

Note: B.Sc (Biotechnology), Biotechnology Papers I, II, III & IV have been completed in 1<sup>st</sup> Year.

B.Sc Biotechnology Part II  
SYLLABUS-BIOTECHNOLOGY  
Paper V: GENETICS

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- Mendelian laws of inheritance.
  - Lethality and interaction of genes.
  - Multiple alleles and isoalleles.
  - Linkage and crossing-over: Mapping of genes.
  - Sex determination in plants and animals: Sex-linkage, nondisjunction as a proof of chromosomal theory of inheritance.
  - Basic microbial genetics: Conjugation, transformation, transduction and their use in genetic mapping.
  - Concept of gene: Classical and modern gene concepts, pseudoallelism, position effect, intragenic crossing over and complementation (cistron, recon, and muton), benzer's work on rII locus in T4 phage.
  - Mutations-spontaneous and induced: chemical and physical mutagens, induced mutations in plants, animals and microbes for economic benefit of man.
  - Structural and numerical aberrations involving chromosomes: evolution of wheat, cotton and rice, hereditary defects-Klinefelter, Turner, Cri-du-Chat and Down syndromes.
  - Extrachromosomal inheritance: cytoplasmic inheritance, mitochondrial and chloroplast genetic systems (Differences between them and general concept).
  - Population genetics: Hardy - Weinburg equilibrium, gene and genotypic frequencies.

B.Sc Biotechnology Part II  
SYLLABUS - BIOTECHNOLOGY  
Paper VII: MOLECULAR BIOLOGY

Molecular basis of life: Structure of DNA (Watson & Crick model, B DNA and Z DNA in detail): DNA replication both prokaryotes and eukaryotic; DNA recombination molecular mechanisms prokaryotic and eukaryotic.

Insertion elements and transposons (composite, transposons, Tn 3 transposons)

Organisation of genetic material: Split genes; overlapping genes; pseudo genes; cryptic genes.

Genetic code: Properties of genetic code, codon assignment (chain initiation and chain termination codons), wobble hypothesis.

Structure of prokaryotic genes: Prokaryotic transcription, prokaryotic translation, prokaryotic gene expression (*lac*, *trp*, catabolic repression).

Structure of eukaryotic genes: Eukaryotic transcription; eukaryotic translation.

Prokaryotic gene regulation: operon model for regulation of *lac* genes; positive control of the *lac* operon; molecular details of *lac* operon; regulation of *trp* operon

Eukaryotic gene expression: levels of control of gene expression; RNA processing, transport, mRNA translation, mRNA degradation (nucleases, AU rich sequences) and protein degradation controls (ubiquitin molecule).

Molecular mapping of genome: genetic and physical maps, molecular marker for genomic analysis (RFLP, RAPD, VNTR, STRs).

Genome sequencing: methods of genome sequencing (Maxam and Gilbert method, Sanger method).

B.Sc Biotechnology Part II  
SYLLABUS-BIOTECHNOLOGY  
Paper VI: MICROBIOLOGY

History and development of microbiology: Pasteur's experiments, concept of sterilization, methods of sterilization (dry, heat, wet heat, radiation, chemical, and filtration etc.), microscopy (optical, TEM and SEM EM staining of specimen), concept of microbial species and strains; growth curve, various forms of micro-organisms (bacteria, fungi, viruses, protozoa, PPLOs); nature of microbial cell surface, gram positive and gram negative bacteria (Differences), fimbria flagella, sero typing, nutritional classification of microorganisms (Autotroph, heterotroph, chemotrophs parasitic in bacteria & fungi).

Genetic homogeneity in clonal populations: Isolation of auxotrophs (replica plating technique and analysis of mutations in biochemical pathways), microbial assays for vitamins and antibiotics, strain improvement by selection.

Control of microorganisms: Physical agents, chemical agents, antibiotics and other chemotherapeutic agents (sulphonamides, penicillin, streptomycin).

Microbial agents of diseases: Bacterial (staphylococcal, streptococci, mycobacterium), viral (TMV, HIV), fungal (General) and protozoan-malaria.

Microbes in extreme environments: The thermophiles & alkalophiles, pathogenic microorganisms (general in bacteria, virus), defence mechanism against micro organisms, symbiosis and antibiosis differences) among microbial population, N<sub>2</sub>-fixing microbes in agriculture and forestry (Nif genes, Azotobacteria, Blue green algal).

Industrial microbes and their uses: Production of food (Dairy and SPC) and drugs (Antibiotics- with special reference to penicillin & streptomycin), fermentation products, a survey of products from microorganism. (GEMS- useful proteins, crop production)

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B.Sc Biotechnology Part II

## SYLLABUS - BIOTECHNOLOGY

Paper VIII: IMMUNOLOGY

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Historical perspective of immune system and immunity, innate and specific immunity.  
The organs and cells of the immune system.  
Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures, isotypes, allotypes, idiotypes.  
Measurement of antigen: antibody interaction, agglutination, immunodiffusion, immuno-electrophoresis, ELISA, RIA, production of monoclonal antibodies.  
Histocompatibility: structure of MHC class I, II & III antigens & their mode of antigen presentation, MHC restriction, antigens & antigenicity.  
Humoral immunity and clonal selection theory;  
Cell-mediated immunity.  
Immunoglobulin gene: Genetic basis of creation of antibody diversity. Effect of T cell functions.  
Immunity to infection of diseases: Vaccine, (attenuated and recombinant ) and vaccination.  
Antibodies in targeting therapeutic agents.  
Autoimmunity: Mechanism of autoimmune diseases ( Hashimoto's thyroiditis, myasthenia gravis; Rheumatoid arthritis, pernicious anemia Asthma).

## B.Sc Biotechnology Part II

### SYLLABUS-BOTANY

Paper III: (Plant Physiology, Ecology and Plant Anatomy)

#### UNIT-I

(10 Hours)

1. Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential water potential.
2. Types of soils and water: passive and active absorption.
3. Ascent of sap.
4. Transpiration, closing and opening mechanism of stomata, and diffusion capacity of the stomata, significance of transpiration, guttation, factors affecting transpiration.

#### UNIT-II & III

(20 Hours)

1. Mechanism of absorption of mineral salts.
2. Elementary knowledge of the macro-elements.
3. Symptoms of mineral deficiency, Hydroponics and sand cultures.
4. Mechanism of translocation of solutes.
5. Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, path of carbon and factors affecting photosynthesis  $C_3C_4$  (Kranz's plant's anatomy cycle), chemosynthesis.
6. Respiration: Glycolysis, Krebs cycle, factors affecting respiration, fermentation.

#### UNIT-IV

(15 Hours)

1. Ecosystem with reference to forest and pond.
2. Energy flow and productivity.
3. Ecological niche and biological indicators.
4. Biogeochemical cycle: Carbon, Nitrogen and Hydrological cycles.
5. Biotic communities.
6. Ecological concept of species.

#### UNIT-V

(15 Hours)

1. Techniques for the study of plant anatomy.
2. Meristem.
3. Leaf anatomy, Epidermis, Stoma.
4. Origin, Structure and function of the Vascular cambium.
5. Structure of Xylem and Phloem.
6. Cork cambium activity and products.
7. Root-stem transition.

B.Sc Biotechnology Part II

SYLLABUS-BOTANY

Paper IV: (Embryology, Plant Pathology, Plant Breeding  
& Economic Botany)

UNIT-I

(18 Hours)

1. Structure of anther, microsporogenesis and development of the male gametophyte.
2. Structure of ovule, megasporogenesis and development of the female gametophyte with particular reference to *polygonum* type.
3. Fertilization, Endosperm, and embryo onograd type.
4. Apomixis and Polyembryony

UNIT-II

(15 Hours)

1. General symptoms of fungal, bacterial & viral diseases & their control.
2. Systematic position, morphology of the causal organisms, parasite relationship, disease cycle in the following diseases- White rust of Crucifers, Late blight of Potato, Loose smut of Wheat, Rust of Wheat, Citrus canker and yellow vein disease of Bhindi.

UNIT-III

(12 Hours)

1. Nature and objectives of plant breeding.
2. General methods of plant breeding.
3. Role of hybrid vigour in plant breeding.

UNIT-IV

(15 Hours)

1. Economic importance with special reference to plant yielding:
  - a). Food: Cereals (Rice, Wheat, Maize) potato, Sugarcane, Legumes (Pigeon pea, Gram, and Pea). Oil yielding plants (Sarson, Til, Groundnut, Cotton). Fruits - (Apple, Peach and Citrus)
  - b). Common fibre yielding plants - Cotton, Sunhemp, Jute and Coir.
  - c). Medicinal plants - (*Papaver somniferum*, *Rauwolfia serpentina* and *Atropa beladon*)
  - d). Common timber yielding plants - *Pinus* sp., *Cedrus deodara*, *Shorea robusta*, *Dalbergia sisso*, Teak

B.Sc. (Biotechnology) Chemistry Papers I & II  
10 books completed in Part - I

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B.Sc. II (Biotechnology) SYLLABUS - CHEMISTRY

Paper III- Inorganic and physical chemistry

UNIT-I (40 Hours)

INORGANIC

Acid and Bases: Elementary idea of Bronsted-Lowry and Lewis concept of acids and bases (proton-donor acceptor and electron donor systems). Relative strengths of Lewis acids bases and the effect of substituents and the solvent on them.

General properties of 3<sup>rd</sup> elements & Co-ordination compounds, molecular compounds, werners co-ordination theory. IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner Orbit complexes. Role of tracer elements (Ne, K, Mg, Ca, Fe, Co, Zn, Cr, P, S, Cl, and I) in biological systems.

General trends in the chemistry of p-block elements: preparation properties, uses and the structure of the following compounds. Tin Chlorides, hydrazine, hydroxylamine and acids, Oxides, Oxyacids and phosphorus, tartaremetic, hydrogen sulphide (analytical application of oxides and oxyacids of sulphur, sulphury chloride and oxyacids of chlorine.

UNIT- II (20 Hours)

PHYSICAL

Liquids: Vapour pressure, variation of vapour pressure of liquid with temperature. (clausious-claperon equation), surface tention viscosity, their experimental determination and applications parachor, raéochar, and their applications.

Solutions: Harnery's law, Raoult's law, critical solution temperature, fractional distillation and steam distillation, osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions. Calculations of molecular weight, abnormal molecular weight.

Heterogenous equilibria: phase rule, phase diagrams of water sulphur system, Nernst's distribution law, solvent extraction.

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Paper-IV-

Organic and physical chemistry

UNIT-I

(40 Hours)

ORGANIC

Carbohydrates: Classification, properties and uses, preparation of cane sugar, constitution of glucose and fructose, mutarotation. General study of: Cycloalkanes, arenes, halogen substituted aromatic compounds, simple phenols, nitro and amino compounds, aldehydes and ketones, phenolic aldehydes & ketones, carboxylic acid (mono and di). Electrophilic substitutions: orientation in aromatic compounds.

Descriptive study of benzene, toluene, chloro-benzene, nitrobenzene, aniline, benzene diazonium chloride, benzene sulphonic acid, sulphanic acid, phthalic acid and salicylic acid. Naphthalene preparation, structure and synthesis, preparation of  $\alpha$  and  $\beta$  naphthylamines. Preparation of di & tri hydroxyphenols, constitution of pyridines and quinoline.

UNIT-II

(20 Hours)

PHYSICAL

Chemical Thermodynamics: Energy, work, heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume, Hess's law, Kirchoff's Equations. The second law of thermodynamics. Entropy (S), determination of Entropy. Changes for reversible transition process. Free energy (G), free energy change and chemical equilibrium.

Electrochemistry: Galvanic cell's, standard electrode potential, types of electrodes, measurement of pH.

Photochemistry: Lambert-Beer law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.