

DEPARTMENT OF BIOTECHNOLOGY

SYLLABUS FOR B.Sc., (BIOTECHNOLOGY)

**Applicable to the Candidates admitted from the Academic year
2015-2016 onwards**



**RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)
THANJAVUR- 613 005**

RAJAH SERFOJI GOVT. COLLEGE (AUTONOMOUS), THANJAVUR-5
COURSE STRUCTURE FOR B.Sc.,
SUBJECT: BIOTECHNOLOGY

(Applicable to the Candidates admitted from the academic year 2015-2016 onwards)

Part	Code	Course	Title	Hrs	Marks		Total	Credit
					IE	WE		
I-SEMESTER								
I	RR1T1	LT	PART-I Tamil-I	6	25	75	100	3
II	RR1E1	LE	PART-II English-I	6	25	75	100	3
III	RR1BT1	CC1	General Microbiology	6	25	75	100	5
III	RR2BTP1	CC3	Major Practical-I	3	-	-	-	
III	RR1AZ1	Allied 1	Allied Zoology-I	4	25	75	100	4
III	RR2AZP	Allied 3	Allied Zoology Practical	3	-	-	-	
IV	RR1VE	VE	Value Education	2	25	75	100	2
TOTAL				30			500	17
II-SEMESTER								
I	RR2T2	LT	PART-I Tamil-II	6	25	75	100	3
II	RR2E2	LE	PART-II English-II	6	25	75	100	3
III	RR2BT2	CC2	Cell and Molecular Biology	6	25	75	100	5
III	RR2BTP1	CC3	Major Practical-I	3	40	60	100	4
III	RR2AZ2	Allied 2	Allied Zoology-II	4	25	75	100	4
III	RR2AZP	Allied 3	Allied Zoology Practical	3	40	60	100	4
IV	RR2ES	ES	Environmental Studies	2	25	75	100	2
TOTAL				30			700	25

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Part	Code	Course	Title	Hrs	Marks		Total	Credit
					IA	AE		
III-SEMESTER								
I	RR3T3	LT	PART-I Tamil-III	6	25	75	100	3
II	RR3E3	LE	PART-II English-III	6	25	75	100	3
III	RR3BT3	CC4	Molecular Genetics	6	25	75	100	5
III	RR4BTP2	CC6	Major Practical-II	3	-	-	-	
III	RR3ABC1	Allied 4	Allied Biochemistry-I	4	25	75	100	4
III	RR4ABCP	Allied 6	Allied Biochemistry Practical	3	-	-	-	
IV	RR3SB1	SB1	Skill Based-I	2	25	75	100	2
TOTAL				30			500	17
IV-SEMESTER								
I	RR4T4	LT	PART-I Tamil-IV	6	25	75	100	3
II	RR4E4	LE	PART-II English-IV	6	25	75	100	3
III	RR4BT4	CC5	rDNA Technology	6	25	75	100	5
III	RR4BTP2	CC6	Major Practical-II	3	40	60	100	4
III	RR4ABC2	Allied 5	Allied Biochemistry-II	4	25	75	100	4
III	RR4ABCP	Allied 6	Allied Biochemistry Practical	3	40	60	100	4
IV	RR4SB2	SB2	Skill Based-II	2	25	75	100	2
Total				30			700	25

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Part	Code	Course	Title	Hrs	Marks		Total	Credit
					IA	AE		
V-SEMESTER								
III	RR5BT5	CC7	Animal Biotechnology	6	25	75	100	5
III	RR5BT6	CC8	Plant Biotechnology	6	25	75	100	5
III	RR5BTP3	CC9	Major Practical-III	3	40	60	100	4
III	RR5BTEL1	MEC1	Bioinformatics	5	25	75	100	4
III	RR5BTEL2	MEC2	Immunotechnology	4	25	75	100	4
III	RR5SELO1	NMEC1	Biostatistics	4	25	75	100	4
IV	RR5SB3	SB3	Skill Based-III	2	25	75	100	2
TOTAL				30			700	28
VI-SEMESTER								
III	RR6BT7	CC10	Bioprocess Technology	6	25	75	100	5
III	RR6BT8	CC11	Enzyme Technology	6	25	75	100	5
III	RR6BT9	CC12	Environmental Biotechnology	5	25	75	100	4
III	RR6BTP4	CC13	Major Practical-IV	3	40	60	100	4
III	RR6BTEL3	MEC3	Biotechnology and Human Health	4	25	75	100	4
III	RR6BCELO2	NMEC2	Nutrition & Health Sciences	4	25	75	100	4
V	RR6GS	GS	Gender Studies	2	25	75	100	1
V		Ext. Act	NSS/ NCC/ Sports/ Red Cross	-	-	-	-	1
TOTAL				30			700	28
GRAND TOTAL							3800	140

PART	COURSE	PAPERS	CREDITS
PART-I	TAMIL	4 x 3	12
PART-II	ENGLISH	4 x 3	12
PART-III	CORE	8 x 5 = 40 5 x 4 = 20	60
	ELECTIVES	3 x 4	12
	ALLIED	6 x 4	24
	NON-MAJOR	2 x 4	8
PART-IV	ES, VE	2 x 2	4
	SKILL BASED	3 x 2	6
PART-V	GS	1 x 1	1
	EXT.ACTIVITIES		1
TOTAL PAPERS		38	TOTAL CREDITS 140

Credits : 5
Hours/Week : 6
Medium of Instruction : English
Semester : I

Code: **RR1BT1**

CC1- GENERAL MICROBIOLOGY

UNIT-I

History of microbiology - Basic principles in microscopy, Types of microscopes - light, dark, phase contrast, fluorescent and electron microscope (TEM & SEM).

UNIT-II

A detailed account of general structure, growth and reproduction of Algae, Bacteria, Fungi and Virus. Bacterial classification- three kingdom and five kingdom concept.

UNIT-III

Microbiological Media - types, preparation, techniques of pure culture, maintenance and preservation, Staining - stains and types of staining.

UNIT-IV

Microbial Disease - Water borne disease (Cholera), Food borne disease (Typhoid), Air borne (Pneumonia), Sexually transmitted disease (Syphilis), Vector borne disease (Malaria) - Viral disease (Rabies, HIV) - Fungal disease (Candidiasis).

UNIT-V

Control of Microorganisms - Methods of sterilization, physical agents - chemical agents, chemotherapeutic agents (Penicillin, Streptomycin & Tetracycline).

Text & Reference Books:

1. Prescott L.M, J.D. Harley. and D. A. Klein, (1999). Microbiology, McGraw Hill.
2. Pelczar M.J., Jr., E.C.S. Chang. and N.R. Krieg, (1993). Microbiology - Concepts and Applications, McGraw Hill Company.
3. Ronald M. Atlas, (1987). Microbiology, Fundamentals and Applications, Prentice Hall.
4. Stainer, M. (1986). General Microbiology, McMillan Publishing Co.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	: Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	: Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	: Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 4
Hours/Week : 3
Medium of Instruction : English
Semester : II

Code: **RR2BTP1**

MAJOR PRACTICAL - I

CC3 - LAB IN GENERAL MICROBIOLOGY AND CELL & MOLECULAR BIOLOGY

Lab in Microbiology

1. Laboratory rules and regulations of Microbiology.
2. Microscope and its functions.
3. Media preparation and sterilization.
4. Enumeration of microorganism from soil, water and spoiled food - serial dilution technique.
5. Pure culture technique - Pour plate, Spread plate and Streak plate methods.
6. Biochemical characterization of selected bacteria.
7. Measurement of growth of bacteria.
8. Staining of bacteria - simple, Gram's, spore and capsule.
9. Fungal staining - Wet Mount technique.

Lab in Cell and Molecular Biology

10. Microscopic identification of chromosome in Chironomous larvae.
11. Barr body identification in buccal smear cells.
12. Identification and characterization of different types of Blood cells.
13. Histo-chemical staining techniques.
14. Identification of various stages of cell division (mitosis and meiosis).

Credits : 5
Hours/Week : 6
Medium of Instruction : English
Semester : II

Code: **RR2BT2**

CC2 - CELL AND MOLECULAR BIOLOGY

UNIT-I

Cell as a basic unit - Cell size and shape - cell theory - structure of prokaryotic and eukaryotic cells.

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, endoplasmic reticulum, nucleus, cytoskeleton, ribosomes, vacuoles, peroxisomes and lysosome).

UNIT- III

Cell division (Eukaryotic and Prokaryotic) - mitosis, meiosis and cell cycle. DNA replication - prokaryotes and eukaryotes.

UNIT-IV

Gene expression: Transcription in prokaryotes and eukaryotes post transcriptional modifications. Genetic code. Translation in prokaryotes and eukaryotes post translational modification.

UNIT-V

Regulation of gene expression - regulatory elements- sigma factor, promoter, operator, attenuator. Operon concept- lac, trp, Si RNA.

Text & Reference Books:

1. De Robertis E. D. P. (2001). Cell and Molecular Biology, 8th Edition. Blaze Publishers and Distributors Pvt. Ltd., New Delhi.
2. De Roberties and De Roberties, (2001). Cell Biology, Blaze Publishers & Distributors Pvt. Ltd., New Delhi.
3. Harvey F. Lodish, Arnold Berk, Paul Matsudaira, David Baltimore, S. Lawrence Zipursky. and James Darnell. (1999). Molecular Cell Biology. 4th Edition, W H Freeman and Co. (Sd).
4. James Darnet, Harvey Lodish. and David Baltimore. (1986). Molecular Cell Biology, Scientific American Books Ins.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 5
Hours/Week : 6
Medium of Instruction : English
Semester : III

Code: **RR3BT3**

CC4 - MOLECULAR GENETICS

UNIT-I

Mendelian Principles, principles of population genetics - Hardy Weinberg law, Chromosome structure and functions - Organization of chromosomes, specialized chromosomes, chromosome abnormalities.

UNIT- II

Human Chromosomes - Pedigree analysis, chromosomal analysis - Epistasis - Linkage and crossing over - three point cross -tetrad analysis- chromosome mapping- genome analysis.

UNIT-III

Structure of gene - modern concept of gene, DNA as the genetic material (Griffith, Avery - MacLeod - McCarty experiment) and RNA as a genetic material.

UNIT -IV

DNA structure and functions - Watson crick model, types of DNA, structure of RNA, types and functions. Transposable elements.

UNIT-V

Viruses and their genetic system - Life cycles (lytic and lysogenic), RNA phages, Gene transfer methods - Conjugation, Transformation, Transduction, Transfection.

Text & Reference Books:

1. David Freifelder. (1990). Essentials of Molecular Biology, Narosa Publishing House, New Delhi.
2. Klug, W.S. and M.R. Cummings. (1997). Concepts of Genetics, Prentice Hall, NJ, USA.
3. Gardner E.J., Simmons, M.J, and Squstad, D.P. (1991). Principles of Genetics, John Wiley and Sons, California.
4. Lewin, B. (2008). Genes IX, Jones and Bartlett, London.
5. Darnell, J.E., Baltimore, D. and Lodish, H.F. (1994). Molecular Cell Biology, Scientific American Books, Inc., Virginia.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 4
Hours/Week : 3
Medium of Instruction : English
Semester : IV

Code: **RR4BTP2**

MAJOR PRACTICAL - II

CC6 - LAB IN MOLECULAR GENETICS & rDNA TECHNOLOGY

Lab in Molecular Genetics

1. Isolation of DNA.
2. Estimation of DNA.
3. Transformation in *E. coli*.
4. Replica plate technique.
5. Mutant isolation by gradient plate technique.

Lab in rDNA Technology

6. Preparation of plasmid DNA and genomic DNA from *E. coli*.
7. Preparation of genomic DNA from animals / human / plant.
8. Agarose gel electrophoresis of plasmid and genomic DNA.
9. PCR amplification.*
10. Southern blotting.*
11. Transformation of *E. coli* with plasmid DNA using CaCl₂.*

* Practical by demonstration only.

Credits : 5
Hours/Week : 6
Medium of Instruction : English
Semester : IV

Code: **RR4BT4**

CC5 - rDNA TECHNOLOGY

UNIT-I

Generation of DNA, cutting and joining of DNA molecules - exonucleases, endonucleases, ligases. DNA modifying enzymes - methylase, alkaline phosphatase and topoisomerase.

UNIT-II

Vectors - Plasmids (pBR322, pUC18), Bacteriophage, Phagemids, Cosmids, Ti and Ri plasmids, BAC, YAC, expression vectors, shuttle vectors.

UNIT-III

Transfer of DNA into Cells - transformation, CaCl₂ mediated Ultra-sonication, Electroporation, Micro-injection, Macro-injection, Particle bombardment system and Liposome mediated gene transfer.

UNIT-IV

Cloning in *E. coli*, Bacilli and Yeast. Selection and screening of recombinants (antibiotics, expression basis - GUS expression) Blotting techniques - Southern, Western and Northern blot.

UNIT-V

Construction of genomic libraries and cDNA library, DNA sequencing methods - chemical degradation, chain termination. Application of rDNA Technology in animals - Production of Vaccine - Insulin.

Text & Reference Books:

1. Brown T.A. (2010). Gene Cloning and DNA Analysis: An Introduction, 6th Edition, Wiley-Blackwell.
2. Old, R.W and S.B. Primrose. (1996). Principles of Gene Manipulation: An Introduction to Genetic Engineering, Blackwell Scientific Publications, Oxford.
3. Glover, DM. and B.D. Hames. (1995). DNA Cloning: A Practical Approach, IRL Press, Oxford, Innis,
4. Persing, D.H., K T.F Smith, F.C. Teower and T.J. While. (1993). Diagnostic Molecular Microbiology, ASM Press, Washington, D.C.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 5
Hours/Week : 6
Medium of Instruction : English
Semester : V

Code: **RR5BT5**

CC7- ANIMAL BIOTECHNOLOGY

UNIT-I

Structure and organization of animal cells. Embryology - Gametogenesis and fertilization in animals. *In vitro* fertilizations and embryo transfer, Stem cell culture.

UNIT-II

Animal cell culture: media formulations. Types of cell culture - primary cell culture, secondary cell culture, cell transformation, cell lines, stem cell cultures, cell viability and cytotoxicity. Cryopreservation.

UNIT-III

Construction of animal vectors - SV40, Adenovirus, Baculovirus. Transgenic animals production and application. Hybridoma technology and Xenografting.

UNIT-IV

Gene therapy, mapping of human genome - RFLP and its applications, DNA finger printing and foot printing.

UNIT-V

Ethical issues in animal biotechnology - use of antibodies and nucleic acids, problems in clinical diagnosis of genetic disorders. Merits and demerits of transgenic animals.

Text & Reference Books:

1. Ramadas, P. (2008). Animal Biotechnology, MJP Publishers, Chennai.
2. Ignacimuthu. S. (1995). Basic Biotechnology, Tata McGraw Hill Publishers, New Delhi.
3. Butler, M. (Ed.). (1990). Mammalian Cell Biotechnology - A Practical Approach, Oxford Univ. Press, Oxford.
4. Murray E.J. (Ed). (1991). Gene Transfer and Expression Protocols - Methods in Molecular Biology, Vol.7. Humana Press, Totowa, NJ.
5. Ranga M.M. (2004). Animal Biotechnology, 2nd Edition, Agrobios, India.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	: Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	: Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	: Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 5
Hours/Week : 6
Medium of Instruction : English
Semester : V

Code: **RR5BT6**

CC8 - PLANT BIOTECHNOLOGY

UNIT-I

Plant genome organization. Organization of chloroplast genome, organization of mitochondrial genome, cytoplasmic male sterility. Genomic interaction - Protoplasmic fusion.

UNIT-II

Plant tissue culture - sterilization of explants, media preparation and composition (MS), plant growth hormones - auxin, cytokinins.

UNIT-III

Embryogenesis, organogenesis (direct and indirect callus cultures, production of haploids and cybrids. Plant hormones and phytochrome. Seed storage proteins.

UNIT-IV

Molecular Biology of Plant - pathogen interactions (an overview) - Importance of RFLP in plant Breeding - Ti plasmid vectors for plant transformation. Biochemistry and molecular biology of nitrogen fixation in legumes by Rhizobium. Synthetic seed.

UNIT-V

Transgenic plants - pest resistant, herbicide resistant, disease resistant, drought tolerance, delay fruit ripening, merits and demerits.

Text & Reference Books:

1. Chawla, H.S. (2009). Introduction to Plant Biotechnology, 3rd Edition. New Delhi.
2. Ignachimuthu, S. (1995). Basic Biotechnology, Tata McGraw Hill Publishers, New Delhi.
3. Grierson, D. and S.N. Covey. (1988). Plant Molecular Biology, Blackie & Sons. Ltd.
4. Dubey, R.C. (1993). A Text Book of Biotechnology, 5th Edition S. Chand Publishing Pvt. Ltd., India.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 4
Hours/Week : 3
Medium of Instruction : English
Semester : V

Code: **RR5BTP3**

MAJOR PRACTICAL – III

CC9 - LAB IN ANIMAL BIOTECHNOLOGY, PLANT BIOTECHNOLOGY AND IMMUNOTECHNOLOGY

Lab in Animal Biotechnology

1. Preparation of tissue culture medium.
2. Preparation of single cell suspension from spleen and thymus.
3. Cell counting and viability.
4. Cryopreservation and thawing.

Lab in Plant Biotechnology

1. Surface sterilization.
2. Micro propagation - Direct and Indirect Organogenesis.
3. Protoplast Isolation and culture.
4. Cytological examination of regenerated plants.

Lab in Immunotechnology

1. Blood film preparation and identification of cells.
2. Radial Immune Diffusion.
3. ELISA.
4. Immunodiagnosics - Widal test and Pregnancy test.

Credits : 4
Hours/Week : 5
Medium of Instruction : English
Semester : V

Code: **RR5BTEL1**

MEC1 - BIOINFORMATICS

UNIT-I

Bioinformatics - Overview definition and history. Structure and chemical composition of nucleic acids and proteins.

UNIT-II

Biological resource database - Protein and nucleic acid sequence databases (NCBI, EMBL, GenBank, Swiss-Prot and PIR), Pattern and motif searches (BLOCKS, PRINTS). Structural, classification, Alignment and analysis (SCOP, CATH, FSSP)

UNIT-III

Sequencing analysis - pairs wise comparison; Local (Smith and Waterman algorithm) and Global (Needleman and Wunsch algorithm), BLAST, FASTA. Multiple sequence alignment.

UNIT-IV

Protein prediction - Secondary structure prediction - Chou-Fasman method, predicting 3D structure - comparative (homology) modeling. Protein structure visualization tools - Rasmol, Chime.

UNIT-V

Evolutionary analysis - distance based method, clustering based method - rooted and unrooted tree - phylogenetic trees - PHYLIP.

Text & Reference Books:

1. Attwood, T.K and Parry-Smith. (2006). Introduction to Bioinformatics, 1st Edition, Pearson Education, India.
2. David W. Mount. (2005). Bioinformatics sequence and Genome analysis, 2nd Edition, CBS.
3. Andreas D., Baxevanis. B.F. and Francis Ouellette. (2005). Bioinformatics, 3rd Edition, John Willey & Sons.
4. Brayen Bergeron. (2003). Bioinformatics Computing, M.D. Pearson Education.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 4
Hours/week : 4
Medium of Instruction : English
Semester : V

Code: **RR5BTEL2**

MEC2 - IMMUNOTECHNOLOGY

UNIT-I

Introduction - History and scope of Immunotechnology. Organs of the immune system: bone marrow, spleen, lymph nodes, MALT.

UNIT-II

Types of immunity - Antigen-Antibody reactions. Antigen - types, immunoglobulins - distribution and functions. Lymphoid tissues - ontogeny and physiology and immune system. T & B Cells - receptors - activation and function.

UNIT-III

Cellular interactions in immune response, Hypersensitivity reactions, HLA Tissue typing, transplantation immunity, vaccine production.

UNIT-IV

Immunodiagnostics - precipitation, agglutination, Widal test, pregnancy test. Immunoblotting techniques - ELISA and FISH.

UNIT-V

Autoimmune disorders and immunology of infectious diseases including AIDS. Introduction to tumor immunology - Immune evasion - Immune suppression. General introduction to monoclonal antibodies and vaccines. Structure and functions of cytokines.

Text & Reference Books:

1. Kuby, J. (1997). Immunology, 3rd Edition, W.H. Freeman and Co.
2. Roitt, I.M., J. Brostoff. and D.K. Male. (1993). Immunology, Gower Medical Publishing, London.
3. Benzamini, E., G. Sunshine and Leskpwitz. (1996). Immunology - A Short Course, Willy - Liss.
4. Gabriel Virellce. and Marcel Dekkar. (1993). Introduction to Medical Immunology, W.H Freeman and Co.
5. Donald M. Weir. and John Steward, (1993). Immunology, 7th Edition. ELBS, London.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 5
Hours/week : 6
Medium of Instruction : English
Semester : VI

Code: **RR6BT7**

CC10 - BIOPROCESS TECHNOLOGY

UNIT-I

Isolation, preservation and maintenance of industrially important microorganisms. Major classes of commercial products using micro organisms.

UNIT-II

Basic principles of bioprocess - media formulation for various organisms sterilization methods - batch and continuous sterilization system. Types of fermentation.

UNIT-III

Parts, designing, types of fermentor (batch, fed-batch and continuous bioreactors, Air - lift, stirred tank, tower, fluidized bed, packed bed, pulsed and photo bioreactors) - Downstream processing.

UNIT-IV

Bioprocess control and monitoring of temperature, pressure, agitation and aeration, pH, computers in biocontrol.

UNIT-V

Industrial Production of Chemicals: Alcohol (Ethanol), Acids (Citric) Antibiotics (Penicillin), Amino acids (Lysine), Single Cell Protein (Algae / Fungi) and their applications.

Text & Reference Books:

1. Patel, A.H. (2007). Industrial Microbiology, Macmillan India Limited, New Delhi.
2. Stanbury, P.F. and Whitaker, A., (Eds). (1984). Principles of Fermentation Technology, Pergamon Press, Oxford.
3. Frazier, W.C. and Dennis C. Westhoff. (1995). Food Microbiology, Tata McGraw Hill Publishing Company, New Delhi.
4. Casida, L.E. (2003). Industrial Microbiology, New Age International (P) Ltd., New Delhi.
5. Michael Shuler. and Fikret Kargi. (2002). Bioprocess Engineering: Basic Concepts, 2nd Edition, Prentice Hall, Englewood Cliffs, NJ.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 5
Hours/week : 6
Medium of Instruction : English
Semester : VI

Code: **RR6BT8**

CC11 - ENZYME TECHNOLOGY

UNIT-I

Enzymes - history and general characteristics, definition and IUB enzyme classification. Enzyme specificity, holoenzyme, apoenzyme, coenzyme, cofactors, activators, inhibitors, active site, metallo enzymes.

UNIT-II

Enzyme kinetics - effect of pH, temperature, activator, enzyme and substrate concentration - Michaelis Menten plot and inhibitor kinetics (competitive, uncompetitive and non- competitive). Lineweaver Burk plot, Eadie-Hofstee plot and Hanes Woolf equation. Significance of K_m and V_{max} .

UNIT-III

Enzyme regulation - allosteric modification of enzymes, feedback inhibition and forward simulation. Mode of enzyme action - lock and key hypothesis and induced fit hypothesis.

UNIT-IV

Enzyme catalysis - acid base catalysis, bond catalysis, strain, proximity and orientation effects. Mechanism of action of lysozyme, chymotrypsin, enzyme substrate complex formation - bisubstrate (random and ping pong mechanism).

UNIT-V

Isolation, extraction and purification of enzymes - enzyme immobilization -advantages and disadvantages of immobilization techniques and its applications.

Text & Reference Books:

1. Palmer T. (2004). Enzymes: Biochemistry, Biotechnology and Clinical Chemistry, West Press Edition.
2. Geoffrey L. Zubey., William. W. Parson. and Dennis E. Vance. (1995). Principles of Biochemistry, W.M.C. Brown Publisher.
3. Stanbury, P.F., A. Whitaker. and S.J. Hall. (1997). Principles of Fermentation Technology, Aditya Books Pvt. Ltd., India.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 4
Hours/week : 5
Medium of Instruction : English
Semester : VI

Code: **RR6BT9**

CC12 - ENVIRONMENTAL BIOTECHNOLOGY

UNIT-I

Environment - basic concepts and issues. Environmental Pollution, Water Pollution, sources of pollution and pollutants. Industrial effluents and Domestic wastes. Agrochemical - Heavy metals. Effects, prevention and control of water pollution - Water pollution analysis and monitoring. Soil pollution - sources, effects and its control.

UNIT-II

Air pollution - sources, air pollutants, effects and control measures. Ozone depletion, global warming - Air pollution analysis and monitoring. Noise pollution, radioactive pollution, Thermal pollution - their sources, effects, prevention and control measures.

UNIT-III

Biopesticides: Bacterial (Bt pesticides), fungal (Trichoderma); Viral biopesticides -Baculovirus, NPV insecticides, Production of biofertilizers and biopesticides for large scale application.

UNIT-IV

Biofertilizers and their importance in crop productivity - Algal and fungal (mycorrhizae) biofertilizers, bacterial biofertilizers (rhizobial, free living N₂ fixers and phosphate solubilising bacteria) and their significance and practice.

UNIT-V

Waste water treatment - Sewage and common Industrial effluent treatment - Concepts of bioremediation (*in-situ* & *ex-situ*), Bioremediation of toxic metal ions - Biosorption and Bioaccumulation principles. Concepts of Phyto-remediation - Microbial biotransformation of pesticides and Xenobiotics, Microbial leaching of ores - direct and indirect mechanisms.

Text & Reference Books:

1. Mohapatra, P. K. (2006). Text Book of Environmental Biotechnology, I K International Publishing House Pvt. Ltd., New Delhi.
2. Indu Shekhar Thakur. (2011). Environmental Biotechnology: Basic Concepts and Applications, 2nd Edition, I K International Publishing House Pvt. Ltd., New Delhi.
3. De, A.K. (2004). Environmental Chemistry, Wiley Eastern Ltd., New Delhi.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

Credits : 4
Hours/week : 3
Medium of Instruction : English
Semester : VI

Code: **RR6BTP4**

MAJOR PRACTICAL – IV

CC13 - LAB IN BIOPROCESS TECHNOLOGY, ENZYME TECHNOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY

Lab in Bioprocess Technology

1. Isolation of pure culture - *E. coli*, *Streptomyces*.
2. Isolation of industrially important organisms for the production of amylase and cellulose.
3. Growth - growth curve, measurement of bacterial population by Turbidometry and Serial dilution methods.
4. Study of optimal culture conditions for the production of amylase in a bioreactor.

Lab in Enzyme Technology

1. Isolation, fractionation and purification of enzymes - ALP.
2. Effect of pH, temperature and enzyme substrate concentration on the activity of enzymes ALP.
3. Gel filtration chromatography.
4. Ion Exchange Chromatography.

Lab in Environmental Biotechnology

1. Estimation of Nitrate in Drinking water.
2. Determination of COD and BOD in Sewage water.
3. Determination of Total Dissolved Solids and Suspended Solids of water.

Credits : 4
Hours/week : 4
Medium of Instruction : English
Semester : VI

Code: **RR6BTEL3**

MEC3 - BIOTECHNOLOGY AND HUMAN HEALTH

UNIT-I

Human Genetics and Human Genome - History and development of human genetics - Organization of the human genome. Chromosome and gene organization - Inherited human diseases - single gene diseases, complex traits.

UNIT-II

Gene Therapy - Identification and isolation of disease genes - Cancer genetics - Genetic counseling. Gene therapy. Infectious Diseases - Classification: protozoan, fungal, helminthic, bacterial and viral. Vaccines - types. Hospital - acquired infections (nosocomial), water-borne diseases.

UNIT-III

Antigens and Antibodies - Acquired and Innate Immunity, Immune system, Immune diseases, Allergy. Immunity to infections by viruses, bacteria, fungi and parasites. Blood groups. Monoclonal antibodies.

UNIT-IV

Embryonic Stem Cells - Culture and Therapy. Artificial blood. Amniocentesis. Biochemical and molecular diagnostics.

UNIT-V

IPR - Patents and Copyrights. Human Cloning - Prenatal sex determination and foeticide. Genetically Modified Organisms.

Text & Reference Books:

1. Schacter, Bernice (Ed.). (2006). Biotechnology and Your Health : Pharmaceutical Applications, Chelsea House Publications, New York.
2. Dinesh, K.P. and Chetan, D.M. (2007). Health and Pharmaceuticals Biotechnology, Laxmi Publications (P) Ltd., India.
3. Crommalin, D.J.A., R.D. Sindeler. and B. Meibohm (Eds). (2007). Pharmaceuticals Biotechnology: Fundamentals and Applications, Informa Health Care, London.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	:	Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	:	Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	:	Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)

SYLLABUS FOR

NON MAJOR ELECTIVE

NMEC1 - **RR5BTELO1** for B.Sc., (Statistics) students

NMEC2 - **RR6BTELO2** for B.Sc., (Biochemistry) students

DEPARTMENT OF BIOTECHNOLOGY

Credits : 4
Hours/week : 4
Medium of Instruction : English
Semester : V / VI

Code: **RR5BTELO1 / RR6BTELO2**

NMEC1 / NMEC2 - **HEALTH EDUCATION**

UNIT-I

Dimensions and Determinants of health, Indicators of health - Characteristics of indicators, Types of indicators, Disease agents - Classification of disease agents.

UNIT-II

Nutrition - Classification and functions of food, sources and requirement of Carbohydrates, Proteins, Fats, Vitamins and Minerals, Malnutrition - Protein energy Malnutrition (PEM), Balanced diet - Composition of balanced diet

UNIT-III

Water - Safe and wholesome water, criteria for water quality standards, household purification of water. Air - Health effects of air pollution, prevention and control Ventilation - Standards of ventilation, Light - The requirements of good lighting,

UNIT-IV

Noise - Effects of noise exposure, Types of mental illness - Major and minor illnesses, Causes of mental ill health - Social pathological causes, Preventive aspects - Primary - Secondary - Tertiary.

UNIT-V

Immunization - Vaccines and Immunization Schedule, Principles of disease control and prevention.

Text & Reference Books:

1. Muruges, N. (2002). Health Education and Community Pharmacy, 3rd Edition, Sathya Publishers, Madurai.
2. Park, J.E. and Park. (2000). Text book of Preventive and Social Medicine, 17th Edition, Banarasisdas Publishers, Jabalpur, India.
3. Khurana, S.P.S. (2007). Health Education and Community Pharmacy, S. Vikas Company, India.
4. Kumar, N. (2010). Health Education and Community Pharmacy, 1st Edition, AITBS Publishers, New Delhi.

Question Paper Pattern (Marks: 75) (Time: 3 Hours)

Part - A	: Two Questions from each Unit (No choice)	(10 x 2 = 20 Marks)
Part - B	: Either or Questions (One pair from each Unit)	(5 x 5 = 25 Marks)
Part - C	: Three out of Five (One from each Unit)	(3 x 10 = 30 Marks)