Telangana State Council of Higher Education, Govt. of Telangana
B.Sc., CBCS Common Core Syllabi for all Universities in Telangana
BSc GENETICS (*wef* 2019-20)

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
FIRST YEAR- SEMESTER I				
BS 101	Environmental Science/Basic Computer Skills	AECC-1	2	2
BS 102	English	CC-1A	4	4
BS 103	Second language	CC-2A	4	4
Bs 104	**Optional I- Transmission Genetics**	DSC-1A	4T+3P=7	4+1=5
BS 105	Optional II	DSC-2A	---------	4+1=5
BS 106	Optional III	DSC-3A	---------	4+1=5
	TOTAL			**25**
FIRST YEAR- SEMESTER II				
BS 201	Gender Sensitization	AECC-2	2	2
BS 202	English	CC-1B	4	4
BS 203	Second language	CC-2B	4	4
BS 204	Optional I- **Molecular Genetics & Genetic Engineering**	DSC-1B	4T+3P=7	4+1=5
BS 205	Optional II	DSC-2B	-----	4+1=5
BS 206	Optional III	DSC-3B	-------	4+1=5
	TOTAL			**25**
SECOND YEAR- SEMESTER III				
BS 301	**Genetic Analysis & Model organisms**	SEC-I	2	2
BS 302	**Cytogenetics- Lab Processing and Analysis**	SEC-2	2	2
BS 303	English	CC-1C	3	3
BS 304	Second language	CC-2C	3	3
BS 305	Optional I- **Biostatistics & Bioinformatics**	DSC-1C	4T+3P=7	4+1=5
BS 306	Optional II	DSC-2C	---------	4+1=5
BS 307	Optional III	DSC-3C	----------	4+1=5
	TOTAL			**25**
SECOND YEAR- SEMESTER IV				
BS 401	**Analytical Techniques in Molecular Genetics**	SEC-3	2	2
BS402	**DNA technology in health care & Transgenics**	SEC-4	2	2
BS 403	English	CC-1D	3	3
BS 404	Second language	CC-2D	3	3
BS 405	Optional I- **Population Genetics & Evolution**	DSC-1D	4T+3P=7	4+1=5
BS 406	Optional II	DSC-2D	--------	4+1=5
BS 407	Optional III	DSC-3D	---------	4+1=5
	TOTAL			**25**

THIRD YEAR- SEMESTER- V				
CODE	**COURSE TITLE**	**COURSE TYPE**	**HPW**	**CREDITS**
BS 501	English	CC-1E	3	3
BS 502	Second language	CC-2E	3	3
BS 503	**Basic & Applied Genetics**	GE	4	4
BS 504	**Optional I- A/B** **A. Plant Genetics & Biotechnology** **(or)** **Animal Cell Technology & Animal Genetics**	DSE -1E	4T+3P=7	4+1=5
BS 505	Optional- II **A/B**	DSE -2E	------	4+1=5
BS 506	Optional- III **A/B**	DSE -3E	-------	4+1=5
	TOTAL			**25**
THIRD YEAR- SEMESTER- VI				
BS 601	**Project in Genetics/Optional Paper**	Project work		4
BS 602	English	CC-1F	3	3
BS 603	Second language	CC-2F	3	3
BS 604	**Optional I- A/B** **A. Human Genome & Human Genetics** **(or)** **Cellular & Molecular Immunology**	DSE-1F	4T+3P=7	4+1=5
BS 605	Optional- II **A/B**	DSE -2F	--------	4+1=5
BS 606	Optional- III **A/B**	DSE -3F	-------	4+1=5
	TOTAL			**25**
	TOTAL Credits			**150**

Total credits= 164-12 (AECC 4 + SEC 8) =15

AECC: Ability **E**nhancement **C**ompulsory **C**ourse
SEC: S*kill* ***E****nhancement* ***C****ourse*
DSC: D*iscipline* ***S****pecific* ***C****ourse*
DSE: D*iscipline* ***S****pecific* ***E****lective*
GE: ***G****eneric* ***E****lective*

BSc GENETICS I YEAR
SEMESTER- I
DSC-Paper- I: TRANSMISSION GENETICS

Credit- 1: Mendelian inheritance and its extensions

1.1. Mendel's experiments; Law of segregation, monohybrid cross, reciprocal cross, back cross, test cross; Law of independent assortment, dihybrid cross; Chromosomal theory of Inheritance

1.2. Variations to dominance- Co-dominance and Incomplete dominance; Lethal and Sub-lethal genes, Penetrance and Expressivity; Pleiotropism; Multiple alleles- Eye colour in Drosophila, ABO blood groups in human; Rh Blood group incompatibility; Self incompatibility in plants

1.3. Gene interactions– types of epistasis (9:7; 9:3:4; 9:6:1; 12:3:1; 15:1)

1.4. Multifactorial inheritance: Features of quantitative inheritance- additive effect, Kernel colour and size in wheat /maize, skin color in man

1.5. Sex linked inheritance – X-linked and Y-linked traits – holandric genes, SRY gene; Sex limited and sex influenced traits; Sex determination –mechanisms of sex determination in Drosophila and Human

1.6. Non-medelian inheritance: Plastid inheritance – Variegation in *Mirabilus jalapa;* Maternal effects and inheritance – Shell coiling in snails, Poky mutants in *Neurospora*.

Credit- 2: Linkage, Crossing over and Gene mapping

2.1 Discovery of linkage – Phases of linkage

2.2 Chiasmata and Crossing over formation– Recombination

2.3 Cytological proof for crossing over – Curt Stern and McClintock experiments

2.4 Linkage analysis – Recombination frequencies, Two-point and Three-point crosses

2.5 Gene mapping – Coincidence and Interference, Determination of gene order

2.6 Gene mapping in Neurospora – Tetrad analysis; Mitotic recombination in *Aspergillus* and Drosophila

Credit- 3: Cell division and Chromosome segregation.

3.1 Eukaryotic Cell cycle – Phases of cell cycle G0, G1, S, G2

3.2 Regulation of cell cycle cyclins, CDK proteins, role of p^{53} in cell cycle

3.3 Mitosis – Stages in mitotic cell division- significance of mitosis

3.4 Meiosis – Formation of Synaptonemal complex, crossing over, chiasma formation, significance of meiosis

3.5 Apoptosis – extrinsic & intrinsic pathways, & significance

3.6 Senescence, Necrosis –characteristics & mechanisms

Credit- 4: Chromosome structure, chromatin organization and variation

4.1 Chromosome morphology- size and shape; Euchromatin and Heterochromatin- constitutive and facultative heterochromatin
4.2 Components of chromatin, histones & non-histones
4.3 Packing of DNA into chromatin – Nucleosome and higher order organization
4.4 Specialized Chromosomes – Lampbrush chromosomes, Polytene Chromosomes
4.5 Chromosome Variation Structural aberrations-duplications, deletions, inversions & translocations with examples, Genetic consequences
4.6 Numerical aberrations – aneuploidy, euploidy auto-polyploidy and allo-polyploidy, Genetic consequences

Credit- 5: Practicals

1. Identification of normal and mutant stocks of Drosophila
2. Drosophila- monohybrid and dihybrid segregation
3. Problems on Mendelian segregations- monohybrid, dihybrid and trihybrid crosses; multiple alleles, non-allelic interactions, multi-factorial inheritance; linkage and mapping of genes.
4. Neurospora – tetrad analysis
5. Study of Mitosis in Onion root tips
6. Study of Meiosis in Maize/Grasshopper
7. Preparation of Drosophila salivary gland chromosomes
8. Identification of structural and numerical aberrations

Recommended Books

1. Genetics by Gardener
2. Theory and problems in Genetics by Stansfield
3. Introduction to Genetic Analysis by Suzuki, Griffith, Richard and Lewontin
4. Genetics by Strickburger
5. Genetics by Snustad & amp; Simmonds
6. Principles of Genetics by Tamarin
7. Cell & Molecular Biology – E.D.D. De Robertis & E.M.F. De Robertis
8. Molecular Biology of the Cell – Bruce Alberts

BSc GENETICS I Year
SEMESTER- II
DSC-Paper II: MOLECULAR GENETICS & GENETIC ENGINEERING

Credit-1: Nucleic acids, DNA replication & DNA repair

1.1 DNA as the genetic material-Griffiths transformation experiment, Avery, MacLeod and McCarty's experiments and Hershey & Chase phage-labelling experiment; RNA as genetic material- tobacco mosaic virus
1.2 Chemistry of Nucleic acids- Nucleotides, Franklin's X-ray crystallography, Chargaff's rule, Watson-Crick model and forms of DNA (A, B & Z); types of RNA (rRNA, mRNA & tRNA)
1.3 DNA replication-conservative, semi-conservative and dispersive models, Meselson–Stahl experiment; Mechanisms of DNA replication-linear, circular, rolling circle, D-loop and θ- models
1.4 DNA replicative enzymes (DNA polymerases, helicase, primase, ligase, telomerase, nuclease & topoisomerases) and proteins (initiator protein & single strand binding proteins);
1.5 Mutations: types of mutations- transition, transversion, frame shift, silent, mis-sense and non-sense; Induced mutations- physical and chemical mutagens
1.6 DNA damage and repair mechanisms - direct, excision and mismatch, SOS non- homologous end joining (NHEJ)

Credit-2: Gene expression in Prokaryotes & Eukaryotes

2.1 Structure of prokaryotic gene; Structure of eukaryotic gene; structure and functions of RNA polymerase & it's subunits in prokaryotes
2.2 Transcriptional machinery in eukaryotes (RNA polymerases) and their structural and functional features
2.3 Genetic code-properties, deciphering of genetic code, Wobble hypothesis
2.4 Transcription mechanism-initiation, elongation & proof reading, termination (rho independent & rho dependent)
2.5 Transcription in eukaryotes-Initiation, elongation & termination factors
2.6 Translation mechanism- initiation, elongation and termination

Credit-3: Gene regulation in prokaryotes & eukaryotes

3.1 Prokaryotic transcriptional regulation (negative control)- Operon concept-lac operon & glucose effect
3.2 Prokaryotic transcriptional regulation (positive control)- tryptophan operon
3.3 Post-transcriptional modifications- capping, poly- adenylation
3.4 Splicing and alternate splicing, rRNA and tRNA splicing
3.5 Post-translational modifications-glycosylation, lipidation, acetylation, ubiqutination and chaperones
3.6 Gal locus regulation in yeast- regulation of mating type

Credit-4: Microbial Genetics & Genetic Engineering

4.1 Transformation- competence of bacterial cells; mechanism of transformation; gene mapping by transformation; Transduction: generalized transduction, co-transduction and linkage; Mapping by co-transduction, Specialized transduction

4.2 Conjugation- unidirectional gene transfer- F^+ and F^- High frequency recombination, Gene mapping by conjugation

4.3 Introduction to r-DNA technology; enzymes used in molecular cloning- restriction endonucleases, DNA modifying enzymes- methylases, polymerases, ligases and phosphatases

4.4 Vectors used in cloning: *E.Coli*, plasmid vectors- pBR322, pUC vectors; cosmids; shuttle vectors- yeast vectors

4.5 Strategies for genomic libraries and cDNA libraries construction:

4.6 Screening for detection of cloned genes-antibiotic resistance, blue-white screening; Blotting techniques (Southern, Western & Northern)

Credit-5: Practicals

1. Extraction of genomic DNA
2. Quantification of DNA by spectrophotometer
3. Agarose gel electrophoresis of DNA
4. Estimation of DNA by DPA method
5. Estimation of RNA by orcinol method
6. Effect of UV on bacterial growth
7. Preparation of competent cells of bacteria
8. Problems on restriction mapping

Recommended Books

1. Principles of Genetics- Irwin Herscowitz
2. Molecular Biology of the gene- Watson, Hopkins, Roberts, Steitz and Weiner
3. Genes- Benjamin Levin
4. General virology- Luria, Darnell, Baltimore and Campbell
5. Molecular Biology- David Frefielder
6. Practical Microbiology- Aneja
7. Microbial Genetics By Maloy, Freifelder
8. Molecular Genetics By Gunther and Stent
9. Genetic Analysis By Griffith, Suzuki and others
10. Gene cloning and DNA analysis: an introduction / T.A. Brown