BIOLOGY AND DIVERSITY OF CRYPTOGAMS & GYMNOSPERMS 22BOT11
52 Hrs

Module-I

Algae: Introduction and history of phycology with special reference to Indian work. General and unique characteristics (from primitive to specific), classification (Fritsch, Smith and Chapman). Thallus organization. Algal pigments, Plastids, Flagella, Pyrenoids and Eyespots. Algae of diverse habitat (Fresh water, Terrestrial and Marine) and their behavioural significances in growth. Effects of algal blooms, bloom control, carbon sequestration, algae as Bioindicator. Economic importance of algae.

Module-II

Bryophytes: Introduction, general and important characteristics (primitive to evolutionary), distribution and classification Systems (Eichler, Smith and Wardlaw). Structure and evolution of Gametophytes and Sporophytes. Affinities with Algae and Pteridophytes. Economic importance of bryophytes. Ecological significance- colonization, Succession and role of Bryophytes in ecosystem.

Module-III

Pteridophytes: Introduction, evolution, general characteristics, distribution and classification system (Arthur J Eames, Tippo and Bierhorst). Stelar Evolution, Heterospory, Seed Habit and Life cycle. Pteridophytes as Ecological indicators. Economic importance of pteridophytes. Comparative study of morphology, anatomy and Reproduction in Psilotales, Selaginellales, Equisetales, Ophioglossales, Marsiales and Salviniales.

Module-IV

Gymnosperm: Introduction and evolution, General characteristics, Affinities, classification system (Sahni, Bierhorst and Christenhusz). Embryogeny in gymnosperms. Phylogeny and morphologaical variation. Phylogenetic and functional signals in gymnosperm ovular secretions. comparitive study: Vegetative habit, anatomy and reproduction in Cycadales, Ginkgoales, Coniferales, Ephedrales and Gnetales. Economic importance of gymnosperms.

Module-V

Paleobotany: Scope and Objectives, Geological time scale, Paleoclimatic and Evolution of plants, Fossilization- Fossil types, techniques in paleobotany. General studies in fossil Pteridophytes- *Rhynia, Lepidodendron, Calamites*. General studies in fossil Gymnosperms- *Cycadeoidae, Pentoxylon,* Paleobotanical contribution in India.

Selected Reference:

1. B.P. Pandey. 2011. College Botany Vol. I, II, III. S Chand publication.
2. Bierhost. 1947. Morphology of vascular plants: (MacGraw Hill N.Y.)
3. Fristch F.E. Structure and reproduction of algae (Vol I and II 1935 and 1945).
4. Ganguli, Kamkar & Datta. 2018. College Botany Vol. I. NCBA Publication.
5. O.P. Sharma. 2011. Algae. McGraw Hill Education.
6. O.P. Sharma. 2014. Bryophyta. McGraw Hill Education.

7. PC Vashishta, AK Sinha, Aadash Kumar. 2014. Botany for degree students. Bryophyata. S Chand publication.
8. PC Vashishta, AK Sinha, V.P. 2015. Botany for degree students. Algae Singh, S Chand publication.
9. Rashid A. 1986. An Introduction to Pteridophytes. Vikas, New Delhi.
10. Smith.G.M. 1985. Cryptogamic Botany Vol I: Introductory phycology: Kumar H.D.

TAXONOMY OF FLOWERING PLANTS 22BOT12

52Hrs

MODULE-1

Taxonomy: Introduction, aims, principles and importance. **Identification tools**; Specimen preparation, Herbarium methods, Taxonomic literature and keys. Botanical gardens of India and world, maintenance and importance of herbaria. History and development of Botanical Survey of India.

International Code of Nomenclature of Algae Fungi and Plants (**ICN**): Brief history and Development of Botanical Code, Principles, Scientific names, Principle of priority, typification, valid and effective publication, Publication of Names, nomina conservanda, nomina rejicienda, Names of Hybrids, Names of Cultivated Plants.

MODULE- 2

Plant Morphology and Evolution:

Plant structure - Roots, Stems, Leaves, Flowers, Perianth, Androecium, Nectaries, Gynoecium, Carpel, Pistil, Inflorescences, Fruits and seeds.

Evolution of flowering plants: Angiosperm apomorphias- Flower, Stamens, Reduced male gametophyte, Carpel, Two integuments, Reduced female gametophyte, Endosperm formation, Sieve tube members, Angiosperm specializations, Vessels. Origin of angiosperms.

MODULE- 3

Systems of classification:

Pre-Darwinian Classifications: Systems based on habit: By different Taxonomists.

The sexual system: Carolus Linnaeus

Systems based on form-relationships by different Taxonomists, Bentham and Hooker-Detailed Classfication.

Post Darwinian Classifications: The evolutionary theory by Darwin and Wallace. Takhtajan and Overview of APG (I-IV)

MODULE- 4

Modern trends in Taxonomy; Cytotaxonomy, Palynology, Chemotaxonomy and Molecular taxonomy; DNA bar coding and ITS sequencing.

Numerical and Cladistics approach in plant classification; methodology, merits and demerits

MODULE- 5

Angiosperms families: characteristics, interrelationships, economic and medicinal importance and classification as per APG-IV of the following clades and families;

ANA grade: Amborellaceae, Nymphaeaceae, Austrobaileyaceae
MAGNOLIIDS; Magnoliaceae, Annonaceae
MONOCOTS; Poaceae, Orchidaceae
EUDICOTS; Papaveraceae
CORE EUDICOTS; Dilleniaceae
SUPERROSIDS; Crassulaceae
ROSIDS; Zygophyllaceae, Fabaceae

SUPERASTERIDS; Plumbaginaceae, Amaranthaceae
ASTERIDS; Rubiaceae, Lamiaceae, Asteraceae.

Selected Reference

1. Airy-show, H.K. 1983. Eighth edition. A dictionary of flowering plants and ferns, Cambridge Uni. Press.
2. Bennet, S.S.R. 1979. An introduction to plant nomenclature, International Book Distributors, Dehradun.
3. Cronquist, A. 1968. The evolution and classification of flowering plants, Thomas Nelson and Sons Ltd. London.
4. Jeffery, C. 1982. Sec. Edn. An introduction to plant taxonomy, Cambridge Uni. Press.
5. Jhori, B.M. and Bhatnagar,S.P. 1994. Taxonomy of Angiosperms. Narosa Publishers, New Delhi.
6. Jones,S.B. and Luchsinger,A.E. 1979. Plant systematics Mc Graw Hill Book Co. N.Y.
7. Lawrence,G.H.M. 1951. taxonomy of vascular plants. Mac Millan, London.
8. Naik,N. 1984. Taxonomy of angiosperm., Tata McGraw Hill, New Delhi,
9. Pullaih ,T. 1998. Taxanomy of angiosperms, Regenecy publication, New Delhi.
10. Mondal A. K. Advanced Plant Taxanomy (2005) New Central Book Agency (P.) Ltd.
11. Radford, A. E., Dickinson, Massey, J. R. and Bell, c. R. 1974. Vascular plants systematic- Harper and Row, N. Y.

CROP DISEASE AND MANAGEMENT **22BOT13**
52Hrs.

Module-I

Diseases Concept in Pathology: Introduction, concept and scope of plant pathology, disease classification, Symptomology of Fungal, Bacterial and Viral. Causal factors (Biotic and Abiotic), disease diagnosis, identification of plant diseases- Koch's rule. Defense mechanism in plants- structural and biochemical systemic resistance mechanism. Disease development, disease cycle (Triangle and Tetrangle).

Module-II

Disease Epidemiology: Introduction, terminology, Plant disease forecasting, methods of assessment of disease incidence, disease severity and estimation of yield loss. Plant tumor-caused by microbes, new tools in epidemiology- GIS, Remote sensing and Plant clinic. Aerobiology- introduction, aerobiology in relation to epidemiology. Epidemiology in relation to important crop plant of the region, Karnataka and India. The aerobiology of *Fusarium*.

Module-III

Molecular Plant Pathology: Introduction, genetics of host interaction molecular aspects of host pathogen interaction- PR proteins and phytoalexins, genetics of virulence in pathogens and of resistance in host plants. Types of plant resistance to pathogens (Horizontal and Vertical Resistance), correlation between plant pathology and RNAi. Enzyme Linked Immunosorbent Assay (ELISA) in plant pathology.

Module-IV

Crop Disease Detection Techniques: Mechanism of seed transmission and entry point of seed infection. Traditional methods- morphological, serological assay, nucleic acid-based assay, Spectroscopy based methods. New trends in disease detection- Lateral flow microarrays, Image-Based Plant Disease Detection. Seed and foliar diseases of locally important crop plants and identification. (Red gram, Jowar, Cotton, Bajra and Sugarcane).

Module-V

Disease Management: Regulatory methods- plant quarantine regulation, inspection and certification. Physical method- heat and cold treatment using water and air, Radiation treatment. Cultural method- crop rotation, flooding, trap crops, sanitation, host eradication. Chemical methods- chemical nature, mode of action and mode of application of the following- Sulphur fungicide and Copper fungicide. Biological method-use of antagonistic microorganisms and VAM fungi in disease control. Integrated disease management.

Selected References

1. Agrios, G.N., 2012. Plant Pathology. Elsevier.
2. Alexopolus C.J., Mims C.W. and Blackwell M. 1996. Introductory mycology, 4th edition Replika press, North New Delhi.
3. B.P. Pandey. Plant Pathology pathogens and plant diseases. 2018. S. Chand Publication.

4. Flint S.J. Enquist L.W, Krug R.M., et al. 2000, Principles of virology, molecular biology, pathogenesis and control.
5. Mehrotra, R.S. 1991. Plant Pathology. Tata McGraw – Hill Publishing Company Ltd.
6. Rangaswamy G. 1979. Diseases of crop plants in India (Prentice Hall, New Delhi,).
7. Scheffer, R.P. 1999. The nature of disease in plants. Cambridge University Press.
8. Singh R S. Introduction to principles of plant pathology: (Oxford & IBH New Delhi).

DIETARY, MEDICINAL AND INDUSTRIAL PLANTS **22BOT141**
52 hrs

Module-I

Food Plants and Products: Cereals and Millets- Rice, Barley, Sorghum and Bajra. Pulses- Red gram and Bengal gram. Oil yielding Plants- Sunflower and Groundnut. Vegetables- Spinach, Fenugreek (leaves), Tomato, Onion. Origin, distribution, cultivation, botanical description, nutritional and medicinal and therapeutic value of aforesaid plants.

Module-II

Medicinal systems and formulations: Different system of medicine- Ayurveda, Siddha, Unani, Tibetian and Homeopathy. Medicinal plants of Naturopathy and Aromatherapy. Formulation of traditional medicines- Aristha and Asava, Arka, Avaleha, Paka, Gruta, Churna and Sathva. Commercial and medicinal importance of *Rauwolfia*, *Withania*, *Tinospora*, *Centella* and *Emblica*.

Module-III

Medicinal plants and drugs: Drugs from underground parts, Bark, Stem and Woods, Leaves, Flower, Fruits and seeds. Drugs from lower plants. Medicinal plants with reference to India- Hortus malabaricus, Indian medicinal plants, Indian *Materia medica*, poisonous plants of India, Dictionary folk medicine India. Status and prospectus of medicinal plants in India and Karnataka.

Module-IV

Industrial plants 1: Therapeutic properties of Medicinal Plants- Plants as Anticancer, Anti jaundice, Antimicrobial, Anti-aging and CNS effectors. Medicinal food plants- Spices and Condiments, wild food medicinal plants. Medicinal plant industry. Medicinal Plant Database. Promising phytochemicals from Indian medicinal plants. Controversial plants and drugs. Contributions of ICMR on medicinal plants. Initiatives by government to promote medicinal plants cultivation and export.

Module-V

Industrial plants 2: Major and general features in relation to industrial importance of - Crop plants (Coffee and Tea). Commercialised Medicinal Plants for Perfumes (Lemon grass oil and Jasmine) and flavouring agents (Ginger and Clove), Cosmetics (Aloe and Rose), Ornamental (Orchids and Tulips), Biodiesel plants (Neem and Jatropha). Masticatories and fumitories (Areca and Tobacco), Wood/ timber (Teak), Rubber (Hevea), Pulp and paper (Papyrus and Sugarcane), Dyes (Acacia and Bixa). Status of industrial plants in India and Karnataka.

Selected References:

1. Harborne, J. 1984. Phytochemical Methods. Ed. Chapman & Hall, London
2. Kirtikar K.R. and Basu, B.D. 1932. Indian Medicinal Plants.

3. Mann, J., Davidson, R.S. Hobbs, J.B., Benthorpe, D.V. and Harborne. Natural products, Longman Scientific and Technical Co, Essex.
4. Vaidya, B.1982. Some controversial drugs in Indian Medicine. Chaukamba Orientalia, Varanasi.
5. Kochar, L.S. 1981. Economic Botany in the Tropics, Macmillan.

PLANT MICROBES AND INTERACTION **22BOT142**

52 Hrs

Module – I

Plant Microbes: Introduction and identification of plant microorganisms. Morphology, structure and reproduction of bacteria and fungi. Distinguishing characters and symptoms of microbes in crop plants. Role of environment in plant and microbe interaction. General approach in mode of attachment, penetration and invasion of fungi, bacteria, virus and mycoplasma.

Module – II

Plant–microbe interactions: Introduction, types of interaction- competition, commensalism, mutualism and parasitism (symbiotic, pathogenic and neutral). Aboveground Plant Microbiota-microbes in vegetative foliar tissues, leaves, and floral parts. Below ground Plant Microbiota-Root microbiome- horizontal and vertical transfer of microbes in plant. Above ground and below ground ectophytic and endophytic microflora (fungi and bacteria).

Module – III

Plant, bacteria and interactions: Plant penetration (foliar and soil-borne bacteria), attachment Role of cell-wall degrading enzymes (CWDEs), toxins, hormones and extracellular polysaccharides (EPSs). Positive Interactions-Rhizosphere and Phyllosphere. Plant growth promoting rhizobacteria. Legume-*Rhizobium* association. *Frankia*. *Azospirillum.* bacteria-plant associations: Substrates released from plant, microbial processes in the rhizosphere and plant growth.

Module – IV

Plant, fungi and interaction: Dispersal of spores, attachment, penetration methods, appressorial development Cell-wall degrading enzymes (CWDEs) and mycotoxins. Necrotrophy and biotrophy. Host barriers, overcoming host barriers (quiescence, detoxification of phytoanticipins, detoxification of phytoalexins, suppression of active oxygen species, avoidance of recognition). Ectotrophic and Arbuscular mycorrhizal associations. Beneficial fungi (*Yeast*, *Aspergillus*), pathogenic fungi (*Fusarium*, *Colletotrichum*).

Module-V

Plant, other microbes (virus, mycoplasma): Virus: Structure of plant viruses, RNA viruses, DNA viruses, Transmission of viruses by vectors (insects, nematodes, fungi, seeds and pollens). Viral effects on plants (Alteration in host gene expression, host cell metabolism and suppression of defence responses), Virus-resistance mechanisms in plants. **Mycoplasma:** characteristics, structure and diseases (Sandal spike, little leaf of Brinjal and Witches broom).

Reference:

1. Ananthanarayanan, R. and Paniker, CKG. 2004. Textbook of Microbiology. Orient Longman Pvt. Ltd., New Delhi.
2. Arora, D. R. 2004. Textbook of Microbiology, CBS, New Delhi.

3. Alexepoulos, C. J. and Mims, C.W. 1989. Introductory Mycology, Wiley Eastern Ltd., New Delhi.
4. Bruns, T. D. White, T. J. and Taylor, J.W. 1991. Fungal molecular systemtics. Annu. Rev. Ecol. Syst, 22: 525-64.
5. Chandhniwala, 1996. K.M. Infectious fungi, Anmol Publications, Pvt. Ltd.,
6. Dubey, R. C. and Maheshwari, D. K. 2007. A textbook of Microbiology, S. Chand and Company, New Delhi.
7. Michel, J. Pelczar, Jr.E.C. and Channoel R.Krieg, 2005. Microbiology, McGraw-Hill, New Delhi.
8. 10. Sullia, S.B. and Shantharam, S. 2005. General Microbiology, Oxford and IBH, New Delhi.
9. 11.Vasanthkumari, R. 2007. A textbook of Microbiology, BI Publications Pvt. Ltd., New Delhi.

PRACTICALS: BIOLOGY AND DIVERSITY OF CRYPTOGAMS AND GYMNOSPERMS (22BOTL15)

1. Collection, identification and study of algae.
2. Culturing of algae in laboratory.
3. Separation of algal pigments by TLC.
4. Thallus, structure and reproductive features of Chara, Sargassum.
5. Collection, preservation and identification of Bryophytes
6. Thallus structure, Anatomy and reproductive features of *Marchantia, Riccia, Anthoceros, Sphagnum and Polytrichum.*
7. Morphological, anatomy and reproductive studies of *Psilotum*, *Lycopodium*, *Selaginella*, Azolla, Marsilea and Salvinia.
8. Vegetative Reproduction and Anatomical studies of *Cycas, Pinus, Ginkgo, Gnetum and Ephedra.*
9. Identification of fossil and types of it.

PRACTICALS: TAXONOMY OF FLOWERING PLANTS (22BOTL16)

1. Identification of genus and species of locally available wild plants using regional and state
2. floras along with botanical illustrations. (At least 10 plants species)
3. Preparation of dichotomous keys (indented and bracketed) for identification.
4. Visit to nearby forest area, preparation of tour report and submission.
5. Preparation and submission of herbarium sheets of locally available weeds (at least 10).
6. Methods to describe new taxon in flowering plants.
7. Study of different types of ovules and placentation

PRACTICALS: CROP DISEASES AND MANAGEMENT (22BOTL17)

1. Study of locally available diseases of crop plants.
2. Study of Koch's postulations.
3. Assessment affected leaf area by Stover's method.
4. Field visits to assess disease incidence and severity.
5. Preparation of NA, Preparation of PDA for cultivation of plant pathogens.
6. Techniques of isolation of fungi: Dilution method, soil plate method, agar plate method and single spore isolation.
7. Estimation of percentage of spore germination.
8. Experiment to show fungicidal inhibition of spore germination.
9. Isolation of fungi from disease plants /parts.
10. Calculation of spore count using Haemocytometer.
11. Biochemical analysis of healthy and deteriorated fruits and vegetables to detect changes in proteins and sugars.
12. Estimation of polyphenols in diseased and healthy plants.

PRACTICALS: DIETARY, MEDICINAL AND INDUSTRIAL PLANTS (22BOTL181)

1. Study of Medicinal Plants.
2. Extraction using Soxhlet apparatus.
3. Preliminary tests for secondary metabolites.
4. Separation of Alkaloids (TLC).
5. Estimation of Phenols using FCR Method.
6. Estimation of essential oil.
7. Identification of Raw drugs- Pharmacognostic studies.
8. Identification of Controversial drugs.
9. Preparation of traditional medicine formulation.

PRACTICALS: PLANT MICROBES AND INTERACTION (22BOTL182)

1. Preparation of Fungal and Bacterial fixatives and Stains.
2. Study of bacterial and fungal infected plants (Locally Available).
3. Isolation of Fungi and Bacteria from infected samples.
4. Media preparation, dilution plate technique.
5. Study of morphological and reproductive features of fungi.
6. Staining of Bacteria
    a. Gram's staining.
    b. Flagella Staining.
    c. Capsule Staining.
7. Determination of microbial counts using Haemocytometer.
8. Isolation of Rhizobium from Legume root nodules.
9. Production of alcohol using Yeast.