

Telangana State Council of Higher Education, Govt of Telangana
BSc CBCS Common Core Syllabi for All Universities in Telangana (wef 2016 onwards)

**PROPOSED SCHEME FOR BSc BIOTECHNOLOGY PROGRAMME
UNDER CHOICE BASED CREDIT SYSTEM**

FIRST YEAR SEMESTER-I				
<i>Code</i>	<i>Course title</i>	<i>Course type</i>	<i>HPW</i>	<i>Credits</i>
BS101	Communication	AECC-1	2	2
BS102	English	CC-1A	5	5
BS103	Second language	CC-2A	5	5
BS104	OPTIONAL-I	DSC-1A	4T+2P=6	4+1=5
BS105	OPTIONAL-II	DSC-2A	4T+2P=6	4+1=5
BS106	Cell biology and Genetics	DSC-3A	4T+2P=6	4+1=5
			30	27
SEMESTER-II				
BS201	Environmental Studies	AECC-2	2	2
BS202	English	CC-1B	5	5
BS203	Second language	CC-2B	5	5
BS204	OPTIONAL-I	DSC-1B	4T+2P=6	4+1=5
BS205	OPTIONAL-II	DSC-2B	4T+2P=6	4+1=5
BS206	Nucleic Acids and Bioinformatics	DSC-3B	4T+2P=6	4+1=5
			30	27

***Optional III- BIOTECHNOLOGY**

AECC: Ability Enhancement Compulsory Course, DSC: Discipline Specific Course

Career Oriented Courses opted for BSc Biotechnology Under Graduates

S.NO	COURSE	S.NO	COURSE
1.	Applied Biotechnology in Herbal Medicine	23.	Herbal and Medicinal Plants
2.	Applied Techniques in Industry and Laboratory	24.	Herbal Medicine
3.	Biodiversity and Conservation	25.	Herbal Medicines and Technology
4.	Bioinformatics	26.	Identification and Cultivation of Medicinal Plants
5.	Biomedical	27.	Industrial and Applications of Biostatistics
6.	Biotechnology	28.	Industrial and Applications of Medicinal Plants
7.	C.C. in Advanced Biological Techniques	29.	Industrial Microbiology
8.	C.C. in Plant Biotechnology	30.	Medicinal and Aromatic Plants
9.	C.C. in Plant tissue culture	31.	Medicinal Botany
10.	C.C. in Statistics & SPSS	32.	Medicinal Herbs and Mass cultivation
11.	Certificate in Bio-fertilizer Production	33.	Medicinal Plants
12.	Clinical Biochemistry	34.	Medicine and Plants
13.	Computational Biology	35.	Microbial Biotechnology
14.	Computer Assisted Drug Designing and Synthesis	36.	Mushroom cultivation
15.	Computer Soft Skills	37.	Mushroom culture
16.	Diploma in Bioinformatics	38.	Plant Tissue Culture
17.	Diploma in Medical Laboratory Technician	39.	Plant Tissue Culture Technology
18.	Environment Management Applications of Microbiology	40.	Techniques in Biological Research
19.	Fermentation and Alcohol Technology	41.	Entrepreneurship
20.	Food Processing	42.	Entrepreneurship Development
21.	Food Processing Food Technology		
22.	Food science and Quality Control		

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Pattern for OPTIONAL III- BIOTECHNOLOGY COURSE

Semester	Course Type	Credits-Theory	Teaching Hours per week-Theory	Credits-Practicals	Lab hours per week-Practical	Dept workload per week per section
ONE	BS106 (Cell Biology and Genetics)	4	4	1	2	6
TWO	BS206 (Nucleic acids and Bioinformatics)	4	4	1	2	6
THREE	BS306 (Biological Chemistry)	4	4	1	2	6
FOUR	BS406 (Microbiology and Immunology)	4	4	1	2	6
FIVE	BS505 (Molecular Biology and r-DNA technology)	3	3	1	2	5
	BS 508 A- Elective (Plant Biotechnology)/ BS 508 B- Elective (Medical Biotechnology)	3	3	1	2	10 (A+B)
	BS502 GE1: Food Technology	2	2	-	-	2
SIX	BS605 Microbial Technology	3	3	1	2	5
	BS 608 A-Elective (Animal Biotechnology)/ BS 608 B-Elective (Environmental Biotechnology and Biodiversity)	3	3	1	2	10 (A+B)
	BS602 GE2: (Biotechnology Perspectives)	2	2	-	-	2

GE: Generic Elective

SEMESTER-I
CORE THEORY-I
CELL BIOLOGY AND GENETICS

Unit 1: Cell structure and Functions

- 1.1. Cell as basic unit of living organisms-bacterial, fungal, plant and animal cells
- 1.2. Ultrastructure of prokaryotic cell (cell membrane and plasmids, Nucleoid)
- 1.3. Ultrastructure of eukaryotic cell (cell wall, cell membrane, nucleus, mitochondria, chloroplast, endoplasmic reticulum, Golgi apparatus, vacuoles)
- 1.4. Fluid mosaic model, Sandwich model, Cell membrane permeability
- 1.5. Structure of chromosome-morphology, components of chromosomes (histones and non-histones), specialized chromosomes (Polytene, Lampbrush)
- 1.6. Chromosomal aberrations- structural and numerical

Unit 2: Cell cycle

- 2.1 Bacterial cell division
- 2.2 Eukaryotic cell cycle –phases
- 2.3 Mitosis - Stages (spindle assembly)-significance
- 2.4 Meiosis- Stages (synaptonemal complex)-significance
- 2.5 Senescence and necrosis
- 2.6 Apoptosis

Unit 3: Principles and mechanism of inheritance

- 3.1 Mendel's experiments- factors contributing to success of Mendel's experiments
- 3.2 Law of segregation- Monohybrid Ratio; Law of independent assortment- Dihybrid Ratio, Trihybrid Ratio
- 3.3 Deviation from Mendel's laws- partial or incomplete dominance (eg: Flower Color in *Mirabilis jalapa*), Co-dominance (eg: MN Blood groups), Non allelic interactions-types of epistasis, modification of dihybrid ratios
- 3.4 Penetrance and Expressivity (eg: Polydactyly, Waardenburg syndrome), pleiotropism, phenocopy- microcephaly, cleft lip
- 3.5 Multiple allelism (eg: Coat color in Rabbits, eye color in *Drosophila* and ABO Blood groups)
- 3.6 X-Y chromosomes - Sex determination in *Drosophila*, Birds, Man, *Bonellia*; X-linked inheritance– Hemophilia and Color blindness; X-inactivation; Y-linked inheritance- Holandric genes

Unit 4: Linkage, Recombination and Extension to Mendel's Laws

- 4.1 Linkage and recombination- Cytological proof of crossing over, phases of linkage, recombination frequency, gene mapping and map distance
- 4.2 Non-Mendelian Inheritance – Maternal effect (Shell coiling in snail), variegation in leaves of *Mirabilis jalapa*
- 4.3 Cytoplasmic male sterility in Maize and *Paramecium*,
- 4.4 Mitochondrial inheritance in human and poky in *Neurospora crassa*
- 4.5 Chloroplast inheritance in *Chlamydomonas*
- 4.6 Hardy-Weinberg Equilibrium, allelic and genotypic distribution

CORE-I: PRACTICALS

1. Microscopic observation of cells: bacteria, fungi, plant and animal
2. Preparation of different stages of Mitosis (onion root tips)
3. Preparation of different stages of Meiosis (grasshopper testis)
4. Preparation of Polytene chromosome from *Drosophila* salivary gland
5. Identification, maintenance and culturing of *Drosophila* stock
6. Monohybrid and dihybrid ratio in *Drosophila*
7. Monohybrid and dihybrid ratio in Maize
8. Problems on co-dominance, epistasis, two point and three point test cross, gene mapping, Tetrad analysis
9. Statistical applications of t-test
10. Statistical applications chi square test
11. Statistical applications of Hardy-Weinberg Equilibrium

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

SEMESTER II
CORE THEORY II
NUCLEIC ACIDS & BIOINFORMATICS

Unit 1: Nucleic Acids and Genome organization

- 1.1 DNA as the genetic material- Griffith's experiments on transformation in *Streptococcus pneumoniae*, Hershey-Chase experiments with radio labeled T2 bacteriophage, Avery, MacLeod and McCarty's experiments
- 1.2 RNA as genetic material- Tobacco Mosaic Virus
- 1.3 Structure and forms of DNA (A, B and Z)
- 1.4 Genome organization in prokaryotes
- 1.5 Genome organization in eukaryotes, C-value and C-value paradox, Reassociation kinetics-cot curve, Denaturation, Renaturation, T_m curve
- 1.6 Kinetic classes of DNA- unique sequences, moderately repeated and highly repeated sequences; tandem repeats (satellite, minisatellite and micro satellites), interspersed repeats (SINES-eg: Alu repeats, LINES); palindromic sequences and transposable genetic elements

Unit 2: DNA Replication, Recombination and Repair

- 2.1 DNA replication- enzymes; semi conservative DNA replication-Messelson and Stahl experiment; Linear, Circular, Rolling circle, Theta, D loop models
- 2.2 Mutation- spontaneous, induced (frame shift, transition, transversion)
- 2.3 Physical and chemical mutagens
- 2.4 DNA damage- intrinsic and extrinsic factors
- 2.5 DNA repair-Direct, Excision and methyl mediated mismatch, recombinational and SOS repair
- 2.6 DNA recombination-homologous, site specific recombination and NHEJ (Non-Homologous End Joining)

Unit 3: Concepts of Bioinformatics

- 3.1 Bioinformatics – a historical perspective
- 3.2 Internet and its role in bioinformatics
- 3.3 Bioinformatics Data: Genomes, nucleic acids, proteins, protein structures
- 3.4 Storage of databases in DNA (GenBank, EMBL, DDBJ)
- 3.5 Protein data banks (PDB, SWISS-PROT, UNIPROT, PIR) and their utilization
- 3.6 Data retrieval tools-BLAST, ENTREZ

Unit 4: Applications of Bioinformatics

- 4.1 Genome annotation: Gene identification tools
- 4.2 Basics of sequence alignment, Pairwise alignment (global and local)
- 4.3 Multiple sequence alignment and phylogenetic analysis
- 4.4 Structural classification of proteins and homology model building
- 4.5 Applications of Bioinformatics- drug targets, overview of drug designing
- 4.6 Concepts of Pharmacogenomics

CORE-II: PRACTICALS

1. Isolation of DNA from Plant cells
2. Isolation of DNA from Animal cells
3. Estimation of DNA by Diphenylamine method
4. Estimation of RNA by Orcinol method
5. Exploring data bases: Genbank and Uniprot
6. Exploring the structural data bases: PDB, MMDB
7. Visualization of Protein structures-RASMOL
8. Database searching and downloading bioinformatics data- DNA (Gen bank, DDBJ, ENA) Protein (Uniprot)
9. Pairwise sequence alignment (global and local) of DNA and proteins
10. Multiple sequence alignment of DNA & protein sequences using ClustalW
11. Database searching with heuristic algorithms: BLAST

REFERENCE BOOKS

1. Genes VII. Benjamin Lewin, Oxford Univ. Press, Oxford
2. Molecular Biology by D. Freifelder Narosa Publishing house New York, Delhi
3. Molecular Cell Biology Lodish, H., Baltimore, D; fesk, A., Zipursky S.L., Matsudaride, P. and Darnel. American Scientific Books. W.H. Freeman, NewYork
4. Molecular Biology by Brown
5. Essentials of Molecular Biology. D. Freifelder, Panima Publishing Corporation.
6. Bioinformatics: Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press
7. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids by Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Cambridge University Press
8. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Andreas D. Baxevanis, B. F. Francis Ouellette, Wiley-Interscience
9. Bioinformatics tools and Resources – free online tools, downloadable free tools, software packages, internet, Bioinformatics books and Journals, Bioinformatics web-portals