial diseases: - Normal human micro flora; host - parasitic interaction ; epidemics; exo Endotoxins. Water borne disease (Cholera), Air borne (Pneumonia), Sexually transmitted disease (Syphilis), Vector borne disease (Malaria) - Viral disease (Rabies, HIV) - Fungal disease (Candidiasis).

Unit VI: Self study - Current events in Microbiology- Expert lectures, online seminars, webinars.

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Books for study:

1. Michael J. Pelczar, Chan, E.C.S and Noel R. Kreig, (2019). Microbiology, 5th edition, McGraw Hill.
2. Joaenne Wille, Linda Sherwood and Christopher Woolverton, (2019). Prescott Microbiology, 11th edition, Mc Graw Hill.

Books for Reference:

1. Jawetz, Melnick and Adelbergs Geo F. Brooks, (2019). Medical Microbiology, 28th edition, Lange Med.
2. Roger Stainer, (1999). General Microbiology, 5th edition, Prentice Hall.
3. Hans Zinnser, Wolfgang K. Joklik. (1988). Zinsser's Microbiology, 20th edition, McGraw-Hill Professional.
4. Michael T. Madigan, John M. Martinko, Paul V. Dunlap, David. P clark, (2018) Brock Biology of microorganisms, 15th edition, Prentice Hall.

Web Resources:

1. www.microbenotes.com
2. www. Shomus biology.com
3. www.microbiologyinfo.com
4. www.microbenotes.org

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	of COs
CO-1	2	3	3	2	1	3	3	3	2	1	2.3
CO-2	2	3	3	2	1	3	3	2	2	2	2.3
CO-3	3	3	3	3	1	3	3	2	3	3	2.7
CO-4	2	3	3	1	2	3	3	3	3	3	2.6
CO-5	2	3	3	3	2	3	2	3	3	2	2.6
Mean Overall Score											2.5
Result											High

Semester Question paper Pattern: (3Hours)

Section A	10x2=20
Section B	5x5=25
Section C	3x10=30

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Credits	4	Hours/Week	3	Sub Code	A1BTP1	Semester	I
Medium of Instruction : English						Core Course : 2	

MAJOR PRACTICAL – I

GENERAL MICROBIOLOGY

1. Laboratory rules and regulations of Microbiology.
2. Microscope and its functions.
3. Media preparation and sterilization (Bacteria and Fungi).
4. Enumeration of bacteria from soil, water and air - serial dilution technique.
5. Isolation of fungi from soil and other sources.
6. Pure culture technique - Pour plate, Spread plate and Streak plate methods.
7. Staining Techniques - simple, Gram's, spore and capsule.
8. Fungal staining - Wet Mount technique, lactophenol cotton blue staining
9. Biochemical characterization of bacteria. IMViC Test, TSI.

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Credits	5	Hours/Week	6	Sub Code	A2BT2	Semester	II
Medium of Instruction : English						Core Course : 3	

CELL BIOLOGY AND GENETICS

Objectives:

1. To understand the concept of cell, their organelles and functions.
2. To know the basics of genetics and mutation.
3. They will understand the cellular components underlying mitotic cell division

CO No.	Course Outcomes:
	On the successful completion of the course, student will be able to:
CO-1	Gained knowledge about the features of cell wall, plasma membrane, cell transport mechanisms and cytoskeleton.
CO-2	Know the structures and functions of the nucleus and different cell organelles.
CO-3	Learned the mechanisms of cell division/cell cycle and its regulation.
CO-4	Explain the nature of inheritance, the genetic material and how it results in phenotype variation in genetics and relationship
CO-5	Use the Hardy-Weinberg equation to determine genotype frequencies in population dispositions.

Unit I: Cell as a basic Unit. Cell theory. Classification of cell types, specialized cells such as motile, nerve and muscle cells. Ultrastructure of prokaryotic and eukaryotic cells. Comparison of microbial, plantand animal cell.

Unit II: Cellular organization - plasma membrane, cell wall their structural organization, transport of nutrients, ions and macromolecules across the membranes. Cellular energy transactions - Role of mitochondria and chloroplast. Cellular organelles (Cytosol, nucleus, endoplasmic reticulum, golgi bodies, cytoskeleton, ribosomes, vacuoles, peroxisomes and lysosome).

Unit III: Structure of DNA, structure of chromosomes, chromatin structure and composition, packaging of DNA into chromosomes - melting, dissociation and cot curve, specialized chromosome, chromosomal abnormalities.

Unit IV: Mendelian Genetics: Definitions of common terms in genetics- Phenotype, genotype, heterozygous, homozygous, allele, gene, gene locus, pure line, hybrid. Monohybrid cross, Dihybrid cross, Mendel's laws, Test cross, Back cross and Incomplete dominance. Population Genetics - Hardy Weinberg law- identify genetic variation.

Unit V: Cell signaling, cell cycle and cell death and renewal- signaling molecules and their receptors, function, Mitosis and Meiosis. Cancer causes- oncoviruses, oncogenes, tumour suppressor genes, Mutation types- mutagens.

Unit VI: Self study - Current events in Microbiology- Expert lectures, online seminars, webinars.

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Book for study:

1. Verma and Agarwal, 1991, Cytology, S. Chand and company.Rajasthan
2. S.C. Rastogi, (2006) Cell and Molecular Biology, 3rd edition, New Age International Publishers, New Delhi.

Books for Reference:

1. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Kreiger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Kelsey C. Martin. (2021). Molecular cell biology, 9th edition. W. H. Freeman publisher
2. E. J. Gardener, M. J. Simmons and D. P. Snustad, (2012) Principles of Genetics, 8th edition, John Wiley & Sons Publications.
3. E. D. P. De Robertis and E. M. F. De Robertis, Jr, (2017) Cell Biology and Molecular Biology, 8th edition. Lippincott Williams and Wilkins.

Web Resources:

1. www.harvard.edu / genetics
2. www.openoregon.pressbooks.pub
3. www.bio.libretexts.org
4. www.cs.cmu.edu.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	of COs
CO-1	3	2	2	3	1	2	3	3	3	2	2.4
CO-2	2	2	2	3	1	3	2	3	3	3	2.4
CO-3	2	2	3	2	3	3	3	3	3	3	2.7
CO-4	2	2	3	3	3	3	3	3	2	3	2.7
CO-5	3	3	3	3	3	3	3	3	3	3	3
Mean Overall Score											2.6
Result											High

Semester Question paper Pattern: (3Hours)

Section A	10x2=20
Section B	5x5=25
Section C	3x10=30

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Credits	4	Hours/Week	3	Sub Code	A2BTP2	Semester	II
Medium of Instruction : English						Core Course : 4	

MAJOR PRACTICAL – II

CELL BIOLOGY AND GENETICS

1. Measurement of cells - Micrometry
2. Observation of distinguishing features of different eukaryotic cells
3. Preparation of blood smear and differential staining
4. Motility determination - Hanging drop method
5. Identification of polytene chromosome in Chironomous larvae.
6. Identification of Barr body in buccal cells.
7. Identification of various stages of mitosis in Onion root tip.
8. Identification of various stages of meiosis in Grasshopper testis.
9. Demonstration of simple Mendelian traits in humans and pedigree analysis.
10. Demonstration of Human karyotype analysis.
11. Verification Mendelian mono and dihybrid ratio using beads.
12. Verification of Hardy-Weinberg equilibrium using beads.
13. Verification of Laws of probability using coins (Single coin tossing and double coin tossing)
14. Survey of colour blindness among students using Ishikara's chart.

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