LOYOLA COLLEGE
(Autonomous)
College Conferred with Potential for Excellence by UGC
Re-accredited at A+ Level by NAAC
Chennai – 600 034

MISSION STATEMENT OF THE DEPARTMENT

The Department of Plant Biology and Biotechnology rechristened from Department of Botany in tune with the current developments, aims at producing graduates well versed in fundamentals of Plant Biology and in the applied areas of Biotechnology enabling them to apply for higher studies in life sciences. It also imparts skill based training in Mushroom cultivation and Bio-fertilizer production so that our graduates are employable or become entrepreneurs by themselves.

DEPARTMENT OF PLANT BIOLOGY AND BIOTECHNOLOGY
B. Sc., Plant Biology and Plant Biotechnology
LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI 600 034

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Objectives:
1. To provide knowledge on the structure and reproduction of certain selected algal and bryophyte forms besides giving an overview.
2. To introduce students to basics of algal biotechnology and economic importance of both groups.

Unit I: Algae - Overview

Unit II: Algae -Type Study
Structure and reproduction with reference to the following algal forms – Anabaena, Chlorella, Volvox, Chara, Ectocarpus, Sargassum, Polysiphonia and Gracilaria. (excluding the developmental stages).

Unit III: Algae - Applications
Cyanobacterial inoculants (BGA): Isolation, preparation of starter culture, mass cultivation, field applications and crop response.
Economic importance of algae: Algae as food and fodder, use of algae in agriculture and space research, commercial products of algae: Agar Agar, Alginates, Carrageenin, diatomite, mucilage, minerals and elements - Algae in medicine and biofuels.

Unit IV: Bryophytes - Overview

Unit V: Bryophytes - Type Study
A detailed study of the range of vegetative and reproductive structure - life cycle of liverworts (Marchantia); hornworts (Anthoceros) and mosses (Funaria) (excluding the developmental stages).

TEXT BOOKS :
BOOKS FOR REFERENCE


PB 1509 MYCOLOGY

SEMMESTER: I CREDITS: 3
CATEGORY: MC NO.OF HOURS/ WEEK: 3

Objectives:
1. To provide knowledge on the structure and reproduction of certain fungal forms besides giving an overview.
2. To introduce students to basics of fungal biotechnology and clinical mycology.

Unit I: General characters of fungi

Unit II: Fungal forms
Structure and reproduction with reference to the following fungal forms (no developmental stage) Albugo, Rhizopus, Aspergillus, Saccharomyces, Neurospora, Peziza

Unit III: Fungal forms
Structure and reproduction with reference to the following fungal forms (no developmental stages) Puccinia, Polyporus and Colletotrichum. Lichens : Types, structure, reproduction and economic importance.

Unit IV: Fungal Applications
Baker’s yeast, YAC vector, penicillin production and Mycorrhiza : Types, identification and importance. Economic importance of fungi in general.

Unit V: Clinical mycology
Structure, reproduction, diagnoses and control measures of the following: Dermatophytoses : (Trichophyton); Systemic mycoses (Candida), Fungal toxins.

TEXT BOOKS :
BOOKS FOR REFERENCE

PB 1510 PRACTICAL I
(Algology & Bryology and Mycology)

SEMESTER: I                  CREDITS: 3
CATEGORY: MC              NO. OF HOURS / WEEK: 3

1. Morphological study of the following algal forms - Anabaena, Chlorella, Volvox, Chara, Ectocarpus, Sargassum, Polysiphonia and Gracilaria.

2. Algal Biotechnology: Cultivation of algae in - Chu 10 medium (Demonstration only).

3. Morphological study of the following bryophyte forms - Marchantia, Anthoceros, and Funaria.

4. Morphological study of the following fungal forms Albugo, Rhizopus, Aspergillus, Saccharomyces, Neurospora, Peziza, Puccinia, Polyporus and Colletotrichum.

5. Study of economically important products obtained from algae, bryophytes and fungi.

6. Photographs and permanent slides related to clinical mycology.

7. Field visit / trip to collect algal specimens - algae herbaria (5 numbers) to be submitted.

8. Visit to algal and fungal biotechnology laboratories.

CH-1100: CHEMISTRY FOR BIOLOGISTS -I
(Offered to students of Advanced Zoology and Plant Biology and Biotechnology)

SEMESTER: I                  CREDITS: 3
CATEGORY: AR              NO. OF HOURS / WEEK: 4

Objective:
To enable the students to understand the concepts of chemistry.

Unit 1: Handling of chemicals and Data analysis (15 h)

1.1 Storage and handling of chemicals: Handling of acids, ethers, toxic and poisonous chemicals. Antidotes, threshold vapour concentration and first aid procedure.

1.2 Errors in chemical analysis: Accuracy, precision. Types of error-absolute and relative errors. Methods of eliminating and minimizing errors.
1.3 *Separation techniques*—Solvent extraction. Principle of adsorption and partition chromatography, column chromatography, thin layer chromatography (TLC), paper chromatography and their applications.

**Unit 2: Chemical bonding** (15 h)


2.2 *Covalent Bond*: Nature of covalent bond. Structure of CH₄, NH₃, H₂O based on hybridisation.

2.3 *Coordinate Bond*: Nature of coordinate bond. Coordination complexes. Werner’s theory. Geometrical and optical isomerism in square planar and octahedral complexes. Mention of structure and functions of chlorophyll and hemoglobin

2.4 *Hydrogen Bond*: Theory and importance of hydrogen bonding. Types of hydrogen bonding. Hydrogen bonding in carboxylic acids, alcohol, amides, polyamides, DNA and RNA.

2.5 *van der Waal’s forces*: Dipole – dipole and dipole - induced dipole interactions.

**Unit 3: Volumetric analysis** (10 h)

3.1 *Methods of expressing concentration*: normality, molarity, molality, ppm.

3.2 *Primary and secondary standards*: preparation of standard solutions

3.3 *Principle of volumetric analysis*: end point and equivalence points.


**Unit 4: Kinetics** (10 h)

4.1 *Chemical Kinetics*: Rate, rate law, order and molecularity. Derivation of rate expressions for I and II order reactions.

4.2 *Catalysis*: Homogeneous and heterogeneous catalysis. Enzyme catalysis, enzymes in biological system and in industry.

**Unit 5: Chemistry of biomolecules** (10 h)


5.2 *Vitamins*: Source, provitamin, properties and classification. Structure and function of vitamin A, C, D, K and E
5.3 *Hormones* – Thyroxin, adrenaline and sex hormones (structure and functions only)

**Text Books:**

**References:**
Objective:

To enable the students to understand the concept of organic analysis.

Organic Analysis:

a) Detection of N, S and halogens
b) Test for aliphatic and aromatic nature.
c) Test for saturation and unsaturation.
d) Nature and identification of the following functional groups
   i) Carboxylic acid
   ii) Phenols
   iii) Aldehydes
   iv) Ketones
   v) Carbohydrates
   vi) Primary amines
   vii) Amides

Text Books:

Objectives:
1. To provide knowledge on the comparative studies of steles, sporangia and gametangia in eusporangiate and leptosporangiate groups.
2. To impart knowledge on morphology, anatomy and reproduction of selected Gymnosperms. This course also includes the study of a few representative fossil forms.

Unit I: Pteridophytes A

Unit II: Pteridophytes B
Study of the structure and reproduction in the following forms (no developmental aspects): Sporophyte (morphology, anatomy and reproduction) and gametophyte (structure, sex organs and mature embryo) of Psilotum, Lycopodium, Equisetum, Adiantum, Azolla and Marsilea – Economic importance of Pteridophytes – Indian contribution of Pteridology.

Unit III: Gymnosperms A
General characters – Concept of pro-gymnosperms – Classification (Bierhorst): Characters up to classes only – distribution – salient features of pteridosperms – Bennettitales, Cycadales, Cordaitales, Coniferales and Gnetales – Affinities and differences with other major vascular plant groups – evolutionary tendencies among Gymnosperms.

Unit IV: Gymnosperms B
Detailed study of structure and reproduction (no developmental aspects) of Cycas, Pinus and Gnetum – comparative anatomy and developmental morphology of gymnosperms – economic importance – Indian contribution to Gymnosperms.

Unit V: Paleobotany

TEXT BOOKS:

**BOOKS FOR REFERENCE:**

**PB 2506 – CELL BIOLOGY AND EVOLUTION**

**SEMESTER: II**

**CREDITS: 3**

**CATEGORY: MC**

**NO. OF HOURS / WEEK: 3**

**Objectives:**
1. To make the student to understand the organization of prokaryotic and eukaryotic cell, structure and function of organelles. The student is also given information on cell division.
2. To give an insight into evolution of organisms.

**Unit I: Introduction**
History, microscopy: Light, dark field, phase contrast, fluorescent, SEM and TEM. Cell Theory – Structure of prokaryotic and eukaryotic cell. Cytoplasm and its properties.

**Unit II: Organelles**
Structure and function of cell wall, plasma membrane, ribosomes, Endoplasmic reticulum, golgi apparatus, mitochondria, chloroplast, lysosomes, peroxisomes and cell inclusions - Organization of nucleus: nuclear envelope, nucleoplasm and nucleolus.

**Unit III: Chromosome**

**Unit IV: Cell division**

**Unit V: Evolution**
TEXT BOOKS


BOOKS FOR REFERENCE:


PB 2507 – PRACTICAL II

SEMESTER:II CREDITS:3
CATEGORYE:MC NO. OF HOURS / WEEK: 3

Pteridophytes, Gymnosperms and Paleobotany
1. Comparative study of morphology, anatomy and soral organization in *Psilotum, Lycopodium, Equisetum, Adiatum, Azolla* and *Marsilea*.
2. Morphological and anatomical studies of the genera mentioned for detailed study: *Cycas, Pinus* and *Gnetum*.
3. Comparative study of wood anatomy of *Cycas, Pinus* and *Gnetum*.
4. Field trip to study fossils.
5. Field trip to an out station to study the flora.
6. Study of economically important Pteridophytes and Gymnosperms and their products.
7. Submission of photographs of atleast 10 different Pteridophytes and Gymnosperms.

Cell Biology & Evolution

1. Study of organelles / inclusions.
3. Mitosis (squash)
4. Meiosis (smear)
5. Polytene chromosomes.
7. Spotters on Evolution.
AZ 2104- ANIMAL DIVERSITY

SEMESTER : II  
CREDITS : 03

CATEGORY : AR  
NO. OF HOURS / WEEK : 04

Objectives: To observe the organization, functional morphology and diversity of representative invertebrates and chordates.

UNIT I
Structure, organization and life history of *Entamoeba histolytica* and *Plasmodium vivax*, *Obelia geniculata*.

UNIT II
Structure, organization and life history of *Taenia solium*, Nematode parasites of man - *Ascaris*, *Hirudinaria*.

UNIT III
Structure, organization and life history of *Penaeus indicus*, *Pila globosa*, Star fish.

UNIT IV
Organization of Frog, Calotes, Pigeon and Rat.

UNIT V
Types of chordata eggs; extra embryonic membranes and their functions in chick, placentation in mammals.

SUGGESTED READING

AZ 2105- ANIMAL DIVERSITY LAB COURSE

SEMMETER : II  CREDITS : 01
CATEGORY : AR  NO. OF HOURS / WEEK : 02

Objectives: To observe the organization, functional morphology and diversity of representative invertebrates and chordates

Unit I: MAJOR DISSECTION

Cockroach: Digestive system, Nervous system. Freshwater mussel: Digestive system
Prawn: Nervous system. Frog: Arterial system, venous system

UNIT II: MINOR DISSECTION

Earthworm: Lateral hearts. Cockroach: Reproductive system

UNIT III: MOUNTING


UNIT IV: SPOTTERS

Representatives from each phylum based on structural organization and phylogeny.

UNIT V: RECORD

Submission of certified laboratory record is mandatory.

SUGGESTED READING

Objectives:
1. To provide information on the classification, growth, morphology and genetics of microbes and the recent advances in the field of microbiology. The role of microbes as beneficial and as pathogens is also studied.
2. To understand the applied aspects of microbiology in dairy industries, pharmaceuticals, food and waste water.

Unit I: Introduction
History-place of microorganisms in the living world-major characteristics of microorganisms-Classification–characterization- microscopic examination-staining.

Unit II: Morphology and fine structure of bacteria

Unit III: Microbial physiology and Genetics

Unit IV: Viruses

Unit V: Applied microbiology
Food microbiology: microbial flora-microbial spoilage-preservation-fermented foods
Industrial microbiology: major classes of products – Production of Lactic acid- Vinegar- Alcohol-Penicillin.

TEXT BOOKS:

BOOKS FOR REFERENCE:
Objective: To make the student to become familiar and to understand the plant cell, tissues, and internal structures of stem, root and leaves.

Unit I: Plant cell structure and tissues
Plant cell structure – nature of plant cell wall.
Tissue and tissue systems - meristematic tissue, permanent tissue and分泌 cells

Unit II: Morphogenesis and Differentiation
Morphogenesis in plants - Differentiation of stem, root and leaf - Vascular bundles and Vascular cambium.

Unit III: Organization of meristems
Meristems – types of meristems: apical, intercalary and lateral; primary meristem and secondary meristem.
Apical meristems – theories on organization of meristems – apical cell theory, Tunica-Corpus theory and histogen theory.

Unit IV: Anatomy of stem and root
Structure of Dicot stem – primary and secondary structure; Structure of Monocot stem; Nodal anatomy.
Structure of Dicot root – primary and secondary structure; Structure of monocot root.

Unit V: Anatomy of leaf and anomalous secondary growth
Leaf anatomy – dorsiventral and isobilateral; Stomatal types
Anomalous secondary growth – *Bignonia, Aristolochia, Boerhaavia* (dicot stem) *Dracaena* (monocot stem).

TEXT BOOKS

BOOKS FOR REFERENCE:
PB 3512 - PRACTICAL - III
(MICROBIOLOGY AND PLANT ANATOMY)

SEMESTER: III
CATEGORY: MC
CREDITS: 3
NO. OF HOURS / WEEK: 3

MICROBIOLOGY
4. Preparation of culture media.
5. Pour plate- spread plate, streak plate-serial dilution – hanging drop.
6. Microbial examination of different habitats.
7. Smear preparation – Gram staining, endospore staining, capsular staining and fungal staining. IMVIC test.
8. Industrial products as mentioned in theory.
10. Visit to microbiological lab/ microbe based industry.

ANATOMY
1. Tissue types
2. Organization of Apical meristems.
4. Anatomy of dicot root (bean) and monocot root (*Canna*) – Primary structure.
6. Anatomy of dorsiventral leaf (mango) and isobilateral leaf (grass).
7. Stomatal types
10. Maceration of wood samples to study tracheids and vessels – micrometry.
Objectives:
1. To know the basic principles involved in classification, naming and identification of angiospermic plants.
2. To expose the students to the diagnostic features of selected families and to know the economically important plant products and their utilization.

Unit I: Taxonomy- fundamentals

Unit II: Nomenclature and Herbarium techniques

Unit III: Type studies - I
Detailed study of the diagnostic characteristics and economic importance of the following Angiospermic families: Dicotyledones: Polypetalous: Annonaceae, Rutaceae, Caesalpinaceae, Capparidaceae, Anacardiaceae, Cucurbitaceae.

Unit IV: Type studies - II
Detailed study of the diagnostic characteristics and economic importance of the following following Angiospermic families: Gamopetalae: Rubiaceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae - Monochlamydeae: Amaranthaceae, Euphorbiaceae- Monocot: Orchidaceae, Poaceae.

Unit V: Economic Botany
A brief study of the following economic plants products with their botanical name , family, uses and morphology of the useful parts of any five cereals, millets, pulses, beverages, narcotics, spices, condiments, essential oils, medicinal plants, fibre and timber yielding plants.

TEXT BOOKS:

BOOKS FOR REFERENCE :
PB 4511 – EMBRYOLOGY OF ANGIOSPERMS

SEMESTER: IV CREDITS: 3
CATEGORY: MC NO. OF HOURS/WEEK: 3

Objectives: This course enables the students to understand the lifecycle of angiospermic plant development and the various processes that are involved.

Unit I: Microsporangium and pollen grains

Unit II: Megasporangium and female gametophyte

Unit III: Pollination and fertilization

Unit IV: Endosperms and embryogeny

Unit V: Polyembryony and Apomixis

TEXT BOOKS

BOOKS FOR REFERENCE
PB 4512 PRACTICAL - IV
ANGIOS.TAXONOMY, ECO. BOTANY AND EMBRYOLOGY

SEMESTER: IV CREDITS: 3
CATEGORY: MC NO. OF HOURS / WEE: 3

Taxonomy
1. Study of diagnostic characters mentioned in the theory syllabus (1 material / family)
   **Dicotyledons:** Polypetalae: Annonaceae, Rutaceae, Caesalpinaceae, Capparidaceae
   Anacardiaceae, Cucurbitaceae. Gamopetalae: Rubiaceae, Apocynaceae, Solanaceae, Acanthaceae,
   Lamiaceae.
   Monochlamydeae: Amaranthaceae, Euphorbiaceae **Monocotyledons:** Orchidaceae and
   Poaceae.
2. Submission of 15 herbarium sheets (1 material from each family). Herbarium sheets to be
   submitted during the model practical examination.
3. Use of dichotomous key in the classification of the given specimens.
4. Economically important plant products of the families mentioned in unit III and unit IV of the
   theory syllabus.

Economic Botany:

1. Economically important plant products mentioned in unit V of the theory syllabus.
2. Submission of 5 economically important products with information on binomial, vernacular name
   and nature of product.

Embryology of Angiosperms

1. T.S of Anther at various stages of development
2. Structure of pollen grains using whole mounts (Catharanthus, Hibiscus, Acacia, Grass)
3. Pollen viability test using in-vitro germination (Crinum/Catharanthus)
4. Types of ovules (Permanent slides)
5. Isolation of pollinium (Calotropis)
6. L. S. of monocot embryo (Maize)
7. L.S. of oily endosperm (Ricinus)
8. Perisperm (Piper)
9. Embryo mounting (Tridax)
PB 5411 PHYTOCHEMICALS

SEMESTER: V          CREDITS: 2
CATEGORY: ES         NO. OF HOURS/WEEK: 3

Objective: The main objective is to provide an overview of the plant derived natural products for their occurrence, sources, basic chemistry and therapeutic applications.

Unit I: Introduction
Plant natural products - History- general significance- classification- list of floral sources- general detection, extraction and characterization procedures.

Unit II: Glycosides and Flavonoids
Glycosides: Classification, therapeutic value, chemical properties & tests for identification.
Flavonoids: Sources, classification, biogenesis, extraction, isolation, identification and therapeutic applications.

Unit III: Anthocyanins and Coumarins
Anthocyanins : Sources, classification, extraction, isolation, identification and therapeutic applications.
Coumarins: Sources, classification, biosynthesis - furanocoumarins and pyranocoumarins: pharmacological properties and photo-toxicity.

Unit IV: Lignans, Terpenes, Volatile oils and Saponins
Lignans and Neolignans: classification, natural sources and pharmacological applications.
Terpenes: Classification, biosynthesis, origin of 5-carbons isoprene unit, head to tail coupling and tail-to-tail coupling of isoprene units - Volatile Oils: Classifications, sources, medicinal and non-medicinal uses - Saponins : Sources, classification, physical and biological properties)

Unit V: Carotenoids and Alkaloids
Carotenoids: Sources, biogenesis, classification and therapeutic values.
Alkaloids: Classification, distribution in nature, localization, nomenclature, physico - chemical properties, extraction, detection, isolation, purification, biosynthetic origin and pharmacological activities.

TEXT BOOKS

BOOKS FOR REFERENCE:
PB 5412 AGRICULTURE AND HORTICULTURE

SEMESTER: V  CREDITS: 2
CATEGORY : ES  NO. OF HOURS/WEEK : 3

Objectives:
1. To expose the students to the basic principles of agriculture and agricultural practices.
2. To provide the students a theoretical knowledge of horticulture so as to establish home gardens scientifically.

Unit I: Agriculture in India

Unit II: Basic practices of crop production

Unit III: Cultivation of crops
Agronomic practices (varieties, climatic condition, soil, field preparation, manuring, seed sowing, watering, application of fertilizers, irrigation, crop protection and harvesting followed in paddy, legumes, sugarcane, Banana and Mango.

Unit IV: Horticulture Introduction

Unit V: Garden features and operations.

TEXT BOOKS

BOOKS FOR REFERENCE:

BIOINSTRUMENTATION AND BIOSTATISTICS

SEMESTER: V CREDITS:2
CATEGORY:ES NO. OF HOURS / WEEK: 3

Objectives:
1. To understand working principle of various instruments used in biological studies.
2. To provide details on the application of statistical methods in biology.

Unit I: pH and Centrifugation

Unit II: Spectrophotometry
Spectrophotometric techniques, Instrumentation: ultraviolet and visible spectrophotometry (single and double beam, double wavelength spectrophotometers) Infrared spectrometers - Plasma atomic emission spectroscopy - Luminometry and densitometry – principles and their applications - Mass Spectroscopy - principles of analysis, application.

Unit III: Chromatography
Chromatographic techniques: Principle and applications – Column - thin layer - paper and gas chromatography - Gel filtration - Ion exchange and High performance liquid chromatography - Examples of application for each chromatographic system - Basic principles of electrophoresis.

Unit IV: Biostatistics
Collection and presentation of data: Statistical methods - Basic statistics - measures of dispersion - Probability - simple correlation - linear regression analysis.

Unit V: Biostatistics
Fundamentals of normal - binomial and poison distribution - Population and samples –methods of sampling - analysis of variance - Computer application in biostatistics - MS Excel and SPSS.

Suggested Readings:
SEMESTER: V CREDITS: 2
CATEGORY: ES NO. OF HOURS/WEEK: 3

Objective:
To introduce the students to the essential basics of phytogeography and forestry of India.

UNIT I: Phytogeography.
Phytogeography: Types of plant distribution: Continuous distribution; cosmopolitan, circumpolar, circumboreal or circumaustral, and pantropical; Discontinuous distribution; Theory of land-bridge, theory of continental drift, theory of polar oscillations or Shifting of poles, glaciations. Centers of origin and diversity of plants; Methods of dispersal, migrations and isolation; Theory of area and theory of tolerance. Factors influencing plant distribution; Migration of floras, and Evolution of floras. Floristic regions of the world: Vegetation Zones in relation to latitudes and altitudes; a brief account of the phytochoria of the Indian subcontinent; Endemics: Neo and relics.

UNIT II: Deforestation and forest protection
Destructive forces: Shifting cultivation, fire losses and bad grazing practices. Destructive agencies: insect-pests and disease. Forest protection: Forest enemies, poaching, encroachment, improper management, damages by animals, birds, parasitic plants and climatic factors. Biological and chemical control. General forest protection against forest fire and grazing. Afforestation, reforestation and effect of wild animals on forest regeneration. Role of tribals in forest preservation. Sanctuaries, National parks, Reserve forests, Sacred groves and Biosphere reserves.

UNIT III: Silviculture
General silvicultural principles; ecological and physiological factors influencing vegetation; natural and artificial regeneration of forests; nursery techniques; seed technology collection, storage, pre-treatment and germination; establishment and tendings. Silvicultural systems-clear felling, uniform, shafter-wood, selection, coppice and conversion systems. Social forestry-objectives, scope, necessity; agro-forestry; extension forestry: recreation forestry; people's participation.

UNIT IV: Forest Mensuration, Management and Utilization
Methods of measuring-diameter, girth, height and volume of trees; form factor; volume estimation of stand: sampling methods; yield calculation; current annual increment; mean annual increment; sample plots; yield and stand tables; scope and objectives of forest inventory; aerial survey and remote-sensing techniques. Forest management-objectives and principles; techniques; sustained yield relation; normal forest; growing stock; regulation of yield-methods of application; working plans-preparation and control. Forest utilisation: Logging and extraction techniques and principles; transport, storage and sale. Minor and major forest product: definition and scope. Collection, processing and disposal of minor and major forest products.

UNIT V: Forest Economics, Policies and Legislation
Fundamental principles of forest economics; Cost-benefit analysis; estimation of demand and supply; assessment and projection of market structures; role of corporate financing; socio-economic analyses of
TEXT BOOKS

BOOKS FOR REFERENCE

PB 5521 - PLANT PHYSIOLOGY

<table>
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<tr>
<th>SEMESTER: V</th>
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Objectives:
1. To provide an insight into the physico-chemical organization and the functional aspects of plants.
2. To orient the students to understand effectively the concepts on morphogenesis and ultimately plant biotechnology.

Unit I: Plant and Water relations

Unit II: Mineral nutrition and absorption in plants

Unit III: Photosynthesis
Unit IV: Respiration and nitrogen assimilation
Glycolysis, Krebs cycle and generation of ATP synthesis through oxidative electron transfer chain (Cytochrome system), chemiosmotic regeneration of ATP, Gluconeogenesis, photorespiration.
Sources of nitrogen – plants/soil, nitrogen assimilation and recycling, symbiotic nitrogen fixation in legumes, amino acid synthesis, reductive and transamination process. Relation between carbon and nitrogen metabolism.

Unit V: Plant Growth and Development

TEXT BOOKS :

BOOKS FOR REFERENCE:

PB 5522 – GENETICS AND PLANT BREEDING

SEMESTER:V CATEGORY:MC NO. OF HOURS / WEEK:3

Objectives:
1. To understand the principles of genetics and transfer of hereditary characters.
2. To make the student to understand the mechanisms of gene expression and its regulation.
3. To understand the process of crop improvement and hybridization.

Unit I: Basic concepts of genetics
History; branches of genetics and application of genetics. Mendelism Mendel’s laws- law of segregation and law of independent assortment. Monohybrid crosses and its modification (incomplete dominance, codominance, heterodominance, lethal genes and pleiotropism) - Dihybrid cross.

Unit II: Gene interaction and Sex linked inheritance

Unit III: Molecular Genetics
Genetic material in prokaryotes and eukaryotes. DNA as the genetic material ; structure and organisation of DNA; Supercoiling of DNA. Replication of DNA ; semiconservative model of replication. Gene and its organization; the genetic code; cistron, recon and muton. Transcriptional and post transcriptional modifications; translation; Regulation of gene expression.
Unit IV: Chromosomal aberrations and Gene Mutations

Unit V: Plant breeding

TEXT BOOKS:

BOOKS FOR REFERENCE:

PB 5523 - PLANT DISEASES AND MANAGEMENT

SEMESTER: V
CATEGORY: MC
CREDITS: 3
NO. OF HOURS / WEEK: 3

Objectives:
1. To study about the plant diseases with special reference to southern India.
2. To understand the diseases, symptoms, causal organisms – etiology of the diseases and control measures.

Unit I: Plant Diseases
Introduction, Concept, importance, history, classification, diagnosis and identification – Koch’s postulates. Basic concepts of infection: inoculum, inoculum potential, predisposition, penetration,
infection, invasion, growth, reproduction and dispersal – Methods of infection: Mechanical forces and chemical weapons (enzymes, toxins and growth regulators). Pathogenic impacts: changes in the host (morphological, anatomical, physiological and biochemical).

Unit II:

Unit III: Symptomatology
Study of the following diseases with reference to their incitants, symptom manifestation and control measures.
  a) Fungal diseases:
    1. Damping off of Mustard seedling
    2. Club root of cabbage
    3. Powdery mildew of cucurbits
    4. Ergot of Rye
    5. Smut of Sorghum
    6. Rust of wheat
    7. Blast of Rice
    8. Wilt of tomato
    9. Tikka of Groundnut
    10. Red rot of Sugar cane

Unit IV: Symptomatology
Study of the following diseases with reference to their incitants, symptom manifestation and control measures.
  a) Bacterial diseases: Bacterial blight & Citrus canker.
  b) Mycoplasmal disease: Little leaf of brinjal.
  c) Viral diseases: Tobacco Mosaic Virus (TMV) & Tungro disease of Rice.
  d) Nematode disease: Root knot disease of Potato.
  e) Insect disease: Galls.
  f) Other parasitic diseases of plants: Cuscuta.

Unit V: Plant disease control
Concepts on prophylaxis.
Exclusion: Legislation – plant quarantine principles.
Eradiication – crop rotation, field sanitation, elimination of alternate hosts, soil treatment and seed treatments.
Management strategies: chemical, environmental and – Disease forecasting.
Microbial antagonists: Bacterial, Fungal and viral (mode of action, mass production and field application). Engineered resistance against fungal, viral and bacterial pathogens.

TEXT BOOKS:
2. Rangaswamy, G. 1975. Diseases of crop plants in India. 2nd Edn. Prentice Hall, India

BOOKS FOR REFERENCE:

PB 5524 - ETHNOBOTANY AND HERBAL SCIENCES

SEMESTER: V
CREDITS: 3
CATEGORY: MC
NO. OF HOURS / WEEK: 3

Objectives:
1. To know the elementary treatment of various morphological, anatomical and biochemical parameters used in the identification and utilization of medicinal plants in general.
2. To provide an overview of ethnobotany, methods of herbal preparation, tribal medicine and their importance in present day drug research.

Unit I: Ethnobotany I
Introduction, origin and basic notion of ethnobotanical study - Ethnobotany as an emerging science and its scope - Ethnobotany in India: Areas and recent studies - Methodologies of ethnobotanical research: Field work, Literature, Herbaria and Musea and other aspects of ethnobotany. Importance of ethnobotany in Indian systems of medicine (Siddha, Ayurveda and Unani), Role of AYUSH, NMPB, CIMAP and CARI.

Unit II: Ethnobotany II
Basic knowledge of tribes in India with special reference to Tamil Nadu - Todas, Irulas and Paliyars. Tribal economy - Schemes of state forests department for tribal development - Tribal knowledge towards disease diagnosis, treatment, medicinal plants, plant conservation and cultivation.

Unit III: Pharmacognosy
Introduction - history of Pharmacognosy - definitions and terms - Basic concepts: Preparation of drugs for commercial market - Organoleptic evaluation of drugs - Microscopic evaluation of drugs - Physical evaluation of drugs - Active and inert constituents of drugs - Classification of drug plants - individual drugs - drug adulteration.

Unit IV: Organoleptic Study

Unit V: Herbal Preparations

TEXT BOOKS:
BOOKS FOR REFERENCE:

PB 5525 PRACTICAL V
(Plant Physiology, Genetics and Plant Breeding)

SEMESTER: V
CATEGORY:MC
CREDITS:6
NO. OF HOURS / WEEK:6

Plant Physiology
1. Potato osmoscope.
2. Determination of water potential by Dye method.
3. Determination of osmotic pressure.
4. Determination of relative water content.
5. Transpiration
7. Separation of leaf pigments by paper chromatography.
8. Wiltmott’s Bubbler on photosynthesis using different light and carbon di oxide concentration.
9. Estimation of carbohydrates, protein and total lipids
10. Respiroscope - Demonstration
11. Separation of leaf pigments by column chromatography - Demonstration.

Genetics and Plant Breeding
1. Biometry.
   Monohybrid cross and modification.
   Dihybrid and modification.
4. Chi square analysis.
5. Percent seed germination study.
6. Seed viability test using tetrazolenium salt.
6. Demonstration on emasculation.
7. Spotters related to plant breeding
7. Chromosomal abnormality study using onion root tip.
8. Visit to plant breeding station.
PB 5526 - PRACTICAL VI
(Plant Diseases and Management; Ethnobotany and Herbal sciences)

SEMESTER: V
CATEGORY: MC
CREDITS: 6
NO. OF HOURS / WEEK: 6

Plant Diseases and Management
1. Study on the incitants, symptoms of locally available fungal, bacterial and viral diseases.
2. Preparation of PDA, NA and Nutrient Broth.
3. Isolation of plant pathogens from infected tissues and verification (Demonstration).
5. Estimation of flavonoids and phenols in diseased and healthy plants.
6. Spoters: Botanicals, Microbial pesticides; Predators and parasites; Chemicals (Organic and inorganic).

Ethnobotany and Herbal Sciences
Organoleptic studies of plants mentioned in the theory in the following aspects.
1. Morphological studies of vegetative and floral parts.
3. Stomatal number and stomatal index.
4. Vein islet number.
5. Palisade ratio.
6. Fibres and vessels (maceration).
7. Starch test.
8. Proteins and lipid test.
9. Determination of the percentage of foreign leaf in a drug composed of a mixture of leaves.
10. Dimensions of Calcium oxalate crystals in powdered crude drug.
Preliminary phytochemical tests for alkaloids, terpenoids, glycosides, volatile oils, tannins & resins. Any 5 herbal preparations.

PB 6612 - PLANT BIOTECHNOLOGY

SEMESTER: VI
CATEGORY: MS
CREDITS: 4
NO. OF HOURS / WEEK: 3

Objectives:
1. To understand the fundamental aspects of plant tissue culture and molecular biology of plants for the production of transgenics.
2. To understand the concepts of modern technology pertaining to large scale production of agricultural products.

Unit I: Plant Tissue Culture
Unit II: Plant Tissue Culture

Unit III: Plant Molecular Biology
Organisation and function of Plant nuclear genome(Arabidopsis thaliana), Genetic transformation of plants by Agrobacterium: Genetic organization of Ti plasmids Functions encoded by integrated T- DNA. Molecular mechanism involved in transformation of plants by Agrobacterium tumefaciens.

Unit IV: rDNA Technology

Unit V: Crop Improvement and Transgenic plant
Crop improvement in terms of yield and quality. Molecular markers (RFLP, RAPD and DNA fingerprinting) in crop improvement program. Transgenic plants resistant to insect. Biosafety and bioethics.

TEXT BOOKS:

BOOKS FOR REFERENCE:

PB6613 - MICROBIAL TECHNOLOGY

SEMESTER: VI CREDITS:4
CATEGORY: MS NO. OF HOURS / WEEK:3
Objectives: To provide information on the fundamentals of the fermentation process, strain improvement and culture, and the use of different microorganism for the production of a variety of industrial products.

Unit I: Introduction to fermentation technology
Chronology and components of fermentation processes - A general account on microbial biomass, enzymes, metabolites and recombinant products - Range of fermentation processes - Transformation
processes. Isolation, preservation, optimization and improvement of industrially important microorganisms.

Unit II: Fermentor and Media
Fermentor - basic functions - body construction - aerators, agitators (impellers and spargers) - asepsis - containment - valves and steam traps - types of fermentors.
Substrates for media preparation - Medium formulation – Sterilization of medium.
Steps and Methods in recovery of products.

Unit III: Food dairy, beverages
Single cell proteins (SCP) - SCP as food and feed – mass cultivation of Spirulina – Mycoprotein - Yogurt and cheese production. Alcoholic beverages – Beer and wine fermentation.

Unit IV: Pharmaceutical and related industries
Antibiotics- sources and types- production of Penicillin and Streptomycin. Production of insulin and Hep B vaccine. Transformation of steroids. Vitamins- Production of vitamin B₁₂

Unit V: Enzymes, Amino acids, Organic acids and other products
Microbial enzymes- Production and application of amylase, protease, and lipase. Microbes used for amino acid production- production of L- glutamic acids - Organic acids: citric acid, acetic acid production - Bioplastics and Exopolymer production - Biofertilizers and biofuels.

TEXT BOOKS:

BOOKS FOR REFERENCE:
Objectives:

1. To give an insight into ecology, environmental pollution and microbial processes in the environment.

2. To provide knowledge on the use of microbes for a safe environment and in the treatment of hazardous waste using biotechnological processes.

UNIT I: Ecology - Basic Principles
Ecosystem: concepts – types, structure and function - productivity and energy flow – food chains, food web and ecological pyramids – Gene ecology - basic concepts, ecotype, ecophenes, ecads – Microbial communities: Diversity, structure and development - Biodiversity and conservation.

UNIT II: Environment
The environment - air, water and soil. Pollution and its causes: Air pollution, water pollution (heavy metal pollution and thermal pollution) soil pollution (pesticide pollution) (outline only). Nonconventional energy resources- biogas production, methane and hydrogen production - Recycling of waste products- composting and silaging.

UNIT III: Bioremediation
Introduction to bioremediation – types of bioremediation – factors influencing bioremediation – bioremediation mechanisms – microbes in bioremediation – Bioremediation techniques: ex situ and in situ bioremediation –Phytoremediation - Types of reactors used in bioremediation.

UNIT IV: Treatment of Polluted water and effluents

UNIT V: Treatment of Polluted Soil and air

TEXT BOOKS:
BOOKS FOR REFERENCE:

PB 6615 - PRACTICAL – VII
(PLANT BIOTECHNOLOGY, MICRO. TECHNOLOGY AND ECO. & ENV. BIOTECH.)

SEMESTER: VI          CATEGORY: MS
CREDITS:8             NO. OF HOURS / WEEK:6

PLANT BIOTECHNOLOGY

Basic Techniques in tissue culture:
1. Preparation of MS and Modified White’s Medium.
2. Embryo culture.
3. Preparation of Murashige and Skoog’s Medium.
4. Meristem Culture.
5. Preparation of Nitsch Medium.
6. Anther Culture.
7. Isolation of Protoplast from leaves (mechanical method)

Molecular Techniques
8. Extraction and separation of Plant protein by SDS-PAGE. (In batches)
9. Extraction and separation of plant DNA by agarose gel electrophoresis. (In batches)

MICROBIAL TECHNOLOGY
2. Screening of microbes for various products (Enzymes).
3. Demonstration of Fermentor operation.
4. Batch culture Technique a) Still culture & b) Shake culture.
5. Growth measurement in batch fermentation.
7. Ethanol production.
8. Wine fermentation.
9. Citric acid production.
10. Glutamic acid production.
11. Visit to Biotech Industries.
ENVIRONMENTAL BIOTECHNOLOGY
1. Vegetation analysis – Quadrat and line transect method
2. Estimation of Dissolved oxygen.
3. Estimation of BOD.
4. Determination of net primary productivity.
5. Potability of water (MPN Technique).
6. Determination of acidity of water.
7. Determination of alkalinity of water.
8. Determination of hardness of water.
9. Field visit to sewage treatment plant.

SKILL BASED COURSE
PB6655 MUSHROOM CULTIVATION AND BIO-FERTILIZER PRODUCTION
SEMESTER:VI CREDITS:15
CATEGORY: SK NO. OF HOURS/WEEK:15
(Theory: 6; Practical: 9)

Objectives:
1. To help the students to learn mushroom cultivation, bio-composting and biofertilizer production through hands-on experience.
2. To enable the students to become self-employed/entrepreneur.

Unit I: Mushroom Biology
Morphology - classification: edible and poisonous mushrooms. Life cycle of Basidiomycetes fungi-Breeding and Genetic improvement of mushroom strains. Medicinal and Nutritional value of mushrooms.

Unit II: Mushroom cultivation Techniques

Unit III: Economics of Mushroom Cultivation
Economics of the production of oyster mushroom, milky mushroom and paddy straw mushroom cultivation : Infrastructure facilities, expenditure on fixed assets, plant and machinery, cost of the project, recurring expenditure, interest and depreciation of the expenditure, cost of production and profit. Entrepreneurship in mushroom cultivation.

Unit IV: Composting Technique

Unit V: Bio-fertilizers and their Production
Introduction - Types: Microbes as biofertilizer, Green manure, importance of macronutrients ;Biofertilizers vs Chemical fertilizers; Nitrogen fixers – types and examples; Phosphate solubilizers – role of bacteria and Mycorrhizae - Mass cultivation and Application of the following biofertilizers: i) Rhizobium  ii) Azospirillum iii) Cyanobacteria iv) Mycorrhizae
Quality control; Challenges and opportunities; Biofertilizer Entrepreneurship
PRACTICAL

Mushroom Cultivation
1. Training on sterilization techniques (Glass wares, Medium, and Laboratory).
3. Media preparation; Isolation and purification of mushroom fungus
4. Spawn preparations
5. Cultivation of mushroom – conditions for cultivation of mushroom
9. Composting of solid waste generated in mushroom cultivation.

Biofertilizer Production
1. Isolation and mass cultivation of the following
   i. Rhizobium
   ii. Azospirillum
   iii. Blue green alga (Anabaena /Nostoc)
2. Packaging of biofertilizers with carrier material.
3. Isolation and morphological characterization of mycorrhiza from soil.
4. Isolation and culture of Phosphate solubilising microbes.

Evaluation:
(i) I and II CA theory tests with other components : 100
(ii) Internship (10 days each); report preparation and viva : 100
(iii) Regular lab assessment – practical and record : 100

Average Total : 100

TEXT BOOKS

BOOKS FOR REFERENCE