Syllabus for Part A / Section A

It is of the level of 10+2 in the subjects of Physics, Chemistry, Mathematics and Biology.

Syllabus for Part B / Section B is given below:

1. Biochemistry: Biomolecules-structure and functions;

- Basic concepts and designs of metabolism (carbohydrates, lipids, amino acids and nucleic acids)
- Enzymes- classification, kinetics and mechanism of action;

Bioenergetics- Respiration and electron transport chain; Photosynthesis,

2. Cell biology:

- Prokaryotic & eukaryotic cell structure; Biological membranes, structure, action potential & transport processes.
- Cell cycle and cell growth control; Cell-Cell communication, Cell signaling and signal transduction.

3. Molecular biology:

- Nucleic acid replication, organelle DNA replication, Molecular structure of genes & chromosomes; transcription, translation and their regulatory mechanisms in prokaryotes and eukaryotes; RNA interference; DNA damage and repair; OSatellite-and repetitive DNAs. DNA repair. Regulation of gene expression

4. Microbiology, Immunology and infectious diseases:

- History of Immunology; Innate, humoral and cell mediated immunity; Antigen; Antibody structure and function; Molecular basis of antibody diversity; Synthesis of antibody and secretion; Antigen-antibody reaction.
- Complement; Primary and secondary lymphoid organ; B and T cells and macrophages; Major histocompatibility complex (MHC); Antigen processing and presentation; Polyclonal and monoclonal antibody; Regulation of immune response; Immune tolerance; Hypersensitivity; Autoimmunity; Graft versus host reaction.
- Methods in microbiology; Microbial growth and nutrition; Aerobic and anaerobic respiration; Nitrogen fixation; Microbial diseases and host-pathogeninteraction.
- Viruses- structure and classification; Microbial classification and diversity (bacterial, algal and fungal);

5. Inheritance biology:

Mendelian inheritance; Gene interaction; Complementation; Linkage, genetics (plasmids, transformation, transduction, conjugation); Horizontal gene transfer and Transposable elements; Chromosomal variation; Molecular basis of genetic diseases. Mutations and mutagenesis;

6. Methods in biology:

Principles of microscopy-light, electron, fluorescent and confocal; Centrifugation- high speed and ultra; Principles of spectroscopy-UV, visible, CD, IR, FTIR, Raman, MS, NMR;

Separation techniques: Principles of chromatography- ion exchange, gel filtration, hydrophobic interaction, affinity, GC,HPLC, FPLC; Electrophoresis; Microarray.

Bioinformatics Major bioinformatics resources and search tools; Sequence and structure databases; Sequence analysis (biomolecular sequence file formats, scoring matrices, sequence alignment, phylogeny); Data mining and analytical tools for genomic and proteomic studies;

Molecular biology techniques: Molecular dynamics and simulations (basic concepts including force fields, protein-protein, protein-nucleic acid, protein- ligand interaction). DNA sequencing; Polymerase chain reactions; DNA fingerprinting; Southern and northern blotting; In- situ hybridization; RAPD, RFLP;

Recombinant DNA technology: restriction enzymes, Restriction and modification enzymes; Vectors; plasmid, bacteriophage and other viral vectors, cosmids, Ti plasmid, yeast artificial chromosome; mammalian and plant expression vectors; cDNA and genomic DNA library; Gene isolation, cloning and expression; Transposons and gene targeting; DNA labeling;

Gene cloning. Methods of gene transfer in plants. Achievements and recent developments of genetic engineering in agriculture. Development of transgenics for biotic & abiotic stress tolerance, bioethics, terminator technology, nanotechnology, DNA fingerprinting, gene silencing. cloning vectors, Site-directed mutagenesis; Gene transfer technologies; Gene therapy.

Tissue culture techniques: Totipotency; Regeneration of plants; Plant growth regulators and elicitors; Tissue culture and Cell suspension culture system: methodology, kinetics of growth and, nutrient optimization; Production of secondary metabolites by plant suspension cultures; Hairy root culture; transgenic plants; Plant products of industrial importance. Animal cell culture; media composition and growth conditions; Animal cell and tissue preservation; Anchorage and non-anchorage dependent cell culture; Kinetics of cell growth; Micro & macro-carrier culture; Hybridoma technology; Stem cell technology; Animal cloning; Transgenic animals. Tissue culture and its application, Micropropagation. Meristem culture and production of virus-free plants. Anther and microspore culture. Embryo and ovary culture. Protoplast isolation. Protoplast fusion-somatic hybrids, cybrids. Somaclones. Synthetic seeds. In vitro germplasm conservation. Cryopreservation.

Fermentation technology: Chemical engineering principles applied to biological system, Principle of reactor design, ideal and non- ideal multiphase bioreactors, mass and heat transfer; Rheology of fermentation fluids, Aeration and agitation; Media formulation and optimization; Kinetics of microbial growth, substrate utilization and product formation; Sterilization of air and media; Batch, fed-batch and continuous processes; Various types of microbial and enzyme reactors; Instrumentation control and optimization; Unit operations in solid-liquid separation and liquid-liquid extraction; Process scale-up, economics and feasibility analysis. Engineering principle of bioprocessing - Upstream production and downstream; Bioprocess design and development from lab to industrial scale; Microbial, animal and plant cell culture platforms; Production of biomass and primary/secondary metabolites;
Biofuels, Bioplastics, industrial enzymes, antibiotics; Large scale production and purification of recombinant proteins; Industrial application of chromatographic and membrane based bio-separation methods; Immobilization of biocatalysts (enzymes and cells) for bioconversion processes; Bioremediation-Aerobic and anaerobic processes for stabilization of solid / liquid wastes.