

Telangana State council of Higher Education, Govt. of Telangana
B.Sc. CBCS Common Core Syllabi for all Universitites in Telangana

Proposed Scheme for B.Sc. Programme under Choice Based Credit System – Dept. of Genetics				
First Year – Semester I				
Code	Course Title	Course Type	HPW	Credits
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	Classical 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	Cytogenetics	DSC-3B	4T+2P=6	4+1=5
			30	27

***Optional III considered as Genetics Course**

Career Oriented Courses that can be opted by B.Sc. Genetics Undergraduates

1. Advanced Diploma in Biotechnology
2. Advanced Diploma in Healthcare Informatics and Management
3. Applied Biotechnology in Herbal Medicine
4. Applied Techniques in Industry and Laboratories
5. Biodiversity and Conservation
6. Bioinformatics
7. Biotechnology
8. C.C. Hospital Waste Management
9. C.C. Advance Biological Techniques
10. C.C. in Biodiversity
11. C.C. in Plant Biotechnology
12. C.C. in Plant tissue Culture
13. C.C. in Statistics and SPSS
14. C.C. on Statistical Package R
15. Certificate in Bio-fertilizer Production
16. Certificate Programme in Health Care
17. Clinical Biochemistry
18. Clinical Pathology
19. Computation with Matlab
20. Computational Biology
21. Computer assisted Drug Designing and Synthesis
22. Computer Programing and Utilization
23. Computer and Software skills
24. Database Management System
25. Diploma in Bioinformatics
26. Diploma in in Medical Laboratory Technician
27. Diploma in Medical Transcription
28. Diploma Nano Science and Nano Technology
29. Drug Analysis
30. Fermentation and Alcohol Technology
31. Health care and Waste Management
32. Herbal Medicine
33. Herbal Medicine and Tech.
34. Hospital Waste Disposal Management
35. Identification and Cultivation of Medicinal Plants
36. Industrial and Applications of Biostatistics
37. Industrial applications of Medicinal Plants
38. Medical Lab Technology
39. Medical Laboratory Technician
40. Medicinal Plants
41. Microbial Biotechnology
42. Plant Tissue Culture
43. Plant Tissue Culture Technology
44. Tissue Culture
45. Vermicomposting

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**Department of Genetics
Scheme Pattern in Genetics for B.Sc. Course-CBCS**

Semester	Course Type	Credits - Theory	Teaching hours/week- Theory	Credits - Practicals	Lab hours/week- Practical	Dept. workload/ week/section
ONE	BS106- Classical Genetics	4	4	1	2	6
TWO	BS206- Cytogenetics	4	4	1	2	6
THREE	BS306- Microbial Genetics	4	4	1	2	6
FOUR	BS406- Molecular Genetics	4	4	1	2	6
FIVE	BS505-Plant Genetics	3	3	1	2	5
	BS508A - Bioinformatics / BS508B - Animal Genetics	3	3	1	2	10 (A+B)
	BS502 - Genetics - Science and Technology	2	2	-	-	2
SIX	BS605 - Human Genetics	3	3	1	2	5
	BS608A - Medical Genetics / BS608B - Plant Biotechnology	3	3	1	2	10 (A+B)
	BS602 - Computational Genetics	2	2	-	-	2

B.Sc. Genetics
Semester I
Paper I – Theory (BS106) - DSC
Title – Classical Genetics

Unit I: Mendelian Inheritance

1. Mendel's experiments- Choice of material, characters. Terminology and definitions –phenotypes, genotype, locus, allele, homozygotes, heterozygotes, Johanssen's Pure line concept, filial generations, reciprocal cross, back cross, test cross.
2. Law of Segregation- Monohybrid crosses with examples, Law of Independent Assortment – Dihybrid and Trihybrid crosses with examples.
3. Variations to Dominance - Penetrance and Expressivity; Co-dominance & Incomplete dominance, Pleiotropism.
4. Lethal and Sub-lethal Genes – Dominant and recessive lethals. Balanced lethals – *Drosophila* (Cy /Pm, H / Sb).
5. Paramutation – mottling phenotypes in maize; Segregation distortion – Sd gene in *Drosophila*.
6. Features of Quantitative Inheritance – Additive effect; Kernel colour in Maize, skin colour, height and IQ in man. Effect of Temperature, altitude etc.
7. Multifactorial inheritance – Hypertension, Diabetes mellitus.

Unit II: Extensions to Mendelian Genetics

1. Gene-Gene Interactions - Different types of Epistasis with examples from different organisms.
2. Multiple alleles – theories of multiple allelic inheritance- Eye color in *Drosophila*, coat color in mice and rabbits. ABO blood groups, blood group incompatibility in transfusion. Self incompatibility in plants.
3. Extrachromosomal inheritance in *Paramecium*, Yeast, *Drosophila*.
4. Sex linked inheritance: X—linked and Y-linked traits.
5. Sex chromosome inactivation – dosage compensation
6. Gynandromorphs.

Unit III: Linkage and gene mapping

1. Cytological proof of crossing over
2. Phases of linkage, test cross, recombination frequency, gene mapping, determination of map distances based on two and three point test crosses, coincidence, interference eg. *Drosophila* and Maize
3. Tetrad analysis – *Neurospora*
4. Mitotic crossing over - *Drosophila*

Unit IV: Organellar inheritance

1. Non-Mendelian inheritance.
2. Variegation in leaves of higher plants – *Mirabilis jalapa*.
3. Maternal inheritance – poky mutants in *Neurospora*, shell coiling in snails, Leber's optic atrophy.

4. Uniparental inheritance – mutations in extra nuclear genes in Chlamydomonas, Male sterility in Maize, Plasmids, Is elements.
5. Mitochondrial and Chloroplast genomes, evolutionary significance

Paper I – Practicals

1. Scoring of Drosophila and Maize cobs for Monohybrid and Dihybrid segregations.
2. Problems on Mendelian Segregations (Monohybrid, Dihybrid & Trihybrid Crosses).
3. Problems on Multiple alleles and non-allelic interactions.
4. Problems on Linkage analysis and mapping of genes.
5. Phenotyping of ABO blood groups.
6. Screening for Barr body.

Recommended Books

1. **Genetics - Strickberger**
2. **Theory and problems in Genetics - Stansfield**
3. **Genetics - Redei**
4. **Genetics - Ursula Goodenough**
5. **Introduction to Genetic Analysis - Suzuki, Griffith, Richard and Lewontin.**
6. **Principles of Genetics - Gardner, Simmons and Snustad.**
7. **Principles of Genetics - Simmons and Snustad.**
8. **Concepts of Genetics - Klug and Cummings.**

Semester II
Paper II – Theory (BS206) - DSC
Title – Cytogenetics

Unit I: Cell division and Chromosome segregation.

1. Eukaryotic Cell cycle - Phases of cell cycle G₀, G₁, S, G₂.
2. Genes that determine the cell cycle – cyclins, CDK proteins, role of p⁵³ in cell cycle.
3. Mitosis – Stages in mitotic cell division- significance of mitosis.
4. Meiosis - Formation of Synaptonemal complex, crossing over, chiasma formation, significance of meiosis.

Unit II: Chromosome structure, chromatin organization and variation

1. Chromosome morphology- size and shape; Euchromatin and Heterochromatin- constitutive and facultative heterochromatin.
2. Components of chromatin, histones & non-histones.
3. Packing of DNA into chromatin – Nucleosome and higher order organization.
4. Specialized Chromosomes – Lampbrush chromosomes, Polytene Chromosomes, Super numerary chromosomes.
5. Chromosome Variation – Structural aberrations- duplications, deletions, inversions & translocations with examples, Genetic consequences.
6. Numerical aberrations – aneuploidy, euploidy auto-polyploidy and allo-polyploidy, Genetic consequences.

Unit III: Cell communication and signaling

1. Overview of extracellular and intracellular signaling.
2. Basics of cell signaling – paracrine, endocrine, autocrine.
3. Tight junctions and gap junctions.
4. Secondary messengers and their role in cell communication and signaling (cAMP, phosphatidylinositol, Ca⁺² and IP₃).
5. G-protein coupled receptors and Tyrosine Kinase receptors.

Unit IV: Dysregulation of Cell cycle

1. Necrosis, senescence, programmed cell death (apoptosis).
2. Mechanism of necrosis, senescence and programmed cell death (intrinsic and extrinsic factors).
3. Cancer as a negative regulator of cell cycle.

Paper II – Practicals

1. Study of Mitosis in Onion root tips.
2. Study of Meiosis in Maize/Grasshopper.
3. Preparation of Drosophila salivary gland chromosomes.
4. Identification of structural and numerical aberrations

Recommended Books

1. Cytology and cytogenetics - Swanson, Merz and Young
2. Cell & Molecular Biology – E.D.D. De Robertis & E.M.F. De Robertis
3. Molecular Biology of the Cell – Bruce Alberts