Telangana State Council of Higher Education, Govt. of Telangana
B.Sc., CBCS Common Core Syllabi for all Universities in Telangana
(*wef* 2016-2017)

PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN BSc GENETICS

FIRST YEAR- SEMESTER I

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 101	Communication	AECC-1	2	2
BS 102	English	CC-1A	5	5
BS 103	Second language	CC-2A	5	5
BS 104	Optional I	DSC-1A	4T=2P=6	4+1=5
BS 105	Optional II	DSC-2A	4T=2P=6	4+1=5
BS 106	**Optional III- Classical Genetics**	DSC-3A	4T=2P=6	4+1=5
	TOTAL			**27**

FIRST YEAR- SEMESTER II

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 201	Environmental studies	AECC-2	2	2
BS 202	English	CC-1B	5	5
BS 203	Second language	CC-2B	5	5
BS 204	Optional I	DSC-1B	4T=2P=6	4+1=5
BS 205	Optional II	DSC-2B	4T=2P=6	4+1=5
BS 206	**Optional III- Cytogenetics**	DSC-3B	4T=2P=6	4+1=5
	TOTAL			**27**

SECOND YEAR- SEMESTER III

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 301	**Basic Statistics and Genetic Analysis**	SEC-I	2	2
BS 302	English	CC-1C	5	5
BS 303	Second language	CC-2C	5	5
BS 304	Optional I	DSC-1C	4T=2P=6	4+1=5
BS 305	Optional II	DSC-2C	4T=2P=6	4+1=5
BS 306	**Optional III- Molecular Genetics**	DSC-3C	4T=2P=6	4+1=5
	TOTAL			**27**

SECOND YEAR- SEMESTER IV

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 401	**Cytogenetics- Lab Processing and Analysis**	SEC-2	2	2
BS 402	English	CC-1D	5	5
BS 403	Second language	CC-2D	5	5
BS 404	Optional I	DSC-1D	4T=2P=6	4+1=5
BS 405	Optional II	DSC-2D	4T=2P=6	4+1=5
BS 406	**Optional III-Microbial Genetics & Genetic Engineering**	DSC-3D	4T=2P=6	4+1=5
	TOTAL			**27**

THIRD YEAR- SEMESTER- V

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 501	**Analytical Techniques in Molecular Genetics**	SEC-3	2	2
BS 502	**Foundations of Genetics**	GE-1	2T	2
BS 503	Optional - I	DSC-1E	3T=2P=5	3+1=4
BS 504	Optional- II	DSC-2E	3T=2P=5	3+1=4
BS 505	**Optional- III- Biostatistics & Bioinformatics**	DSC-3E	3T=2P=5	3+1=4
BS 506	Optional I- A/B	DSC-1E	3T=2P=5	3+1=4
BS 507	Optional II- A/B	DSC-2E	3T=2P=5	3+1=4
BS 508	**Optional III- A/B** **A. Plant Genetics & Biotechnology** **(or)** **B. Animal Cell Technology & Animal Genetics**	DSE-3E	3T=2P=5	3+1=4
	TOTAL		**34**	**28**

THIRD YEAR- SEMESTER- VI

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 601	**DNA Technology in Health Care &Transgenics**	SEC-4	2	2
BS 602	**Applied Genetics**	GE-2	2T	2
BS 603	Optional - I	DSC-1F	3T=2P=5	3+1=4
BS 604	Optional- II	DSC-2F	3T=2P=5	3+1=4
BS 605	**Optional- III- Population Genetics & Evolution**	DSC-3F	3T=2P=5	3+1=4
BS 606	Optional I- A/B	DSC-1F	3T=2P=5	3+1=4
BS 607	Optional II- A/B	DSC-2F	3T=2P=5	3+1=4
BS 608	**Optional- III- A/B** **A. Human Genome & Human Genetics** **(or)** **B. Cellular& Molecular Immunology**	DSE-3F	3T=2P=5	3+1=4
	TOTAL		**34**	**28**
	TOTAL Credits			**164**

Total credits= 164-12 (AECC 4 + SEC 8) =152

AECC:Ability **E**nhancement **C**ompulsory **C**ourse
SEC:Skill Enhancement Course
DSC:Discipline Specific Course
DSE:Discipline Specific Elective
GE:Generic Elective

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Department of Genetics
Scheme Pattern for each optional in Genetics for BSc Course

Year	Semester	Course Type	Credits/ Theory	Teaching hours/ week-Theory	Credits-Practicals	Lab hours/ week-Practical	Dept. workload/ week/ section
FIRST YEAR	**ONE**	**BS106-Classical Genetics**	**4**	**4**	**1**	**2**	**6**
	TWO	**BS206-Cytogenetics**	**4**	**4**	**1**	**2**	**6**
SECOND YEAR	**THREE**	**Bs306-Molecular Genetics**	**4**	**4**	**1**	**2**	**6**
	FOUR	**BS406-Microbial Genetics & Genetic Engineering**	**4**	**4**	**1**	**2**	**6**
THIRD YEAR	**FIVE**	**CORE:** **BS505-Biostatistics & Bioinformatics**	**3**	**3**	**1**	**2**	**5**
		ELECTIVE: **A. BS508A-Plant Genetics & Biotechnology (or)** **B. BS508B-Animal Cell Technology & Animal Genetics**	**3**	**3**	**1**	**2**	**10 (A+B)**
	SIX	**CORE:** **BS605-Population Genetics & Evolution**	**3**	**3**	**1**	**2**	**5**
		ELECTIVE: **A. BS608A-Human Genome & Human Genetics (or)** **B. BS608B-Cellular& Molecular Immunology**	**3**	**3**	**1**	**2**	**10 (A+B)**

BSc GENETICS II Year
SEMESTER- III
SKILL ENHANCEMENT COURSE-1 (SEC-1)
BS301: STATISTICS FOR GENETIC ANALYSES

Unit 1: Basic concepts in Biostatistics

1.1 Introduction to Biostatistics: methods of sampling- random & non-random; types of variables; types of estimates (point, interval estimates)

1.2 Data representation- Diagrammatic (line diagram, bar diagram, pie diagram) and graphic representation of data (histogram, frequency polygon & frequency curve)

1.3 Descriptive analysis: Measures of central tendency (mean, median & mode); measures of dispersion (range, mean deviation, variance & standard deviation)

1.4 Concepts of probability, probability distribution (binomial, normal, poisons distributions)

1.5 Hypothesis testing-Null and alternate hypothesis, level of significance, steps in hypothesis testing, test statistic (z test)

1.6 Comparison of means of two samples by t-test (paired & unpaired); features of chi-square test; Analysis of Variance (ANOVA)

Unit 2: Applications of Biostatistics in Genetics

2.1 Applications of probability for predicting the phenotype ratios (monohybrid and dihybrid crosses)

2.2 Applications of probability in human pedigree analysis (risk prediction, carrier incidence)

2.3 Chi-square test (for goodness of fit, for testing linkage)

2.4 Applications of ANOVA

2.5 Correlation analysis (simple & multiple correlation, drawing inferences from scatter plot & graphs, estimation of correlation coefficient & its significance)

2.6 Regression analysis (simple & multiple correlation)

RECOMMENDED BOOKS

1. Fundamentals of Biostatistics: Khan and Khanum. Ukaaz publications, India
2. Biostatistics by: N.T.J. Bailey
3. Biostatistics; Jayasree publishers by: VishweswaraRao K
4. Biostatistics; Himalaya publishing house by: Arora, P.N &Mashan P.K.
5. Biostatistics by: S. Prasad

BSc GENETICS II Year
SEMESTER- III
DSC-3C
BS306: MOLECULAR GENETICS

Unit 1: Nucleic acids
1.1 DNA as the genetic material-Griffiths transformation experiment, Avery, MacLeod and McCarty's experiments and Hershey & Chase phage-labelling experiment
1.2 RNA as genetic material- tobacco mosaic virus
1.3 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)
1.4 DNA replication-conservative, semi-conservative and dispersive models, Meselson–Stahl experiment
1.5 DNA replicative enzymes (DNA polymerases, helicase, primase, ligase, telomerase, nuclease &topoisomerases) and proteins (initiator protein & single strand binding proteins)
1.6 Mechanisms of DNA replication-linear, circular, rolling circle, D-loop and θ-models

Unit 2: Gene expression and regulation in prokaryotes
2.1 Structure of prokaryotic gene (promoter, initiator & terminator regions), structure and functions of RNA polymerase & it's subunits
2.2 Transcription mechanism-initiation, elongation & proof reading, termination (rho independent & rho dependent); reverse transcription
2.3 Genetic code-properties, deciphering of genetic code, Wobble hypothesis, aminoacylation
2.4 Translation mechanism- initiation, elongation and termination
2.5 Prokaryotic transcriptional regulation (negative control & positive control)
2.6 Operon concept- lac operon & glucose effect, tryptophan operon

Unit 3: Gene expression and regulation in eukaryotes
3.1 Structure of eukaryotic gene (promoter, exons, introns, terminator, enhancer &silencer)
3.2 Transcriptional machinery in eukaryotes (RNA polymerases) and their structural and functional features
3.3 Transcription-initiation, elongation and termination
3.4 Post-transcriptional modifications-capping,polyadenylation,splicing and alternate splicing**,** rRNA and tRNAsplicing
3.5 Translation- initiation, elongation and termination
3.6 Post-translational modifications- glycosylation, lipidation, acetylation, ubiqutination and chaperones

Unit 4: Mutations and repair mechanisms

4.1 Mutations- spontaneous mutations (tautomerism, depurination, deamination, slipped strand mispairing, errors in DNA replication and repair),

4.2 Induced mutations-mutagens, physical and chemical mutagens

4.3 Types of mutations- transition, transversion, frame shift, silent, lethal mutations, mis-sense and non-sense

4.4 DNA damage &repair mechanisms-direct, excision and methyl mediated mismatch, recombinational and SOS repair

4.5 DNA recombination-homologous, site specific recombination and non-homologous end joining (NHEJ)

4.6 Diseases caused due to mutation- sickle cell anaemia and cystic fibrosis

PRACTICALS
PAPER III (BS306): MOLECULAR GENETICS

1. Extraction of genomic DNA from plant tissue
2. Extraction of genomic DNA from animal tissue
3. Quantification of DNA by spectrophotometer
4. Agarose gel electrophoresis of DNA
5. Estimation of DNA by DPA method
6. Estimation of RNA by orcinol method
7. Separation of proteins by SDS-PAGE
8. Effect of UV on bacterial growth

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. Principles and Techniques of Biochemistry and Molecular Biology- Keith Wilson, John Walker
8. Text book of cell and molecular Biology- Ajoy Paul; Books and allied pvt ltd
9. Essentials of molecular Biology by George M. Malacinski; Narosa publications

BSc GENETICS II Year
SEMESTER- IV
SKILL ENHANCEMENT COURSE-2 (SEC-2)
BS401: CYTOGENETICS LAB PROCESSING AND ANALYSIS

Unit 1: Methods for Preparation of Chromosome

1.1 Cell culture – aseptic techniques, media, culture techniques of cell or tissue types, variables affecting cell growth, different cell types in cultured tissues, contamination in tissue culture, preservation of cells

1.2 Specimen collection and handling – peripheral blood specimens, bone marrow samples, amniotic fluid, solid tissue sources

1.3 Culture initiation and harvest techniques – growth media, culture vessels, harvest for chromosomal analysis- slide making

1.4 Chromosome staining and banding - G-banding, Q-banding, R-banding, C-banding, T-banding, Cd staining, G-11 banding

1.5 Karyotyping – idlogram, metaphase spread, counting the metaphase spread, karyotyping

Unit 2: Chromosome Analysis

2.1 Chromosome analysis - chromosome number, humans; chromosome shapes, karyotyping of human chromosomes – normal variation and clinically significant chromosome abnormalities; Fragile sites and their detection,

2.2 Chromosome abnormalities - translocations, inversions, insertions, deletions, duplications, ring chromosomes, marker chromosomes, double minutes; sex chromosome abnormalities

2.3 FISH – methodology, probes, chromosome paints, applications, advantages and limitations

2.4 Microscopy – operation and maintenance of bright-field microscopy, inverted and fluorescence microscopy

2.5 Screening Tests - amniotic fluid sampling and analysis, second trimester maternal serum screening, first trimester Down syndrome screen, chorionic villi sampling, bone marrow aspiration and biopsy

RECOMMENDED BOOKS

1. AGT Cytogenetics Laboratory Manual (2017)Arsham, Barch&Lawce, Wiley Blackwell publications
2. Human cytogenetics-A practical approach (2001) Rooney, Oxford University press
3. Manual of Cytogenetics in Reproductive Biology (2014). PankajTalwar, Jaypee Brothers Medical Publishers (P) Ltd.
4. Clinical Biochemistry (2013) Gaw, Cowan, Murphy, Srivastava and O'Reilly, Elsevier

BSC GENETICS II Year
SEMESTER- IV
DSC-3D
BS406: MICROBIAL GENETICS AND GENETIC ENGINEERING

Unit 1:Bacterial recombination and mapping
1.1 Bacteria- structure, techniques of cultivation, counting
1.2 Bacterial phenotypes- colony morphology, nutritional requirement,resistance and sensitivity
1.3 Transformation: discovery of transformation- competence of bacterial cells; mechanism of transformation; gene mapping by transformation.
1.4 Conjugation- unidirectional gene transfer- F^+ and F^-
1.5 High frequency recombination, interrupted mating experiment
1.6 Gene mapping by conjugation

Unit 2:Genetics of bacteriophages
2.1 Structure and classification of bacteriophages
2.2 Lytic cycle-infection of host cells; formation of viral components; maturation and release of virus particles
2.3 Lysogeny- nature of lysogeny; λ-phage, integration of viral genome into host genome; lysogenic stage and prophage cycle; factors governing lysogeny
2.4 Transduction: generalized transduction, co-transduction and linkage; Mapping by co-transduction
2.5 Specialized transduction- formation of specialized transducing particle from a λ-lysogen
2.6 Specialized transduction from λ gal and λ bio

Unit 3:Genetic engineering
3.1 Introduction to r-DNA technology; enzymes used in molecular cloning-restriction endonucleases, DNA modifying enzymes- methylases, polymerases, ligases and phosphatases
3.2 Vectors used in cloning: *E.Coli*, plasmid vectors- pBR322, pUC vectors; cosmids; shuttle vectors- yeast vectors
3.3 Genomic libraries: strategies for construction of genomic libraries
3.4 cDNA libraries: strategies for construction of cDNA libraries
3.5 Blotting techniques (southern, western & northern) and PCR
3.6 Screening for detection of cloned genes-antibiotic resistance, blue-white screening

Unit 4:Applications of genetic engineering
4.1 Gene productsinmedicine-Humulin, Erythropoietin, Growth hormone/Somatostatin,tPA, Interferon-γ
4.2 DNA based vaccines; Subunit vaccines- Herpes simplex virus; Attenuated vaccines- Cholera
4.3 Environment- genetically engineered microorganisms for bioremediation, phytoremediation
4.4 Transgenic plants-Btcotton, Golden rice
4.5 Transgenic animals: Molecular pharming- Buffalo and Goat
4.6 Industrial products- Cheese and Yoghurt

PRACTICALS
PAPER IV (BS406): MICROBIAL GENETICS AND GENETIC ENGINEERING
1. Methods of sterilization, media preparation
2. Gram staining
3. Isolation, purification and maintenance of bacteria
4. Bacterial growth curve
5. Induction and isolation of mutants in bacteria
6. Preparation of competent cells of bacteria
7. Amplification of gene of interest by PCR
8. Restriction digestion analysis
9. Problems on restriction mapping

RECOMMENDED BOOKS
1. Microbial Genetics ByMaloy, Freifelder
2. Molecular GeneticsByGunther and Stent
3. MicrobiologyByPrescot
4. Genetic AnalysisBy Griffith, Suzuki and others
5. Microbiology : Concepts and ApplicationsByJohn Wiley
6. General Microbiology By Stanier
7. Microbiology ByPelczar
8. Introductory MicrobiologyByJ. Heritage
9. Fundamentals of Medical Biotechnology By Irfan Ali Khan and AtiyaKhanum