BSc BIOTECHNOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS)
DEPARTMENT OF GENETICS AND BIOTECHNOLOGY, OSMANIA UNIVERSITY

Schedule for Instruction and Examination

(Proposed Scheme for Academic year 2016 onwards)

Year	Semester	Paper	Title of the Paper	No. of Credits	Exam Hrs	Max. Marks		
						I.A	End Exam	Total
I	I	Core-I Theory	Cell Biology and Genetics	04	3	20	40	60
		Core-I Practical	Cell Biology and Genetics	01	3	-	40	40
	II	Core-II Theory	Nucleic acids and Bioinformatics	04	3	20	40	60
		Core-II Practical	Nucleic acids and Bioinformatics	01	3	-	40	40
II	III	Core-III Theory	Biological chemistry	04	3	20	40	60
		Core-III Practical	Biological chemistry	01	3	-	40	40
	IV	Core-IV Theory	Microbiology and Immunology	04	3	20	40	60
		Core-IV Practical	Microbiology and Immunology	01	3	-	40	40
III	V	Core-V Theory	Molecular Biology and rDNA technology	03	3	20	40	60
		Core-V Practical	Molecular Biology and rDNA technology	01	3	-	40	40
		Elective-A Theory	Plant Biotechnology	03	3	20	40	60
		Elective-A Practical	Plant Biotechnology	01	3	-	40	40
		Elective-B Theory	Medical Biotechnology	03	3	20	40	60
		Elective-B Practical	Medical Biotechnology	01	3	-	40	40
		Generic Elective	Food Technology	02	3			
	VI	Core-VI Theory	Microbial technology	03	3	20	40	60
		Core-VI Practical	Microbial technology	01	3	-	40	40
		Elective-A Theory	Animal Biotechnology	03	3	20	40	60
		Elective-A Practical	Animal Biotechnology	01	3	-	40	40
		Elective- B Theory	Environmental Biotechnology and Biodiversity	03	3	20	40	60
		Elective-B Practical	Environmental Biotechnology and Biodiversity	01	3	-	40	40
		Generic Elective	Biotechnology Perspectives	02	3			
TOTAL				**48**	**66**	**200**	**800**	**1000**

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- dihybrids, trihybrids
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 alleleism (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, 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 coilng 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- Griffiths 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, Reanturation, Tm 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 involved, semi conservative DNA replication-Messelson and Stahl experiment, Linear, Circular, Rolling circle, Theta, D loop
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 Phramacogenomics

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