

DEPARTMENT OF BIOTECHNOLOGY

TELANGANA UNIVERSITY, NIZAMABAD, [TS]

SYLLABUS FOR Ph.D ENTRANCE TEST -2015 -2016

**Unit-I: Biomolecules, Cell Biology and Genetics**

1. Hydrodynamic properties of biomolecules,
2. Structure classification and properties of carbohydrates: mono, di and polysaccharides
3. Structure classification and properties of Lipids and Amino acids,
4. Structure, classification and properties of Proteins, glycoproteins and lipoproteins
5. Structure of Nucleic Acids, different forms of DNA and RNA. Three dimensional structure of RNA, Cot curves, chemical synthesis of DNA
6. Organization of eukaryotic chromosome: structure of nucleosome and extent of chromatin and special type of chromosomes
7. Cell cycle - Overview of eukaryotic cell cycle its regulation- Check points, CDKs- Cyclins.
8. Genetics: Mendel's principles, Multiple alleles, multiple factors of inheritance, extra chromosomal inheritance, Linkage and crossing over
9. Phages Genetics: Fine structure of Gene, concepts of cistron, muton & recon, r II locus
10. Mutations: Chromosome variations in number and structure, Role of mutations in crop improvement and Molecular mechanisms of mutations, Ames test for mutagenesis, DNA damage and repair mechanisms

**Unit-II: Biochemistry & Immunology**

1. Definitions and nomenclature of enzymes, enzyme kinetics and mechanisms of enzyme action
2. Coupled reactions and oxidative phosphorylations, group transfer, biological energy transducers, bioenergetics. Glycolysis and TCA cycle, HMP shunt, gluconeogenesis, energy derivations in fermentation, aerobic and anaerobic respirations.
3. Glyoxylate cycle, components and organization of mitochondrial electron transport system
4. Photosynthetic pigments and photosynthesis in bacteria and higher plants. Cyclic and non-cyclic photophosphorylation, Mechanism of photophosphorylation.
5. Pathways of CO<sub>2</sub> fixation by C<sub>3</sub>, C<sub>4</sub>. and CAM pathways.
6. Nitrogen fixation: Organization, regulation and expression of Nif genes,
7. Cells of the immune system - B cells, T cells, phagocytes, inflammatory cells, antigen presenting cells.
8. Antigens - nature, types, factors influencing antigenicity and Antibodies -structure, types, classes and functions
9. Antigen- antibody reaction types.
10. Vaccines: Types of vaccines and component vaccines
11. Hybridoma technology



### **Unit-III : Biodiversity & Biophysical techniques**

1. History, general properties and structure of bacteria, fungi and viruses.
2. Biodiversity: Definition, levels, organization, uses, and valuing biodiversity, Biodiversity vs. Biotechnology and Biodiversity for Sustainable Development.
3. Microbial Diversity: Bacteria, Archea and their broad classification: Eukaryotic microbes, Yeast, Fungi, moulds and Protozoa; Viruses and their diversity.
4. Animal Diversity: IUCN categories. Rare and endangered categories and extinct animals of India and different methods of Biodiversity Conservation.
5. Different types of Centrifugation Methods: differential centrifugation, density-gradient, analytical ultracentrifugation.
6. Chromatography techniques: Paper chromatography, adsorption chromatography (thin-layer chromatography), gas-liquid chromatography and HPLC.
7. Electrophoretic Methods: PAGE-Native-PAGE, SDS-PAGE, 2D electrophoresis and PFGE
8. Spectroscopy: Beer-Lambert law, absorbance, transmittance, extinction, coefficient, light sources, monochromatic, type of detection, UV, visible spectrophotometer, infra red spectroscopy. Raman spectroscopy, mass ESR and NMR spectrometry.

### **Unit-IV: Molecular Biology, Bioinformatics & Biostatistics**

1. DNA Replication : Modes of replication, Replication fork. Enzymes and proteins involved in replication of Prokaryotes & Eukaryotes.
2. Transcription: RNA polymerases, Promoters and their characterization. Enhancer sequences, initiation, elongation and termination of RNA synthesis and Posttranscriptional modifications.
3. Translation: General features of genetic code, Mechanism of initiation, elongation and termination of protein synthesis
4. Regulation of gene expression: House-keeping genes, constitutive genes, and regulatory genes, Negative regulation and positive regulation. Fine structure of lac operon and Transcriptional control by attenuation in trp operon.
3. Introduction to Computers and Overview of computer organization.
6. Biological databases: DNA databases, protein-sequencing databases, functional motifs databases, protein-structure databases.
7. Comparative-sequence analysis: Pair-wise sequence alignment, multiple-sequence alignments
8. Proteomics and Genomic studies, Microarray technology and human genome project and applications
9. Introduction to biostatistics: mean, median, mode, frequency distribution, frequency curve, frequency polygon and histogram.
10. Test of hypotheses: Students t-test, X<sup>2</sup> distribution (Chi square), correlation coefficient and analysis of variance (ANOVA).
11. Softwares : SPSS, SAS, Stata, Mini tab & 'R' software.

### **Unit-V: Microbial, Environmental and Advanced Biotechnology**

1. An overview of fermentation technology, range of fermentation processes components of fermentation process and various types of fermentations.



2. Biomonitoring of Environment - biological indicators, biosensors, geosensors and Waste water treatment through aerobic and anaerobic microorganisms, biotechnology for pollution control
3. Microbial degradation of pesticides, Microbial leaching and biomining and Microbial degradation of lignocelluloses, biofuels.
4. Molecular aspects of biotic and abiotic stress responses and genetic engineering for insect, fungal, drought, salinity and temperature resistance..
5. Plastid transformation-Chloroplast genetic system, plastome engineering in higher plants & advantages.
6. GM Crops, Molecular Pharming, Plantibodies and plants as bioreactors.
7. Regulatory mechanisms in releasing GMOs. IPRs. Plant breeders rights and Biosafety regulations.
8. Various Methods of gene therapy,
9. Pharmacokinetics: drug delivery & designs.
10. Mass production of bioactive substances: interferon, interleukins.

#### **Unit-VI: Cell and Tissue Culture**

1. Introduction to Plant Tissue Culture, -Micropropagation and production of virus free plants
2. Cytodifferentiation *in vitro* and the role of growth regulators in differentiation
3. Somatic Embryogenesis and synthetic seed production.
4. Protoplast isolation, culture, fusion and Somatic hybridization
5. Production of Androgenic haploids and their role in crop improvement
6. Cell suspension cultures, Production of Secondary metabolites and biotransformation.
7. Cryopreservation and conservation of Germplasm
8. Animal Cell Culture: Cell culture media, culture procedures in preparation of animal cell cultures, primary culture, cell lines
9. Measurement of cell death and apoptosis
10. Stem cell technology: stem cell culture and transplantation and applications

#### **Unit-VII: Genetic Engineering**

1. Recombinant-DNA technology: The role of Restriction endonucleases in r-DNA technology, different types of Cloning vectors and cloning strategies.
2. C-DNA synthesis and Construction of Genomic libraries
3. Different strategies for sequencing genome
4. Blotting techniques: Southern, Western and Northern blotting techniques.
5. Molecular markers: RFLP, RAPD, AFLP, SSR and their applications.
6. PCR Technology – Types and its potential applications.
7. DNA finger printing and its role in forensic science
8. Gene Transformation Methods: *Agrobacterium* mediated transformation, electroporation, micro-injection and particle bombardment and selection of transformants and regeneration of transgenic plants.
9. Gene silencing and RNA- i technology and ribozymes and application of ribozyme technology