B Sc. CBZ with Biotechnology

B. Sc. Biotechnology Syllabus

Paper 1: Environmental Biotechnology and Fermentation Technology

UNIT-I

Environment: Basic concepts and issues
Environmental pollution: type of pollution. Methods for the measurement of pollution.
Air Pollution: Sources and its control: Biotechnological initiatives.

UNIT-II

Water pollution: Sources and its control: Water as a scarce natural resource, Need for water management.
Waste water collection, waste water treatment-physical, chemical and biological treatment processes.

UNIT-III

Restoration of waste land/degraded ecosystem.
Global environmental problems: Ozone layer depletion, green house effect and acid rain their impact and biotechnological approaches for management.

UNIT-IV

Fermentation: Definition and scope, Elementary idea about microbial growth kinetics, batch and continuous culture.
Culture preservation and inoculum development, substrate development for fermentation.

UNIT-V

Products of fermentation: Ethanol, Acetone, Glycerol, Citric acid, Enzymes, Single cell protein, antibiotics (Penicillin, streptomycin).

Paper 2: Molecular Cell Biology and Molecular Genetics

UNIT – I

Signal transduction: Basic idea of chemical signals and cellular receptors. G protein linked receptors and role of cAMP growth factors as messengers.
Electrical signals in nerve cells: membrane potential, action potential and its propagation, synaptic transmission.

UNIT-II

Cells and transport processes: simple diffusion, facilitated diffusion, role of carrier and channel proteins, general idea of active transport.
Vasicular transportation in eukaryotic cells: role of transport signals.

UNIT-III

Mutation: Mutagens, mechanism of mutation and repair.
Cancer as a genetic disease, preliminary idea of oncogenes and protooncognes.
Molecular events of recombination.

UNIT-IV

General account of plasmids and transposons: Types and functions.
Mechanism of Conjugation, transformation and transduction in bacteria.

UNIT-V

Regulation of gene expression: lac operon, positive and negative control, promoter, operator and enhancer sequences.
Control of λ phage replication, lytic and lysogenic cycles.

Paper 3: Immunology and Recombinant DNA Technology

UNIT-I

Innate, acquired, active and passive immunity, cell mediated and humoral immune response.
Cells of immune system and general idea about their phylogeny, function of lymphoid organs.

UNIT-II

Antigenecity and immunogenecity, epitopes, haptens, Factors influencing immunogenecity and role of adjuvents.
General structure, classes and function of antibodies.

UNIT-III

Precipitation, agglutination reactions, Brief account of ELISA, RIA techniques.
General idea about MHC and complement system.

UNIT-IV

Role of various enzymes involved in Genetic engineering: restriction endonuclease, ligase, terminal transferase, polynucleotide kinase, reverse transcriptase, alkaline phosphatase.

General account of cloning vectors including plasmids, phage vectors, cosmids and expression vectors.

UNIT-V

General steps of gene cloning: cutting, ligation, transformation and analysis of recombinants.
Genomic and cDNA library, Steps of PCR (Polymerase chain reaction) and its applications in biology.

Paper 4: Cell and Tissue Culture

UNIT-I

Historical background and terminology used in cell and tissue culture.
Laboratory organization, equipments and materials used for plant tissue culture, green house, types and composition of media, sterilization techniques.

UNIT-II

General account of Cytodifferentitation, organogenic differentiation, seed culture, embryo culture, callus culture, organ culture, cell and protoplast culture.
Somatic embryogenesis and organogenesis in plants, somaclonal variations.

UNIT-III

In vitro production of haploids: Anther culture, microspore culture, ovary culture and ovule culture.
Micropropagation, production of secondary metabolites through plant tissue culture.

UNIT-IV

Laboratory requirements for animal cell culture, media preparation, Serum and serum free media, culture vessels.
Primary culture and Cell lines Adhesion, proliferation and differentiation of cultures cells.

UNIT-V

Monolayer, suspension and immobilized culture. Large scale cultivation of animal cells, idea of bioreactors for animal cell cultivation.

Paper 5 Biological Techniques & Intellectual Property Rights

UNIT- I

Analytical separation methods : Principles and techniques.
Chromatography - General principle, application and types. Paper chromatography, thin layer chromatography, Gel filtration chromatography, affinity chromatography, ion exchange chromatography, Gas chromatography, liquid chromatography. Electrophoresis - General principle, application, and types: Paper electrophoresis, moving boundary method, Gel electrophoresis (Native, Denaturing & Reducing), Disc Gel electrophoresis.

UNIT- II

Centrifugation: Basic principles. Common centrifuges used in laboratory (clinical, high speed & ultra centrifuges). Types of rotors (fixed angle, swing bucket).
Types of centrifugation: Preparative, differential & density gradient.
Ultra centrifugation: Sedimentation rate: zonal centrifugation. Biosensors: Introduction & principles, first, second & third generation instruments, cell based biosensors.

UNIT- III

Spectroscopic methods: principle and applications of UV-visible, IR, NMR, ES Round X-ray. Spectroscopy.
Application of radioisotopes in biology. Properties and units of radioactivity.
Radioactive isotopes and half-life.
Measurement of radioactivity: (basic knowledge) gamma counter, Tracer techniques (basic knowledge): Autoradiography.

Intellectual Property Rights

UNIT- IV

General Patent Information: Intellectual Property laws, Patent Claims and Patent Life, Utilization of Intellectual Patents, Patent Search, Patent Databases & Library, Ownership of Patents, IPR Rights, Elements of Patentability: Patentable subject matter, Utility, novelty and non-obviousness. Requirement of patentability. Worldwide Patent Protection.

UNIT- V

Patent Infringement: Literal Infringement, Contributory Infringement, Defenses to infringement including experimental use, patent misuse, IPR as Protection Strategy, Applying for foreign patent protection, Amendments, Unique aspects of Biotechnology patent laws & Procedures. Future Developments of Intellectual Property Rights: Indian Traditional Medicine & IP Protection.

Books Recommended:

1. Sharma, V.K.: Techniques in Microscopy and Cell Biology Tata McGraw Hill, 1991.
2. Alberts et al.: Molecular Biology of the cell (2nd ed.), Garland, 1989.
3. Biochemical Technique: Theory & Practical J.F. Robyt & B.J. White $ 30.95 Waveland Press, Inc.
4. Wilson & Walker: Practical Biochemistry (4th ed) University of Hertfordshire Cambridge University Press
5. Jayraman: Laboratory Manual in Biochemistry
6. Arnold L. Demain & Julian E. Davies: Manual of Industrial Microbio. & Biotech. 2nd ed.

Paper 6: Applications of Biotechnology

UNIT-I

Production of transgenic plants: marker genes and various gene transfer methods.
Transgenics in crop improvement: Resistance to biotic ad abiotic stresses, transgenic for quality, terminator seeds, transgenic plants as bioreactors, commercial transgenic crops.

UNIT-II

General idea of the production of transgenic animals, Molecular pharming.
Applications of transgenic animals.
Production and applications of monoclonal antibodies.

UNIT-III

Introduction to Bioinformatics and its Importance, Internet, EMB net, NCBI, Introduction to genome projects, genomics and proteomics, Databases of DNA and protein sequences, sequence alignments.

UNIT-IV

Biotechnology in medicine: Vaccine Development, Molecular diagnosis of Genetic diseases, gene therapy.
Introduction to DNA fingerprinting techniques.

UNIT-V

General account of biotechnological innovations in the area of bioremediation, biosensor development, immobilized enzymes, environmental sustainability, biological fuel generation.