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

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
FIRST YEAR- SEMESTER I				
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 I	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				
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				
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				
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	
BS 504	Optional- II	DSC-2E	3T=2P=5	3+1=4
BS 505	**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	**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- IV				
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	
BS 604	Optional- II	DSC-2F	3T=2P=5	3+1=4
BS 605	**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	**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: S*kill* ***E****nhancement* ***C****ourse*
DSC: D*iscipline* ***S****pecific* ***C****ourse*
DSE: D*iscipline* ***S****pecific* ***E****lective*
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 III YEAR
SEMESTER- V
SKILL ENHANCEMENT COURSE- 3
BS501: ANALYTICAL TECHNIQUES IN MOLECULAR GENETICS

Unit 1: Instrumentation in Molecular Genetics

1.1. Spectroscopy –Principles, instrumentation, ultraviolet and visible light spectroscopy, CD spectroscopy
1.2. Chromatography–basic chromatographic theory; types of chromatographic techniques – ion exchange chromatography, affinity chromatography, size exclusion chromatography
1.3. Centrifugation – basic principles of sedimentation, preparative centrifugation (Differential centrifugation, Density gradient centrifugation), analytical centrifugation- applications, ultra centrifugation
1.4. Electrophoretic techniques- principle, types and applications
1.5. Microscopy- Fluorescence microscopy, Immunofluorescence, GFP, Confocal microscopy

Unit 2: Molecular Genetic Techniques

2.1. Target amplification: PCR – Principle and applications and types – Multiplex PCR, Nested PCR, Colony PCR
2.2. Reverse Transcriptase PCR and quantitative Real Time PCR
2.3. Next Generation Sequencing technology
2.4. Blotting techniques- Southern blot, Northern blot and Western blot
2.5. Mass spectrometry- Proteomics

RECOMMENDED BOOKS

1. Principles and Techniques of Biochemistry and Molecular Biology edited by Keith Wilson, John Walker Cambridge University Press,-2010
2. Basic Techniques in Biochemistry and Molecular Biology By R. K. SharmaI. K. International Pvt Ltd, 2008
3. Techniques in Molecular Biology. Textbook Student Edition; Agrawal S. International Book Distributing Company, 2008
4. Analytical Techniques in Biochemistry and Molecular Biology
   By Rajan Katoch Springer Science & Business Media, 2011

SEMESTER- V
GENERIC ELECTIVE- 1
BS502: FOUNDATIONS OF GENETICS

Unit 1: Mechanisms of Inheritance

1.1. Scope of Genetics – reasons for studying genetics, genes as unit of inheritance, genetics in modern world
1.2. Mendelian genetics – Principle of dominance, Principle of segregation, Principle of Independent Assortment
1.3. Extensions of Mendelian Principles – multiple alleles, co-dominance, gene interaction, lethal alleles, penetrance, expressivity
1.4. Cell Division – Mitosis, cell cycle, regulation of cell cycle, Meiosis and gametogenesis
1.5. Sex determination – genetic sex determining systems, sex chromosome systems, sex determination in Drosophila, Sex determination in humans, and Sex determination in plants
1.6. Sex and inheritance – sex linked inheritance in drosophila, sex linkage in man, sex-influenced traits, sex-limited traits

Unit 2: Molecular Genetics

2.1. DNA structure and its alternative forms (A, B & Z)
2.2. RNA structure and types of RNA
2.3. DNA packing and chromosomes – histones, non-histones, nucleosome, loops and scaffolds
2.4. Structure of chromosomes- centromere & telomere
2.5. Genome size and complexity- c-value paradox
2.6. Reassociation kinetics, Kinetic classes of DNA- unique, moderately, highly repetitive DNA sequences, tandem repeats (satellite, minisatellite and micro satellites), interspersed repeats (SINES- eg: Alu repeats, LINES)

RECOMMENDED BOOKS

1. The Foundations of Genetics By F. A. E. Crew Elsevier, 2014
2. Concepts of Genetics, 7/E By Klug Pearson Education India, 2002
3. Genetics By Karvita B. Ahluwalia New Age International, 2009
4. Genetics by M. Yadav Discovery Publishing House, 2003 By M. Yadav

SEMESTER-V
DISCIPLINE SPECIFIC COURSE (DSC)
BS505: BIOSTATISTICS & BIOINFORMATICS

Unit 1: Biostatistics

1.1. Introduction to Biostatistics - kinds of variables, types of data (nominal, ordinal and interval data), population and samples, methods of sampling
1.2. Descriptive measures - measures of central tendency (mean, median and mode), measures of dispersion (range, variance, standard deviation, standard error and coefficient of variation)
1.3. Grouped data and graphical methods– Bar graphs, stem and leaf plot, line diagram, pie diagram, frequency distribution, histogram, frequency polygon, percentiles and quartiles, box plot
1.4. Probability - random variables, probability rules, Bayes theorem
1.5. Binomial distribution, Poisson distribution, Normal distribution
1.6. Hypothesis testing - Steps in testing for statistical hypothesis, t-test, z-test, chi-squared test

Unit 2: Introduction to bioinformatics and biological databases

2.1. Computer Basics: Input and output devices, Computer Memory, Computer operations-Binary, Arithmetic; Logical operations, Operating Systems
2.2. Internet Basics: Connecting to the Internet, E-mail, FTP, WWW, Difference between WWW and Internet
2.3. Bioinformatics definition, history, scope and applications
2.4. Biological databases: Classification of databases - primary (Genbank), secondary (PIR) and tertiary or composite (KEGG) databases
2.5. Sequence databases - DNA sequence databases (ENA, DDBJ)
2.6. Protein sequence databases (Swissprot, PROSITE)

Unit 3: Sequence Alignment

3.1. Basics of sequence alignment - match, mismatch, gaps, gap penalties, scoring alignment
3.2. Types of sequence alignment - pairwise and multiple alignment, local and global alignment
3.3. Dot matrix comparison of sequences
3.4. Scoring matrices - PAM and BLOSUM
3.5. Pairwise sequence similarity search by BLAST and FASTA
3.6. Concepts of phylogeny - Distance based and character based tree construction methods.

PRACTICALS

DISCIPLINE SPECIFIC COURSE

BS505: BIOSTATISTICS & BIOINFORMATICS

1. Calculation of mean, median, mode, standard deviation, variance, standard error, coefficient of variation for a variable
2. Construction of bar diagram, pie diagram, line diagram, histogram and box plot for a data
3. Problems on hypothesis testing using Z test, t-test and Chi-squared test
4. Problems on probability and probability distributions
5. Exploring web portals – NCBI, EBI, ExPASy
6. Literature search through Pubmed and Pubmed Central
7. Sequence retrieval from Genbank, ENA, Swissprot
8. Pairwise homology search by BLAST and FASTA

RECOMMENDED BOOKS

1. Khan & Khanum (2004), Fundamentals of Biostatistics, II Revised Edition, Ukaaz Publication
2. Bailey, N.T.J , Statistical methods in Biology, Cambridge Univ. Press
3. Fundamentals of Biostatistics, P Hanmanth Rao and K.Janardhan
4. Danial, W. W , Biostatistics, Wiley
5. Introduction to Bioinformatics By Aurther M lesk
6. Developing Bioinformatics Computer Skills By: Cynthia Gibas, Per Jambeck
7. Bioinformatics second edition By David M mount
8. Essential Bioinformatics By Jin Xiong
9. Bioinformatics Computing By Bryan Bergeron
10. Bioinformatics: Concepts, Skills & Applications By R.S. Rastogi

SEMESTER-V
DISCIPLINE SPECIFIC ELECTIVE (DSE- 3E)
DSE-3E (A)
BS508A: PLANT GENETICS & BIOTECHNOLOGY

Unit 1: Basics of Plant Life Cycle and Genetics

1.1. Overview of plant development and life cycle- embryogenesis, seed germination, meristems, flower and fruit development
1.2. Plant Nuclear Genome Organization – General features, Variation of Genome size among plants, fine structure of plant gene
1.3. Plant Organellar Genome Organization – Mitochondria, Chloroplast
1.4. Plant hormones and their actions - auxins, cytokinins, gibberellins, abscisic acid, ethylene, brassinosteroids
1.5. Plant secondary metabolites- classes, advantages and economical importance

Unit 2: Plant Tissue culture

2.1. Media and culture conditions, sterile technique
2.2. Regeneration methods of plants in culture - organogenesis, somatic embryogenesis
2.3. Culture types and their uses - callus and somatic embryo culture, cell suspension cultures, anther/microspore culture
2.4. Protoplast culture and meristem culture
2.5. Production of synthetic seeds

Unit 3: Methods of Plant Breeding & Plant Recombinant DNA technology

3.1. Plant reproductive biology - Mating systems
3.2. Self-pollinating species – pedigree breeding, single-seed descent, bulk breeding method
3.3. Cross-pollinating species – mass selection, recurrent selection, hybrid varieties, synthetic varieties
3.4. Transgenic plant production – methods of transformation – *Agrobacterium tumefaciens*, particle bombardment, protoplasts, whole tissue electroporation, silicon carbide whiskers, viral vectors, laser micropuncture, nanofiber arrays
3.5. Genes and traits for improved crop production – herbicide resistance, insect resistance, pathogen resistance, product quality.

PRACTICALS

DISCIPLINE SPECIFIC ELECTIVE (A)

BS508A: PLANT GENETICS & BIOTECHNOLOGY

1. Histological studies of embryos at different stages
2. Seed testing for germination
3. Introduction to Plant tissue culture laboratory - equipment
4. Sterilization methods in plant tissue culture laboratory – aseptic technique
5. Preparation of stock solutions of MS basal medium and plant growth regulators
6. Isolation of explants, establishment and maintenance of callus
7. Culture of anthers and establishment of haploid plants
8. Preparation of synthetic seeds

RECOMMENDED BOOKS

1. Principles of Plant Genetics and Breeding (2012) by George Acquaah, Second Edition Wiley- Blackwell Publishers
2. Plant Tissue Culture: Techniques and Experiments (2013) by Roberta H. Smith, Academic Press, U.K
3. Plant Tissue Culture and Biotechnology: Emerging Trends (2003) by P.B. Kavi Kishor, Universities Press
4. Plant Tissue Culture: Basic and Applied (2005) by Timir Baran Jha, Universities Press
5. Plant Biotechnology: Practical Manual (2007) by C. C. Giri, Archana Giri, I.K International Publishers
6. From Plant Genomics to Plant Biotechnology (2013) edited by Palmiro Poltronieri, Natalija Burbulis, Corrado Fogher, Woodhead Publishing Limited, New Delhi
7. Plant Genomics and Biotechnology (2016) Isabelle Nickel, Syrawood Publishing House
8. Plant Biotechnology and Agriculture: Prospects for the 21st Century (2012) edited by Arie Altman, Paul M. Hasegawa, Elsevier
9. Plant Cell Biotechnology by Rudolf Endress, Springer-Verlag Berlin

SEMESTER-V
DISCIPLINE SPECIFIC ELECTIVE (DSE)
DSE- (B)
BS508B: ANIMAL CELL TECHNOLOGY & ANIMAL GENETICS

Unit I: Animal Cell Culture

1.1. Establishing cell lines, cell line maintenance, cryopreservation and storage of cell lines
1.2. Culture media– main components of animal cell culture media, natural media, synthetic media, advantages and limitations of the use of media supplemented with animal serum
1.3. Cell growth phases, influence of environmental conditions on animal cell culture
1.4. Types of animal cell cultures- suspension culture and adherent cell culture, continuous flow cultures and Immobilized cultures
1.5. Use of animal cells for commercial purposes (production of therapeutic proteins and monoclonal antibodies)

Unit 2: Genetic Manipulation of Animal Cell Cultures

2.1. Introduction of DNA into mammalian cells: calcium phosphate co-precipitation method, cationic polymers, lipofection and electroporation
2.2. Transient and Stable expression of heterologous genes: transfection using retroviral, lentiviral and baculoviral vectors
2.3. Selection markers (biochemical markers and reporters)
2.4. Isolation and culturing of murine bone marrow stem cells and mouse embryonic fibroblasts
2.5. Modelling disease in animal cell cultures: cancer and neurodegenerative diseases

Unit 3: Animal Breeding &Veterinary Diseases

3.1. Reproductive biotechnology – artificial insemination, In vitro maturation, fertilization, and culture of oocytes, embryo cryopreservation
3.2. Embryo splitting, Nuclear transfer cloning, Sexing of embryos and creation of transgenic animals
3.3. Veterinary bacterial and viral diseases, Diseases of poultry
3.4. Disease diagnostics – nucleic acid hybridization technique, diagnostics based on PCR, diagnosis based on RFLP approaches
3.5. Vaccines for Veterinary bacterial and viral diseases, genetically engineered vaccines

PRACTICALS

DISCIPLINE SPECIFIC ELECTIVE (B)

BS508B: ANIMAL CELL TECHNOLOGY & ANIMAL GENETICS

1. Cell culture laboratory - Cell culture equipment
2. Preparation of animal cell culture media
3. Sterilization methods for animal cell culture
4. Primary cell culture
5. Staining of animal cells
6. Cell counting
7. Cell viability assay

RECOMMENDED BOOKS

1. Animal Genetics and Breeding (2015) by Arun & Tomar, Daya Publishing House
2. Animal Biotechnology (2005) edited by Srivastava, Singh & Yadav. Oxford & IBH Publishing Co. Pvt. Ltd
3. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications (2015) seventh edition by Ian Freshney, Wiley Blackwell
4. Genetic Engineering in Livestock: New Applications and Interdisciplinary perspectives (2009) edited by Margret Engelhard, Kristin Hagen., Springer
5. The Mouse in Biomedical Research (2007) 2nd edition, vol. III Normative Biology, Husbandry and Models. Editors Fox et al., Elsevier

BSC III YEAR
SEMESTER- VI
SKILL ENHANCEMENT COURSE -4
BS601: DNA TECHNOLOGY IN HEALTH CARE AND TRANSGENICS

Unit 1: DNA Technology in Health care

1.1. Methods of DNA analysis – DNA probes, PCR, signal amplification, DNA chip, RFLP analysis, DNA fingerprinting
1.2. Diagnosing infectious diseases – AIDS, tuberculosis
1.3. Identifying genetic disease –DMD, Huntington's disease
1.4. Gene therapy- ADA deficiency and Cystic fibrosis
1.5. Pharmaceutical products of DNA technology – Recombinant insulin, recombinant growth hormone, recombinant vaccines-Hepatitis-B

Unit 2: Applications of Transgenic Technology

2.1. Custom Made Animals – Human mouse, Oncomouse, Alzheimer's mouse, Knockout mouse; Diagnosing infectious disease – AIDS and tuberculosis
2.2. Animal bioreactors- Pharm Animals
2.3. Enhancing resistance in plants – ice-minus experiments, resistance to biological agents, and resistance to herbicides. Coat protein-mediated protection against virus infections, genetic engineering of crops for insect resistance using genes of plant origin
2.4. Bioengineered foods – Vegetable vaccines, GM foods
2.5. Energy applications – biohydrogen, bioethanol, biomethanol, biobutanol

RECOMMENDED BOOKS

1. DNA Technology: The Awesome Skill By I. Edward Alcamo Gulf Professional Publishing, 2001
2. Recombinant DNA Technology Keya Chaudhuri The Energy and Resources Institute (TERI), 2013
3. Recombinant DNA Technology edited by Sardul Singh Sandhu I. K. International Pvt Ltd, 2010
4. From Genes to Genomes: Concepts and Applications of DNA Technology By Jeremy W. Dale, Malcolm von Schantz, John Wiley & Sons, 2011

SEMESTER- VI
GENERIC ELECTIVE-2
BS602- APPLIED GENETICS

Unit 1: Human Genetics

1.1. Human nuclear genome – general features, protein coding genes, RNA-coding genes, non-coding DNA
1.2. Human genome project – objectives and achievements
1.3. Karyotyping analysis of human chromosomes and its significance
1.4. Alterations in chromosome number - Down's syndrome and Klinefelter's syndrome
1.5. Alterations in chromosome structure – deletions, duplications & translocations

Unit 2: Recombinant DNA technology

2.1. DNA analysis – DNA probes, PCR, DNA chip, RFLP analysis
2.2. Diagnosing infectious disease – AIDS and tuberculosis
2.3. Identifying genetic diseases – Single gene disorders- cystic fibrosis; Multiple gene disorders- Hypertension
2.4. Transgenics – transgenic plants (enhancing resistance in plants), bioengineered foods
2.5. Pharm Animals- Animals as bioreactors

RECOMMENDED BOOKS

1. Human Genetics: The Basics By Ricki Lewis Taylor & Francis, -2016
2. Essentials of Human Genetics (Rev) By Bhatnagar, S.M. Orient Blackswan, 1999
3. DNA Technology: The Awesome Skill By I. Edward Alcamo Gulf Professional Publishing, 2001
4. Recombinant DNA Technology Keya Chaudhuri The Energy and Resources Institute (TERI), 2013
5. Recombinant DNA Technology edited by Sardul Singh Sandhu I. K. International Pvt Ltd, 2010

SEMESTER- VI
DISCIPLINE SPECIFIC COURSE (DSC)
BS605 – POPULATION GENETICS & EVOLUTION

Unit 1: Principles of population genetics

1.1. Population structure, Random mating population, Concepts of a population (gene pool, deme and panmictic unit)
1.2. Genetic and phenotypic variation in a population, allele frequencies and genotype frequencies at a locus
1.3. Hardy-Weinberg Law- Assumptions and implications, establishment of Hardy-Weinberg equilibrium for single gene loci
1.4. Extensions of Hardy-Weinberg Law –multiple alleles, X- linked gene
1.5. Linkage disequilibrium
1.6. Snyder's ratios

Unit 2: Systematic & Dispersive Forces

2.1. Selection – fitness, patterns of natural selection, general selection equation, equilibrium under selection, Selection favouring heterozygote (stable equilibrium, balanced polymorphism, sicke cell anemia, heterozygote advantage) – selection against heterozygote (unstable equilibrium, Rh incompatibility), complete elimination of recessive gene
2.2. Mutation – mutation models, influence of mutation on allele frequency and autozygosity, balance between forward and backward mutation, interaction of mutation with selection
2.3. Genetic load – mutational and segregational
2.4. Gene flow – Migration - Population structure and gene flow – Wahlund effect
2.5. Inbreeding – non-random mating, Identity by descent, selfing, construction of pedigrees (Raw & forked pedigrees) inbreeding coefficient, effect of inbreeding on genotypic frequencies and inbreeding depression
2.6. Genetic Drift - Bottle neck effect, Founder effect, effective population size, consequences of a decreasing population size

Unit 3: Genetic Variation, Molecular Evolution and Quantitative inheritance

3.1. The origins of genomes- Acquisition of new genes by gene duplication and from other species
3.2. Origin of non-coding DNA, transposable elements and introns
3.3. Molecular phylogenetics- DNA sequence and protein sequence phylogenetics
3.4. Molecular Evolution – neutral theory, measure of divergence and polymorphism;
3.5. Construction of molecular phylogenetic trees, establishment of evolutionary relationship-molecular clock
3.6. Quantitative vs qualitative traits – genetic and environmental values - measures of variances

PRACTICALS

DISCIPLINE SPECIFIC COURSE

BS 605- POPULATION GENETICS & EVOLUTION

1. Calculating allele and genotypic frequencies
2. Testing of gene frequencies for Hardy-Weinberg equilibrium – monogenic, multiple allelic and X-linked loci
3. Estimation of Snyder's ratio
4. Testing for deviation of HW equilibrium using chi-square test
5. Estimation of mutation rates
6. Calculation of gene frequencies under different types of selection
7. Estimation of genetic load – mutational and segregational load
8. Construction of pedigrees – raw and forked pedigrees – estimation of inbreeding coefficient using pedigrees

RECOMMENDED BOOKS

1. Hedrick P.W. -Jones & Bartlett, Genetics of Population
2. Hartl D. L. And Clark A. G. ,Principle of Population Genetics, Sinauer Associates
3. Falconer, D (1995) Introduction to Quantitative Genetics, 4th edition, Longman, London
4. Stickberger, M. W (1990) Evolution, Jones and Bartlett, Boston
5. Population Genetics- C C Lee

SEMESTER- VI
DISCIPLINE SPECIFIC ELECTIVE (DSE)
DSE- A
BS608A - HUMAN GENOME & HUMAN GENETICS

Unit 1: The Human Genome

1.1 Human nuclear genome organisation- gene size and density, organisation of protein coding genes
1.2 Gene families (globin gene family, histone gene family,etc) pseudogenes.
1.3 Non-coding sequences, Repetitive elements (LINES, SINES, LTR elements, satellites, minisatellites, microsatellites, Transposons, etc)
1.4 Human Mitochondrial genome organisation
1.5 Human Genome variation- DNA sequence variants, genetic polymorphisms, gene duplication and evolution.
1.6 Human genome project –Goals and achievements

Unit 2: Human genetic defects/disorders

2.1. Human chromosomal disorders- Variations in Chromosome number and structure, disorders due to Autosome and sex chromosome aneuploidy, and structural defects
2.2. Inborn errors of metabolism- Types of metabolic disorders, Phenyleketonuria, Alkaptonuria
2.3. Single gene disorders- Pattern of inheritance: Autosomal Dominant- Huntingtons disease; Autosomal recessive- Haemophilia, X-linked disorders: X-linked dominant- Fragile X syndrome; X-linked Recessive- DMD
2.4. Complex disorders- Multifactorial inheritance (Diabetes mellitus, Hypertension), threshold effect
2.5. Genetics of cancer- Familial and sporadic (Breast and Colon cancers)
2.6. Mitochondrial inheritance and associated disorders- Lebers Hereditary Optic Neuropathy, Kearns-sayer syndrome

Unit 3: Genetic testing and therapeutics

3.1. Prenatal diagnosis (invasive and non-invasive)
3.2. New born screening (PKU)
3.3. Pre-clinical screening- Sickle cell anaemia
3.4. Ethical, legal and Social Issues of Genetic testing and screening
3.5. Traditional treatment modalities- PKU, ADA
3.6. Gene therapy trials- ADA deficiency, Cystic fibrosis

PRACTICALS

DISCIPLINE SPECIFIC ELECTIVE (A)

BS608A - HUMAN GENOME & HUMAN GENETICS

1. Karyotyping and G-banding of Human chromosomes
2. Separation of haemoglobin variants by electrophoresis
3. Diagnosis of diseases by PCR-based methods
4. Screening for Barr bodies
5. Construction of pedigrees and identification of mode of inheritance of a trait.
6. New born screening-PKU/ other

RECOMMENDED BOOKS

1. A.G. Motulsky and F. Vogel (1986) Human Genetics
2. R. F. Mueller and I.D Yound (2001) Emery's Elements of Medical Genetics
3. Curt Stern (1960) Principles of Human Genetics
4. Gardner, A. and Davies, T. (2009) Human Genetics-Scion Publishing, 2nd ed.
5. Lewis, R. (2008) Human Genetics: Concepts and Applications, McGraw-Hill Publishing, New York, 8th ed.
6. Lewis, R. (2011). Human Genetics —The Basics , Routledge, London
7. Mange, E.J. and Mange, A.P. (1999). Basic Human Genetics. Sinauer, Sunderland
8. Scriver, C.R. A.L. Beudit, W.S. Sty abnd D. Valle, Molecular Basis of Inherited Diseases, (6th Edition 1989) by EdsO McGrawHill, New York.
9. Tom Strachan and Andrew Read (1996) Human Molecular Genetics

SEMESTER- VI
DISCIPLINE SPECIFIC ELECTIVE (DSE)
DSE-B
BS608B – CELLULAR & MOLECULAR IMMUNOLOGY

Unit 1: Innate and Adaptive Immunity

1.1 Introduction to Immune System, types of immunity-innate and adaptive
1.2 Innate immunity – anatomical barriers & physiological barriers, phagocytic barriers
1.3 Cellular components of immunity – Lymphoid cells (B cells, T cella and NK cells), Myeliod cells (Neutrophils, Eosinophils, basophils, mast cells, macrophages and dendritic cells)
1.4 Lymphoid organs- Primary lymphoid organs (Bone marrow, thymus); secondary lymphoid organs (lymph node and spleen)
1.5 Antigens- Immunogens, epitopes
1.6 Haptens and types of adjuvants

Unit 2: Humoral and cell-mediated immune responses

2.1. Basic structure of Immunoglobulin: Immunoglobulin domains-variable region and constant region domains; isotypes, allotypes, idiotypes. Immunoglobulin classes and its functions- IgG, IgM, IgA, IgD , IgE
2.2. Polyclonal antibodies; Monoclonal antibodies- its production and applications
2.3. Structure and organization of MHC class I and class II molecules; Types of grafts: Role of HLA typing in organ transplantation
2.4. Cell mediated immunity: Structure and functions of T-cell receptors; Antigen presenting cells (APCs), ternary complex (TCR, peptide and MHC); Cytokines
2.5. Hypersensitivity- Types (I, II, III & IV)
2.6. Autoimmunity- mechanisms of autoimmunity and autoimmune diseases (thyroid and Rheumatoid arthritis)

Unit 3: Immunological techniques

3.1. General features of ag-ab reactions- Agglutination, neutralization test, complement fixation test, opsonisation
3.2. Immunoprecipitation, immunoelectrophoresis, immunodiffusion tests
3.3. ELISA – Priniciple, Types (Sandwich, Indirect, Dot ELISA) and applications
3.4. Immuno fluorescence assays (direct & indirect)- Principle and procedure
3.5. Western blot -Principle, procedure and applications
3.6. Flow cytometry -Principle, procedure and applications

PRACTICALS

DISCIPLINE SPECIFIC ELECTIVE (B)

BS608B – CELLULAR AND MOLECULAR IMMUNOLOGY

1. Differential count of lymphocytes
2. Single Radial Immunodiffusion
3. ELISA
4. Agglutination
5. Haemagglutination test
6. Coomb's test
7. Western Blot

RECOMMENDED BOOKS

1. Essential Immunology by I.Roitt, Publ:Blackwell
2. Immunology by G. Reever & I.Todd, Publ:Blackwell
3. Immuno diagnostics by S.C.Rastogi, Publ:New Age
4. Immunology by Richard A.Golds by, Thomas J Kindt, Barbaraa. Osborne, Janiskuby
5. Fundamental immunology by William E.Paul
6. Basic Immunology by Bhoosreddy G.L. and Wadher B.J.
7. Text book of immunology by Baruj Benacerraf
8. Immunology by Kuby: Publ:Freeman