Syllabus for the post of PGT -Biotechnology

Subject specific syllabus includes the concepts of NCERT/CBSE syllabus and Text Books (Classes XI & XII), however, the questions will be testing the depth of understanding and application of these concepts at the level of Post- Graduation.

Introduction to Bio-technology: Historical perspectives, scope and importance, commercial potential , interdisciplinary challenge, a quantative approach-scale up – stages in commercialization of product and process, the fermenter , aseptic operation. Manufacturing quality control, good manufacturing practices, good laboratory practices, product safety, bio safety principles-environment and health risk , assessment, bio safety regulatory guidelines and controlling agency, environmental law for hazardous drugs , microbes and GMO'S , Biotechnology related issues of Public concern, Bioethics. Marketing, Biotechnology in India and global trends.

Fundamentals of Biochemical engineering-Concept of pH , buffer , physical variables , dimensions and units , measurement conventions , physical and chemical properties, data , stoichiometry , errors in data and calculation, absolute and relative un certainty and types of error statistical analysis presentation of experimental data , data analysis , trends , testing mathematical models, goodness to fit , use of graph paper with logarithmic coordination and plotting of data process flow diagrams, material balance, fluid flow and mixing , mass transfer , heat transfer, unit operations, homogenous reactions , microbial growth , substrates utilization and product formation kinetics, reactor engineering – rheology of fermentation fluids , scale up concepts, design of fermenting media, aseptic transfer, various microbial and enzyme reactors, instrumentation in bio reactors.

Biotechnology and Society-Public perception of Biotechnology intellectual property, patents, reading a patent, International scenario, National scenario, Varietals protection, ethical issues in agriculture and health care.

Biochemistry: Biomolecules- Structure and Dynamics; Thermodynamics**:** concept of free energy, entropyBuilding blocks of carbohydrates – sugars and their derivatives , chemical properties of sugar , polysaccharides – glycogen , cellulose, chitin etc.Building blocks of proteins – Amino acids, Chemical properties of amino acids, regulation of amino acid metabolism and inborn errors of metabolism determination of sequencing of amnino acids , fragmentation of polypeptide chain , 3D structure of proteins, secondary , tertiary and quarternary structure of proteins, vitamins and enzymes. Lipids –simple fatty acids , Sphingosine, Glycerol and cholesterol and their chemical properties , lipid metabolism and its regulation. Nucleic acids- Nucleo tides, chemical properties , optical activities and stereo chemistry of bio molecules, polarimetry , conformations and configuration, RNA, DNA, 3D model of DNA , chromosome structure , circular and super coiled DNA. Biochemical transformations-carbohydrates metabolism-glycolytic path way, krebs cycle, homo fermentative path way. KH , PPP, photosynthesis- light reaction Kelvin cycle, nitrogen fixtation , nitrogen cycle, nitrogenase , gluconeogenesis, electron transport and oxidative phosphorylation , precursor-product relationship, supramolecular assembly, biomolecular database, biomembranes, structure and function of liposomes and their applications

Techniques, Instrumentation and principles

Techniques based on molecular weight or size- Centrifugation and ultra centrifugation, gel permeation , osmotic potential.Techniques based on polarity- Ion exchange chromatography, elctrophoresis, isoelectric focusing , hydro phobic interaction , partition chromatography.Techniques based on spectroscopy- Colorimetry, UV visible , spectro photometry, fluorescence , spectroscopy , x-ray crystallography , mass spectrometry , radio isotopes techniques; Techniques based on solubility – Salt perceipitation , precipitation with organic solvent. **Cellular techniques-** Microscopy-LM,TEM,SEM cell sorting , cell fractionation , cell growth determination , electronic particle counter, culture based counting methods **Genetical techniques-** Chromosomal techniques- Staining , bending, pattern, Karyotyping, chromosomal painting. Mutagenic techniques- Bacterial and seed mutagenesis , recombination in bacteria, conjugation, transduction, breeding methods in plants, pedigree analysis, DNA isolation.

Cell Biology: Cell structure and components- Cell membrane – composition, Structure, membrane , associated receptors, artificial membrane, membrane proteins, principals of membrane organization, cell junction, membrane lipids. Cell organellels – Golgi bodies, Endoplasmic reticulum, lysosomes, per oxisomes, ribosomes, internatilsation of macro molecules , endo and exocytosis , mitochondrial structure and oxidative phosphorylation. Cytoskeleton- Micro tubules , micro filaments, lattice and cytosol ;Nucleus –nuclear envelope , nucleolus , chromosome tissue and organs , evolution and population , speciation , biodiversity , adaptation, natural selection, organization of life, size and complexity , interaction with environment .**Cell growth and development** - Cell division, cell cycles, cell communication and signal transduction , movement, nutrition, gaseous exchange , internal transport, maintaining the internal environment, reproduction, animal and plant development, immune

response, apoposis, plant-pathogen relation, secondary metabolism, defence strategy in microbes and insects.

Genetics and Molecular Biology

Principles of Genetics- Mendelian genetics, role of chromosome in inheritance, multiple alleles , linkage and crossing over , genetic recombination, genetic mapping, gene interaction , sexed linked inheritance , extra nuclear inheritance, quantitative inheritance, genes at the population level, discovery of DNA as genetic material-Griffiths experiment, Hershey and Chase experiment, mutagenesis , types of mutations, genome, chromosome and gene mutations, molecular mechanism of mutation , DNA repair , genetic disorder, transposons, animal and plant breeding. **Genome function-** Genome organization, sequencing DNA replication, fine structure of gene, from gene to protein, transcription , genetic code , translation, regulation of gene expression, genetic basis of development, genetic of cancer, immuno genetics, evolutionary genetics.

Protein and gene manipulation

Protein Structure and engineering.-3D shape of proteins, non covalent bonds, hydrogen bonds, van der waals forces, hydro phobic interaction. Structure function relationships in proteins – Chymotrypsin, molecular disease. protein finger printing, 2D gel electrophoresis, purification of proteins, characterization of proteins , proteins based products, mass spectrometry, blood products and vaccine , therapeutic antibodies and enzymes, hormones and growth factor, regulatory factor , analytical application , industrial enzymes , functional non catalytic proteins, nutraceutical proteins, designing proteins, proteomics, genes and proteins type of proteomics .

Recombinant DNA Technology -Tools of recombinant DNA technology, restriction enzymes, making of recombinant DNA , DNA library, introduction of recombinant DNA into host cells-plasmid , cosmid, vectors, lambda, bacteriophage , identification of recombinants , PCR, DNA probes, hybridization techniques , DNA sequencing, site directed mutagenesis, cloning strategies.

Genomics and Bioinformatics- Structural and functional genomics, genome sequencing projects, genetic mapping, gene prediction and counting , genome similarity, SNPs and comapartive genomics , functional genomics-micro array techniques , fluorescence , in situ hybridization , comparative DNA hybridisation, history of bio informatics, sequences and nomenclature , DNA and protein sequences, information sources-major databases, blast family search tools, resources for gene level sequences , analysis using bio informatics tools.

Cell culture technology

Microbial cell culture and its applications-nutrients , energy sources, sterilization procedures, environment for microbial growth, aeration and mixing , equipments for culture-bioreactors, Types of microbial culture, measurement and kinetics of microbial growth, scale up of microbial process, isolation of microbial products, strain isolation and improvement, application of microbial culture technology bioethics.

Plant Cell culture and applications- Cell and tissue culture techniques- Nutrient media, types of cultures, plant regeneration pathways, application of cell and tissue culture, gene transfer methods in plants, transgenic plants with beneficial traits, stress tolerance, herbicide tolerance, insect resistance, transgenic plant as bio reactor, diagnostics in agriculture and molecular breeding, morphological and molecular markers , bioethics.

Animal cell culture and applications- Primary cell culture, secondary cell culture and lines, types of cell lines , physical environment , osmolality , media , pH temperature cryopreservation, equipments required for animal cell culture, carbon dioxide incubators, Characterisation of cell lines- Scale up of animal culture, applicantions of animal cell culture-Tissue plasminogen activator, factor VIII , erythropoietin, hybridoma technology, mono colonal antibodies, therapeutic antibodies, stem cell technology- morphological approach, in vitro clonal assay, long term marrow culture, embryonic stem culture, cell and tissue engineering , bioethics in animal genetic engineering.

Immunology

Immune system , molecules of immune system, immuno globulins , MHCs, cytokines, T cell receptor, generation of antibodies and T cell receptor diversity , complement system, humoral and cell mediated immunity, immune regulation, vaccines , hybridoma, immuno deficiencies, AIDS, transplantation immunity and cancer.

Applied Biotechnology

Biotechnology industry , Bioinformatics, molecular technology for diagnosis of genetic disorders, onco viruses and immunity, lymphocyte, homoestasis, viral induced modulation of host immune response, HLA polymorphism, induction and maturation of B cells, safe limits for radiation determined , radiation carcinogenesis.

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