SEMESTER – I

CORE - Disc C

LS 501: Genetics and Molecular Biology

[Full Marks = 100; Total credit = 04]

Unit – I: (Chromosome inheritance)

1. Mendelian principles : Dominance, segregation, independent assortment, pleiotropy, genomic imprinting, phenocopy, linkage and crossing over, sex linkage
2. Concept of gene : Allele, multiple alleles, pseudoallele, complementation tests, Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.
3. Extra chromosomal inheritance: Mitochondrial and chloroplast genes. Chromosomes deletion, duplication, inversion, translocation, ploidy.
4. Mutation types, causes and detection, mutant types, lethal, conditional, biochemical, loss and gain of function, germinal verses somatic mutants, insertional mutagenesis.

Unit-II: (Genetic inheritance)

1. Microbial genetics: Methods of genetic transfers, transformation, conjugation, transduction, mapping genes by interrupted mating, fine structure analysis of genes.
2. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders. Polygenic inheritance, heritability, QTL mapping.
3. The genomes of bacteria, viruses, plasmids; conjugation, transformation, transduction
4. Homologous and non-homologous recombination including transposition.

Unit – III: (Fundamental structure)

1. Structure of nucleic acids: double helical structure of DNA, right handed and left handed structure of DNA, RNA
2. DNA replication: DNA polymerase, replication in prokaryotes and eukaryotes.
3. Genetic code: deciphering the code and preparation of genetic code dictionary, exception to the universality of genetic code.
4. DNA damage and Repair: Mutations – Spontaneous and induced, mechanisms

Unit – IV: (DNA biology)

1. DNA replication, repair and recombination: replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination.
2. RNA synthesis and processing: transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport.
3. Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination,

genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors

4. Post- translational modification of proteins.

Unit – V: (Gene regulation)

1. Control of gene expression at transcription and translation level: regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing.
2. Cancer**:** Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis
3. Therapeutic interventions of uncontrolled cell growth.
4. Bioethics: Dos and donts in modern biology, ethical limitation, copyright information,

LS – 101: Suggested Readings:

1. Lodish Molecular Cell Biology
2. Brown Genome (Gen),
3. Friedfelder, D. Molecular Biology, 4th Edition, Jones and Barlett Pub. Inc., USA.
4. Karp,. Cell and Molecular Biology,
5. Genes IX (2007 or later);Benjamin Lewin
6. Alberts-Molecular Biology of the Cell
7. Thrope, B. -Cell Biology, John Willey and Sons, USA.
8. Gardner, E.J. and Saastad, D.P.- Principles of Genetics, 7th Edition,
9. Wollff (ed.). Gene Therapeutics, Researchco Book Center.
10. Daniell L.Hartl & et al ;Genetics,6th edition
11. Benjamin Lewin; Essential Genes

CORE - Disc C
LS 502: Cell Biology & Immunology

[Full Marks = 100; Total credit = 04]

Unit – I: (Fundamental cell)

1. Structure and differences between prokaryotic and eukaryotic cells.
2. Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.
3. Structural organization and function of intracellular organelles**:** Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Unit – II: (Cell structure and cycle)

1. Cytoskeleton: Cell junction and cell adhesion, molecular organization of microtubules, microfilaments and intermediary filaments. Vesicular trafficking: secretory and endocytotic pathway.
2. Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle in yeast and multicellular organism.
3. Microbial Physiology: Growth yield and characteristics, strategies of cell division, stress response.

Unit – III: (Cell communication)

1. Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.
2. Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.
3. Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.
4. Concept of apoptosis

Unit – IV: (Basic immunology)

1. Basic Elements of the Immune System: Exterior defenses to infection (Skin & mucosal surface, Physiological Barriers, Phagocytic barriers, Inflammation); Innate and adaptive immune system.
2. Cellular (Lymphocytes, Phagocytes, Auxillary cells and others) and Humoral components of the immune system

3. Adaptive Immune System: Primary and secondary lymphoid organs; Lymphocyte heterogeneity - concept of T cell and B cell, Natural Killer cells; Antigens - Structure, properites, types, Epitopes, Haptens
4. Antigen Receptor Molecules: Immunoglobulins (B-cell antigen receptor)- Structure, classes and biological activities; Genetic basis of antibody heterogeneity – Isotypic, Allotypic and Idiotypic variations; T-cell antigen receptor (TCR); Major Histocompatibility Complex (MHC) – Class I and Class II molecules; HLA

Unit – V: (Advanced immunology)

1. Immune Effector Mechanisms: Lymphocyte activation, Antigen presentation, Clonal selection, Immunological memory; Antigen Recognition: Antigen-antibody binding, kinetics, specificity - Affinity and Avidity; monoclonal antibody; Cell-mediated immune reactions
2. Cytokines and Lymphokines: interleukins, interferons, TNF, CSF. Complement system: classical and alternate pathway of activation;
3. Immuno Pathology: Basic ideas about Transplantation and autoimmunity; Immunodeficiency and AIDS; Hypersensitive reactions (Type I, II, III and delayed type (DTH); Acquired immunity –Vaccines

LS – 102: Suggested Readings:

1. Bruce Alberts et al.- Molecular Biology of the Cell
2. Ivan Roit et al. – Immunology
3. Brnjamin lewin – Genes IX
4. Lodish Molecular Cell Biology
5. A.L. Lehninger – Principles of Biochemistry
6. Friedfelder, D. Molecular Biology, 4th Edition, Jones and Barlett Pub. Inc., USA.
7. Karp,. Cell and Molecular Biology,
8. Thrope, B. -Cell Biology, John Willey and Sons, USA.
9. Gardner, E.J. and Saastad, D.P.- Principles of Genetics
10. Wollff (ed.). Gene Therapeutics, Researchco Book Center.
11. Daniell L.Hartl & et al ;Genetics,6th edition
12. Benjamin Lewin; Essential Genes

CORE - Disc C
LS 503: Biochemistry

[Full Marks = 100; Total credit = 03]

Unit – I: (Molecular interactions)

1. Introduction to Biochemistry and biomolecules; Structure of atoms, molecules and chemical bonds.
2. Stabilizing interactions: covalent bonds, hydrogen bonds, van der Waals interactions, hydrophilic and hydrophobic interactions
3. Biophysical properties, Water as a solvent; Ionization of acids, bases, pH, buffer, reaction kinetics, thermodynamics, colligative properties
4. Concept of free energy, entropy, enthalpy and Basic Biological reactions

Unit – II: (Proteins and enzymes)

1. Proteins Structure functions: structures of proteins. Ramachandran plot
2. Enzymes: Chemical nature, Nomenclature and classification; coenzymes
3. Mechanism of Enzyme Action: Effects of substrate, temperature, pH and inhibitors on enzyme activity and stability.
4. Enzyme kinetics: Concept of Km and Vmax - Michaelis-Menten equation, Lineweaver-Burk plot and Enzyme inhibition

Unit – III: (Carbohydrates and lipids)

1. Lipids structure functions: fatty acids, and glycerides, phospholipids sterols.
2. Carbohydrate metabolism: glycolysis, TCA cycle, pentose phosphate pathway
3. Oxidation of fatty acids
4. Electron transport system -oxidative phosphorylation, mitochondrial respiratory complexes and supercomplexes

Unit – IV: (Plant biochemistry-I)

1. Photosynthesis**:** Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO2 fixation, C3 and CAM pathways; Photorespiration.
2. Nitrogen metabolism: Nitrate reduction and ammonium assimilation.
3. Plant hormones: structure and function.
4. Secondary metabolites: structure and function

Unit – V: (Plant Biochemistry-II)

1. Sensory photobiology: Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins
2. Photoperiodism and biological clocks, flower development.
3. Signal communication in plants
4. Plant signaling during development and stress.

LS - 103: Suggested Readings:

1. Mazur, A. (2002). A Text Book of Biochemistry, Benjamin Harrow, Toppan Co. Ltd., Japan.
2. Campbell, (1998). Biochemistry, Purnima Book Distributors, New Delhi.
3. Stryer, L. (2005). Biochemistry.
4. Hans- Walter Heldt (2005) Plant Biochemistry , Academic Press
5. Lehninger Albert L., Cox, Michael M. and Nelson, David L. (2008) Principles of Biochemistry, W.H. Freeman & Co.
6. Alexander, R.R. and Criffithn, J.M. (1992). Basic Biochemical Methods, John Willey and Sons, Singapore.
7. Buchanan B, Gruissem, W and Jones, R. (2002) Biochemistry & Molecular Biology of Plants, Wiley.
8. Lewin, B. (1996). Genes VI, Panima Eds,., Agency, New Delhi.

Inter Departmental Course (IDC)

CORE/ ELECTIVE/AILF - ID C

LS 505: Environment and Conservation Biology

[Full Marks = 100; Total credit = 03]

Unit – I: (Organization & taxonomy)

1. Levels of structural organization: Unicellular, colonial and multicellular forms. Levels of organization of tissues, organs & systems. Comparative anatomy, adaptive radiation, adaptive modifications.
2. Principles & methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical & quantititative methods of taxonomy of plants, animals and microorganisms.
3. Outline classification of plants, animals & microorganisms: Important criteria used for classification in each taxon.
4. Evolutionary relationships among taxa.

Unit – II: (Environmental biology)

1. The Environment: Physical environment; biotic environment; biotic and abiotic interactions.
2. Habitat and Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.
3. Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.
4. Population Ecology: Characteristics, growth curves and regulation of a population; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemic, age structured populations.

Unit – III: (Ecology)

1. Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.
2. Natural history of Indian subcontinent: Major habitat types of the subcontinent, geographic origins and migrations of species. Common Indian mammals, birds. Seasonality and phenology of the subcontinent.
3. Concept of an ecosystem: Ecosystem and its structural components - Abiotic and Biotic components, Productivity and Energy flow, Lindemann's concept of Community dynamics, Ecological succession- Ecosystem stability, climax community
4. Levels of Organisations: Biosphere organizaton, Emergence theory, Liebig's Law of minimum; Leibig-Blackman concept of Limiting factors, Shelford's Law of Toleranc

Unit – IV: (Applied ecology)

1. Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.
2. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

3. Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).
4. Applied Ecology: Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change and management approaches.

Unit – V: (Conservation Biology)

1. Conservation Biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).
2. Organisms of conservation concern: Rare, endangered species. Conservation strategies. Organisms of health & agricultural importance (Common parasites and pathogens of humans, domestic animals and crops).
3. Concept of sustainability: Wetlands and Fisheries management and conservation with special emphasis on North-East India
4. Biodiversity Conventions and Acts: Application of Remote Sensing in biodiversity assessment.

LS 104: Suggested Readings:

1. Daubenmire, R. (1974). Plants and Environment, John Wiley and Sons
2. Kormondy, E.J. (1978). Concepts of Ecology, Prentice Hall of India
3. Odum, E.P. (1971). Fundamentals of Ecology, W.B. Saunders, Philadelphia
4. Whittaker, R.H. (1975). Communities and Ecosystems, McMillsn
5. Grime, J.P. (1979). Plant strategies and Ecosystem Processes, John Wiley and Sons
6. Mishra, R. (1968). Ecology Workbook, Oxford and IBH (New Delhi).
7. Smith, W.H. (1981). Air pollution and Forests, Springer Verlag (New York).
8. Weaver, J.E. and Clements, F.E. (1983). Plant Ecology, McGraw Hill (USA).
9. Freeman, B. (1989). Environmental Ecology, Academic Press (UK).

Annex-1

507: Orientation Course

Course Objectives:

- To make aware the students about the academic and research environment of the University, along with the departmental facilities, resources and activities.
- To guide the students for a purposeful learning during their complete tenure of programme.
- To make the students aware about their curriculum, evaluation process, academic flexibility and extracurricular activities
- To enlighten the students about quality of education, feedback mechanisms, grievance redressal, discipline and their rights and duties.

Course Outcome:

The course will enable the students to be aware of their overall learning procedure, resources, and methods for their optimum use.

Evaluation:

This will be a non-credit course, with contact duration spread over minimum one week, and maximum of two weeks. The student must attend 70% of the classes to pass the course, and there shall be No test or Exam. Classes for orientation course will run along with the normal classes.

Mode of teaching:

Interaction with experts/faculty members, discussions through physical/online mode, exchange of materials - digital lectures, documents, guidelines.

Topics for interaction:

1: About the University and Department, mutual expectations of students and department to achieve Mission of Department / University. Student behaviour and discipline, anti-ragging campus, Placements

2: Curricular aspects and evaluation process, Online registration processes, Scholarships and Awards, safety / lab-safety/ biosafety at workplace.

3: Feedback mechanisms, Quality framework and role of students, Mentor and mentee system, Green campus initiatives, Waste management and Zero-plastic use in the campus.

4: Library activities, Extracurricular activities, University facilities for students and its maintenance, Student Union, Rights and Duties of the students.

5: Grievance redressal system, Gender issues and sensitization, Ethics in education, Protocols for emergencies like natural disasters and fire at workplace.

Registrar, Assam University