

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

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**Mendelian law of inheritance**

**Linkage 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, recom 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 – Weinberg equilibrium, gene and genotypic frequencies.**

**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 stains; growth curve, various forms of micro-organisms (bacteria, fungi, viruses, protozoa, PLOs); nature of microbial cell surface gram positive and gram negative bacteria (Differenes), 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 by selection).

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

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

**Microbes in extreme environments:** The thermophiles & alkalophiles, pathogenic microorganisms (general in bacteria, virus), defense mechanism Micro organisms, symbiosis and antibiosis differences) among microbial population, N<sub>2</sub>-fixing microbes in agriculture and forestry (Nif genes, Anotobacteria, 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).

## Paper VII: MOLECULAR BIOLOGY

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**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 operon 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, 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 Gillbert method, Sanger method).

## 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 of 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 of 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).

# SYLLABUS – BOTANY

## Paper III: (Plant Physiology, Ecology and

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### Plant Anatomy)

#### UNIT-I

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

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 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  $C_3$   $C_4$  (Kranz's plant's anatomy cycle), chemosynthesis.
6. Respiration: Glycolysis, Krebs cycle, factors affecting respiration, fermentation.

#### UNIT-IV

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. Ecological concept of species.

#### UNIT-V

Techniques for the study of plant anatomy,

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

# SYLLABUS – BOTANY

## Paper IV: (Embryology, Plant Pathology,

### Plant Breeding & Economic Botany)

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#### UNIT-I

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 polygamete type.
3. Fertilization, Endosperm and embryo onagrad type.
4. Apomixis and Polyembryony

#### UNIT-II

1. General symptoms of fungal, bacterial & viral diseases & their control.
2. Systematic position, morphology of the causal organisms, parasite relationship, and 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

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

### UNIT-IV

1. Economic importance with special reference to plant yielding:
    - (a) Food: Cereals (Rice, Wheat, Maize) potato, Sugarane, Legumes (Pigeon and Pea). Oil yielding plants (Sarson, Til, Groundnut), Fruits – (Apple, Peach and Citrus).
    - (b) Common fibre yielding plants – Cotton, Sunhemp, Jute and Coir.
    - (c) Medicina Plants – (Papaver somniferum, Rauwolfia serpentine and Atropabeladona.
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## SYLLABUS – CHEMISTRY

### Paper IV: (Organic and physical chemistry)

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#### UNIT-I

##### ORGANIC

**Carbohydrates:** Classification, properties and uses, preparation of cane sugar, constitution of glucose and fructose, mutarotation, General study of : Cycloalkanes, arenas, halogen

substituted aromatic compounds, simple phenols, nitro and amino compounds, aldehydes and ketones, phenolice & ketones, carboxlic acid (mono and di) electrophilic substiutions, orientation in aromatic compounds .

- (12 Hrs) **Descriptive Study of benzene:** toluence, chloro-benzene, nitrobenzene, aniline, benzene diazonium chloride, bezene sulphonic acid, sulphanilic acid, phthalic acid and salicylic acid. Naphthalene preparation, structure and synthesis, preparation of  $\alpha$  and  $\beta$  naphthylamines. Preparation of di & tri (15 Hrs) hydroxyphenols, constitution of pyridines and quinoline.

#### UNIT-II

##### PHYSICAL

**Chemical thermodynamics:** energy, work, heat capacity the first low of thermodynamics, heat of a reaction at constant pressure and constant, Hess's low, kirchoff's equations. The second low of thermodynamics. Entropy (S), determination of entropy. Changes for reversible transition process. Free energy (G) free energy change and chemical equilibrium.

**Electrochemistry;** Galvanic cells standard electrode potential types of electrodes measurement of ph.

**Photochemistry:** Lambert-beer low: law of photochemical equivalence; quantum efficiency, high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

## Paper III: (Inorganic and physical chemistry)

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### UNIT-I INORGANIC

**Acid and Bases:** Elementary idea of Bronsted-Lowry and Lewis Concept of acid 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, Werner's co-ordination theory, IUPAC system of nomenclature of coordination compounds, Discussion of outer and inner orbit complexes, Role of trace 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 oxides, oxides oxyacids and phosphorus tartaric acid hydrogen sulphide (analytical application of oxides and oxyacids of sulphur sulphur chloride and oxyacids of chlorine).

### Unit-II Physical

**Liquids:** vapour pressure, variation of vapour pressure of liquid with temperature. (Clausius-Clapeyron equation), surface tension viscosity, their experimental determination and applications parachor, rheochor and their applications.

**Solutions:** Raoult's law Dalton'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 calculations of molecular weight abnormal molecular weight.

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