BABA FARID GROUP OF INSTITUTIONS

DEPARTMENT OF BOTANY

"Plants," to most people, means a wide range of living organisms from the smallest bacteria to the largest living things - the giant sequoia trees. By this definition plants include: algae, fungi, lichens, mosses, ferns, conifers and flowering plants. Today scientists believe bacteria, algae and fungi are in their own distinct kingdoms.

Because the field is so broad, there are many kinds of plant biologists and many different opportunities available. Botanists interested in ecology study interactions of plants with other organisms and the environment. Other field botanists search to find new species or do experiments to discover how plants grow under different conditions. Some botanists study the structure of plants. They may work in the field, concentrating on the pattern of the whole plant. Others use microscopes to study the most detailed fine structure of individual cells. Many botanists do experiments to determine how plants convert simple chemical compounds into more complex chemicals. They may even study how genetic information in DNA controls plant development. Botanists study processes that occur on a time scale ranging from fractions of a second in individual cells to those that unfold over eons of evolutionary time. The results of botanical research increase and improve our supply of medicines, foods, fibers, building materials, and other plant products. Conservationists use botanical knowledge to help manage parks, forests, range lands, and wilderness areas. Public health and environmental protection professionals depend on their understanding of plant science to help solve pollution problems.

--Dr. Ajay Pundir
In-Charge
Department of Botany

Distribution of Marks in different courses:

I Semester	Course Title	Theory External	Theory Internal	Total Marks
Course I	Cell and Molecular Biology of Plants	50	50	100
Course II	Biology and Diversity of Viruses and Bacteria	50	50	100
Course III	Biology and Diversity of Algae and Bryophytes	50	50	100
Course IV	Biology and Diversity of Pteridophytes, Gymnosperms and Palaeobotany	50	50	100
Practical I (4 hours)		100	100	200
Total Marks		300	300	600

II Semester	Course Title	Theory External	Theory Internal	Total Marks
Course V	Genetics & Cytogenetics	50	50	100
Course VI	Taxonomy of Angiosperms, Plant Resource Utilization and Conservation	50	50	100
Course VII	Biology and Diversity of Fungi and Plant Pathology	50	50	100
Course VIII	Phytotechniques	50	50	100
Practical II (4 hours)		100	100	200
Total Marks		100	300	600

III Semester	Course Title	Theory External	Theory Internal	Total Marks
Course IX	Phytochemistry and Metabolism	50	50	100
Course X	Plant Physiology	50	50	100
Course XI	Ecology	50	50	100
Course XII	Plant Reproduction & Development	50	50	100
Practical III (4 hours)		100	100	200
Total Marks		300	300	600

IV Semester	Course Title Plant Biotechnology	Theory External	Theory Internal	Total Marks
Course XIII	I-R-DNA Technology	50	50	100
Course XIV	II-Environmental Biotechnology	50	50	100
Course XV	III-Microbial Biotechnology	50	50	100
Course XVI	IV-Plant Cell, tissue and Organ Culture	50	50	100
Practical IV (4 hours)		100	100	200
Total Marks		300	300	600

I Semester:

Course I: Cell and Molecular Biology of Plants
Course II: Biology and Diversity of Viruses and Bacteria
Course III: Biology and Diversity of Algae and Bryophytes
Course IV: Biology and Diversity of Pteridophytes, Gymnosperms & Palaeobotany
Practicals : Based on the above courses

II Semester:

Course V: Genetics and Cytogenetics
Course VI: Taxonomy of Angiosperms, Plant Resource Utilization and Conservation
Course VII: Biology and Diversity of Fungi and Plant Pathology
CourseVIII: Phytotechniques
Practicals : Based on the above courses

III Semester:

Course IX: Phytochemistry and Metabolism
Course X: Plant Physiology
Course XI: Ecology
Course XII: Plant Development and Reproduction
Practicals : Based on the above courses

IV Semester:

Course XIII: Plant Biotechnology I- Genetic Engineering
Course XIV: Plant Biotechnology II- Environmental Biotechnology
Course XV: Plant Biotechnology III-Microbial Biotechnology
Course XVI: Plant Biotechnology IV- Plant Cell, Tissue and Organ Culture
Practicals : Based on the above Courses

M.Sc. BOTANY

Teaching hours: 50

Course I : Cell and Molecular Biology of Plants.

Unit I

The dynamic cell: Microscopy, Principle, parts and functioning of Light and Electron microscopes including stereoscopic binocular, dark field illumination, confocal, phase contrast, fluorescence and polarizing microscopes, camera lucida, SEM, TEM, STEM, Chemical foundation of cell

Unit II

(a) Ultrastructure and function of biological membranes with special emphasis on plasma membrane and tonoplast membrane (b) Structural organization of chloroplast and mitochondria. (c) Ultrastructure of nucleus (d) Ultrastructure of cell wall (e) Ribosome structure (f) Structure and function of microbodies, dictyosomes, lysosomes, endoplasmic reticulum and plasmodesmata

Unit III

Cell Cycle & Apoptosis - Biochemical and genetic mechanism. (a) Mitosis and spindle formation mechanism, cytokinesis and cell plate formation, role of cyclins and cyclin dependent kinases, mechanism of programmed cell death, (b) Cytoskeleton with emphasis on spindle apparatus, motor movements.

Unit IV

(a) Structure and morphology of chromosomes.
(b) Biochemical composition and ultrastructure of chromosome and chromatin.
(c) Genetic material – DNA, RNA, experimental evidences.
(d) Structure of DNA & RNA - Primary, secondary and super coiling of DNA.
(e) Types of RNA, differences between DNA & RNA.

Unit V

(a) DNA replication and its biosynthesis.
(b) DNA damage and repair. (c) Basis of transposons, and mechanism of transposition.
(d) Genetic code and transcription RNA processing
(e)Translation and Regulation of protein synthesis in prokaryotes,

Suggested Readings:

Alberts,B., Bray, D., Lewis, J., Raff,M., Roberts, K. and Watson, J.D. 1999. Molecular Biology of the Cell. Garland Publishing , Inc. New York

Buchanan, B.B., Gruissemem, W. and Jones, R.L.2000.Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, USA.

Lewin B. 2000. Genes VII . Oxford University Press, N.Y.

Lodish,H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J.2000. Molecular Cell Biology (4th edition) W.H. Freeman & Co., N.Y.

Malacinski, G.M. and Freifelder, D. 1998. Essentials of Molecular Biology (3rd edition) Jones and Bartlet Publishers, Inc. London.

M.Sc. BOTANY

Teaching hours: 50

Course II : Biology and Diversity of Viruses and Bacteria.

Unit -I (a) Development of microbiology as science; important contributions of pioneer microbiologists; golden eras of microbiology; present trends; types of organisms studied by microbiologists.
(b) Methods in microbiology: sterilization, culture media, pure culture techniques, isolation of microbes, maintenance of microbial cultures; microbial culture collection centres
(c) Important criteria used for classification (morphological, ecological, biochemical, molecular and numerical criteria) of microorganisms.
(d) Evolutionary relationships among taxa; three domain concept

Unit -II (a) Ultrastructure of bacteria in general; important differences between archaebacteria and bacteria; features of special interest of cyanobacteria.
(b) Classification of bacteria based on Bergey's manual of systematic bacteriology.
(c) Viruses: characteristics and ultrastructure of viruses; isolation and purification of viruses; chemical nature; multiplication of animal viruses, plant viruses and bacteriophages; transmission of viruses.
(d) Viroids: structure and multiplication; general structure, reproduction and importance of mycoplasma, phytoplasma and rickettsiae; actinomycetes and actinorhizae.

Unit -III (a) Nutritional requirements of bacteria, nutritional uptake and transport; growth yield and characteristics, stress response.
(b) Methods of genetic transfer; transformation, conjugation, transduction and sexduction, mapping genes by interrupted mating, fine structure analysis of genes.
(c) Regulation of gene expression in phages and viruses; a comparison of gene expression between prokaryotic and eukaryotic microbes; viroids and gene silencing.
(d) Host-parasite interaction: a brief idea of recognition and entry processes of bacteria, viruses into animal and plant-host cells, alteration in host cell; virus-induced cancer; bacteria and plant two-component signalling systems; bacterial chemotaxis and quorum sensing.

Unit - IV (a) Microbiology of air.
(b) Microbiology of water.
(c) Microbiology of soil.
(d) Microbes for control of pollution.
(e) Microbial enzymes and their application.
(f) Microbes in nanobiotechnology.

Unit - V Cells and molecules involved in immune system; antigens, antigenicity; B and T cell epitope, structure and function of antibody molecules, generation of antibody diversity, monoclonal antibodies, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cells receptors, complement system, inflammation, hypersensitivity and autoimmunity, immune response during bacterial(tuberculosis), parasitic(malaria) and viral (HIV) infections, congenital and acquired immunodeficiency, vaccines.

Suggested Reading

Calton, A. 1958. Introduction to Bacteria. McGraw-Hill Book Co., NY.

Tortora, G.J., Funke, B.R. and Case, C.L. 2001. Microbiology: An Introduction. Addison Wesley Longman, New York.

M.Sc. BOTANY

Teaching hours: 50

Course III : Biology and Diversity of Algae and Bryophytes

Unit I

(a) Classifications and salient characters of different classes.

(b) Algal pigments and food reserves and their importance in classification.

(c) General aspects of fresh water and marine algae.

(d) Economic importance of Algae as food, source of chemicals and drugs, fertilizer.

Unit II

Comparative study of classes of Cyanophyceae and Chlorophyceae, with reference to :

(a) Range of structure of plant body including ultrastructure.

(b) Methods of reproduction.

(c) Variations in life cycles.

Unit III

Comparative study of Bacillariophyceae, Phaeophyceae and Rhodophyceae with reference to :

(a) Range of structure of plant body.

(b) Range of mode of reproduction and life cycles.

Unit IV

(a) Classification of Bryophytes and their distribution in India.

(b) Range of structure of thallus (plant body) and anatomy in Bryophytes (with suitable examples.

(c) Range of structure of sporophyte in Bryophytes.

Unit V

(a) Evolutionary tendencies in the gametophytes and sporophytes of Bryophytes.

(b) Origin, inter-relationships and affinities of various groups in Bryophytes.

(c) Ecology and Economic importance of Bryophytes.

Suggested Readings:

Bold, H.C. and Wynne, M.J. 1978. Introduction to the Algae. Prentice-Hall of India, N.D.

Chapman, V.J. 1962. The Algae. Macmillan & Co. Ltd., London

Fritsch, F.E. 1935. The Structure and the Reproduction of the Algae. CUP-VIKAS Students' Edition, Vikas Publishing House Pvt. Ltd., Kanpur. Vol. I & II.

Kashyap, S.R. 1932. Liverworts of Western Himalayas. The University of Punjab, Lahore.

Kumar, H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.

Morris, I. 1986. An introduction to the Algae. Cambridge University Press, U.K.

Round, F.E. 1986. The Biology of Algae. Cambridge University Press, Cambridge.

Smith, G.M. 1951. Manual of Phycology : An Introduction to the Algae and Their Biology. Chronica Botanica Co., Waltham, Massachusetts

VenkataRaman, G., Goyal, S.K., Kaushik, B.D. and Roychoudhury, P 1974. Algae: Form and Function. Today and Tomorrow's Printers and Publishers, New Delhi.

M.Sc. BOTANY

Teaching hours: 50

Course IV: Biology and Diversity of Pteridophytes, Gymnosperms and Palaeobotany.

Unit I

(a) Principles of Palaeobotany, fossils, types of rocks, types of fossils.
(b) Geological area and distribution of plants in geological time scale.
(c) Techniques of study of fossils.

Unit II

(a) Classification of Pteridophytes, salient features.

Comparative organography, systematics, ,reproduction and Phylogeny of the following :

(a) Psilophytales and Lycopodiales.
(b) Sphenophyllales, Marattiales, Osmundales.
(c) Filicales, Marsileales, Salviniales.

Unit III

(a) Telome theory;
(b) Stelar system and evolutionary tendencies
(c) Soral organization and evolution: Prothallial evolution.
(d) Heterospory and evolution of seed habit.
(e) Phylogeny and evolution of Eusporangiatae and Leptosporangiatae

Unit IV

(a) Classification and distribution of Gymnosperms , morphology, anatomy and reproduction in groups (a comparative account).
(b) Cycadales and Ginkgoales.
(c) Coniferales and Gnetales.

Unit V

(a) General account of vegetative and reproductive organs of Pteridosperms.
(b) General account of vegetative and reproductive organs of Pentoxylales, Cordaitales.
(c) Bennettitales and Evolution & Phylogeny of Gymnosperms.

Suggested Readings:

Pant, D.D. 1973. The Cycadales.

Sporne, K.K. 1991. The morphology of Pteridophytes. B.I. Publishing Pvt. Ltd., Bombay

Stewart, W.N. and Rathwell,G.W. 1993. Palaeobotany and the evolution of plants. Cambridge University Press, UK

Johri, B.M.

Bhatnagar, S.P.

Ogura

M.Sc. BOTANY

Teaching hours: 50

Course V : Genetics And Cytogenetics.

Unit I

(a) Mendel' s Laws of inheritance and modified ratios.

(b) Multjple alleles; - Self incompatibility, alleles, coat colour in "Rodents, blood groups in Humans

(c) Inheritance of quantitative traits.

Unit II

(a) Linkage, crossing over, molecular mechanism, chromosome mapping and mechanism of chromosome pairing & Synaptonemal complex.

(b) Sex determination in man, *Drosophila* and plants. (c) Extra-nuclear inheritance.

Unit III

(a) Biochemical genetics, concept of gene.

(b) Types of mutations, Induction & Detection.

(c) Duplications and deficiency: classification, meiotic pairing and phenotypic effects.

Unit IV

(a) Inversions: classification, paracentric and pericentric, meiotic pairing and crossing over in different regions.

(b) Translocations: classification, meiotic pairing, chromosome disjunction, multiple translocations.

(c) Types of numerical changes and Haploidy.

Unit V

(a) Polyplojdy: classification, production, role in evolution, utility in crop improvement.

(b) Aneuploidy: trisomics, tetrasomics, monosomy, multisomy - Meiotic behaviour, breeding behAviour.

(c) Apomixis - Cytogenetic basis and types of Apomictic reproduction.

Suggested Readings:

Burnham, C.R. 1962. Discussions in Cytogenetics. Burgess Publishing Co., Minnesota.

Khush, G.S. 1973. Cytogenetics of Aneuploids. Academic Press. New York.

Russel, P.J. 1998. Genetics (5th ed.) The Benjamin/ Cummings Publishing Co., Inc. USA

Snostad, D.P. and Simmons, M.J. 2000. Principles of Genetics (2nd ed.) John Wiley & Sons, Inc.,USA

M.Sc. BOTANY

Teaching hours: 50

Course VI: Taxonomy of Angiosperms and Anatomy

Unit I

(a) A brief account of Plant exploration in India

(b) International code of Botanical Nomenclature : Salient features, important rules and recommendation

(c) Taxonomic evidence : Morphology, plant anatomy, embryology, palynology, cytotaxonomy, chemotaxonomy, serotaxonomy, genome analysis and nucleic acid hybridization .

Unit II

(a) Systems of classification-Hutchinson, Cronquist, Takhtajan, Dahlgren

(b) A basic knowledge of phylocode and APG system

(c) Origin and evolution of angiosperms.

Unit III

(a) Concepts of species, variation and speciation in plants

(b) Threatened plants: Different categories of threatened plants, IVCN, Red Data Book, important threatened plants of India

(c) Relevance of taxonomy to conservation, sustainable utilization of bioresources

Unit IV

(a) Stomata : ontogeny, classification, trichomes and secretory glands

(b) Nodal anatomy: evolution of nodal vasculature

(c) Vascular cambium: its activity, formation of secondary tissues, factors influencing the activity of vascular cambium

Unit V

(a) Phloem: Structure and development of sieve elements, P- Proteins

(b) Xylem: Structure and development of tracheary elements

(c) Wood: Structure and properties.

Suggested Reading:

Davis, P.H. and Heywood, V.H. 1973. Principles of Angiosperm Taxonimy. Robert E. Kreiger Pub. Co. New York.

Grant, W.F. 1984. Plant Biosystematics. Academic Press, London.

Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press. London.

Kochar, S.L. 1999. Economic Botany in the Tropics. MacMillan India, New Delhi.

Nordenstam, B., El Gazaly, G. and Kassas, M. 2000. Plant Systematics for 21st Century. Portland Press Ltd. London.

Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd ed.) Edward Arnold Ltd. London.

Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, N.Y.

M.Sc. BOTANY

Teaching hours: 50

Course VII : Biology and Diversity of Fungi and Plant Pathology.

Unit I

(a) General characters of fungi; their taxonomic position in the living world (the True Fungi and the Pseudo-Fungi).

(b) Range of thallus organization in fungi.

(c) The architecture of fungal cells, cell walls, cell membrane, cell organelles and cytoskeleton.

(d) Nutrition and growth in fungi including factors affecting fungal growth.

(e) Types of reproduction in fungi.

(f) Differentiation in fungi: Control of -i) Dimorphism ii) Conidiation and iii)Mating (with the help of sex hormones).

(g) Heterothallism, Heterokaryosis and Parasexual cycle.

(h) Molecular Biology of Fungi.

Unit II

A general account of following groups with special reference to organisms mentioned under :

(a) Myxomycetes - *Stemonites, Ceratiomyxa*.

(b) Plasmodiophoromycetes- *Plasmodiophora*.

(c) Mastigomycotina – *Synchytrium,Coelomomyces,Allomyces, Saprolegnia, Pythium, Phytophthora,Albugo,Pilobolus,Saksenaea,Entomophthora.*

(d) Ascomycotina- *Protomyces, Taphrina, Emericella, Talaromyces, Phyllactinia, Erysiphe, Neurospora, Peziza.*

(e) Basidiomycotina- *Puccinia,Uromyces,Hemiliea,Melampsora,Tilletia,Polyporus.*

(f) Deuteromycotina–*Candida, Cercospora, Helminthosporium, Curvularia, Alternaria, Fusarium, Colletotrichum.*

Unit III

(a) Fungal interactions: Role of antibiotics, Hypal Interference, Mycoparasitism, Commensalism, Mycorrhizae, Lichens (general accounts); Fungi as Biocontrol agents.

(b) Symptomatolgy in fungal, bacteria and viral plant diseases.

(c) Causes of plant diseases.

(d) Pathogenesis ;Host-Parasite interactions, Role of enzyme and toxins in disease development.

(e) Effect of infection on physiology of host.

(f) Effect of environment on disease development –epiphytotics.

Unit IV

(a) Disease control by physical methods, crop rotation, plant quarantines.

(b) Disease control by chemical methods, resistance and integrated pest management, its advantages & disadvantages, immunization.

(c) Principles of biological control of air-borne & soil –borne plant diseases, mechanism and its advantages and future prospects.

Unit V

Etiology and control of the following crop diseases :

(a) Paddy-Paddy blast ,bacterial leaf blight,Tungro virus.
(b) Wheat- Black stem rust ,Yellow rust,Brown rust ,Bunt of wheat
(c) Maize –Leaf blight .
(d) Jowar- Smut .
(e) Sugarcane - Red rot & smut.
(f) Cotton - Wilt
(g) Grapes - Downy mildew, powdery mildew,
(h) Apple - Apple scab
(i) Groundnut - Tikka.

Suggested Readings

Agrios, G.N. 1997. Plant Pathology.Academic Press, London.

Albajes, R ., Gullino, M.L, van Lenteren, J.C, and Elad, Y. 2000. Integrated Pest Management in Greenhouse Crops. Kluwer Academic Publishers.

Alexopoulus, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. John Wiley & Sons, Inc.

Mehrotra, R.S. and Aneja, R.S. 1998. An introduction to Mycology. New Age Intermediate Press.

Webster, J. 1985. Introduction to Fungi. Cambridge University Press.

M.Sc. BOTANY

Teaching hours: 50

Course VIII: Phytotechniques

Unit I

Statistical methods

(a) Presentation of data, frequency, distribution
graphical , presentation frequency polygon and curve, &cumulative frequency curve.

(b) Central tendency and measures of dispersion, mean, mode, median and their properties without deviation.

(c) Mean deviation, standard deviation and coefficient of variation.

Unit II

(a) Simple correlation, coefficient and regression,

(b) Principle of experimental designs, randomized block and latin square designs and analysis of variance (ANOVA).

(c) Tests of significance, t-tests, X^2 test for goodness of fit.

Unit III

Computational methods

(a) Introduction to computers - general idea, classification and characteristics of computers, input/ output units, internal representation of data (bits, bytes: binary, octal and hexa-decimal system.

(b) Computer applications- Understanding of Fundamentals of Computation, Elementary idea about operational environment and Microsoft Office software. Basic idea of Inter and Intranet; Nucleic acid and protein sequence databases.

Unit IV

Biophysical methods

Instrumentation, principle and Methods of fractionation- Cell sorting, Chromatography, Electrophoresis, Centrifugation, X- ray diffraction 10

Unit V

Methods of quantitative analysis-

(a) Spectrophotometry, MS, NMR, ESR, ORD/CD spectrometers,

(b) Radioisotopic methods: Geiger Muller & Liquid Scintillation Counters.

(c) Immunological methods: immunodiffusion, immuno- electrophoresis, crossed immuno-electrophoresis, counter- RIA, ELISA , Immunoblotting

Suggested Readings

Wilson, and Walker, 2000. Practical Biochemistry, Wiley Eastern, New Delhi.
Mahajan, B.K. 1989. Methods in Biostatistics. Jaypee Brothers, New Delhi.

M.Sc. BOTANY

Teaching hours: 50

Course IX: Phytochemistry and Metabolism.

Unit I Energy Flow

(a) Fundamentals of thermodynamics and bioenergetics,

(a) Buffers, pH scale, redox potential.

(b) Forces stabilizing macromolecules 10

Unit II Carbohydrate metabolism

(a) Electron transport system in mitochondria and oxidative phosphorylation, Alternate oxidase, Photorespiration and its significance

(b) Mechanism of Electron and proton transport in chloroplast and photophosphorylation, photoprotective mechanisms.

(c) Gluconeogenesis, Pentose Phophate Pathway, Glyoxylate pathway.

Unit III Enzymology and Protein catabolism

(a) Fundamentals of Enzymology: Classification, Mechanism of enzyme Action, Allosteric mechanism, active site and regulatory sites, Isozymes, Michaelis-Menten Equation and its significance, vitamins and coenzymes

(b) Ramachandran's Plot

(c) Protein catabolism

Unit IV Nitrogen and sulphate assimilation

(a) Overview of Biological Nitrogen Fixation, nodule formation and nod factors,

(b) Mechanism of nitrate uptake and ammonia assimilation;

(c) Sulphate uptake and assimilation

Unit V Macromolecular metabolism and micromolecules

(a) Fatty acid metabolism

(b) Nucleotide metabolism.

(c) Elementary idea of secondary metabolites like alkaloids, lignin, and phenolics with emphasis on flavonoids

Suggested Readings

Buchanan,B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.

Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee 1999. Concepts in Photobiology: Photosynthesis and Photomorphogenesis, Narosa Publishing House, N.D.

Goodwin,T.W. and Mercer, E.I. 1987. Plant Biochemistry. Pergamon Press,Oxford.

Voet and Voet 1995. Biochemistry. John Wiley & Sons,

Zubay, G.L., Parson, W.W. and Vance, D.E. 1995. Principles of Biochemistry.Wm. C.BrownPublishers,U.S.A.

M.Sc. BOTANY

Teaching hours: 50

Course X : Plant Physiology

Unit I

(a) Water, bipolar structure and its solvent properties, Cell Water relation in classical and thermodynamics terms.

(b) Cell ionic relation, in classical and thermodynamic terms, mechanism of ion absorption.

(c) Role of micro and macro mineral nutrients, their physiological functions.

Unit II

(a) Driving forces and resistances in transpiration (stomatal mechanism).

(b) Ascent of sap, mechanism of translocation in phloem. Sensor-regulator system, sucrose sensing mechanism

(c) Mechanism of stress resistance.

Unit III

Structure, physiological role, mechanism of action and Bioassay of:

(a) Auxins,

(b) Gibberellins

(d) Cytokinins

(e) Hormone receptors, Cell signaling and Signal transduction,

Unit IV

(a) Elementary idea of structure and function of structure and function of ABA, Ethylene, Ascorbic acid, Brassinosteroids, Polyamines, Jasmonic Acid and Salicylic Acid.

(b) Porphyrins, Phytochrome & Cryptochrome detection, Chemistry, Physiology and Photomorphogenesis.

Unit V

(a) Physiology of flowering : Photoperiodism; Photoinduction.

(b) Endogenous rhythms.

(c) Movements,

(d) Ageing and Senescence.

Suggested Readings

Hooykaas, P.J.J., Hall, M.A. and Libbenga, K.R. (eds.) 1999. Biochemistry and Molecular Biology of plant Hormones. Elsevier, Amsterdam

Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons., Inc.

Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th ed.) Wadsworth Publishing Co., USA.

Taiz, I. And Zeiger, E. 1998. Plant Physiology (2nd ed.) Sinauer Associates, Inc. Publishers. Massachusetts.

Thomas, B. and Vince-Prue, D. 1997. Photoperiodism in Plants. (2nd ed.) Academic Press, USA.

Heldt, hans-Walter 2005. Plant Biochemistry(3rd ed.) Academic Press, USA.

M.Sc. BOTANY

Teaching hours: 50

Course XI : Ecology

Unit I.

Ecology and Environment : Levels of Organization Spectrum, Theory of Integrative Levels, Principles of Ecology, Principles of Environment: Limiting factors, holocoenotic environment and trigger factors, Gaia hypothesis.

Unit II

Climate, Soil and Vegetation Patterns of the World : Life Zones, Major Biomes and Major Vegetation, Biomes Controlling Factors, Nature and Development of Soils, Soil Forming Factors: Laterization, podosalization, calcification, acidification, salinisation. The comprehensive Soil Classification System, Soil and Climate, Soil Erosion and Conservation.

Unit III

Population Dynamics: Biological Attributes, Population Growth and Carrying Capacity, Measurement of Changing Entity, Population Regulation, Biotic Potential, Allee Principle, Interaction between Two species.

Unit IV

Vegetation Organization : Concept of Community and Continuum, Analysis of Communities, Ordination, Species Diversity and Pattern Diversity in Community, Community Stability, Concept of Habitat and Ecological Niche.

Vegetation Development: Community Patterns in Time: Succession, Autogenic-, Degradative- and Allelogenic- succession, Successional Processes: facilitation, inhibition and tolerance, Grime's Strategies, Changes in Ecosystem Properties during Succession, Concept of Climax.

Unit V

Ecosystem Organization: Structure and Functions, Primary Production (methods of measurement, controlling factors), Energy Dynamics (trophic organization, energy flow pathways, ecological efficiencies), Biogeochemical Cycles of C, N, P and S, Hydrological Cycle, Nutrient Sources, Nutrient Budgets in Terrestrial Communities and Aquatic Communities.

Suggested readings:

Barbour, M.G., Burk, J.H. and Pitts, W.D. 1987. Terrestrial Plant Ecology. Benjamin Cummings, California.

Begon, M., Harpur, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science, Oxford.

Chapman, J.L. and Reiss, M.J. 1998. Ecology: Principles and Applications. Cambridge University Press, Cambridge.

Colinvaux, Paul 1993. Ecology, John Wiley & Sons. New York.

M.Sc. BOTANY

Teaching hours: 50

Course XII : Plant Development and Reproduction.

Unit I

(a) Seed germination and seedling growth –metabolism of nucleic acid and proteins; mobilization of reserve food material; Hormonal control of seedling growth, gene expression during seedling growth.

(b) Shoot development-organisation of shoot apical meristem (SAM), Cytological and molecular analysis, tissue differentiation.

(c) Root development-organisation of root apical meristem (RAM), Cell fates and lineage, differentiation of vascular tissue regulation of root growth.

Unit II

(a) Formation of floral organs-floral development, molecular basis of floral organ determination.

(b) Megasporogenesis,organization of embryo sac,gene function during megagametogenesis

(c) Microsporogenesis, tapetum, pollen development, palynology and its applications.

Unit III

(a) Pollen –Pistil interactions and fertilization.

(b) Sexual Incompatibility-its genetic basis, molecular aspects, physiology and biochemistry,

(c) Barriers to fertilization, methods to overcome incompatibility.

Unit IV

(a) Polyembryony-causes, classification and applications

(b) Endosperm-development, types, haustoria

(c) Embryogenesis-nutrition and growth of embryo; development of dicot and monocot embryo.

Unit V

(a) Fruit growth and development and fruit ripening; molecular biology and biochemistry of ripening,

(b) Dormancy of seeds and buds, gene expression during dormancy, bud dormancy

(c) Parthenocarpy-types and importance.

Suggested Reading:

Bhojwani, S.S.and Bhatnagar,S.P.1999.The Embryology of Angiosperms.Vikas publishing House, New Delhi.

Raghwan,V.1997.Developmental biology of flowering plants. Springe verlag,New York.

Salisbury, F.B.and Ross,C.w.1992.Plant physiology(4th edn.).Wadsworth publishing, Belmont, Callifornia.

Shivanna, K.R.and Sawhney,V.K.1997.Pollen biotechnology for crop production and improvement. Cambridge University press, Cambridge.

M.Sc. BOTANY

Teaching hours: 50

Course XIII: Biotechnology I-Genetic Engineering

Unit I

(a) Genetic engineering - Definition & explanation, restriction enzymes and restriction modification system.

(b) Cloning and expression vectors - Definition and explanation: plasmids, cosmids, phagemids, fd, fl & M 13 vectors, transposons vectors.

(c) Artificial chromosome as vector.

(d) Expression vectors; Use of promotors and expression cassettes. Virus expression vectors, binary and shuttle vectors.

Unit II

(a) Reconstruction of chimeric DNA - staggered cleavage, addition of Oligopolymer tailing, blunt end ligation.

(b) Cloning jn bacteria vs. cloning in Eukaryotic cells.

(c) Preparation of molecular probes and their uses; labelling of probes, radioactive vs non-radioactive. Techniques used in probing DNA, RNA & Protein electrophoresis, Southern, Northern and Western blotting.

(d) Techniques of restriction mapping.

Unit III

(a) Polymerase chain reaction- Principles, techniques and modification, gene cloning vs. PCR, application and uses of PCR.

(b) Chromosome walking, Chromosome jumping, Chromosome landing, map based cloning.

(c) Compliment DNA, its cloning and cDNA library.

Unit IV

(a) RFLPs & RAPD and their applications.

(b) Gene sequencing.

Unit V

(a) Protein engineering - definition and explanation, Steps involved, methods used. Achievements and future prospects.

(b) Drug designing - methods used, blocking enzyme activity, blocking hormone receptors, inhibition of DNA/RNA synthesis.

(c) Chemical synthesis vs recombinant DNA technology in protein engineering and drug designing.

Suggested Readings

Gera, V.K.

Chawla, H.S. 2000. Introduction to Plant Biotechnology. Science Publishers, Inc.

Chopra, V.L. , Malik, V.S. Bhatt, S.R. 1999. Applied Plant Biotechnology.Oxford & IBH

Glick, D. and Pasternak 1993. Molecular Biotechnology

Maulik, S. and Patel,S.D. 1997. Molecular Biotechnology. Wiley-Liss, USA.

Murray, P. 1994. Recombinant DNA Technology. Portland Press Ltd. USA.

Old, R.W. and Primrose, S.B. 2002. Principles of Gene Manipulation. Blackwell Science.

M.Sc. BOTANY

Teaching hours: 50

Course XIV: Biotechnology-II: Environmental Biotechnology

Unit I

Pollution and Pollutants: Cost of Pollution, Kinds of Pollution and Pollutants- Air, Water, and Soil Pollution, Their Effects on Plants and Ecosystems; Role of Plants in Pollution Management.

Unit II

Climate Change: Greenhouse Gases(CO_2, CH_4, N_2O, CFCs: sources and roles), Ozone layer and Ozone hole, Consequences of Climate change (acid rain, global warming, sea level rise, UV radiation).

Unit III

Ecosystem Stability: Concept (resistance and resilience), Ecological Perturbations (natural and anthropogenic) and Their Impacts on Plants and Ecosystems, Ecology of Plant Invasion, Environmental Impact Assessment (EIA), Ecosystem Restoration.

Environment and energy, Energy resources- Renewable and Non- renewable.

Natural resources, loss of Diversity, causes and consequences, Environmental Auditing, Conservation of Biodiversity.

Unit IV

Ecological Management: Concepts-Sustainable Development, Remote Sensing and GIS as Tools for Resource Management.

Unit V

Phytoremediation:- Prevention and Control, Methods of reducing Environmental impacts of Chemicals, Weedicides, Pesticides and Fertilizers. Biotechnological advances in pollution control through GEMs.

Suggested Readings

Baltimore, D. Dulbocco, J.F., Montalcini, R.L.2000. Frontiers of Life. Vol.1&4. Academic Press & Treccani Roma, Tokyo.

Bunce, N. 1991. Environmental Chemistry. Wuerz Publications, Ltd. Canada.

Manhan, S.E. 2001. Fundamentals of Environmental Chemistry. Lewis Publ, N.Y.

Park, C.1997. The Environment: Principles and Applications. Routledge, London

Ricklefs, R.E. 2000. The Economy of Nature. W.H.Freeman, N.Y.

M.Sc. BOTANY

Teaching hours: 50

Course XV : Biotechnology III- Microbial Biotechnology

Unit I

(a) Sources and characters of industrial microbes, their isolation and methods for induction of mutations; stabilization of mutants and their isolation.

(b) Fermentation technology; microbial growth, application of fermentation; batch, fed batch and their continuous cultures of microbes.

(c) Patent protection for biological inventions.

Unit II

(a) Bioreactors: Principles and their design.

(b) Microbial transformations with special reference to steroids and alkaloids, polysaccharides.

Unit III

(a) Microbiology and up gradation of alcoholic beverages.

(b) Commercial production of organic acids like acetic, lactic, citric and gluconic acids.

(c) Commercial production of important amino acids, insulin , steroids, vitamins and perfumes .

(d) Commercial production of antibiotics with special reference to penicillin, streptomycin and their derivatives.

Unit IV

(a) Immobilization of microbial enzymes and whole cells and their applications in industries.

(b) Use of microbes in food, feed and dairy; Bioprocess engineering; Down stream processing, various steps for large-scale protein purification.

(c) Single cell proteins, physiological aspects, SCP from hydrocarbons,waste materials and renewable resources ,Improvement in SCP production .

(d) Industrial sources of enzymes: Cellulases, Xylanases, Pectinases, Amylases, Lipases, and Proteases, their production and applications.

Unit V

(a) Bioconversion of waste for fuel and energy.

(b) Petroleum Microbiology

(c) Commercial production of biofertilizers and biopesticides.

Suggested Readings:

Miller, B.M. and Litsky, W. 1976. Industrial Microbiology. Mc Graw Hill Book Co., NY

Schefer, T. (ed.) Advances in Biochemical Engineering and Biotechnology. Vol. 57,61, Springer Verlag, Berlin.

Wainwright, M. 1997. An Introduction to Fungal Biotechnology. John Wiley & Sons, N.Y.

M.Sc. BOTANY

Teaching hours: 50

Course XVI : Biotechnology IV- Plant Cell, Tissue and Organ Culture

Unit I

(a) Planning and organization of tissue culture laboratory; Basic techniques of plant tissue culture.
(b) Induction and maintenance of callus and cell suspension culture.
(c) Study of differentiation through organogenesis and embryogenesis.

Unit II

(a) Cell line selection through suspension culture for the production of stress resistant plants, their application in crop improvement.
(b) Tissue culture techniques for haploid production and their application in agriculture.
(c) Meristem culture for mass and clonal propagation of ornamental plants, virus resistant plants and forests trees.

Unit III

(a) *In vitro* pollination, shotgun wedding, embryo rescue technique and embryo culture.
(b) Encapsulation of somatic embryos and shoot apices for artificial seeds.
(c) Cryopreservation techniques for germplasm conservation.

Unit IV

(a) Protoplast isolation, culture and regeneration.
(b) Somatic hybridization and selection mechanism for hybrids and cybrids, with special reference to crop plants.
(c) Delivery systems for gene transfer in plants through co-cultivation of explants and *Agrobacterium*, or through direct methods-electroporation, silicon carbide method.

Unit V

(a) Transgenic plants: Use of transgene for – herbicides, insecticides, virus, drought, salinity and insect resistance; male sterility and restoration system, molecular farming.
(b) Industrial application of plant tissue culture for:
    i) Secondary metabolites for commercial purpose.
    ii) Scale up and down stream processing for secondary metabolites.

Suggested Readings

Ammirato, P.V., Evans, D.A. Sharp, W.R. and Yamada, Y.(eds.) 1984. Hand Book of Plant Cell Culture, Mac Millan, N.Y.
Bhojwani, S.S. and Rajdan, S.K. 1998. Plant Cell, Tissue and Organ Culture, Narosa Publ,
Lal, R. and Lal, S.1993.Genetic Engineering of Plants for Crop Improvement. CRC Press,
Reinert, J. and Bajaj, Y.P.S. 1976. Plant Tissue and Organ Culture. Springer –Verlag.
Street, H.E. 1977. Plant Tissue and Cell Culture, Blackwell Scientific Publ., UK
Singh, B.D. 2005. Biotechnology,
Gupta, P.K. 2005. Biotechnology, Rastogi Publications, Meerut