

PROGRAMME SPECIFIC OUTCOME

PSO1. Understand the basic concept of Algae, their classification, vegetative structure and comparative study of some genera.

PSO2. Understand the basic concept of fungi, their ecology, their pathology and comparative study of some of the genera.

PSO3. Understand and differentiate Bacteria, Viruses and Lichen based on their morphology, ecology and chemical composition.

PSO4. Understand the basic concept of bryophyta, their economic importance, their role as pollution indicator and place among the organism.

PSO5. Understand the pteridophyta, their economic importance, structure and function.

PSO6. Understand the gymnosperm, their habitat, distribution, classification; general idea about fossil and process of fossilization.

PSO7. Understand the plant angiospermic family and differentiated one family from other, classification of angiosperm, basic knowledge about botanic garden, herbaria and ICBN.

PSO8. Understand the basic concept about cell and their organelles and their function.

PSO9. Understand about process of microsporogenesis and megasporogenesis; general concept of seed germination, dormancy, plant growth hormone and physiology of flower.

PSO10. Understand and differentiate nucleic acid and genetic code, law of inheritance, plant breeding and crop improvement methods.

PSO11. Understand basic concept of DNA, RNA; molecular markers, gene regulation, PCR and DNA fingerprinting.

PSO12. Understand and perform anatomy of root, stem and leaf, types of plant tissue, secondary growth.

PSO13. Perform, understand and classify plant and environment, their habitat, population, community structure, ecological succession, ecological pyramid, biogeochemical cycle-C, N ; Biodiversity and conservation, general idea about pollution.


PSO14. Understand and perform plant physiological process-diffusion, transpiration, mineral nutrition, respiration and photosynthesis.


PSO15. Understand and classify amino acid, proteins, enzymes, carbohydrate, fats and lipids.


PSO16. Understand the basic knowledge and commercial utilization of selected plants like cereals & millets, sugar yielding plant, fruits, fibres, vegetable, timbers,, medicinal plants, oils, beverages, spices and condiment.

PSO17. Understand, describe and perform sampling, measures of central tendency, correlation coefficient, chi square test.

PSO18. Understand basic concept of biotechnology, genetic engineering, plant tissue culture, industrial and agricultural biotechnology, SCP and mycotoxin.


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Paper I: Fungi, Elementary Microbiology and Plant Pathology


- Co1. Describe in detail the introduction, salient features and history of fungi.
- Co2. Classification of fungi (ainsworth) and salient features of the important groups. Fungi up to the class level
- Co3. Describe and illustrate, somatic structure of fungi, nutritional and environmental needs of fungi.
- Co4. Describe in detail the reproduction in fung, heterothallism , heterokaryosis, a general idea of parasexual cycle.
- Co5. Describe the importance of fungi-both beneficial and harmful.
- Co6. Describe the Structure, methods of reproduction and life history of the genera in brief: *Synchytrium*, *Saprolegnia*, *Albugo*, *Rhizopus*, *Penicillium*, *Saccharomyces*, *Phyllactinia*, *Erysiphe*, *puccinia*, *Ustilago*, *Agaricus* and *Alternaria*
- Co7. Describe lichens: characteristics, general structure, reproduction, economic importance, symbiotic relationship and habitats.
- Co8. Describe diversity of microbes, elementary principles of isolation and purification of microorganisms.
- Co9. Describe general account of bacteria: structure, classification, nutrition, reproduction gram positive and gram negative bacteria, and economic importance.
- Co10. Describe viruses: characteristics, isolation and purification of viruses, chemical nature, replication, transmission of viruses, economic importance.
- Co11. Describe general symptoms of plant diseases and principles of infection and resistance; general methods of chemical and biological control of the plant diseases.
- Co12. The symptoms, morphology of the causal organism, disease cycle and control measures of the following diseases : wart disease of potato, white rust of crucifers, powdery mildew of shisham, black rust of wheat, red rot of sugarcane.

Paper II: Algae and Bryophytes

- CO1 Describe about introduction and salient features of algae and their place among the organism.
- CO 2. Classification of algae (Fritsch's and Smith's) up to class level.
- CO 3. Describe range of thallus, vegetative structure and Cell structure in algae.
- CO 4. Describe various types of Reproduction and alternation of generation in algae.
- CO 5. Describe the ecology of algae and its types.
- CO 6. Describe the economic importance of algae as food, fodder, in agriculture, industry and public health.
- CO 7. Describe Structure, reproduction and life cycles of the genera- *Nostoc*, *Chlamydomonas*, *Volvox*, *Oedogonium*, *Chara*, *Vaucheria*, *Sargassum*, *Polysiphonia*, Diatoms
- CO8. Describe Introduction, features, distribution, habitat and economic and ecological importance of Bryophyta.
- CO9. Classify Bryophyta (ICBN) upto order level giving the characteristic features of each class.
- CO10. Comparative study of *Riccia*, *Marchantia*, *Porella*, *Anthoceros* and *Funaria* on the basis of morphology and anatomy of gametophyte, vegetative, sexual reproduction and sporophyte.
- CO11. Describe alternation of generation, spore dispersal in Bryophyta.


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Paper III: Pteridophytes, Gymnosperm and Elementary Palaeobotany

- CO1. Describe introduction and salient features of Pteridophytes and economic importance.
CO2. Describe alternation of generation in Pteridophyta.
CO3. Classify Pteridophyta upto order level (proposed by Pichi-Sermolli).
CO4. Comparative study of *Rhynia*, *Lycopodium*, *Selaginella*, *Equisetum*, *Adiantum*, *Marsilea* on the basis of morphology and anatomy of vegetative plant body, spore producing organs and sexual reproduction.
CO5. Describe Stelar system, heterospory and seed habit.
CO6. Describe introduction and salient features of Gymnosperms and their place among the plant kingdom.
CO7. Classify gymnosperms upto order level (proposed by Pichi-Sermolli)
CO8. Describe Alternation of generation in Gymnosperms.
Distribution of Gymnosperms in India. 2. Economic importance of the Gymnosperms.
CO9. Comparative study of *Cycas*, *Pinus* and *Ephedra* on the basis of morphology and anatomy of the vegetative plant body, sporophylls.
CO10. Describe Fossils, their types and process of fossilization, general idea about various geological eras and living fossils.



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B.Sc IInd Year

Paper I :Taxonomy of Angiosperms and Economic Botany

CO1. Describes the taxonomy- fundamental components ,Comparasion and evolution of the system of classification as proposed by Linnaeus, Betham and Hooker and Hutchinson.

CO2. Describe International Code of Botanical Nomenclature. History, scientific naming of plants, priority, types, validity, nomina conservanda.

CO3. Describe Botanical gardens and Herbaria and Botanical Survey of India.

CO4. Distinguishing features of the following families Dicotyledonae Polypetalae : Ranunculaceae, Brassicaceae, Caryophyllaceae, Rutaceae, Malvaceae, Rosaceae and Apiaceae , Gamopetalae: Solanaceae, Apocynaceae, Acanthaceae, Lamiaceae 2. Monochlamydae: Euphorbiaceae, Polygonaceae , Monocotyledonae: Orchidaceae, Liliaceae, and Poaceae.

CO5. Describe and explain about the brief knowledge of Botany and commercial utilization and uses of the following plants:

CO6. Describe Cereals and millets- Wheat, Rice and Maize, Ragi, Pearl millet and some important Legumes:

CO7. Describe Oils (Volatile and non-volatile oils): Castor oil, linseed oil and mustard oil.

CO8. Describe Fruits- Mango, apple, banana, Citrus and Litchi.

CO9. Describe Fibres- Cotton, jute, flax, hemp, coir, Agave and Semal.

CO10. Describe Vegetables- Root vegetables, stem vegetables and fruit vegetables.

CO11. Describe Timbers- Teak, Shisham, Sal, Chir and Deodar.

CO12. Describe Medicinal plants- *Aconitum*, *Atropa*, *Cinchona*, *Rauwolfia*, *Ephedra* and *Withania*.

Paper II:Anatomy, Embryology and Elementary Morphogenesis

CO1. Describe The techniques for the study of plant anatomy.

CO2. Describe about Meristematic and Permanent tissues: Root and Shoot apical meristems and their function; Simple, Complex and Special types of tissues.

CO 3. Describe Epidermis and stomata

CO4. Explain and perform anatomy of dicot and monocot root, stem and leaf.

CO5. Describe Secondary growth: vascular cambium, structure and function; seasonal activity (growth rings), secondary growth in root and stem; sap wood, heart wood, anomalous secondary growth in *Bougainvillea*, *Salvadora*, *Nyctanthes*, *Dracaena*, *Orchids* and *Tinospora*..

CO7. Describe the Structure of anther and pollen, microsporogenesis and male gametophyte.

CO8. Describe structure and types of ovules, megasporogenesis and female gametophyte.

CO9. Explain pollination mechanism, Fertilization, self incompatibility, double fertilization.

CO10. Describe endosperm types, structure and functions; dicot and monocot embryo.

CO11. Describe general concept of morphogenesis.

CO12. Describe seed germination and dormancy.

CO13. Describe a general account of Plant Growth Regulators.

CO14.Explain physiology of Flowering- Photoperiodism and Vernalization.

Paper III:Ecology and Remote Sensing

Describe plant and environment: Principles of environment, atmosphere, light, temperature, water, soil and biota

Describe ecosystem concept, energy flow, food chain, food web and ecological pyramids and ecological niche.

Define Productivity, type, measurement of primary productivity, energy flow and ecological energetics, Lindeman's concept of Energy Flow.

Explain biogeochemical cycles with emphasis on carbon, nitrogen and phosphorus cycles.

CO 3. Explain population: Growth curves, population characteristics, growth curves, carrying capacity and population fluctuation. ecotype and ecads.

CO 4. Explain definition of community; Structure and attributes of community: frequency, density, cover, life forms and biological spectrum; ecological succession

Explain preliminary idea of environmental pollution, prevention and control of pollution.-air, water, soil, noise and radioactive pollution

Understand the cause and effect of Global warming, desertification and ozone depletion.

Describe the Biogeographical regions of India ; Vegetation types in Uttarakhand

Explain basic concept of Biodiversity and its conservation.

Explain the concept of Soil erosion and conservation.

Definition of remote sensing, aerial photography, principles and fundamentals of aerial photo interpretation. and role of remote sensing in ecology.


B.Sc IIIrd Year


Paper I: Cytogenetics, Molecular Biology and Biotechnology

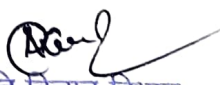
- CO1. Describe Cell structure: Prokaryotic and eukaryotic cells; and models of plasma membrane).
- CO2. Describe structure and functions of cell organelles: Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi complex, Ribosome, Microbodies (Lysosomes, Peroxisomes, Glyoxisomes); structure and function of Nucleus and Nucleolus
- CO3. Describe cell division: cell cycle, process and significance of mitosis and meiosis, structure and function of synaptonemal complex and crossing over
- CO4. Describe eukaryotic chromosome: structure, chemical composition, Karyotype analysis, Ideogram; structure and functions of Polytene and Lampbrush chromosomes
- CO5. Describe structure and function of nucleic acid and different forms of DNA (A, B, Z).
- CO6. Explain genetic code: properties of genetic code, classical and modern concept of gene. . Explain DNA chemistry and DNA replication; replication error and repair mechanism.
- CO7. Describe introns, exons, transposons, molecular basis of gene mutation
- CO8. Explain Molecular markers: A general idea of RAPD (Random Amplified Polymorphic DNA), RFLP (Restriction Fragment Length Polymorphism), VNTR (Variable Number of Tandem Repeats).
- CO 9. Explain Polymerase chain reaction techniques (PCR). A brief idea of DNA finger printing.
- CO10. Explain law of inheritance: Mendel's experiments, principle of segregation, independent assortment, incomplete dominance.
- CO11. Explain chromosomal aberration- structural (deficiency, duplication, inversion & translocation) and numerical (Euploidy & Aneuploidy), alteration in chromosomes.
- CO12 Describe sex determination: sex chromosomes, sex determination in Drosophila, Man and plants specially *Melandrium*;
- CO13. Describe sex linked inheritance
- CO14. Describe introduction to Biotechnology: Role in modern life, history and ethical issues connected with Biotechnology.
- CO15. Describe Genetic Engineering: Enzymes and vectors involved in genetic engineering, Recombinant DNA technology, tools and techniques of genetic engineering.
- CO16. Explain plant tissue culture technique: Basic requirements of Tissue culture Laboratory, different types of media and their composition, basic technique of tissue culture, types of culture on the basis of explants, collection and storage of germplasm (Cryopreservation), PTC with reference to somaclonal variations, synthetic seeds, somatic hybridization and hairy root culture.
- CO17. Describe Industrial Biotechnology and Agricultural Biotechnology: Crop (yield /quality) improvement, bio fertilizers and biological control.
- CO19. Explain biotechnology with regard to microorganisms: Mycotoxin based health hazards and their control, single cell protein.

Paper II: Plant Physiology and Elementary Biochemistry

- CO 1. Explain Diffusion, osmosis, water potential and its components, Plasmolysis, Imbibition and Absorption of water.
- CO 2. Explain root pressure and guttation, Transpiration and its significance, Factor affecting transpiration, mechanism of stomatal (opening and closing).
- CO 3. Describe Mineral nutrition: Essential elements, macro and micro nutrients, criteria of essentiality of elements, role of essential elements, minerals deficiency symptoms.
- CO 4. Explain Translocation in phloem: composition of phloem sap, girdling experiment, pressure flow model, phloem loading and unloading
- CO 5. Explain Respiration: aerobic and anaerobic respiration. Glycolysis and Krebs's cycle. Oxidative phosphorylation, electron transport system, fermentation, R.Q.
- CO 6. Describe and explain Photosynthesis: photosynthetic pigments. Photo system I and II, electron transport system and ATP synthesis. Path of carbon in C3 plants (C3 cycle), C4 plants (C4 cycle), CAM pathway, photorespiration,
- CO 7. Explain enzymes: Properties, classification, mechanism of enzymes action and factors affecting enzymes activities
- CO8. Describe and explain amino acids and proteins: : Classification, structure and chemical bonds in protein structure and properties. (An elementary account with special reference to plants)
- CO 9. Explain and describe Biological Nitrogen fixation and nitrate and ammonia assimilation.
- CO 10. Explain carbohydrates: Structure and function.
- CO11. Describe elementary idea of fats and lipids in plants.



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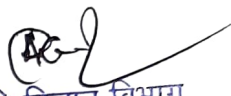

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Paper III: Plant Breeding and Biostatistics

- CO1. Describe plant breeding- aims and objectives, basic techniques of plant breeding (selection, plant introduction and acclimatization, hybridization and mutational breeding), hybrid vigour).
- CO2. Explain introduction, definition, scope and importance of statistics,
- CO3. Describe sampling: aim, simple random sampling, stratified random sampling, systematic sampling.
- CO4. National Seed Corporation (NSC), seed testing laboratories, International and National Centre for plant breeding.
- CO4. Explain measures of central tendency, mean, median and mode.
- CO5. Describe classification, tabulation and graphic presentation of data.
- CO 6. Explain measures of dispersion-range, variance, standard deviation, standard error.
- CO 6. Explain correlation: correlation coefficient.
- CO 7. Explain Chi-square (χ^2) test.


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