REVISED SYLLABUS

II SEMESTER: HARD CORE THEORY- BOT: HCT-2.1
ECOLOGY AND ENVIRONMENT BIOLOGY

Credits-04 **Theory-64 Hrs**

***Learning Objectives**: Aim of this course is to introduce students to the principles and components of ecosystems, community structure, and environmental biology. Students will learn about energy flow, primary productivity, biogeochemical cycles, plant succession, soil formation and properties, and ecological interactions such as competition and allelopathy. The course also focuses on understanding various types of pollution, their sources and effects, climate change and its impact on vegetation and crop productivity, as well as modern techniques for environmental monitoring, assessment, and sustainable management.*

***Course Outcome**: Course provides comprehensive knowledge on both basic and applied aspects of ecology, environmental biology, and ecosystem management. Further, the course equips students with practical skills in monitoring environmental quality, analyzing ecological interactions, understanding pollutant impacts, and implementing conservation and sustainable management strategies.*

Unit I. Ecosystem: Concept and components; Tropic structure; Diversity and characters of major ecosystems- Aquatic, Terrestrial; Productivity- Primary production and measurement of primary productivity; Energy flow in ecosystems; Biogeochemical cycles- Water, Carbon, Nitrogen, Sulphur and Phosphorus. **16 h**

Unit II. Communities: Classification, structure and characteristics- Analytic and Synthetic; Plant succession- Views and types; Climatic climax; Genecology- Concepts, ecotypes and ecads; Soil: Formation, profile and properties; Soil erosion and conservation; Plant interaction- Competition and allelopathy; Water bodies and their classification; Methods and importance of rain water harvesting. **16 h**

Unit III. Environmental Biology: Definition, scope and importance; Structure and composition of atmosphere- Lithosphere, Hydrosphere and Biosphere; Pollution- Air, Water and Land- Sources of pollutants and their effects on plants; Management of pollutants; Greenhouse effect, ozone depletion and acid rain; Climate change and its effects on vegetation and crop productivity; Environmental Toxicology: Definition, toxic chemicals, pesticides and insecticides; Bioaccumulation and their effects. **16 h**

Unit IV. Environmental monitoring and management: Biological and physicochemical monitoring; Remote sensing and geographical information system; Biodegradation of pollutants. Environmental protection and conservation: Environmental education and awareness, Environmental Protection Acts, Current environmental issues in India. **16 h**

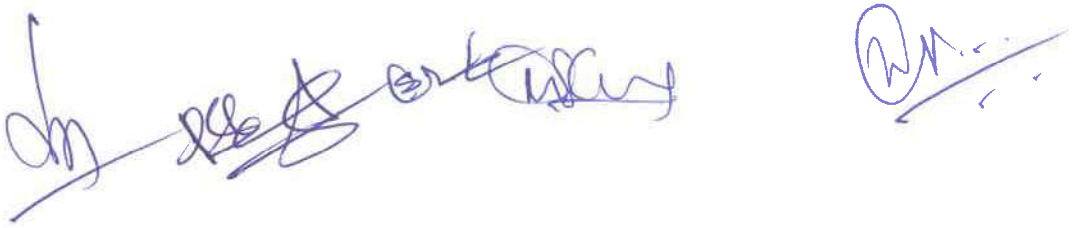
Suggested Readings/References:

1. Fundamentals of Ecology: Odum EP (1971)
2. Elements of Ecology and field Biology: Robert Leo, Smith (1980)
3. Concepts of Ecology: Kormondy E J (1989)
4. Ecology and Environment: Sharma PD (1999)
5. A Text book of plant Ecology: Ambasht RS and Ambasht N K (1999)
6. Terrestrial Plant Ecology: Barbour MG, Burk JH and Pitts WD (1987)
7. Ecology: Begon M, Harpur JL and Townsend CR (Blackwell, Oxford 1996)
8. Ecology: Principles and Applications: Chapman JL and Reiss MJ (Cambridge UnivPress1998).
9. Ecology: Paul, John Wiley & Sons (New York 1993)
10. Principles of Environment Science: Enquiry and Applications Cunningham WP and Cunningham M A (2nd Edn, Tata McGraw Hill, New Delhi 2004)
11. Natural Resource Management: Jha L K (APHA Pubs, New Delhi 1997)
12. Environmental Science: Kemp M J (Tata McGraw-Hill, New Delhi 1997).
13. Fundamentals of Geographical Information Systems: John Michael & N Demers (2008)
14. Ecology of Natural Resources: Ramade F (John-Wiley & Sons, New York 1991).
15. Essentials of Ecology and Environmental Sciences: Rana S V S (Prentice-Hall 2005).

PRACTICALS

BOT: HCP-2.1. ECOLOGY AND ENVIRONMENT BIOLOGY

1. Determination of leaf area by Planimeter method.
2. Determination of available soil moisture by Moisture meter.
3. Determination of stomatal index.
4. Determination of organic content of soil.
5. Determination of soil pH using pH meter.
6. Water quality analysis- DO, COD, BOD, Chlorides, Sulphates, TDS, Carbon dioxide.
7. Determination of minimum size of the quadrate by species area curve method.
8. Study of frequency of herbaceous plants by applying Law of frequency.
9. Study of plant abundance and density by quadrat method.
10. Meteorological instruments and their working principles.



REVISED SYLLABUS

II SEMESTER: HARD CORE THEORY- BOT: HCT-2.2
PLANT ANATOMY AND EMBRYOLOGY

Credits-04 **Theory-64 Hrs**

***Learning Objectives**: Aim of this course is to introduce students to the structure, development, and organization of the primary and secondary plant body, including the role of apical and vascular meristems in growth. Students will learn about the anatomy of xylem and phloem, secondary growth, nodal anatomy, and anomalous growth patterns. The course also focuses on plant embryology, covering male and female gametophyte development, pollen-pistil interactions, fertilization, embryogenesis, endosperm development, polyembryony, apomixis, and experimental techniques such as in vitro pollination and somatic embryogenesis.*

***Course Outcome**: Course provides comprehensive knowledge on both fundamental and applied aspects of plant anatomy and embryology. Further, the course equips students with practical skills in studying the structure and development of plant tissues, understanding reproductive biology, analyzing gametophyte and embryo development, and applying experimental embryology techniques. By the end of the course, students will be capable of interpreting plant anatomical and embryological data, and applying this knowledge in research, breeding, and conservation programs.*

Unit I. Anatomy: Organization of primary plant body, Apical meristems and primary growth, Primary xylem- composition, Primary phloem- composition. Shoot Apex: Apical Cell Theory, Tunica Corpus Theory, Cyto-histological Zonation Theory. Root Apex: Histogenic boundries; Quiscent center. Structure and development of the cell wall- Structure (light microscopic and ultramicroscopic structure), composition of the cell wall, cell wall development. The effect of hormones on cell differentiation, Genetic control of cell growth and development, Role of the cytoskeleton in cell growth and development, Cell shaping by microtubules. **16 h**

Unit II. Development of the secondary vascular system of the stem and root. Role of the vascular cambium, the effect of secondary growth on the primary body on leaf and branch traces. Secondary Xylem: Structure of secondary xylem, secondary xylem of gymnosperms and dicotyledons. Patterns of distribution of xylary elements and rays, Tyloses, Gentic control of differentiation of secondary xylem. Evolution in secondary xylem of dicotyledons. Seconadary phloem: Gross and ultra structure, development of the phloem. Nature and development of the cell wall of sieve elements. Nature of protoplast of sieve elements, nature and function of P-protein, Distinctive features of phloem of gymnosperms, The nature and function of companion cells and Strasburger cells, nodal anatomy, anamalous secondary growth: *Aristolochia*, *Boerhaavia*, *Dracaena*, Periderm, Secretary tissues in plants. **16 h**

Unit III. Embryology: Introduction, brief history of Embryology with particular reference to the contribution of Indian embryologists, Male gametophyte: Microsporogenesis, tapetum, types, function of tapetum. Pollen morphology- structure, stratification, unit of dispersal,

aperture, types arrangement, classification NPC system. Female gametophyte: Types of embryosac development, organization of an embryosac, Ultrastructural studies, Embryosac haustoria. Pollination: Structure of the style and stigma, histochemical studies, pollen-pistil interaction, compatability/ incompatability, pollen germination, pollen embryosac. **16 h**

Unit IV. Fertilization: Post pollination events; Path pollen tube, site of pollen discharge, double fertilization, Embryogenesis: Monocot (*Najas*), Dicot embryo development (*Capsella*), genetics of embryo development (*Arabidopsis*), Endosperms: Types, structure, development and function of Endosperm, Endosperm haustoria. Polyembryony & Apomixis- a brief account, Experimental Embryology: Intra ovarian pollination, *in vitro* Pollination and *in vitro* fertilization, ovule and embryo culture and somatic embryogenesis. **16 h**

Suggested Readings/References:

1. Cutter, D.G. 1971. Plant anatomy- Part-1. Cell and Tissues. Edward Arnold, London.
2. Pandey, B.P. 2010. Plant anatomy, S. Chand Limited
3. Raghavan, V. 1997. Molecular embryology of flowering plants. Cambridge University press, Cambridge.
4. Santra S. C., Chatterjee, T.P. & Das A.P. College Botany practical vol. I. New central book agency, Calcutta.
5. Shivanna, K.R. and Sawhney, V.K. (eds) 1997. Pollen Biotechnology for crop production and improvement. Cambridge University Press, Cambridge.
6. Cutter, D.G. 1971. Plant Anatomy, Part II, Cell and tissues, Edward Arnold, London.
7. Beck, C. 2010. An Introduction to plant structure and Development. 2nd ed. Cambridge Univ. Press. New York.
8. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. Vikas Publishing House. New Delhi.
9. Cutter, E.G. 1969 & 1971. Plant anatomy: Experiments and interpretations, vol I & II. Edward Arnold, London.
10. Fahn. Plant anatomy (4th Ed.) Pergamon press, Oxford.
11. Maheshwari P. 1950. An introduction to Embryology of angiosperms. McGraw Hill, New York.
12. Metcalf and Chalk, Anatomy of dicotyledons; vol I, Anatomy of monocotyledons vol II
13. Eames E. J. and Macdaniels. 1947. An introduction to plant anatomy. McGraw Hill, New York & London.
14. Chand, S. 2005. Plant Anatomy, S, Chand and Company Ltd., New Delhi.
15. Cutler and Stevenson. 2007. Plant anatomy and applied approach. Blackwell Publishing, USA.
16. Esau, K. 1967. Plant anatomy. Wiley publishers.
17. Easu, K.1996. Anatomy of seed plants, First Wiley prints, New Delhi.

REVISED SYLLABUS

PRACTICALS

BOT: HCP-2.2. PLANT ANATOMY AND EMBRYOLOGY

1. Preparation of fixatives and stains for anatomical studies.
2. Preparation of double stained permanent slides.
3. Preparation and identification of the transverse section of the following plants: *Tridax procumbens, Boerhaavia diffusa, Nyctanthus arborterrestris, Leptadenia reticulate, Aristolochia indica* and *Salvadora persica.*
4. Preparation and identification based on TS, TLS and RLS of the following wood: *Michelia champaca, Dalbergia sisso, Tectona grandia, Azadirachta indica, Mangifera indica* and *Tecoma stans.*
5. Epidermal studies- trichomes and stomata
6. Preparation of Microtome section and staining procedure.
7. Identification of different developmental stages of Embryosac.
8. Identification of different developmental stages of Anther.
9. Histochemical studies for cellulose, callose, chitins, PAS reaction, Lignin.
10. Embryo and endosperm mounting.

Note: submission of 10 permanent slides.

REVISED SYLLABUS

II SEMESTER: HARD CORE THEORY- BOT: HCT-2.3
ADVANCED NANOMATERIALS: BIOLOGICAL INSIGHTS AND APPLICATIONS

Credits-04 **Theory-64 Hrs**

***Learning Objectives**: This course aims to introduce students to nanobiology, including the classification, properties, and structural configurations of nanomaterials. Students will learn physical, chemical, and biological methods of synthesis, advanced characterization techniques, and applications in medicine, agriculture, food, environment, and textiles. The course also covers nanoparticle toxicity and mechanisms of cytotoxicity and genotoxicity.*

***Course Outcome**: Students will gain a clear understanding of different types of nanomaterials, their properties, and synthesis methods. They will be able to apply characterization techniques, analyze nanomaterial data, and evaluate their applications across various fields. By the end of the course, students will be capable of assessing nanoparticle interactions, toxicity, and practical uses in research, biotechnology, and environmental solutions.*

Unit I. Introduction to Nanobiology: History and scope of nanobiology and properties of nanomaterials. Natural bio-nanomaterials, Special note on self-assembly. Classification of Nanomaterials: Origin, Dimension- 0-D, 1-D, 2-D and 3-D. Structural configuration: Carbon based, Organic, Inorganic and Composites. Nanostructured materials: Quantum dots and quantum wire core/Shell structures. **16 h**

Unit II. Synthesis of Nanomaterials: Physical methods: Mechanical milling, Laser ablation, Photolysis, Radiolysis, Microwave and Ultrasound assisted synthesis, Electrosputtering, Electrospinning, and Lithography. Chemical methods: Precipitation and co-precipitation, Sol-gel, Spray pyrolysis, Flame pyrolysis, Hydrothermal, Microemulsion, Chemical reduction, Cryochemical synthesis, Chemical vapor deposition (CVD), Metal organic chemical vapor deposition (MOCVD). Biological methods: Sources, Concept of reducing and capping agents, Biomolecules as reducing and capping agents. Extracellular and intracellular synthesis. **16 h**

Unit III. Characterization of Nanomaterials: Structural Characterization: UV-Visible spectrophotometer, Spectrofluorometer, Powder X-ray diffractometer, FTIR spectrometer. Microscopic and surface analysis: Scanning electron microscope (SEM), Transmission electron microscope (TEM), Atomic force microscope (AFM), Scanning tunnelling microscope (STM), Laser confocal microscope, Energy dispersive X-ray analysis (EDX), Nuclear magnetic resonance (NMR). Thermal and Optical Properties: Differential scanning calorimeter (DSC), Thermogravimetric/Differential thermal analyzer (TG/DTA), Contact angle measurement and Dynamic light scattering (DLS). **16 h**

Unit IV. Applications of Nanomaterials: Agriculture, Fertilizers and plant disease management, Food, Environmental remediation, Textiles, Cosmetics. Nano medicine: Bio sensors, Imaging, Drug delivery, Cancer therapy and tissue repair. Introduction to toxicity of nanoparticles, Types of nanoparticles causing toxicity, Fate of nanoparticles in the living

systems, Cytotoxicity and genotoxicity. Toxicity mechanisms: Mechanisms for radical species production. **16 h**

Suggested Readings/References:

1. Rao, M. B. and Reddy. K. K., 2007. Introduction to Nanotechnology, Campus books international, New Delhi.
2. Lindsay, S. M., 2010. Introduction to Nanaoscience, Oxford university press. New York.
3. Kohler, M. and Fritzsche, W., 2004. Nanotechnology- An Introduction to Nano structuring Techniques. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim.
4. Nalwa, H. S., 2002. Nanostructured Materials and Nanotechnology, Academic Press.
5. Niemeyer, C. M., and Mirkin, C. A., 2004. Nanobiotechnology: Concepts, Applications, and Perspectives, Wiley-VCH, Weinheim, Germany.
6. Pradeep, T., 2012. A Textbook of Nanoscience and Nanotechnology, Tata McGraw Hill Education Pvt. Ltd.
7. Ratner, M. A., and Ratner, D., 2003. Nanotechnology: A Gentle Introduction to the Next Big Idea. Prentice Hall Professional, New York.
8. Boisseau, P., and Lahmani, M., 2009. Nanoscience: Nanobiotechnology and Nanobiology, Springer, UK.
9. Dupas, C., Houdy, P., Lahmani, M., 2007. Nanoscience: Nanotechnologies and Nanophysics, Springer-Verlag Berlin Heidelberg. ss
10. Nicolini, C., 2008. Nanobiotechnology and Nanobiosciences, Pan Stanford Publishing, Singapore.

PRACTICALS

HCP. 2.3. ADVANCED NANOMATERIALS: BIOLOGICAL INSIGHTS AND APPLICATIONS

1. Study of different instruments used in characterization of nanomaterials (UV-VIS, FTIR, XRD, AFM, SEM, EDX, TEM, DLS and Zeta potential).
2. Preparation of plant extract (Organic and aqueous), Crushing, Grinding, Maceration, Hot extraction, using Sohxlet apparatus.
3. Phytochemical analysis of plant extracts.
4. Micro-wave assisted synthesis of Carbon Quantum Dots.
5. Synthesis of metal-oxide nanoparticles by Photocatalysis.
6. Synthesis of silver nanoparticles using sodium citrate (Lee-Meisel method).
7. Preparation of metal-oxide nanoparticles using co-precipitation method.
8. Synthesis of nanoparticles using fungal extracts. 9. Effect of pH on surface plasmon resonance of nanoparticles.
9. Effect of metal ion concentration on surface plasmon resonance of nanoparticles. Determination of effect of nanoparticles on growth of pathogens.
10. Dye degradation using synthesized nanoparticles.
11. Determination of antimicrobial properties of nanoparticles.

REVISED SYLLABUS

II SEMESTER: SOFT CORE THEORY- BOT: SCT-2.1
MEDICINAL AND AROMATIC PLANTS

Credits-04 **Theory-64 Hrs**

***Learning Objectives**: Aim of this course is to introduce students to the historical background, concepts, and importance of ethnobotany and ethnomedicine in modern healthcare. Students will learn about traditional systems of medicine, preparation and use of herbal drugs, cultivation and microbial associations of medicinal and aromatic plants, and pharmacognostic analysis of raw drugs. The course also covers phytochemistry, active compounds, and issues related to intellectual property rights of medicinal plants.*

***Course Outcome**: Course provides comprehensive knowledge on both fundamental and applied aspects of ethnobotany, medicinal plants, and pharmacognosy. Further, the course equips students with practical skills in identifying medicinal plants, preparing and analyzing herbal drugs, understanding cultivation practices and microbial interactions, and performing phytochemical and pharmacognostic analyses. By the end of the course, students will be able to apply this knowledge in healthcare, research, conservation, and the development of plant-based remedies.*

Unit I. Ethnobotany and ethnomedicine: History and importance of ethno- botany and ethnomedicine in modern health care system; Basic concepts and development of Traditional systems of medicine- Ayurveda, Tibetan, Unani, Siddha systems and ethnomedicines of Hyderabad Karnataka Region. **16 h**

Unit II. Herbal drugs: Methods of preparation and their use in the treatment of coronary, respiratory, urinary, gastrointestinal, gynecological, nervous, diabetics, cancer and other common disorders; Plants used as general tonics; Medicinal food plants- Cereals, pulses, vegetables and wild food plants. **16 h**

Unit III. Cultivation and microbial association: Cultivation of medicinal and aromatic plants- *Chlorophytum borivillianum*, *Cassia angustifolia*, *Stevia rebaudiana*, *Aloe vera*, *Gloriosa superba*, *Withania somnifera*, *Mentha piperata*, *Ocimum sanctum* and *Cymbopogon flexuosus*. Methods employed in disease and pest control, harvesting and storage of crude drugs; post-harvest care, deterioration and disintegration of active compounds by microbes. **16 h**

Unit IV. Pharmacognosy: Raw drug analysis, microscopic and macroscopic characteristics; Preliminary chemical analysis of *Mentha piperata*, *Ocimum sanctum*, *Withania*, *Rauwolfia*; Phytochemistry- Classification and properties of alkaloids, steroids, terpenoids, lectins, non-proteinous amino acids; Controversial drugs and IPR related to medicinal and aromatic plants. **16 h**

Suggested Readings/References:

1. Anatomy and Activities of Plants- A guide to the study of flowering plants: Clegg CJ and Cox G (1974)
2. Indian Medicinal Plants: Kirtikar KR and Basu BD (1932)
3. Indian Materia Medica Vol I & II: Nadkarni AK (1954)
4. Ayurvedic drugs and their plant sources: Sivarajan VV and Indira B (Oxford & IBH, New Delhi 1994).
5. Pharmacognosy 12th edn: Trease GE and Evans WL (Bailliere Tindall, London 1983).
6. Some controversial drugs in Indian Medicine: Vaidya B (Chaukamba Orientalia, Varanasi1982)
7. Phytochemical Methods: Harborne J. Edr (Chapman & Hall, London 1984).
8. The chemotaxonomy of plants: Smith PM (Edward Arnold, London 1976).

PRACTICALS

BOT: SCP-2.1. MEDICINAL AND AROMATIC PLANTS

1. Identification of medicinal plants
2. Preliminary tests for the occurrence of secondary metabolites
3. Separation of Alkaloids (TLC)
4. Estimation of Phenols
5. Estimation of essential oils
6. Identification of raw drugs- Pharmacognostic studies.
7. Identification of controversial drugs
8. Collection and identification of endemic medicinal plants.
9. Documentation of plants used in Ayurveda, Sidda, Unani, Tibatian and Homeopathy
10. Study of medicinal fruits, vegetables and aromatic plants.

REVISED SYLLABUS

II SEMESTER: SOFT CORE THEORY- BOT: SCT. 2.2
METHODS IN PLANT SCIENCES

Credits-04 **Theory-64 Hrs**

***Learning Objectives**: Aim of this course is to introduce students to the historical background, concepts, and importance of ethnobotany and ethnomedicine in modern healthcare. Students will learn about traditional systems of medicine, preparation and use of herbal drugs, cultivation and microbial associations of medicinal and aromatic plants, and pharmacognostic analysis of raw drugs. The course also covers phytochemistry, active compounds, and issues related to intellectual property rights of medicinal plants.*

***Course Outcome**: Course provides comprehensive knowledge on both fundamental and applied aspects of ethnobotany, medicinal plants, and pharmacognosy. Further, the course equips students with practical skills in identifying medicinal plants, preparing and analyzing herbal drugs, understanding cultivation practices and microbial interactions, and performing phytochemical and pharmacognostic analyses. By the end of the course, students will be able to apply this knowledge in healthcare, research, conservation, and the development of plant-based remedies.*

Unit I. Microbiological methods: Microscopy (Optical, Phase contrast, Fluorescence, Confocal and Electron- TEM & SEM). Microbial Technique: Sterilization, fungal and Bacterial stains, culture media, Staining techniques simple, negative and Gram's staining and endospore, isolation of microbes from soil, air, water and other substrates. Microbial enumeration techniques- Heamocytomter, Dilution plate technique, selective culture media. Micrometry and different types. **16 h**

Unit II. Aerobiological techniques: Spore sampling techniques- Slides, Petri plates, vertical cylinder, Anderson sampler and Burkard spore trap. Microtomy and staining: Microtomy and double staining of plant sections. Radioisotope Techniques: Types of isotopes, radioactive decay. Detection and measurement of radioactivity- GM counter, scintillation counter, autoradiography. Isotopes used in biology, safety methods in handling radioisotopes. **16 h**

Unit III. Centrifugation: Principles and application: Sedimentation coefficient, types of centrifuges, differential centrifugation, density- gradient, analytical, and ultracentrifugation and their applications. Chromatography, principles and application: Paper chromatography, Thin-layer chromatography (TLC), 2-Dimensional chromatography, HPTLC. Detection methods. Column chromatography, gel filtration, adsorption, partition, affinity, ion exchange and HPLC. Gas chromatography. **16 h**

Unit IV. Electrophoresis: Principle and applications; SDS-PAGE, isoelectric focusing, 2D electrophoresis. Agarose Gel Electrophoresis: Preparation, separation and determination of molecular size of DNA, denaturing agarose gel electrophoresis and their applications.

pH meter: Principle, Glass electrode, Reference electrode, Combination Electrode; Spectroscopy: Principles and application: Beer and Lambert law, Colorimetry and UV-Visible spectrophotometry, Flame photometry and atomic absorption spectrophotometry.**16 h**

Suggested Readings/References:

1. Upadhyay, Upadhyay, Nath, 2002. Biophysical Chemistry- Principals and Techniques (3rd edition). Himalaya Publishing House.
2. P.K. Bajpai 2012. Biological Instrumentation & methodology (Tools and Techniques of Biology) S Chand & Company Pvt Ltd.
3. Wilson & Walker 2000. Practical biochemistry: Principles & Techniques. Cambridge Univ. Press, New York.
4. Williams and Wilson, K. 1991. A Biologist's guide to principles and techniques of practical biochemistry, 2nd ed. Edward Arnold.
5. Lain, D. Campbell and Raymond A. Dwek Biological Spectroscopy Benjamin/Cumming Pub. Co., California, London.
6. Cantor, C.R. and Schimmel, P.R. Biophysical Chemistry by, W.H. Freeman & Co.,
7. Glasel, A and Deutscher, M.P. 1995. Introduction to Biophysical Methods for Protein and Nucleic Acid Research. Academic Press.
8. Principles of gene manipulation- An introduction to genetic engineering: Bold R W and Primerose S B (Black Well, London)
9. Introduction to plant Biotechnology: Oxford and IBH, New Delhi.
10. Experimental Biology- A Laboratory Manual: Datta A (Narosa, New Delhi 2009).
11. Research methodology for Biological Sciences: Gurumani N (2006).
12. Microscopy and microtechniques: Marimuthu R (2011)
13. Principles and Methods of plats molecular Biology, Biochemistry and Genetics: Pratibha Devi (Agrobios, India 2000).
14. Gel electrophoresis of Nucleic acid- A practical approach. III edition Rick Wood D and Hames B D (Oxford. New York 1990)
15. Bioinstrumentation: Veera kumara (MJP Publication 2006)
16. Genome Analysis - A Laboratory manual Vol.-I: Analyzing DNA- Birren et al. (Panima, New Delhi/ Bangalore 2006).

PRACTICALS

BOT: HCP-2.2. METHODS IN PLANT SCIENCE

1. Demonstration of sterilizing methods.
2. Demonstration of serial dilution technique
3. Isolation of bacteria and fungi from soil and plant parts.
4. Plasmid culture.
5. Demonstration of pH meter and UV spetra
6. Chromatography- separation of pigments.
7. Separation of proteins by SDS-PAGE
8. Separation of DNA on agarose gel electrophoresis
9. Separation of RNA on formaldehyde agarose gel electrophoresis
10. Study of statistical analysis

REVISED SYLLABUS

II SEMESTER: OPEN ELECTIVE THEORY- BOT: SCT-2.2
BIOFERTILIZERS AND BIOPESTICIDES

Credits-02 **Theory-32 Hrs**

***Learning Objectives**: Aim of this course is to introduce students to the principles, types, and applications of biofertilizers and biopesticides in modern agriculture. Students will learn about bacterial and cyanobacterial biofertilizers, mycorrhizal associations, microbial inoculants, and their roles in enhancing soil fertility, plant growth, and nutrient cycling. The course also covers the history, production, and application of biopesticides, including microbial and botanical agents, and methods for quality assessment and standardization.*

***Course Outcome**: Course provides comprehensive knowledge on both fundamental and applied aspects of biofertilizers and biopesticides. Further, the course equips students with practical skills in mass production and field application of microbial inoculants, mycorrhizae, and biocontrol agents. By the end of the course, students will be able to integrate microbial technologies for sustainable agriculture, enhance crop productivity, and implement effective pest and nutrient management strategies.*

Unit I. Biofertilizers: Introduction and scope, Definition and classification; Role of biofertilizers in modern agriculture, Bacterial biofertilizers- Symbiotic nitrogen fixers: Root nodules, general account of *Azospirillum*, *Azotobacter*, *Frankia*, Phosphobacteria and *Rhizobium*. Mass production of *Azospirillum*, *Azotobacter* and Phosphobacteria, host specificity and life cycle, Organisms and their importance and asymbiotic nitrogen fixation. Cyanobacteria (BGA) as biofertilizers general account of *Anabaena, Cylindrospermum, Gloeocapsa, Lyngbya,* and *Nostoc.* Symbiotic association of cyanobacteria; Heterocyst and nitrogen fixation Field application of cyanobacterial inoculants; *Azolla* as biofertilizer. **16 h**

Unit II. Biopesticides: History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Mass production of *Trichogramma*, *Cryptolaemus*, *Crysoperla*, Mass HaNPV, and EPN. Importance of *Verticillium/ Beauveria/ Metarhzium /Nomuraea/ Trichoderma/ Pseudomonas/ Bacillus* organic matter decomposers. Testing of quality parameters and standardization of biopesticides. **16 h**

Suggested Readings/References:

1. Gautam, R.D. (2006). Biological suppression of insect pests. Kalyani Publisher, New Delhi.
2. Huffaker, C.B. and Messenger, P.S. (1976). Theory and Practice of Biological control. Academic Press, New York.

3. Ignacimuthu, S.S. and Jayaraj, S. (2003). Biological Control of Insect Pests. Phoenix Publ. New Delhi.
4. Saxena, A.B. (2003). Biological Control of Insect Pests. Anmol Publ. New Delhi.
5. Pepper HJ and Perlman D. 1979. Microbial Technology. 2nd Ed. Academic Press.
6. A century of Nitrogen Fixation Research Present status and Future prospects. 1987. F.J. Bergersen and J.R. Postgate the Royal Soc., London.
7. Biology and Biochemistry of Nitrogen fixation. 1991. M.J. Dilworth, and A.R. Glenn, Elsevier, Amsterdam.
8. Nitrogen Fixation in plants. 1986. R.O.D. Dixon,and C.T. Wheeler, Blackie USA, Chapman and Hall, New York.
9. A treatise on dinitrogen Fixation Section IV. Agronomy and Ecology 1977. R.W.F Hardy, and A.H. Gibson John Wiley & Sons, New York.
10. Bioresearches technology for sustainable agriculture. 1999. S. Kannaiyan, Assoc. Pub. Co., New Delhi.
11. Biofertilizer Technology, Marketing and usage- A source Book -cum- glossary 1995. Motsara, I. M.R., P. Bhattacharyya and Beena Srivastava, FDCO, New Delhi.
12. Symbiotic nitrogen fixation in plants,1976. P. S. Nutman, Cambridge Univ. Press, London.
13. Hand book for Rhizobia; Methods in legume Rhizobium Technology, 1994. P. Somasegaran and H.J. Hoben Springer-Verlag, New York.
14. Biofertilizers in Agriculture and Forestry 1993. N.S. Subba Rao Oxford and IBH Publ. Co., New Delhi.