P.G AND RESEARCH DEPARTMENT
OF
BOTANY

PG SYLLABUS

From the Academic Year 2023-2024

J.J.COLLEGE OF ARTS AND SCIENCE
(AUTONOMOUS)
(Reaccredited by NAAC with B++ Grade)
(Affiliated to Bharathidasan University)
PUDUKKOTTAI – 622 422

SEMESTER I

Title of the Course **: PLANT DIVERSITY – I: ALGAE, FUNGI, LICHENS AND BRYOPHYTES**

Category of the course **:Core Course**

Course Code **:P1R3BOCC1**

Nature of the Course **:Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 7**

Credits: 5 **Total Inst. Hrs: 105**

Course Objectives

1. Toinvestigatetheclassification,distinctive traits,distributionandreproductionandlifehistoryofthevariousclassesand majortypes ofPteridophytesand Gymnosperms.
2. To identify and characterize diversity of lower vascular plants in order to comprehend the dynamics of diversity to realize the importance of diversity.
3. To research the classification, phylogeny and economic importance of Pteridophytes and Gymnosperms.
4. Tostudyandunderstandthephylogenyand PaleontologyofPteridophytesand Gymnosperms.
5. To learn about the conceptoffossilsandprocessoffossilization;distinctive characteristics offossilrecords of Pteridophytes and Gymnosperms.

Unit – I: ALGAE:

General account of algology, Contributions of Indian Phycologist (T.V.Desikachary, V.Krishnamurthy and V.S. Sundaralingam), Classification of algae by F.E. Fritsch (1935-45). Salient features of major classes: Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae, Euglenophyceae, Charophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae. Range of thallus organization, algae of diverse habitats, reproduction (vegetative, asexual and sexual) and life cycles. Phylogeny and inter-relationships of algae, origin and evolution of sex in algae.Structure, reproduction and life histories of the following genera: *Oscillatoria*, *Ulva*, *Dictyota* and *Gelidium.*

Unit – II: FUNGI:

General Characteristics, occurrence and distribution. Mode of nutrition in fungi. Contributions of Indian Mycologists (C.V.Subramanian), Classification of Fungi by Alexopoulos and Mims (1979) - Phylogeny and inter-relationships of major groups of fungi. General characters of major classes: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Heterothallism in fungi, sexuality in fungi, Para sexuality.Structure, reproduction and life cycle of the following genera:*Rhizopus*, *Taphrina*, *Polyporus* and *Colletotrichum.*

Unit – III: LICHENS:

Introduction and Classification (Hale, 1969). Occurrence and inter-relationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basiodiolichens and Deuterolichens.

Unit – IVBRYOPHYTES:

General Characters and Classification of Bryophytes by Watson (1971). Distribution, Structural variations and evolution of gametophytes and sporophytes. General characters of major groups - Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Reproduction - Vegetative and sexual, spore dispersal mechanisms in bryophytes, spore germination patterns in bryophytes. Structure, reproduction and life histories of the following genera: *Targionia*, *Porella* and *Polytrichum.*

Unit – V: ECONOMIC IMPORTANCE:

Algae - Economic importance in Food and feed - Single cell protein, Industrial products (Agar-Agar, Carrageenan, Alginic acid, biofertilizers, Vitamins and biofuel), Medicinal value and Diatomaceous earth. Fungi – Economic importance in food, industries and medicine. Culturing and cultivation of mushrooms *Pleurotus.* Lichen –economic importance and as indicator pollution. Bryophytes – Ecological and economic importance – industry, horticulture and medicine.

SEMESTER I

Title of the Course : PLANTDIVERSITY – II(PTERIDOPHYTES, GYMNOSPERMS \AND PALEOBOTANY)

Category of the course : Core Course

Course code : P1R3BOCC2

Nature of the course : Skill Development

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 7**

Credits: 5 **Total Inst. Hrs: 105**

Course Objectives

1. Toinvestigatetheclassification,distinctive traits,distributionandreproductionandlifehistoryofthevariousclassesand majortypes ofPteridophytesand Gymnosperms.
2. To identify and characterize diversity of lower vascular plants in order to comprehend the d ynamics of diversity to realize the importance of diversity.
3. To research the classification, phylogeny and economic importance of Pteridophytes and Gymnosperms.
4. Tostudyandunderstandthephylogenyand PaleontologyofPteridophytesand Gymnosperms.
5. To learn about the conceptoffossilsandprocessoffossilization;distinctive characteristics offossilrecords of Pteridophytes and Gymnosperms.
6. To learn about the conceptoffossilsandprocessoffossilization;distinctive characteristics offossilrecords of Pteridophytes and Gymnosperms.

Unit – I: PTERIDOPHYTES:

General characteristics and classification (Reimer, 1954). Range of structure, reproduction and evolution of the gametophytes, Gametophyte types – sex organs. Apogamy and Apospory. Life cycles. Stellar evolution. Heterospory and seed habit, Telome theory, morphogenesis, Economic importance of Pteridophytes.

Unit – II: PTERIDOPHYTES:

Structure, anatomy, reproduction and life histories of the following genera: *Isoetes, Equisetum Angiopteris, Osmunda, Pteris* and *Azolla*

Unit – III GYMNOSPERMS:

General characters - A general account of distribution of Gymnosperms. Morphology, anatomy, reproduction, phylogeny and classification (K.R.Sporne, 1965). Economic importance of Gymnosperms.

Unit – IV: GYMNOSPERMS:

Structure (Exomorphic and endomorphic), anatomy, reproduction and life histories of the following genera: *Thuja,Cupressus, Araucaria, Podocarpus, Gnetum* and *Ephedra*.

Unit – V: PALEOBOTANY:

Geological Scale; Radiocarbon dating; Contribution of Birbal Sahni to Paleobotany. Gondwana flora of India. Study of fossils in understanding evolution. Fossilization and fossil types. Economic importance of fossils – fossil fuels and industrial rawmaterials and uses. Study of organ genera: *Rhynia, Lepidocarpon, Calamites,Cordaites* and *Lyginopteris.*

SEMESTER I

Title of the Course: Practical I – Covering CCI and CC2
Category of the course: Core Course
Course code: P1R3BOCC3P
Nature of the course: Skill Development
Marks: CIA: 40+ Ext: 60 = 100 **Hrs / Week: 6**
Credits: 4 **Total Inst. Hrs: 90**

Course Objectives

1. To learn how to employ the use of instruments, technologies and methodologies related to thallophytes and non-flowering plant groups.
2. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of algae, and fungi.
3. To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
4. To develop the technical abilities in staining, sectioning, sterilizing, and characterizing. thallophytes, and other varieties of non-flowering plants.
5. To compare the structural diversity of fossil and extant plant species.

Unit – I: ALGAE

Study of algae in the field and laboratory of the genera included in theory.
External morphology and internal anatomy of the vegetative and reproductive structures of the following living forms: *Oscillatoria*, *Scytonema*, *Ulva*, *Codium*, *Diatoms*, *Dictyota*and *Gelidium*(depending onavailability of the specimen). To record the local algal flora–Study of their morphology and structure Identification of algae to species level (at least One). Preparation of culture media and culture of green algae and blue green algae in the laboratory (Demonstration).

Unit – II FUNGI

Study of morphological and reproductive structures ofthefollowinglivingforms: *Rhizopus*, *Taphrina*, *Polyporus* and *Colletotrichum* (depending onavailability of thespecimen). Isolation and identification of fungi from soil, air, and Baiting method. Preparation of culture media. Cultivationofmushroomin the laboratory (Demonstration).

LICHENS

Study of morphological and reproductive structures of the genera *Parmelia.*

Unit – III:BRYOPHYTES

External morphology and internal anatomy of the vegetative and reproductive organs of thefollowinglivingforms: *Targionia*, *Lunularia*, *Porella* and *Polytrichum* (depending onavailability of thespecimen).

Unit – IV: PTERIDOPHYTES

External morphology and internal anatomy of the vegetative and reproductive organs of thefollowinglivingforms: *Isoetes*, *Equisetum Angiopteris*, *Osmunda*, *Pteris* and *Azolla* (depending onavailability of thespecimen).*Fossilslidesobservation:Rhynia*, *Lepidocarpon*, *Calamites.*

Unit – V: GYMNOSPERMS

External morphology and internal anatomy of the vegetative and reproductive organs of thefollowinglivingforms:*Thuja*,*Cupressus*, *Araucaria*, *Podocarpus*, *Gnetum* and *Ephedra* (depending onavailability of thespecimen).Fossilslidesobservation*: Cordaites* and *Lyginopteris.*

SEMESTER I

Title of the Course: MICROBIOLOGY, IMMUNOLOGY AND PLANTPATHOLOGY
Category of the course: Elective paper
Course code: P1R3BODSE
Nature of the course: Skill Development
Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 5**
Credits: 3 **Total Inst. Hrs: 60**

Learning Objectives

1.To provide comprehensive knowledge about microbes and its effect on man and environment
2.To provide comparative analysis of major groups of microbes.
3.To study the principles of immune system, immunizing agents like antibodies and vaccines and gene therapy methods.
4.To enhance the knowledge and skills needed for self-employment using the microbial derived products.
5.To appreciate the role of immune system in conferring disease resistance.

BACTERIA:

Types of microorganisms. General characteristic of bacteria – Outline classification of Bergey's manual of 9th edition. Classification of bacteria based on Morphological, cultural, physiological and molecular characteristics. Bacterial growth – batch culture and continuous culture. Growth Curve. Factors affecting growth. Determination of bacterial growth – Direct method: Haemocytometer, Viable plate count; Indirect method: Turbidity. Nutritional types. Reproduction - Fission and sporulation. Genetic recombination- Transformation, Transduction and Conjugation. Isolation and cultivation of bacteria. Maintenance of bacterial culture.

VIRUSES:

General characters, Classification, Structure, Multiplication. Overview of Phycoviruses and Mycoviruses. Viruses of Eukaryotes – Animal & Plant viruses. Cultivation of viruses – in embryonated egg and in plants. Control of viral infections. Bacteriophages- classification, replication of DNA and RNA phages -Lytic and Lysogenic cycle. Viroids and prions. Mycoplasma: Structure and classification.

FOOD MICROBIOLOGY:

Beneficial role of microbes – yoghurt, Olives, Cheese, Bread, Wine, Tempeh, Miso & Fermented green tea. Spoilage of fruits, vegetables, meats, poultry, eggs, bakery products, dairy products and canned foods. Microbial toxins - Exotoxin, Endotoxin & Mycotoxin. Action of Enterotoxin, Cytotoxin & Neurotoxin. Food Preservation – temperature, drying, radiation and chemicals. Soil Microbiology: Importance of Microbial flora of soil and factors affecting the microbial community in soil. Interaction among soil microbes (positive and negative interactions) & with higher plants (rhizosphere &phyllosphere). Microorganisms in organic matter decomposition. Environmental

Microbiology: Microbiology of water and air. Water borne diseases - diphtheria, chicken pox. Air borne diseases - Swine flu and **Measles**. Microbial degradation of chemical pesticides and hydrocarbon.

IMMUNOLOGY:

Introduction; Immune System; Types of Immunity - Innate and Acquired.Immune Cells - Hematopoiesis, B and T lymphocytes - Maturation, NK cells. Introduction to inflammation, Adaptive immune system, Innate Immune system. Antigen: Definition, Properties and types. Antibody – Structure, types and function. Generation of antibody diversity.Antigen - Antibody interactions: definition, types- Precipitation, Agglutination, Complement fixation. Immune Response – Humoral and Cell Mediated. Vaccines – history, types and recombinant vaccines. Immunodiagnosis –Blood Grouping, Widal test, Enzyme-Linked Immunosorbent Assay (ELISA), Immunoelectrophoresis and Immunodiffusion.

PLANT PATHOLOGY:

History and significance of plant pathology. Classification of plant diseases, Symptomology (important symptoms of plant pathogens). Principles of plant infection –Inoculum, inoculum potential, Pathogenicity. Disease triangle. Host parasite interrelationship and interaction. Causal agents of plant diseases - biotic causes (fungi, bacteria virus, mycoplasma, nematodes, parasitic algae, angiospermic parasites - Abiotic causes (Physiological, deficiency of nutrients & minerals and pollution).Mechanism of penetration- Disease development of pathogen (colonization) and dissemination of pathogens. Role of enzymes and toxins in disease development. Defence mechanism of host – structural and biochemical defences. Important diseases of crop plants in India - Sheath blight of rice, Late blight of potato, Little leaf of Brinjal and Red rust of tea.

Principles of disease management – Cultural practices, physical, chemical and biological methods, disease controlled by immunization. Biocontrol - merits and demerits; Plant quarantine and legislation. Integrated Pest Management system. Diagnostic technique to detect pest/pathogen infection - Immunofluorescence (IF).

SEMESTER I

Title of the Course: **CONSERVATION OF NATURAL RESOURCES AND POLICIES**
Category of the course: **Elective paper**
Course code: **P1R3BODSE1**
Nature of the course: **Skill Development**
Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 5**
Credits: 3 **Total Inst. Hrs: 60**

Learning Objectives

1.Explain the term natural resources.
2.Describe the reasons for degradation of natural resources and suggest measures to prevent these.
3.List the various endangered species of animals and plants.
4.State the various environmental laws passed to conserve the natural resources.
5.Explain sustainable development and justify its need; and describe the various conventional as well as non-conventional sources of energy.

Unit – I: NATURAL RESOURCES:

Definition – Importance – Classification – Human physiological socio-economic and cultural development – Human Population Explosion – Natural Resource Degradation – Concept of conservation – Value system – Equitable resource use for sustainable life system.

Unit – II: FOREST RESOURCES:

Forest cover in India and the World – Importance – Desertification – Forest Wealth – Afforestation – Vanasamrakshna Samithi– Agroforestry – Social Forestry – Joint Forest Management Strategy for Forest Conservation. **Wild Life:** Resources – Importance – Benefits – Wild life Extinction – Causes for Extinction – List of Endanger species in India and in the World – Ecological approach in wild life management – Eco Tourism – Wild Life projects in India – Sanctuaries and National Parks In India – Man and Bio sphere Programme.

Unit – III:LAND AND SOIL RESOURCES:

Soil, Complexity of soil nature, regional deposits, Land use and capability classification systems, Land use Planning models and their limitations. Impacts of natural and man-made activities on land characteristics and land use planning– Soil Erosion – Loss of Soil Nutrients – Restoration of Soil Fertility – Soil Conservation Methods and Strategies in India. Wet Land Conservation and Management – Ecological Importance of wet lands in India – Conservation Strategy and ecological Importance. Water Resources: Rivers and Lakes In India – Water Conservation and ground water level increase - Watershed Programme.

Unit – IV:MINERAL RESOURCES:

Use and exploitation – Environmental effects of extracting and using mineral resources – Restoration of mining lands – Expansion of supplies by substitution and conservation. Food Resources: World Food Problems – Changes caused by agriculture – overgrazing effects of modern agriculture – Fertilizer-Pesticide problems – Water Logging – Salinity – Sustainable agriculture, life stock breeding and farming.

Unit – V: **ENVIRONMENTAL POLICY IN INDIA:**

Need for policies- Public Policy – Economic policies – Relationship between economic development and environment – Implementing Environmental Public Policy Strategies in pollution control – Constitutional provisions in India regarding environment – Public Awareness and Participation in Environmental Management – National Land Use Policy 1988 – Industrial Policy 1991.

SEMESTER I

Title of the Course : MUSHROOM CULTIVATION
Category of the course : Elective paper
Course code : P1R3BODSE1
Nature of the course : Employability, Entrepreneurship and Skill Development
Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 5**
Credits: 3 **Total Inst. Hrs: 72**

Learning Objectives

1.To teach the identification of mushrooms.
2.To differentiate the edible mushrooms with toxic and hallucinating fungi.
3.To study the cultivation technique of mushrooms
4.To learn the economic importance of mushroom in various fields.
5.To study howto establish mushroom cultivation as business enterprise.
6.To teach the identification of mushrooms.

Unit – I: INTRODUCTION:

Mushroom,EdibleMushroom,commercialproduction,medicinalvalueofmushrooms,nutraceuticals and dietary supplements

Unit – II: MORPHOLOGICAL AND MICROSCOPICAL IDENTIFICATION OF EDIBLE AND POISONOUS MUSHROOMS:

Keysforidentificationofediblemushrooms:*Agaricusbisporus,Pleurotussajorcaju,Volvariellavolvcea*and*Calocybeindica*.Keyforidentifyinghallucinogenicmushroom(*Psilocybe*sp.)MedicinalMushroom –*Cordyceps,Ganoderma lucidum*and*Lentinusedodes.*

UNIT- – III:CULTIVATION:

Substratesterilization,bedpreparation,croppingroomandmaintenance,raising of pure culture and spawn preparation, factors effecting button mushroom production(Temp,pH, airandwatermanagement, competitor mouldsand otherdisease).

Unit – IV: POST-HARVESTMANAGEMENT:

Harvest,storage,qualityassuranceofmushrooms.Pestmanagement.

Unit – V:

Worldproductionediblemushroom,Legalandregulatoryissuesofintroducingthemedicinalmushrooms in different countries. Developing small scale industry and Government schemes.MushroomResearch Centres–Internationaland National levels.

SEMESTER I

Title of the Course: **PHYTOPHARMACOGNOSY**
Category of the course: **Elective paper**
Course code: **P1R3BODSE1**
Nature of the course: **Skill Development**
Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 5**
Credits: 3 **Total Inst. Hrs: 72**

Learning Objectives

1. To learn the traditional knowledge on plant derived drugs and their conventional classification
2. To elucidate the biosynthetic pathway of major classes of secondary metabolites.
3. To study the general pharmacological mode of action of crude drugs of few medicinal plants..
4. To elucidate the isolation and characterization of plant derived drugs using modern biotechniques.
5. Knowledge on pharmacological action of drugs.

Unit – I: General introduction – History and scope of Pharmacognosy including indigenous system of medicine. Various systems of classification of drugs. Pharmacological action of plant drugs. Significance of Pharmacopoeial standards.

Unit – II: FOREST RESOURCES:

MORPHOLOGICAL AND MICROSCOPICAL Biosynthetic pathway of secondary metabolites: Acetate pathway (fatty acids and polyketides), mevalonate and deoxyxylulose phosphate pathway (terpenoids and steroids),shikimate pathway (phenols, amino acids etc.).

Unit – III: Characterization of Therapeutic drugs: Extraction, separation, isolation (Chromatographic techniques) and characterization of secondary metabolites (Spectroscopic techniques). Quality control of plant drugs: Classical and modern approaches of drugs. Significance of Pharmacopoeial standards.

Unit – IV: Pharmacological action of Plant Drugs: Anti-cancer, Bitter tonic, Carminatives and G.I. regulators, Cardiotonics, CNS-Stimulatant, Expectorant, Laxatives, Puragatives. Outline of pharmacogenomics functions.

Unit – V: Hallucinogenic, allergenic and other toxic plants, poisonous plants - biopesticides - biocides – biofungicides.

SEMESTER I

Title of the Course : ALGAL TECHNOLOGY
Category of the course : Elective paper
Course code : P1R3BODSE 2:1
Nature of the course : Entrepreneurship and Skill Development
Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 5**
Credits: 3 **Total Inst. Hrs: 72**

Learning Objectives

1. To provide a basic overview of algae cultivation techniques and resource potentials.
2. To educate people about the widespread commercial uses of algae
3. To educate people about the therapeutic usesof algae.
4. Toenrichthecurrentknowledgeof how algae are used inbasicresearchandtechnologicalapplications
5. To spread awareness of the value of algae biotechnology and its applications in diverse industries.

Unit – I: SCOPE OF ALGAL TECHNOLOGY :

Scope of algal technology – Commercial potential and utility of algae. Algae as sources for food, feed, pigments, Pharmaceuticals and neutraceuticals, fine chemicals, fuel, biofertilizers and hormones. Economic importance of algae in India.

Unit – II: ALGAL PRODUCTS

Industrial application of algae - fuel, algal lipids - transesterification to ester fuel - substitutes for petroleum derived fuel. Algal products - Spirulina mass cultivation and its applications. Mass cultivation of micro-algae as source of protein and as feed. Liquid seaweed fertilizers - method of preparation, applications and its advantages over inorganic fertilizers.

UNIT- – III: ALGAL PRODUCTION AND UTILIZATION

Algal production systems; Strain selection; Algal growth curve; Culture media; cultivation methods – small scale and Large-scale cultivation of algae. Harvesting and packing. Therapeutic uses - antioxidant, anti-ulcerogenic, antifungal, antibiotics, antitumor and antiviral compounds. Production of pigments and their utilization

Unit – IV: IMMOBILIZATION AND RDNA TECHNOLOGY IN ALGAE

Algal immobilization and its applications - culturing for metabolite production and natural compounds. Methods of immobilization - alginate beads-extraction of compounds. Recombinant DNA technology in algae - Transformation systems in algae. Isolation of protoplasts, regeneration of fusion of macro algae. Role of algae in nanobiotechnology.

Unit – V: ROLE OF ALGAE IN ENVIRONMENT MANAGEMENT

Role of algae in environmental health - Sewage treatment, treating industrial effluent, Phytoremediation- heavy metal removal, algae as indicators in assessing water quality and pollution; Saprobic index; Monitoring, assessment, restoration and management of coastal and marine ecosystem environment. Algal culture collection centers in India and abroad and their importance.

SEMESTER I

Title of the Course :ETHNOBOTANY,NATUROPATHYAND TRADITIONALHEALTHCARE

Category of the course : ELECTIVE II

Course code : P1R3BODSE 2:2

Nature of the course : Skill Development

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 5**

Credits: 3 **Total Inst. Hrs: 72**

Learning Objectives

1. Understand the concept of ethnobotany and the life style and traditional practices of plants by Indian tribals.
2. Emphasize the importance of non-timber forest products for Indian tribal people livelihoods.
3. Evaluate the various research techniques to gather tribal knowledge of ethnobotany.
4. Use strategies to turn ethno botanical knowledge into goods with value additions.
5. To save and document ethno botanicalsin order to use plant resources sustainably.

Unit – I: ETHNOBOTANY:

Concept, important landmarks in the development, scope, sub disciplines of ethno botany. Interdisciplinary approaches. Knowledge of following sociological and anthropological terms: culture, values and norms, institutions, culture diffusion and ethnocentrism. History of ethnobotany: A brief history of ethno botanical studies in the world and in India.

Unit – II: PLANTS USED BY TRIBALS OF INDIA:

Distribution of tribes in India. Basic knowledge of following tribes of Tamil Nadu: Irulas, Kanis, Paliyars Badagas, Kurumbres, Thodas and Malayalis. Plants used by tribals of Tamil Nadu.

UNIT- – III:SOURCES OF ETHNOBOTANICAL DATA:

Primary - archeological sources and inventories, Secondary - travelogues, folklore and literary sources, herbaria, medicinal texts and official records. Methods in ethnobotanical research. Prior Informed Consent, PRA techniques, interviews and questionnaire methods, choice of resource persons. Folk taxonomy – plants associated with culture and socio- religious activities. Non – timber forest products (NTFP) and livelihood – Sustainable harvest and value addition.

Unit – IV: NATUROPATHIC MEDICINE:

Role of plants in naturopathy- Importance and relevance of medicinal drugs in India. Indian Systems of Medicine (Ayurveda, Siddha, Allopathy, Homeopathy, Unani, Tibetan, Yoga and Naturopathy). Disease diagnosis, treatment, and cure using natural therapies including dietetics, botanical medicine, homeopathy, fasting, exercise, lifestyle counseling, detoxification, and chelation, clinical nutrition, hydrotherapy, naturopathic manipulation, spiritual healing, environmental assessment,

TRADITIONAL HEALTH CARE:

Health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being.

Unit – V: BIOPROSPECTING AND VALUE ADDITION:

Bioprospecting of drug molecules derived from Indian traditional plants; Methods for bioprospecting of natural resources; From folk Taxonomy to species confirmation - evidences based on phylogenetic and metabolomic analyses; Ethno botanical databases and Traditional knowledge Digital Library (TKDL).

SEMESTER I

Title of the Course : HORTICULTURE
Category of the course : ELECTIVE II
Course code : P1R3BODSE 2:3
re of the course : Employability and Skill Development
Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 5**
Credits: 3 **Total Inst. Hrs: 72**
Learning Objectives

1. Know about the brief history, divisions, classification and structure of horticultural plants.
2. Acquire knowledge on plant growth processes and stages of plant growth
3. Understand the plant growth environment in relation to soil, nutrients, fertilizers, and bio inoculants.
4. Study the sexual and vegetative propagation methods including propagation through specialized vegetative structures.
5. Develop practical skills in micro propagation techniques and soil-less production of horticultural crops.

Unit – I: INTRODUCTION TO HORTICULTURE
Definition; Brief History, Divisions of Horticulture, Classification of horticultural plants, Structure of Horticultural Plants –Cell and Tissue systems, Anatomy of stem root and leaf, Morphological structures, Plant growth processes-A brief account of Photosynthesis, Respiration, Transpiration and Translocation, Stages of plant growth.

Unit – II: FACTORS AFFECTING PLANT GROWTH
Plant Growth Environment: Abiotic factors, Soil –Profile structure, Primary and Secondary nutrients and their functions, Organic matter, Fertilizers –organic, Inorganic and Potting Media, Bio inoculants, Methods of fertilizer application, Directing Plant growth-Training -Pruning and thinning.

UNIT- – III: PLANT PROPAGATION
Plant propagation: Seeds –Advantages, Viability, Mechanism of Dormancy and Dormancy Breaking: Methods of Direct and Indirect Seedling Production in Nurseries and Transplantation; Propagation through specialized underground structures –Corm, Tuber, Sucker, Bulb, Bulbil, Rhizome; Vegetative Propagation –Cutting, Layering, Grafting and Budding.

Unit – IV: MICROPROPAGATION TECHNIQUES
Stages, multiplication by shoot tip, Nodal culture and Callus culture-Application and Limitations, Somatic embryogenesis, Synthetic seeds –Preparation and Potential uses of artificial seeds, Embryo Rescue, Soil-less Production of Horticultural crops – Hydroponics, sand culture, gravel culture.

TRADITIONAL HEALTH CARE:
Health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being.

Unit – V: AESTHETICS OF HORTICULTURE
Design: Elements and Principles of Design, Flower Arrangement, Terrarium Culture, Bonsai, Growing Plants Indoors, Turf Production, Landscaping-Principles, Types of Parks, Xeriscaping. Postharvest handling of Horticultural Products –Harvesting, Storage, Processing, Elements of Marketing. Robotics in Horticultu

SEMESTER I

Title of the Course : HERBAL TECHNOLOGY
Category of the course : ELECTIVE II
Course code : P1R3BODSE 2:4
Nature of the course : Skill Development
Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 5**
Credits: 3 **Total Inst. Hrs: 72**
Learning Objectives

1. To understand various plants based drugs used inayurvedha, unani, homeopathy, siddha etc.
2. To apply the knowledge to cultivate medical plants.
3. To know the pharmacological importance of medicinal plants.
4. To enlist phytochemicals and secondary metabolites of market and commercial value.
5. To design and develop their own business prepositions such as theo in the making of herbal insecticides

Unit – I: PHARMACOGNOSY

Pharmacognosy scope and importance - source - Crude Drugs – Scope and Importance, Classification (Taxonomical, Morphological Chemical, Pharmacological); Cultivation, Collection and processing of crude drugs. Cultivation and utilization of medicinal and aromatic plants in India.

Unit – II: PLANT TISSUE CULTURE AS SOURCE OF MEDICINES

Plant tissue culture as source of medicines, Role of plant tissue culture in enhancing secondary metabolite production (*Withania somnifera*, *Rauwolfia serpentina*, *Catheranthus roseus*, *Andrographis paniculata* and *Dioscorea sp*) - Elicitation - Biotransformation, Hairy root culture. Factors affecting secondary metabolites production. Biogenesis of phytopharmaceuticals.

UNIT- – III:PLANT PROPAGATION ANALYSIS OF PHYTOCHEMICALS

Methods of Drug evaluation (Morphological, microscopic, physical and chemical). Phytochemical investigations – standardization and quality control of herbal drugs. Preliminary screening, Assay of Drugs - Biological evaluation/assays, Microbiological methods - Chemical Methods of Analysis, Detection of Adulterants: Chemical estimations, Spectrophotometry and fluorescence analysis. Drug adulteration - Types of adulterants.

Unit – IV: GENERAL METHODS OF PHYTOCHEMICAL AND BIOLOGICAL SCREENING

Carbohydrates and derived products: Glycosides - extraction methods (*Digitalis*, *Dioscorea*); Tannins (Hydrolysable and Condensed types); Volatile oils - extraction methods (Clove, Mentha). Study of some herbal formulation techniques as drug cosmetics.

Unit – V: TYPES OF PHYTOCHEMICALS

Alkaloids - extraction methods (*Taxus*, *Cinchona*); Flavonoids- extraction methods, Resins-extraction method: Application of phytochemicals in phytopharmacueticals; Biocides, Biofungicides, Biopesticides. Women entrepreneurship development – marketing cultivated medicinal plants – National Medicinal Plants Board of India.

SEMESTER II		
Title of the Course	**:**	**TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY**
Category of the Course	**:**	**Core Course**
Course Code	**:**	**P2R3BOCC4**
Nature of the Course	**:**	**Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 6**
Credits: 5 **Total Inst. Hrs: 90**

Course Objectives

1.To be familiar with the basic concepts and principles of plant systematics.

2.To develop a suitable method for correct characterization and identification of plants.

3.To understand the importance of taxonomic relationships in research of plant systematics.

4.To provide information on various classification systems

5.To know about the economic importance of plants.

Unit- ITAXONOMY AND SYSTEMATICS (18 Hours)

Botanical exploration and contribution with special reference to India by William Roxburgh, J.D. Hooker, Robert Wright, Nathanial Wallich and Gamble, J.S. Principles of classification as proposed – Artificial – Linnaeus, Natural – Bentham and Hooker, Phylogenetic system - Hutchinson, Modern – Takhtajan. Botanical gardens and herbaria of world, preparation and maintenance of Herbarium, Botanical survey of India – its organization and role.

Unit –II MODERN TRENDS IN TAXONOMY (18 Hours)

Modern trends in taxonomy, chemotaxonomy, numerical taxonomy, biosystemics. ICBN uninominal systems- genesis binomial nomenclature, importance and principle. Important articles, typification, principles of priority, effective and valid publication, author citation, recommendations and amendents of code. Glossories and dictionaries, Taxonomic literature (Index Kewensis)

Unit- III SYSTEMATIC ANALYSIS OF PLANTS-I (18 Hours)

Polypetalae – Nympheaceae, Sterculiaceae, Portulaceae, Rhamnaceae, Vitaceae, Sapindaceae, Combretaceae, Turneraceae.

Unit-IV SYSTEMATIC ANALYSIS OF PLANTS-II (18 Hours)

Gamopetalae – Sapotaceae, Oleaceae, Boraginaceae, Scrophulariaceae, Bignoniaceae, Convolvulaceae, Acanthaceae, Verbenaceae.Monochlamydeae – Nyctaginaceae, Aristolochiaceae, Casuarinaceae. Monocots – Orchidaceae, Amarylidaceae, Lilliaceae, Commelinaceae, Cyperaceae.

Unit- V

ECONOMIC BOTANY (18 Hours)

General account on utilization of selected crop plants: (i) Cereals (rice and wheat) – (ii) Pulses (red gram and black gram), (iii) Drug yielding plants (*Withaniasomnifera*and*Coleus aromaticus)* (iv) Oil yielding plants (Groundnut, sunflower).(v) Sugar yielding plants (sugarcane and sugar beet), (vi) Spices and condiments (cardamom, cinnamon). (vii) Commercial crops - fibre (jute), (viii) Timber (Teak and red sanders wood), (ix) Resins and gums (Asafoetida and gum arabic) – (x) Essential oils (lemon grass and menthol), (xi) Beverages (tea, coffee), (xii) Plants used as avenue trees for shade, pollution control and aesthetics (xiii) Energy plantation - uses of *Casuarina.*

SEMESTER II		
Title of the Course	**:**	**PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS**
Category of the Course	**:**	**Core Course**
Course Code	**:**	**P2R3BOCC5**
Nature of the Course	**:**	**Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 6**
Credits: 5 **Total Inst. Hrs: 90**

Course Objectives

1.Learn the importance of plant anatomy in plant production systems.
2.Classify meristems and identify their structures, functions and roles in monocot and dicot plants growth and secondary growth of woody plants.
3.Understand the mechanism underling the shift from vegetative to reproductive phase.
4.Trace the development of male and female gametophyte.
5.Understand the recent advances in palynology.

UNIT- I CELL WALL: (18 Hours)

Morphological and physico-chemical changes; Plasmodesmata- types of pits – growth of cell wall – formation of intercellular spaces; Meristems: Classifications: Theories of shoot and root apices, Cytological zonation in shoot apex. Vascular Cambium: Composition and organization – multiplicative and additive divisions. Xylem: Primary and secondary xylem – tracheary elements and vessels – vesselless dicots – xylem rays and axial parenchyma of angiosperm wood; Dendrochronology – grain, texture and figure in wood; reaction wood; ring porous and diffuse porous wood. Phloem: Ultra structure and ontogeny of sieve tube elements and companion cell. Evolution of tracheary elements.

UNIT – II PERIDERM: (18 Hours)

Structure, organization and activity of phellogen. Polyderm and Rhytiderm – wound periderm. Normal secondary thickening in Dicots; Anomalous secondary growth in Dicots (Amaranthaceae, Aristolochiaceae, Bignoniaceae, Piperaceae, Nyctaginaceae) and arborescent Monocots. Primary thickening in palms; Ontogeny of leaf, Structure and types of Stomata; Leaf abscission; Major nodal types; Kranz anatomy and its significance. Microtechnique: Principle of killing and fixation, dehydration and rehydration of botanical specimens. Stains: Principle of double staining (fast-green and light green) of free hand sections; Protocol for serial sectioning of paraffin wax impregnated specimens; Mounting and mounting media.

UNIT – III MICROSPORANGIUM AND MALE GAMETOPHYTE:

Structure and development of Anther; Ultrastructure and physiology of anther tapetum; Male gametophyte; Palynology: Morphology and ultrastructure of pollen wall, pollen kitt, pollen analysis, pollen storage, pollen sterility and pollen physiology.

UNIT – IV MEGASPORANGIUM AND FEMALE GAMETOPHYTE: (18 Hours)

Structure and development of Megasporangium; Types of ovules, Endothelium, obturator and nucellus. Megasporogenesis: Female gametophyte: Structure, types, haustorialbehavior and Nutrition of embryo sacs. Fertilization: Double fertilization and triple fusion; Endosperm: Development of endosperm, types, physiological efficiency of endosperm haustoria and functions; Ruminate endosperm. Embryogeny: Development of monocot (Grass) and dicot (Crucifer) embryos.

UNIT – V POLYEMBRYONY: (18 Hours)

Causes of Polyembryony, classification, induction and practical application. Apomixis and its significance. Seed and Fruit development and role of growth substances. Parthenocarpy and its importance.

SEMESTER II		
Title of the Course	**:**	**Practical II – (Covering CC4,CC5)**
Category of the Course	**:**	**Core Course**
Course Code	**:**	**P2R3BOCC6P**
Nature of the Course	**:**	**Skill Development**

Marks: CIA: 40 + Ext:60 = 100 **Hrs / Week: 4**
Credits: 5 **Total Inst. Hrs: 60**

Course Objectives

1. To understand and develop skill sets in plant morphological, floral characteristics and artificial key preparation.
2. To expedite skilled workers to carry out research in frontier areas of plant science.
3. To classify meristems and identify their structures, functions and roles in monocot and dicot plants growth and secondary growth of woody plants
4. To learn the importance of plant anatomy in plant production systems.
5. To know about different vegetation sampling methods.

EXPERIMENTS

TAXONOMY AND ECONOMIC BOTANY OF ANGIOSPERMS

Preparation of artificial keys.

Description of a species, based on virtual herbarium and live specimens of the families mentioned in the theory.

Study the products of plants mentioned in the syllabus of economic botany with special reference to the morphology, botanical name and family.

Solving nomenclature problems.

Field trip:

A field trip at least 3-4 days to a floristically rich area to study plants in nature and field report submission of not less than 20 herbarium sheets representing the families studied.

ANATOMY

1. Study of shoot apex of *Hydrilla*
2. Observation of cambial types.
3. Sectioning and observation of nodal types.
4. Study of anomalous secondary growth of the following:

STEM- *Nyctanthus, Bouerhhavia, Aristolochia, Bignonia, Piper* petal and *Mirabilis*.

ROOT: *Acyranthus*

5. Observation of stomatal types by epidermal peeling.
6. Maceration of wood and observation of the components of xylem.
7. Double staining technique to study the stem anomali.

EMBRYOLOGY

1. Observation of T.S. of anther.
2. Observation of ovule types.
3. Observation of mature embryo sacs.
4. Dissection and observation of embryos (globular and cordate embryos).
5. Study of pollen morphology
6. Study of in vitro pollen germination.
7. Observation of endosperm types.

SEMESTER II		
Title of the Course	**:**	**MEDICINAL BOTANY**
Category of the Course	**:**	**ELECTIVE III**
Course Code	**:**	**P2R3BODSE3:1**
Nature of the Course	**:**	**Employability and Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 6**
Credits: 3 **Total Inst. Hrs: 60**
Course Objectives

1. To understand the uses and effects of medicinal plants and herbal supplements
2. To gain knowledge about the historical and modern uses of plants in medicine.
3. To gain insights into the perspectives of ethnobotanical research.
4. To know the various methods of harvesting, drying and storage of medicinal herbs
5. To create new strategies to enhance growth and quality check of medicinal herbs.

Unit- I

HISTORY AND TRADITIONAL SYSTEMS OF MEDICINE:

Historical Perspectives – European, African, American, Southeast Asian Practices. Scope and Importance of Medicinal Plants; Traditional systems of medicine - Definition and Scope. Classical health traditions - Naturopathy, Siddha, Ayurveda, Homeopathy, Unani and MateriaMedica. Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in Ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e-tabiya, tumors treatments/ therapy, polyherbal formulations.

Unit –II

PHYTOCHEMISTRY AND PHARMACOGNOSY:

Phytochemistry, important phytoconstituents, their plant sources, medicinal properties. Histochemistry – definition, principles, staining methods. Biological stains – bright field dyes and flurochromes, detection and localization of phytochemicals. Raw drugs, authenticity, study through physical, microscopic and analytical methods. Different types of formulations. Adulteration and Admixtures.

Unit- III

ACTIVE PRINCIPLE &DRUG DISCOVERY:

Brief description of selected plants, Active principles, biochemical properties and medicinal uses of Guggul (*Commiphora*) for hypercholesterolemia, *Boswellia*for inflammatory disorders, Arjuna (*Terminalia arjuna*) for cardio protection, turmeric (*Curcuma longa*) for wound healing, antioxidant and anticancer properties, Kutaki (*Picrorhizakurroa*) for hepatoprotection, Opium

Poppy for analgesic and antitussive, *Salix* for analgesic, *Cinchona* and *Artemisia* for Malaria, *Rauwolfia*as tranquilizer, *Belladona* as anticholinergic, *Digitalis* as cardiotonic, *Podophyllum* as antitumor, *Stevia rebaudiana*for antidiabetic, *Catharanthusroseus* for anticancer. Bioprospecting, drug discovery from plants with reference to diabetes and cancer. Product development and quality control

Unit-IV

CONSERVATION AND AUGMENTATION:

Significance of Cultivation, management, policies for conservation and sustainable use of medicinal plants. Conservation of endemic and endangered medicinal plants, Red list criteria; *In situ* conservation: Biosphere reserves, sacred groves, National Parks; *Ex situ* conservation: Botanic Gardens, Ethno medicinal plant Gardens. Propagation of Medicinal Plants: seeds, cuttings, layering, grafting and budding.

Unit- V

ETHNO BOTANY AND FOLK MEDICINE:

Concepts and definition of Ethno botany and folk medicines. A brief history of ethnobotanical studies – globally & locally. Methods to study ethno botany; Applications of Ethno botany: Folk medicines of ethno botany, ethno medicine, ethno ecology, ethnic communities of India. Understanding the traditions of tribes in Tamil Nadu – Irulas and Kanis. Repository of Ethnobotanical data – Archeology, inventories, folklore and literature. Traditional Knowledge Sharing - Prior information consent, interviews, questionnaires and knowledge partners.Plants associated with culture, social, religious and medicinal purposes.Commercial use of traditional knowledge – ethics, IPR, biopiracy, equitable benefit sharing models.

SEMESTER II		
Title of the Course	**:**	**RESEARCH METHODOLOGY, COMPUTER APPLICATIONS**
Category of the Course	**:**	**ELECTIVE**
Course Code	**:**	**P2R3BODSE3:2**
Nature of the Course	**:**	**Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 4**
Credits: 3 **Total Inst. Hrs: 60**

Course Objectives

1. To equip students to collect, analyze and evaluate data generated by their own inquiries in a scientific manner.
2. To provide an overview on modern equipments that they would help students gain confidence to instantly commence research careers and/or start entrepreneurial ventures.
3. To develop interdisciplinary skills in using computers in botany to learn about the biological database.
4. Students aware with the most recent technologies for sequencing and bioinformatics analysis and is able to apply them to the structural and functional genomics of plants.
5. Operate various software resources with advanced functions and its open office substitutes.

UNIT - I **(12 Hours)**

proposal writing — dissertation writing – paper presentation (oral/poster) - E-learning tools-monograph — introduction and writing-Standard operating procedure (SOP) – introduction and preparation — Research Institutions - National and International.

UNIT – II **(12 Hours)**

Basic principles and applications of pH meter, UV-visible spectrophotometer, centrifuge, lyophilizer, chromatography- TLC, Gas chromatography with mass spectrum (GC/MS), and HPLC-Scanning electron microscopy-Agarose gel Electrophoresis — Polyacrylamide GelElectrophoresis –Polymerase chain reaction.

UNIT – II **(12 Hours)**

Introduction to computers and Bioinformatics. Types of hardware and software operating systems. Fundamentals of networking, operation of networks, telnet, ftp, www, Internet. Biological Research on the web: Using search engines, finding scientific articles.

UNIT – IV **(12 Hours)**

Public biological databases, searching biological databases. Use of nucleic acid and protein data banks.

UNIT – V **(12 Hours)**

NCBI, EMBL, DDBJ, SWISSPORT, Protein prediction and Gene finding tools. Techniques in Bioinformatics- BLAST, FASTA, Multiple Sequence Analysis **.**

SEMESTER II		
Title of the Course	**:**	**BIOPESTICIDE TECHNOLOGY**
Category of the Course	**:**	**ELECTIVE**
Course Code	**:**	**P2R3BODSE3:3**
Nature of the Course	**:**	**Employability and Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 4**
Credits: 3 **Total Inst. Hrs: 60**

Course Objectives

1. To understand the value and applications of biopesticides
2. To comprehend the various issues related to the use of chemical pesticides in horticulture, forestry, and agriculture.
3. To gain knowledge about several biopesticides (bio-insecticides, bio-fungicides, bio-bactericides, bio-nematicides and bio-herbicides).
4. To gain knowledge of the techniques for mass production of selected biopesticides.
5. To be aware of the application strategies and weeds, nematodes, and disease targets.

UNIT - I **(12 Hours)**

INTRODUCTION

Introduction of biopesticides. Biological control, History and concept of biopesticides. Importance, scope and potential of biopesticide. Advantages for the use of biopesticides.

UNIT – II **(12 Hours)**

TYPES OF BIOPESTICIDES

Classification of biopesticides, botanical pesticides and biorationales. Mass production technology of bio-pesticides. Major classes-Properties and uses of Bioinsecticides,biofungicides, biobactericides, bionematicides and bioherbicides. Importance of neem in organic agriculture.

UNIT – III

IMPORTANT BIOINSECTICIDES (12 Hours)

Bacillus thuringiensis, NPV, entomopathogenic fungi (*Beauveria, Metarhizium, Verticillium, Paecilomyces*). Biofungicides: *Trichoderma, Gliocladium,* non-pathogenic *Fusarium, Pseudomonas* spp., *Bacillus* spp. Biobactericides: *Agro bacterium radiobacter*. Bionematicides: *Paecilomyces, Trichoderma*, Bioherbicides: *Phytophthora, Colletotrichum*.

UNIT – IV

STANDARDIZATION OF BIOPESTICIDES (12 Hours)

Target pests and crops of important biopesticides and their mechanisms of action. Testing of quality parameters and standardization of biopesticides.

UNIT – V

FORMULATION (12 Hours)

Mass multiplication and formulation technology of biopesticides. Prospects and problems in commercialization and efficiacy of biopesticides. Commercial products of biopesticides.

SEMESTER II		
Title of the Course	**:**	**APPLIED BIOINFORMATICS**
Category of the Course	**:**	**ELECTIVE IV**
Course Code	**:**	**P2R3BODSE4:1**
Nature of the Course	**:**	**Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 4**
Credits: 3 **Total Inst. Hrs: 60**

Course Objectives:

1. Tolearnaboutthebioinformaticsdatabases,databanks,dataformatanddataretrievalfromtheonlin esources.
2. Toexplaintheessentialfeaturesoftheinterdisciplinaryfieldofscience forbetterunderstandingbiologicaldata.
3. Tooutlinethetypes ofbiologicaldatabases.
4. Todemonstratedifferent onlinebioinformaticstools.
5. Tosummarizethestrong foundationforperformingfurtherresearch inbioinformatics.

UNIT - I (12 Hours)
BIOINFORMATICSANDINTERNET:

InternetBasics-FileTransferProtocol-TheWorldWideWeb-InternetResources–databases–types-Applications-NCBI DataModel-SEQ-Ids–Biosequences-Biosequencesets–Sequence annotation–Sequencedescription.

UNIT - II GENBANK SEQUENCE DATABASE: (12 Hours)

Introduction- Primary And Secondary Databases - Format Vs.Content-GenbankFlatfile-SubmittingDNASequencestotheDatabases - DNA/RNA-Population,Phylogenetic, and Mutation Studies - Protein-Only Submissions - Consequences of DNA Model-EST/STS/GSS/HTG/SNP and Genome Centers -Contact points for submission of sequence data toDBJ/EMBL/Genbank.

UNIT - III STRUCTURE DATABASES (12 Hours)

Introduction to Structures- Protein Data Bank (PDB) - MolecularModeling Database at NCBI Structure File Formats - Visualizing Structural Information -DatabaseStructureViewers - AdvancedStructureModeling-StructureSimilarity Searching.

UNIT - IV SEQUENCEALIGNMENTANDDATABASESEARCHING: (12 Hours)

Introduction-EvolutionaryBasisofSequenceAlignment-ModularNatureofProteins-OptimalAlignmentMethods-SubstitutionScoresandGap Penalties-DatabaseSimilaritySearching-FASTA–BLAST(BlastP,BlastN,etc.,)-PositionSpecificScoringMatrices, Spliced Alignments.

UNIT – V PREDICTIVE METHODS: (12 Hours)

Using Protein Sequences Protein Identity Based on Composition - PhysicalProperties Based on Sequence - Motifs and Patterns - Secondary Structure and Folding Classes -SpecializedStructures orFeatures-Tertiary Structure.

SEMESTER II		
Title of the Course	**:**	**INTELLECTUAL PROPERTY RIGHTS**
Category of the Course	**:**	**ELECTIVE IV**
Course Code	**:**	**P2R3BODSE4:2**
Nature of the Course	**:**	**Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 4**
Credits: 3 **Total Inst. Hrs: 60**

Course Objectives

1. Cater to the needs of the stakeholders of knowledge economy is designed for those interested in managers and similar individuals.
2. Create awareness of current IPR and innovation trends.
3. Disseminate information on patents, patent system in India and overseas and registration related issues.
4. Pursue a career in IPR, which offers chances for IP consultants and Attorneys.
5. Develop skill sets to enable you to comprehend and assess the methods used in knowledge based economy and innovation ecosystems.

UNIT - I **(12 Hours)**

INTRODUCTION TO IPR

History and Development of IPR. Theories on concept of property: Tangible *vs* Intangible. Subject matters patentable in India. Non patentable subject matters in India. Patents: Criteria of Patentability, Patentable Inventions - Process and Product. Concept of Copyright. Historical Evolution of Copyright Ownership of copyright, Assignment and license of copyright.

UNIT – II **(12 Hours)**

OVERVIEW OF THE IPR REGIME AND DESIGN

International treaties signed by India. IPR and Constitution of India. World Intellectual Property Organization (WIPO): Functions of WIPO, Membership, GATT Agreement. Major Conventions on IP: Berne Convention, Paris Convention. TRIPS agreement. Industrial Designs – Subject matter of Design – Exclusion of Designs – Novelty and originality – Rights in Industrial Design.

UNIT – III **(12 Hours)**

TRADE MARK, LEGISLATIONS AND PATENT ACT

History of Indian Patent Act 1970. Overview of IP laws in India. Major IP Laws in India. Patent Amendment Act 2005. WTO-TRIPS – Key effect on Indian Legislation. Organization of Patent System in India. Concept of Trademarks, Different kinds of marks, Criteria for registration, Non Registrable Trademarks, Registration of Trademarks. Infringement: Remedies and Penalties.

UNIT – IV **(12 Hours)**

PRIOR ART SEARCH AND DRAFTING

Overview of Patent Search. Advantages of patent search. Open source and paid databases for Patent Search. International Patent classification system. Types of specifications: Drafting of Provisional specifications. Drafting of complete specifications. Drafting of claims.

UNIT – V **(12 Hours)**

GI AND PATENT FILING PROCEDURES

Geographical Indications of Goods (Registration and Protection) Infringement – Offences and Penalties Remedies. Plant Variety and Farmers Right Act (PPVFR). Plant variety protection: Access and Benefit Sharing (ABS). Procedure for registration, effect of registration and term of protection. Role of NBA. Filing procedure for Ordinary application. Convention application. PCT National Phase application. Process of Obtaining a Patent. Infringement and Enforcement.

SEMESTER II		
Title of the Course	**:**	**NANOBIOTECHNOLOGY**
Category of the Course	**:**	**ELECTIVE IV**
Course Code	**:**	**P2R3BODSE4:3**
Nature of the Course	**:**	**Employability**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 4**
Credits: 3 **Total Inst. Hrs: 60**

Course Objectives

1. To introduce the learners to the basic concepts in the emerging frontiers of nanotechnology.
2. To give perspective to researchers and students who are interested in nanoscale physical and biological systems and their applications in medicine.
3. To introduce the concepts in nanomaterials and their use with biocomponents to synthesize and interact with larger systems.
4. To impart knowledge on the most recent molecular diagnostic and therapeutic tools used to treat various diseases.
5. Incorporate sustainability in to account when you develop nanotechnology responsibly.

UNIT - I **(12 Hours)**

BASIC CONCEPTS IN NANOBIOLOGY

History of Nanotechnology, Difference between Nanoscience and Nanotechnology, Green nanotechnology, Bottom up and top down approaches.

UNIT – II **(12 Hours)**

DIVERSITY IN NANOSYSTEMS

Carbon based nanostructures - fullerences, nanotubes, nanoshells, buckyballs – biomolecules and nanoparticles, nanosensors, nanomaterials - Classification based on dimensionality quantum dots, wells and wires – metal based nano materials (gold, silver and oxides) - Nanocomposites- Nanopolymers– Nanoglasses–Nano ceramics.

UNIT – III **(12 Hours)**

METHODS OF NANOBIOTECHNOLOGY

Optical tools – Nanoforce and imaging – Surface methods – Mass spectrometry – Electrical Characterization and Dynamics of Transport – Microfludics: Concepts and applications to the Life Sciences.

UNIT – IV **(12 Hours)**

NANOBIOTECHNOLOGY

Nanodevices and nanomachines based on biological nanostructures - Protein and DNA nanoarrays, tissue engineering, and luminescent quantum dots for biological labeling.

UNIT – V **(12 Hours)**

APPLICATIONS OF NANOBIOTECHNOLOGY

Real Time PCR – Biosensors : From the glucose electrode to the Biochip – DNA Microarrays – Protein Microarrays – Cell Biochips – Lab on a chip – Polyelectrolyte multilayers – Biointegrating materials – Pharmaceutical applications of nanoparticles carriers.

SEMESTER II		
Title of the Course	**:**	**AGRICULTURE AND FOOD MICROBIOLOGY**
Category of the Course	**:**	**Skill Enhancement-II**
Course Code	**:**	**P2R3BOSEC1:1**
Nature of the Course	**:**	**Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 4**
Credits: 2 **Total Inst. Hrs: 60**

Course Objectives

1. To provide comprehensive knowledge about plant – microbe interactions.
2. To provide basic understanding about factors affecting growth of microbes.
3. To appreciate the role of microbes in food preservation.
4. To understand about the benefits of microbes in agriculture and food industry.
5. To gain knowledge about practices involved in food industry.

UNIT - I **(12 Hours)**

ROLE OF MICROORGANISMS IN AGRICULTURE

Role of symbiotic and free-living bacteria and cyanobacteria in agriculture., Mycorrhiza, Plant Growth Promoting Microorganims (PGPM) and Phosphate Solubilizing Microorganims (PSM).

UNIT – II **(12 Hours)**

BIOCONTROL AND BIOFERTILIZATION

Biocontrol of plant pathogens, pests and weeds, Restoration of waste and degraded lands,Biofertilizers: Types, technology for their production and application, vermi-compost.

UNIT – III **(12 Hours)**

FOOD MICROBIOLOGY: Intrinsic and extrinsic factors influencing growth of microorganisms in food, Microbes as source of food: Mushrooms, single cell protein.

UNIT – IV **(12 Hours)**

FOOD MICROBIOLOGY

Microbial spoilage of food and food products: Cereals, vegetables, prickles, fish and dairy products. Food poisoning and food intoxication. Food preservation processes. Microbes and fermented foods: Butter, cheese and bakery products.

UNIT – V **(12 Hours)**

PREDICTIVE METHODS:

Using Protein Sequences Protein Identity Based on Composition - PhysicalProperties Based on Sequence - Motifs and Patterns - Secondary Structure and Folding Classes -SpecializedStructures orFeatures-Tertiary Structure.

SEMESTER II

Title of the Course	**:**	**BIOSTATISTICS**
Category of the Course	**:**	**Skill Enhancement-II**
Course Code	**:**	**P2R3BOSEC1:2**
Nature of the Course	**:**	**Skill Development**

Marks: CIA: 25 + Ext: 75 = 100 **Hrs / Week: 4**
Credits: 2 **Total Inst. Hrs: 60**

Course Objectives

1. To provide the student with a conceptual overview of statistical methods.
2. To emphasis on usefulness of commonly used statistical software for analysis, research, and experimentation.
3. To understand and evaluate critically the acquisition of data and its representation.
4. To gain the knowledge about the probability and statistical inference are all topics that will be taught in order to obtain knowledge about the graphical representation of data.
5. To learn more about how to organize, create, and carry out the distribution of scientific knowledge.

UNIT - I **(12 Hours)**

INTRODUCTION TOSTATISTICS

Introduction to biostatistics, basic principles, variables - Collection of data, sample collection and representation of Data - Primary and Secondary - Classification and tabulation of Data – Diagrams, graphs and presentation.

UNIT – II **(12 Hours)**

DESCRIPTIVE STATISTICS

Mean, median and mode for continuous and discontinuous variables. Measures of dispersion: Range of variation, standard deviation and standard error and coefficient variation.

UNIT – III **(12 Hours)**

PROBABILITY

Basic principles - types - Rules of probability - addition and multiplication rules.

PROBABILITY DISTRIBUTION

Patterns of probability distribution; binomial - Poisson and normal.

UNIT – IV **(12 Hours)**

HYPOTHESIS TESTING

Chi-square test for goodness of fit; Null hypothesis, level of Significance - Degrees of Freedom. Student 't' test – paired sample and mean differences 't' tests. ANOVA. Basic introduction to Multivariate Analysis of Variance (MANOVA).

UNIT – V **(12 Hours)**

CORRELATION AND REGRESSION

Correlation - types of correlation - methods of study of correlation - testing the significance of the coefficients of correlation. Regression and types. Sampling and experimental designs of research- Randomized block design and split plot design.