Bhavan's Vivekananda College of Science, Humanities and Commerce, Sainikpuri Autonomous College (Affiliated to Osmania University)
Re Accredited with "A" Grade by NAAC
Template for B Sc Programme under CBCS
Prescribed by TSCHE for implementation from 2023-24 onwards

BSc BIOTECHNOLOGY

FIRST YEAR- SEMESTER I								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
	Environmental Science	AECC-1	2		2	2		2
	English	CC-1A	4		4	4		4
	Second language	CC-2A	4		4	4		4
BT133/BT133P	**Optional I- Cell biology and Genetics**	DSC-1A	4	3	7	4	1	5
	Optional II	DSC-2A	4	3	7	4	1	5
	Optional III	DSC-3A	4	3	7	4	1	5
	TOTAL				**31**			**25**

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FIRST YEAR- SEMESTER II								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
	Computer Skills	AECC -2	2		2	2		2
	English	CC-1B	4		4	4		4
	Second language	CC-2B	4		4	4		4
BT 233/BT233P	Optional I- **Biological Chemistry and Microbiology**	DSC-1B	4	3	7	4	1	5
	Optional II	DSC-2B	4	3	7	4	1	5
	Optional III	DSC-3B	4	3	7	4	1	5
	TOTAL				**31**			**25**

SECOND YEAR- SEMESTER III								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
SE333	**Integrative Pest management**	SEC-I	2		2	2		2
	Communication Skills	AECC-3	2		2	2		2
	English	CC-1C	3		3	3		3
	Second language	CC-2C	3		3	3		3

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BT 333 / BT333P	Optional I- **Molecular Biology and recombinant DNA Technology**	DSC-1C	4	3	7	4	1	5
	Optional II	DSC-2C	4	3	7	4	1	5
	Optional III	DSC-3C	4	3	7	4	1	5
	TOTAL				**31**			**25**

SECOND YEAR- SEMESTER IV

Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
SE433	**Food preservation and adulteration**	SEC-2	2		2	2		2
	Universal Human values	AEC C-4	2		2	2		2
	English	CC-1D	3		3	3		3
	Second language	CC-2D	3		3	3		3
BT 433/ BT433P	Optional I- **Bioinformatics & Biostatistics**	DSC-1D	4	3	7	4	1	5
	Optional II	DSC-2D	4	3	7	4	1	5
	Optional III	DSC-3D	4	3	7	4	1	5
	TOTAL				**31**			**25**

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THIRD YEAR- SEMESTER V								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1E	3		3	3		3
	Second language	CC-2E	3		3	3		3
GE533	**Basics in Biotechnology**	GE	4		4	4		4
BT533A/ BT533AP BT533B/ BT533BP	**Optional I- A/B** **A. Plant Biotechnology** **(OR)** **B. Medical Biotechnology**	DSE - 1E	4	3	7	4	1	5
	Optional- II **A/B**	DSE - 2E	4	3	7	4	1	5
	Optional- III **A/B**	DSE - 3E	4	3	7	4	1	5
	TOTAL				**31**			**25**

THIRD YEAR- SEMESTER VI								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total

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BT633_PW / BT633_O	**Project in Biotechnology/ IPR, Biosafety & Entrepreneurship (Optional)**		4		4	4		4
	Value Added Course- Plant Tissue culture		2	-	2	0		0
	English	CC-1F	3		3	3		3
	Second language	CC-2F	3		3	3		3
BT 633A/ BT633AP BT633B/ GT633BP	**Optional I- A/B** **A. Animal Biotechnology** **(or)** **B. Environmental Biotechnology**	DSE-1F	4	3	7	4	1	5
	Optional- II **A/B**	DSE -2F	4	3	7	4	1	5
	Optional- III **A/B**	DSE -3F	4	3	7	4	1	5
	TOTAL				**33**			**25**

Total credits= 150

AECC: Ability Enhancement Compulsory Course
SEC: Skill Enhancement Course
DSC: Discipline Specific Course
DSE: Discipline Specific Elective
GE: Generic Elective

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Autonomous College
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(Accredited with 'A' grade by NAAC)
Department of Genetics and Biotechnology
Program name: B.Sc BtGC & BtMbC (w.e.f. 2023- '24)
Biotechnology (Optional)

Course Name: Cell Biology and Genetics

Paper Code: BT133 | **No of Classes: 60**
Year/Semester: I/I | **No of Credits: 4**

Skill Development: Knowledge of cell structure, cell division, Mendelian inheritance, recombination, linkage will lay a strong foundation in the field of Cell biology and Genetics.

Course Objective: To evaluate the basic concepts of cell and apply the principles of genetics.

Unit wise Course Objectives:

Cob 1: To distinguish the cell structure and function of prokaryotic and eukaryotic cells.

Cob 2: To analyze all the stages of cell cycle and cell division.

Cob 3: To interpret Mendelian laws and mechanism of inheritance.

Cob 4: To evaluate the fundamentals of recombination, linkage and extensions to Mendelian inheritance.

Unit I: Cell structure and Function **16 hours**

1. Cells as basic units of living organisms- Bacterial, Fungal, Plant and Animal cells. **(2)**
2. Ultra structure of Prokaryotic cell (cell wall, cell membrane, plasmids, Nucleoid). **(1)**
3. Ultrastructure of eukaryotic cell (Cell wall, cell membrane, Nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi complex, vacuoles). **(5)**
4. Fluid mosaic model, Sandwich model, Cell membrane permeability **(3)**

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5. Structure of chromosome-morphology, components of chromosomes (histones and non-histones) Packing of DNA into chromatin, nucleosome, and higher order organization (3)
6. Specialized chromosomes (Polytene and Lampbrush). (2)

Unit II: Cell Division and Cell cycle **14 Hours**

1. Bacterial cell division (2)
2. Eukaryotic cell cycle - phases (2)
3. Mitosis-Stages (spindle assembly) - Significance (2)
4. Meiosis- Stages (synaptonemal complex) - Significance (4)
5. Senescence and necrosis: characteristics & mechanisms. (2)
6. Apoptosis: extrinsic & intrinsic pathways & significance. (2)

Unit III: Principles and mechanism of inheritance **15 Hours**

1. Mendel's experiments - Factors contributing to success of Mendel's experiments (1)
2. Law of segregation - Monohybrid ratio; Law of Independent assortment - Dihybrid Ratio, Trihybrid Ratio. (2)
3. Deviation from Mendel's Laws - Incomplete dominance (Flower color in Mirabilis jalapa), Co-dominance (MN Blood groups), Non allelic interactions-types of epistasis (4)
4. Penetrance and expressivity (Polydactyly), Pleiotropism (Sickle cell anemia), Phenocopy (microcephaly & cleft lip), Multiple alleles (ABO blood groups). (4)
5. Genes and environment – Temperature (Drosophila shibire mutant), Nutrional (Neurospora), Effect on human genes (PKU & Pattern baldness). (1)
6. X-Y chromosomes- Sex determination in Drosophila, Man, X- linked inheritance - Hemophilia & Color blindness, X- inactivation (3)

Unit IV: Linkage, Recombination and extension to Mendel's laws **15 Hours**

1. Linkage and recombination- cytological proof of crossing, phases of linkage, recombination frequency, gene mapping and map distance. (4)
2. Non-Mendelian inheritance- Maternal effect (Shell coiling in snail), Maternal inheritance (Variegation in leaves of Mirabilis jalapa) (4)
3. Cytoplasmic male sterility in maize. (1)

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4. Mitochondrial inheritance in Human (LHON) & Poky in Neurospora crassa (3)

5. Chloroplast inheritance in Chlamydomonas (2)

6. Hardy- Weinberg Equilibrium (1)

Course Outcomes:

By the end of this course, student will be able to

BT133. CO1: Compare the cell structure and function of prokaryotic and eukaryotic cells.

BT133. CO2: Relate the stages of cell cycle and cell division.

BT133. CO3: Solve problems based on Mendelian laws and mechanism of inheritance.

BT133. CO4: Interpret the fundamentals of recombination, linkage and extensions to Mendelian inheritance.

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Paper I- Practicals

Paper Code: BT133P **30 hrs(2 hrs/ week)**
Credits: 1

Skill Development: To comprehend and develop skills in maintaining and handling drosophila and problem solving skills.

Objective: To acquire basic skills like handling the microscope, preparation of slides for microscopic observation and problem solving using Mendelian laws.

1. Microscopic observation of cells: bacterial, fungal, plant and animal cell.
2. Preparation of different stages of Mitosis (garlic root tips).
3. Preparation of different stages of Meiosis (grasshopper testis)
4. Preparation of Polytene chromosomes from drosophila salivary gland
5. Problems on monohybrid and Dihybrid ratio in *Drosophila*/maize.
6. Problems on co-dominance, Epistasis, two-point and three-point test cross, gene mapping.
7. Statistical applications of Hardy-Weinberg Equilibrium.

Outcome: Students evaluate the microscopic handling techniques and develop analytical skills for problem-solving in genetics.

Spotters:

1. Prokaryotic Cell (Bacteria).
2. Mitochondria.
3. Chloroplast.
4. Polytene Chromosomes.
5. Test Cross.
6. Blood Grouping.
7. Hemophilia Pedigree.

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8. Crossing Over.

9. Synaptonemal Complex.

10. Nucleosome Model.

Reference Books:

1. Cell & Molecular Biology. E. D. D De Robertis & E. M. F De Robertis, Waverly publication

2. An Introduction to Genetic Analysis by Anthony, J.F. J.A. Miller, D.T. Suzuki, R.C. Richard Lewontin, W.M-Gilbert, W.H. Freeman publication

3. Principles of Genetics by E. J. Gardner and D. P. Snusted. John Wiley & Sons, New York

4. The science of Genetics, by A. G. Atherly J. R. Girton, J. F. Mcdonald, Saundern College publication.

5. Principles of Genetics by R. H. Tamarin McGrawhill.

6. Theory & problems in Genetics by Stansfield, Schaum out line series McGrawhill.

7. Molecular Cell Biology Lodish, H., Baltimore, D; fesk, A., Zipursky S. L., Matsudaride, P. and Darnel. American Scientific Books. W. H. Freeman, New York.

8. The cell: A molecular approach. Geoffrey M Cooper, Robert E Hausman, ASM press.

9. Cell and Molecular Biology, Concepts and Experiments – Gerald Karp, John Wiley & Sons, Inc.

10. Cell Biology and Genetics by P. K. GUPTA.

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Department of Genetics and Biotechnology
Program name: B.Sc BtGC & BtMbC (w.e.f. 2023- '24)
Biotechnology (Optional)

Course Name: Biological Chemistry and Microbiology

Paper Code: BT233 | **No of Classes: 60**
Year/Semester: I/II | **No of Credits: 4**

Skill Development: Fundamental concepts of biomolecules and their intermediary metabolism will lay a strong foundation in the field of Biochemistry and the basics of Microbiology will help in understanding and comparing microorganisms.

Course Objective: To analyze biological chemistry and understand microbiology.

Unit wise Course Objectives:

Cob 1: To distinguish biomolecules and analyze their structures including enzymes and enzyme action.

Cob 2: To value Intermediary Metabolism of biomolecules.

Cob 3: To understand microbial diversity and disease-causing microorganisms.

Cob 4: To interpret sterilization techniques, isolate microbes in pure form and understand pure culture characteristics.

Unit I: Biomolecules **16 Hours**

1. Carbohydrates- Importance, classification, structure and functions of monosaccharides (glucose and fructose), disaccharides (sucrose, lactose and maltose) and polysaccharides - Homo (starch, glycogen, inulin) and hetero polysaccharides (hyaluronic acid and peptidoglycan). **(4)**
2. Amino acids- Importance, classification, structure, physical and chemical properties of amino acids, peptide bond formation. **(2)**
3. Proteins-importance, structure of proteins- primary, secondary, tertiary, and quaternary. **(2)**
4. Lipids- importance, classification-simple lipids (triacylglycerides and waxes), complex lipids

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(phospholipids and glycolipids), derived lipids (steroids, terpenes, and carotenoids). (2)

5. Nucleic acids: structure and Chemistry of DNA (Watson and Crick Model), forms of DNA (A, B and Z) and RNA (t-RNA) structure. (3)

6. Enzymes – Importance, classification, and nomenclature, Michaelis- Menton Equation, factors influencing the enzyme reactions, enzyme inhibition (competitive, uncompetitive and mixed), co-enzymes (3)

Unit II: Bioenergetics **14 Hours**

1. Glycolysis, Tricarboxylic Acid (TCA) Cycle. (3)
2. Electron Transport, Oxidative Phosphorylation (2)
3. Gluconeogenesis and its significance (2)
4. Transamination and Oxidative deamination reactions of amino acids (3)
5. B-oxidation of Fatty acids (2)
6. Glyoxylate cycle. (2)

Unit III: Fundamentals of Microbiology **15 Hours**

1. Historical development of microbiology and contributors of microbiology (1)
2. Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescent microscopy, Scanning and Transmission electron microscopy. (4)
3. Outlines of Classification of microorganisms-Whittaker classification. (2)
4. Structure and general characteristics of bacteria and virus. (3)
5. Disease causing pathogens and symptoms (Mycobacterium, Hepatitis). (2)
6. Structure and general characteristics of micro-algae and fungi. (3)

Unit IV: Culture and Identification of microorganisms **15 Hours**

1. Methods of sterilization-Physical and chemical methods (2)
2. Bacterial nutrition: nutritional types of bacteria, essential macro and micro nutrients and growth factors (3)
3. Bacterial growth curve– batch and continuous cultures, synchronous cultures, measurement of bacterial growth - measurement of cell number and cell mass. (3)
4. Factors affecting bacterial growth (2)

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5. Culturing of anaerobic bacteria and viruses (3)

6. Pure cultures – characteristics and techniques (2)

Course Outcomes:

By the end of this course, student will be able to

BT233. CO1: To appreciate the structural and functional aspects of various biomolecules including enzymes.

BT233. CO2: To evaluate various biochemical pathways.

BT233. CO3: To interpret microorganism's structure and analyze microbial pathogenesis

BT233. CO4: To identify techniques to isolate them in pure forms and value the pure culture characteristics.

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Paper II- Practicals

Paper Code: BT233P **30 hrs(2 hrs/ week)**
Credits: 1

Skill development: To acquire skills in biochemical and microbiology techniques.

Objective: To provide hands on training in qualitative and quantitative assays of biomolecules and basic microbiological techniques.

1. Preparation of Normal, Molar and Molal solutions
2. Preparation of Buffers (Acidic, Neutral and Alkaline Buffers)
3. Qualitative tests of sugars, amino acids and lipids.
4. Estimation of total sugars by Anthrone method.
5. Separation of amino acids by paper chromatography
6. Estimation of protein by Biuret method.
7. Sterilization methods
8. Preparation of microbiological media (Bacterial, algal and fungal)
9. Isolation of bacteria by streak, spread and pour plate methods
10. Isolation of bacteria from soil.
11. Simple staining and differential staining (gram staining).
12. Bacterial growth curve.
13. Technique of micrometry (Ocular and stage).

Outcome: Expertise in qualitative and quantitative analysis of biomolecules and also in isolation and staining of bacteria.

Spotters:
1. Osazone
2. Globular protein
3. Lock and key model
4. Competitive inhibition

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5. ATP synthase
6. Autoclave
7. Laminar air flow
8. Tyndallisation
9. Bacterial growth curve
10. Hot air oven
12. Serial dilution technique

Reference books:

1. Principles of Biochemistry by David L, Nelson and Cox
2. Biochemistry by Rex Montgomery
3. Harper's Biochemistry by Robert K. Murray
4. Enzymes by Trevor Palmer
5. Enzyme structure and mechanism by Alan Fersht
6. Principles of Biochemistry by Donald J. Voet, Judith G.Voet, Charlotte W.Pratt
7. Analytical Biochemistry by Cooper
8. Principles and techniques of Biochemistry and Molecular Biology Edited by Keith Wilson and John Walker
9. Practical Biochemistry by Plummer
10. Biology of Microorganisms by Brock, T.D. and Madigan, M.T.
11. Microbiology by Prescott, L.M., Harley, J.P. Klein,D.A.
12. Microbiology by Pelczar, M.J, Chan, E.C.S., Ereig, N.R.
13. Microbiological applications by Benson

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