# P.G & RESEARCH DEPARTMENT

# OF

# BOTANY

# UG SYLLABUS

## From the Academic Year 2019-202

## J.J.COLLEGE OF ARTS & SCIENCE

**(*AUTONOMOUS*)**

***(Reaccredited at 'A' Grade by NAAC)***

**PUDUKKOTTAI – 622 422**

# B.Sc. Botany – Programme

**Program objectives**

i. To understand the basic concept of lower plants and morphology of higher plants.

ii. To know the classification, evolution anatomical and physiological details of higher group of plants.

iii. To analyse the cell organelle and application of genetics, molecular biology and plant breeding.

iv. To identify the bacteria, viruses and fungi are the plant pathogens.

v. To understand the basic concepts of ecology and conservation.

vi. To perform the procedure of laboratory technique in biochemistry, biotechnology and utilization of plants.

vii. To motivate the students to become as an entrepreneur in the field of Mushroom cultivation, Vermitechnology and bio fertilizers.

**J.J.COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS), PUDUKKOTTAI**
**POST GRADUATE AND DEPARTMENT OF BOTANY**
**Proposed Course Structure under Choice Based Credit System**
**(Applicable for the Candidates from Academic Year 2019-2020 Onwards)**

**B.Sc. BOTANY**

| Sem. | Part | Course Code | Course | Course Title | Hrs / Week | Credit | CIA | External | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| I | I | U1R1TL1 | Lan -I | Tamil/Hindi/Arabic/French -I | 6 | 3 | 25 | 75 | 100 |
| | II | U1R1EL1 | Lan -II | English –I | 6 | 3 | 25 | 75 | 100 |
| | III | U1R1BOCC1 | CC | Algae, Fungi, Lichens, Plant Pathology and Bryophytes | 5 | 5 | 25 | 75 | 100 |
| | III | U1R1BOCC2 | CC | Major Practical - I | 5 | 4 | 40 | 60 | 100 |
| | III | U1R1CHAC1 | AC | Chemistry Theory -I | 5 | 4 | 25 | 75 | 100 |
| | III | - | AC | Allied Practical –I | 3 | - | - | - | - |
| | | | | **Total** | **30** | **19** | **-** | **-** | **500** |
| II | I | U2R1TL2 | Lan-I | Tamil/Hindi/Arabic/French -II | 5 | 3 | 25 | 75 | 100 |
| | II | U2R1EL2 | Lan-II | English –II | 5 | 3 | 25 | 75 | 100 |
| | III | U2R1BOCC3 | CC | Pteridophytes, Gymnosperms and Palaeobotany | 5 | 5 | 25 | 75 | 100 |
| | III | U2R1BOCC4 | CC | Major Practical - II | 5 | 4 | 40 | 60 | 100 |
| | III | U2R1CHAC2 | AC | Chemistry Theory -II | 4 | 4 | 25 | 75 | 100 |
| | III | U2R1CHAC3 | AC | Allied Practical –I | 4 | 4 | 40 | 60 | 100 |
| | IV | U2R1ES | EVS | Environmental Studies | 2 | 2 | 25 | 75 | 100 |
| | | | | **Total** | **30** | **25** | **-** | **-** | **700** |
| III | I | U3R1TL3 | Lan -I | Tamil/Hindi/Arabic/French -III | 5 | 3 | 25 | 75 | 100 |
| | II | U3R1EL3 | Lan -II | English –III | 5 | 3 | 25 | 75 | 100 |
| | III | U3R1BOCC5 | CC | Anatomy & Embryology of Angiosperms | 5 | 5 | 25 | 75 | 100 |
| | III | U3R1BOCC6 | CC | Major Practical - III | 5 | 4 | 40 | 60 | 100 |
| | III | U3R1ZOAC3 | AC | Zoology Theory - I | 5 | 4 | 25 | 75 | 100 |
| | III | - | AC | Allied Practical - II | 3 | - | - | - | - |
| | | U2R1VE | VE | Value Education | 2 | 2 | 25 | 75 | 100 |
| | | | | **Total** | **30** | **21** | **-** | **-** | **600** |
| IV | I | U4R1TL4 | Lan-I | Tamil/Hindi/Arabic/French -IV | 5 | 3 | 25 | 75 | 100 |
| | II | U4R1EL4 | Lan-II | English –IV | 5 | 3 | 25 | 75 | 100 |
| | III | U4R1BOCC7 | CC | Morphology, Taxonomy of Angiosperms & Economic Botany | 5 | 5 | 25 | 75 | 100 |
| | III | U4R1BOCC8 | CC | Major Practical - IV | 4 | 4 | 40 | 60 | 100 |
| | III | U4R1ZOAC4 | AC | Zoology Theory - II | 5 | 4 | 25 | 75 | 100 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | III | U4R1ZOAC5P | AC | Allied Practical - II | 4 | 4 | 40 | 60 | 100 |
| | IV | U4R1BOSBE1 | SBE | To be Selected from Given List | 2 | 2 | 25 | 75 | 100 |
| | | | | **Total** | **30** | **25** | - | - | **700** |
| V | III | U5R1BOCC9 | CC | Cell Biology and Molecular Genetics | 6 | 5 | 25 | 75 | 100 |
| | III | U5R1BOCC10 | CC | Biophysics, Biochemistry and Plant Physiology | 6 | 5 | 25 | 75 | 100 |
| | III | U5R1BOCC11P | CC | Major Practical - V | 6 | 4 | 40 | 60 | 100 |
| | III | U5R1BOMBE1 | MBE | To be Selected from Given List | 4 | 4 | 25 | 75 | 100 |
| | IV | U5R1BOSBE2 | SBE | To be Selected from Given List | 4 | 2 | 25 | 75 | 100 |
| | V | U5R1BOIDC | IDC | To be Selected from Given List | 4 | 2 | 25 | 75 | 100 |
| | | | | **Total** | **30** | **22** | - | - | **600** |
| VI | III | U6R1BOCC1 | CC | Ecology and Phyto-geography | 5 | 5 | 25 | 75 | 100 |
| | III | U6R1BOCC13 | CC | Bioinstrumentation and Biostatistics | 5 | 5 | 25 | 75 | 100 |
| | III | U6R1BOCC14P | CC | Major Practical - VI | 5 | 4 | 40 | 60 | 100 |
| | III | U6R1BOMBE3 | MBE | To be Selected from Given List | 4 | 4 | 25 | 75 | 100 |
| | III | U5R1BOMBE2 | MBE | To be Selected from Given List | 4 | 4 | 25 | 75 | 100 |
| | IV | U6R1BOSBE3 | SBE | To be Selected from Given List | 3 | 2 | 25 | 75 | 100 |
| | V | U6R1BOIDC2 | IDC | To be Selected from Given List | 3 | 2 | 25 | 75 | 100 |
| | V | U6R1GS | GS | Gender Studies | 1 | 1 | 25 | 75 | 100 |
| | V | - | - | Extension Activity | - | 1 | - | - | |
| | | | | **Total** | **30** | **26** | - | - | **800** |
| | | | | **Grand Total** | - | **140** | - | - | **3900** |

CC- Core Course, AC- Allied Course, MBE- Major Based Elective, SBE- Skill Based Elective,
IDC- Inter Disciplinary Course, CIA- Continuous Internal Assessment.

**I. Major Based Elective offered**

1. Microbiology and Immunology
2. Plant Breeding, Horticulture and Landscape Designing
3. Plant Biotechnology
4. Biodiversity and Conservation biology
5. Eco-tourism

**II. Skill Based Elective offered**

1. Mushroom technology
2. Bio-fertilizer Production and Application
3. Organic farming
4. Computer Applications in Biology
5. Plant Nanotechnology

**III. Inter Disciplinary Course offered**

1. Vermitechnology
2. Plant Tissue Culture
3. Herbal Botany

## B.Sc. BOTANY - PROGRAM OUTCOME

**Program Outcome**

- ✓ They would understand the creative ideas and biological facts in Botany.
- ✓ They would learn the entrepreneurship skills in the field of bio fertilizers, mushroom cultivation, nursery technology and vermin-compost.
- ✓ They could understand the environmental basic concepts of Taxonomy and Ecology.
- ✓ The students would learn the economic values of medicinal plants in agriculture and traditional medicines.
- ✓ The students could have full confidence to face higher education competitive examinations.
- ✓ They could join the private seed and fertilizer companies.

**SEMESTER I**

**ALGAE, FUNGI, LICHENS, PLANT PATHOLOGY AND BRYOPHYTES**

**Course Code : U1R1BOCC1** **Course: Core Course**

**Hours/Week : 5** **Credit : 5**

**Objectives**

- To understand origin and evolution of life with reference to lower plants
- To know the features of Algae, Fungi, Lichens and Bryophytes
- To understand the structure of the microbes
- To understand the structure of the microbes and their economic importance of day to day life
- To study the importance of cryptogams

**UNIT I**

Algae: General characters and Classification of algae by F.E. Fritsch, 1935, Cell structure of prokaryotic and eukaryotic algae, various habitats of algae – terrestrial, freshwater and marine. Economic importance of algae.

**UNIT II**

Thallus organization, Cell structure and Life cycle of following algae: *Oscillatoria, Volvox, Ectocarpus, Dictyota,* and *Polysiphonia.*(Excluding the developmental studies)

**UNIT III**

General characters and Classification of Fungi by Alexopoulos 1979. Economic importance. Structure and life cycle of the following genera: *Albugo, Puccinia*, Lichens – General Characters, Type - *Usnea.*

**UNIT IV**

Plant pathology: Terminologies in Plant Pathology - Study of the following Diseases and Control Measures - Fungal disease – Tikka disease, Bacterial disease – Citrus canker, Viral disease – Tobacco Mosaic Virus.

**UNIT V**

Bryophytes: General Characters and Classification by Rothmaler, 1951. Economic importance. A detailed study of structure, reproduction and life cycle of the following genera – *Riccia* and *Polytrichum* (Excluding the development studies)

**Course Outcomes:**

- Students can explain the importance of microbial diversity.
- Can describe the distribution and occurrence of lower plants.
- Can analyse the differences between various microbes and know the economic importance of the microbes in day to day life.
- They can settle as basic botanist or lower plant taxonomist.
- Can start consultancy to advice farmers on various plant diseases.

**SUGGESTED BOOKS**


1. Bold, H. C. and Wyne, M. J. (1978). Introduction of Algae - Structure and Reproduction. Prentice Hall of India, New Delhi.
2. Dube H.C. (1978), A text Book of Fungi, Bacteria and Viruses, Vikas publishing House, Pvt., Ltd., New Delhi, Bombay, Bangalore, Calcutta, Kanpur.
3. Mishra. A and Agarwal R.P. (1978) Lichens A Preliminary text. Oxford and IBH. 66 Janapath, New Delhi 110 001.
4. Parkar. N.S. (1967) An Introduction to Embryophyta - Vol I. General Book Dept. Indian University press, Allahabat.
5. Singh R.S. (1978) plant Diseases, Oxford and IBH, 66, Janapath, New Delhi - 110 001,
6. Vashishta. B.R. (1970), Botany for Degree students, Fungi, S. Chand & Co, Ramnagar, New Delhi - 110 055,
7. Vashishta. B.R. (1978), Bryophyta, S.Chand & Co, Ram Nagar, New Delhi - 110 001,
8. Watson E.V. (1964), The structure and Life History of Bryophytes Hutchinson University Press, London.

**SEMESTER I**

**Major Practical - I**

**Course Code : U1R1BOCC2P** **Course: Core Course**

**Hours/Week : 5** **Credit :4**

**Objective:**

- To learn identification of lower and primitive group of plants
- To study the vegetative and reproductive organs of sub-microscopic plants
- To identify the plant diseases and casual organisms
- To understand life forms at anatomical level
- To understand the field characters of primitive plants

1. Study of Compound and Dissecting microscope.

2. Make Micro preparation of vegetative and reproductive structures of the following types:

1. *Oscillatoria*, 2. *Volvox*, 3. *Dictyota*, 4. *Ectocarpus* and 5. *Polysiphonia.*

3. Make micro preparation of vegetative and reproductive parts of the following types:

1. *Albugo*, 2. *Puccinia*, 3. Lichens – *Usnea.*

4. Identify the diseases mentioned in the syllabus with respect to causal organism and symptoms. Make micro preparations wherever necessary.

5. Tikka disease, Bacterial disease, Citrus canker, Tobacco mosaic virus.

6. Bryophytes – *Riccia* and *Polytrichum*.

7. Botanical tour for algal collection and submission of field report.

**Course outcome:**

- The student could have understood the structure and reproduction of certain selected algae, fungi and bryophytes.
- They could learn about the importance of the plant diversity.
- They would settle as lower plant taxonomist.
- They could exposure field characters of primitive plants.
- They could get knowledge on bacterial and fungal disease of crop plants

**SEMESTER II**

**PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY**

**Course Code : U2R1BOCC3** **Course: Core Course**

**Hours/Week : 5** **Credit : 5**

**Objective:**

- To learn the diversity of higher cryptogams and their evolution
- To understand the vegetative and reproductive features of Gymnosperms
- To learn the basic knowledge and importance of paleobotany
- To know about the usage of fossils and to study the past plants
- To study the life cycle and alternative generation of lower plants

**UNIT-I**

**Pteridophytes:**

Classification of Pteridophytes by Reimer, 1954. Occurrence and distribution; Stelar Evolution; Homospory and Heterospory; Apogamy and Apospory. Economic Importance.

**UNIT-II**

Structure and life cycle of the following types (Excluding developmental studies)

1. *Lycopodium,* 2. *Selaginella,* 3. *Equisetum,* and 4. *Marselia*.

**UNIT-III**

**Gymnosperms:**

Distribution of Gymnosperms - general characters; economic importance; classification of Gymnosperms by K.R. Sporne, 1965.

**UNIT-IV**

Structure and life cycle of 1. *Cycas* 2. Pinus and 3. *Gnetum*.(Excluding developmental studies)

**UNIT-V**

**Paleobotany:**

Geological time scale. Fossils and fossilization. Kinds of fossils: impressions, compressions, casts, molds, petrifactions and coal balls.

Nomenclalture of fossil plants. Brief study of the following fossils: *Lepidodendron*, *Calamites* and *Williamsonia*. Importance of the study of palaeobotany.

**Course Outcome:**

- The students could have learnt about the structure and reproductive of certain selective species of Pteridophytes and Gymnosperms
- They could earn few representatives of fossils forms
- After completion of this course students could get employment in Botanical Survey of India
- They would start consultancy to identify plants of economic and research interest
- They could get knowledge in fossil types and its importance

**SUGGESTED BOOKS**


1. Smith, G.M. 1972. Cryptogamic botany Vol. - II Mc Graw Hill, New Delhi.
2. Sporne, K.R. 1976. Morphology of Petridophytes, BI Publications. Pvt. Ltd., New Delhi.
3. Pandey B.P. 1977. A Text book of Botany Bryophyta, Peridophyta and Gymnosperms K.Nath & co. Meeret.
4. Sporne K.R. 1965. Morphology of gymnosperms. B.I. Publications Pvt. Ltd. New Delhi
5. Rashid, A 1976. An Introduction to Pteridophyta Vikas Publishing House Pvt. Ltd., New Delhi
6. Bhatnagar S.P. and A. Moitra 1996. Gymnosperms, New age International publishers (p) Ltd. New Delhi.
7. Margulis. L. and K.V. Sehwatz (2nd ed.) 1988. Five Kingdoms: An illustrated guide to phyla of life on Earth W.H. Freeman & Co. New York.
8. Arnold C.R. 1947. Introduction to Paleobotany. TMH Publishing Co. Ltd., Bombay.
9. Shukla. A and Mishra S.P. 1975. Essentials of Paleobotany. Vikas publishing house Pvt. Ltd. Delhi.
10. Shirpad N. Agashe, 1995. Paleobotany. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
11. Wilson N.Stewart and Gar, W.Rothwell. 2005. Paleobotany and the evolution of plants 2nd Edn., Cambridge University Press, Cambridge, U.K.

**SEMESTER II**

**MAJOR PRACTICAL - II**

**Course Code : U2R1BOCC4P** **Course: Core Course**

**Hours/Week : 3** **Credit : 4**

**Objective:**

- To learn the identification and description of specimens belonging to higher cryptogams
- To learn slide preparation techniques of stelar plants
- To understand the fossil plants by the permanent slides
- To study the internal structure of fossils
- To study the anatomical features of cryptogames

**Pteridophytes**

Study of morphology and anatomy of vegetative and reproductive parts of the following:

1. *Lycopodium*,
2. *Selaginella*,
3. *Equisetum*, and
4. *Marselia*.

**Gymnosperms**

Study of morphology and anatomy of the vegetative and reproductive parts of the following:

1. *Cycas*,
2. *Pinus* and
3. *Gnetum.*

**Paleobotany**

Study of internal morphology of the following fossils:

1. *Lepidodendron*
2. *Calamites* and
3. *Williamsonia*. (Extinct and fossil forms).

**Course Outcome:**

- The students could have understood morphology and internal structure of some selected species of Pteridophyte and Gymnosperms.
- Students could know fossils structures internally.
- They would employment in Botanical Survey of India as a lower plants taxonomist.
- Students get knowledge in semi-permanent slide preparation
- They could get knowledge in internal tissue system of non-flowering plants

**SEMESTER III**

**ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS**

**Course Code : U3R1BOCC5** **Course : Core Course**

**Hours/Week : 6** **Credit : 5**

**Objectives**

- To inculcate the primary tissues and anatomical features of plants
- To accrue knowledge about the embryology of Angiosperms
- To understand the primary, secondary and anomalous, anatomical structure of plants
- To know the various types of pollination mechanism
- To study the fertilization and development of embryo in plants

**UNIT I**

General Account – classification and theories of Meristem. Concept of totipotency, differentiation, dedifferentiation and redifferentiation. Structure and Fuction of Simple tissue (Parenchyma, collenchyma, sclerenchyma; fibres and sclereids) and Complex tissues (xylem and phloem)

**UNIT II**

Primary and secondary structure of stem in dicotyledons and Monocotyledons. Nodal Anatomy - unilacunar, trilacunar and multilacunar. Leaf Anatomy of monocot and dicot. The root - primary and secondary structure of dicotyledonous and monocotyledonous roots. Anomalous secondary growth – *Boerhaavia, Dracaena*.

**UNIT III**

Wood anatomy - secondary xylem. Physical and chemical properties of wood. Classification of wood. General account an Commercial wood species of South India (teak wood, rose wood, sandal wood, red sandal wood and silver oak).

**UNIT IV**

Microsporangium, Microsporogenesis - Development of male gametophyte. Megasporangium, Megasporogenesis. Development of female gametophyte (Polygonum). Type and Structure of monosporic (Polygonum), bisporic (Allium) and tetrasporic (Peperomia) embryo sacs.

**UNIT V**

Fertilization - Double fertilization. Triple fusion. Development of dicot embryo – Polygonum: type, Development of monocot embryo – Luzula: type. Endosperm - Definition. Apomixis - types and significance, Polyembryony, Parthenogenesis and its significance.

**Course Outcome:**

By the end of this course, the students will able to:

- Classify the meristimatic and permanent tissues based on origin and position.
- Compare the different theories of tissues.
- Explain the types of ovules.
- Students will understand double staining technique.
- After completion of this course students can get employment in Biodiversity Conservation Centres and Artificial Pollination Centres.

**SUGGESTED BOOKS**


1. Pandey B.P. 2007 Plant Anatomy, S. Chand & Co. De, New Delhi.
2. Bhojwani, S S. & Bhatnagar, SP. 2008. Embryology of Angiosperms, Vikas Publishing House (P) Ltd., New Delhi.
3. Brown et al., 1981. Text book of Wood Technology, Mc Graw Hill Inc. New York.
4. Pullaiah, T., Lakshminarayana, K. and Hanumantha Rao, K. 2001. Text Book of Embryology of Angiosperms, Regency Publications, New Delhi.
5. Cuttler, EG. 1969. Plant Anatomy - Part I Cells & Tissue. Edward Arnold Ltd., London.
6. Esau K. 1985. Plant Anatomy (2nd ed.) Wiley Eastern Ltd. New Delhi.
7. www.wooddatabase.com

**SEMESTER III**

**MAJOR PRACTICAL - III**

**Course Code : U3R1BOCC6P** **Course : Core Course**

**Hours/Week : 5** **Credit : 4**

**Objective:**

- To observe the internal organization of plant body
- To understand primary, secondary and anomalous, anatomical structure of stem and root
- To observe the internal structure of dicot and monocot leaf
- To observe the pollen morphology and types of pollens
- To observe the types and structure of ovule
- To get skill on preparing the permanent slides

**Anatomy:**

Preparation of Transverse Sections of the following plant parts to observe and record the internal structure.

1. Monocot and Dicot stem
2. Monocot and dicot Root
3. Monocot and Dicot leaf
4. Normal secondary thickening in Dicot stem.
5. Anomalous secondary thickening in *Boerhaavia* and *Dracaena* stem.
6. Nodal anatomy-uni-& trilacunar.

**Embryology:**

1. T.S. of anther (young and mature)
2. Pollen types
3. L.S. of ovule
4. Types of ovules - orthotropous and anatropous.
5. Dicot Embryo Dissection.

➢ **Submission of semi-permanent slide at least five per students**

**Course Workout:**

By the end of this course, the students will be able to

- Perform double staining permanent slide mounting.
- Understand the various components of stem and wood during its secondary growth.
- Be enlightened about the mechanism of pollination and basic structure of the embryo
- To acquire knowledge in embryo dissection
- To get knowledge in microtome techniques

**SEMESTER IV**

**MORPHOLOGY, TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY**

**Course Code : U4R1BOCC7** **Course: Core Course**

**Hours/Week : 5** **Credit : 5**

**Objectives**

- To observe the variations among plants, especially angiosperms
- To study the morphology of angiosperms
- To observe the modifications of plant parts
- To understand the way of nomenclature and classifying the plants
- To study the salient features of angiosperm families
- To study the economic importance of angiosperms

**UNIT I:**

Morphology: Root and its modifications; stem and its modification. Phyllotaxy. Inflorescence types – Description of floral parts (Calyx, Corolla, Androecium and Gynoecium) – Floral diagram – Floral formula – Outline classification of fruits.

**UNIT II:**

Types and System of classification: Artificial system (Carolus Linnaeus), Natural system (Bentham & Hooker), Phylogenetic system(Engler & Prantl).

**UNIT III:**

Binomial Nomenclature – International Code for the Nomenclature of Algae, Fungi and Plants (ICN) – Rules of ICN –Plant collection, Preparation and management of Herbarium – Botanical Survey of India (BSI) – Taxonomy in relation to cytology – Taxonomy in relation to phytochemistry.

**UNIT IV:**

Detailed study on salient features, description, distribution and economic importance of the families: Annonaceae, Lythraceae, Malvaceae, Rutaceae, Fabaceae, Cucurbitaceae.

**UNIT V:**

Rubiaceae, Asteraceae, Solanaceae, Apocynaceae, Acanthaceae, Laminaceae, Euphorbiaceae, Liliaceae and Poaceae. Economic importance of Cereals, Spices and Condiments, Resins and Oils yielding plants.

**Course Outcome:**

By end of this course, the students will able to

- Understand various angiosperm plant habits.
- Comprehend the concepts of plant taxonomy and classification of angiosperms.
- Prepare the Herbarium.
- Get employment in BSI.
- To identify the binominal of plants under natural environment.

**SUGGESTED BOOKS**

1. Jeffrey, C. 1982. An Introduction to Plant Taxonomy, Cambridge University Press, UK.
2. Pandey, BP. 1999. Taxonomy of Angiosperms, S. Chand, New Delhi.
3. Clive AS.1989. Plant Taxonomy and Biosystematics, Chapman and Hall Inc. NY
4. Harborne, JB & Turner, BL. 1984. Plant Chemosystematics, Acad. Press, London.
5. Lawrence, GH. 1955. Taxonomy of Vascular Plants, MacMillan Co., USA.
6. Samuel, BJ & Arlene, EL. 1987. Plant Systematics, Mc Graw Hill Inc. NY.

**SEMESTER IV**

**MAJOR PRACTICAL - IV**

**Course Code : U4R1BOCC8P** **Course: Core Course**

**Hours/Week : 4** **Credit : 4**

**Objectives:**

- To identify the plants under natural environment
- To get knowledge on preparation of Herbarium
- To learn about to draw a floral diagrams
- To get exposure on field work
- To acquire knowledge on identification of plants

**Morphology:**

1. Root and stem modifications.
2. Phyllotaxy types.
3. Types of inflorescence – Raceme, Cyme, Mixed and Special.
4. L.S. of Dicot flower-Hypogynous/Epigenous/Perigynous
5. Mounting of floral parts.
6. Construction of floral diagram and floral formula.

**Taxonomy:**

1. Detailed of study of the plants belonging to the families mentioned in theory.
2. Compulsory botanical tour for minimum of three days.
3. Submission of 30 herbarium sheets, field note book and tour report for (10 +5) 15 marks.
4. Spot identification (binomial and family) of plants included in theory syllabus

**Course Outcome:**

By end of this course, the students will able to

- Understand various angiosperm plant habits.
- Comprehend the concepts of plant taxonomy and classification of angiosperms.
- Prepare the Herbarium.
- Get employment in BSI.
- To identify the binominal of plants under natural environment.

**SEMESTER V**

**CELL BIOLOGY AND MOLECULAR GENETICS**

**Course Code : U5R1BOCC9** **Course: Core Course**

**Hours/Week : 6** **Credit : 5**

**Objective:**

- To learn about the structure and function of eukaryotic plant cells
- To acquire a knowledge on molecular level of organelles
- To understand the basic ideas on cell cycle
- To learn the basic structure of chromosomes
- To acquire knowledge on genetics

**UNIT I**

The Cell- history –Prokaryotic and Eukaryotic cells – comparison – Prokaryotic cell-Eukaryotic cell - cell wall - Plasma membrane: chemical composition, membrane function- Bilayer models- fluid mosaic model- Micellar models. Structure of Cellular Organelle: Cytoplasm – Nucleus – Nucleic acids - DNA – Molecular model of DNA structure – RNA - Mitochondria- Chloroplasts- Endoplasmic Reticulum- Golgi complex, Lysosomes- Ribosomes – Vacuoles – Glyoxysomes.

**UNIT II**

Chromosomes – Structure of the chromosomes – centomere – Secondary constrictions – Chemical composition of Chromosomes and types – Cell Cycle: division – mitosis and meiosis

**UNIT III**

Genetics – Introduction – Mendel's laws and principles – Deviation from Mendelian ratio – Lethality – Multiple factor hypothesis. Incomplete dominance – complementary factor – Epistasis – Multiple alleles – physical basis of heredity. Linkage and crossing over – mapping of chromosomes and genes.

**Unit IV**

DNA replication: semi-conservative model, DNA polymerase, chemistry of synthesis, mechanism of replication. Replication of RNA genome - replicase and reverse transcriptase. DNA repair mechanisms – mismatch and proof reading. Polyploidy – types – gene action – Gene unit – cistron, recon, muton, codon, and operon. Gene mutation, physical and chemical mutagens. Mutation rate and its role in evolution.

**Unit V**

Concept of evolution – origin of life –Organic evidences – theories of organic evolution (Charles Darwin, Lamarck) – Modern synthetic theories.

**Course Outcome:**

- The students could have understood the basic concept of molecular biology and genetic engineering.
- They could understand the cell organelles and their functions.
- They also would understand the mitosis and meiosis and its importance.
- They could get knowledge on basic concept of evolution and theories.
- After completion of this course students can get employment in biology instrumentation labs and Molecular Biology Research Centre.

**SUGGESTED BOOKS**

1. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
2. Freifelder, D.1993. Essentials of Molecular Biology, Jones & Bartlett, Boston.
3. Verma, P.S. and V.K. Agarwal, 2003, Genetics. S. Chand, New Delhi.
4. Elliott WH & Elliott DC. 2005. Biochemistry and Molecular Biology, 3rd Ed. Oxford University, Oxford.
5. Gardner, EJ., Simmons, MJ. & Snustad, D. 1991. Principles of Genetics, John Wiley & Sons Inc., New York.
6. Sundara Rajan, S. Cytology Anmol Publication, New Delhi, 2004.

**SEMESTER V**

**BIOPHYSICS, BIOCHEMISTRY AND PLANT PHYSIOLOGY**

**Course Code : U5R1BOCC10** **Course: Core Course**

**Hours/Week : 6** **Credit : 5**

**Objectives**

- To gain knowledge about plant bio molecules
- To understand different pathways occurring in a cell
- To provide an advanced integral knowledge and understanding of topics in Biophysics and Biochemistry
- To understanding in the plant cells and functions
- To acquire basic knowledge in physiological process
- To learn the physiological effects of hormones

**UNIT I**

Bioenergetics: Laws of thermodynamics - Concept of Entropy and Enthalpy - Gibb's Free Energy - Energy transduction in Biological systems - High energy compounds - ATP bioenergetics. Photobiology - Electromagnetic Spectrum - Visible rage of spectrum. pH - definition and its biological significance. Buffer : definition, some importance of buffers.

**UNIT II**

Carbohydrates: Classification, structure and properties of mono and disaccharides. Lipids: Classification, saturated and unsaturated fatty acids. Properties and synthesis of lipids - Amino acids: basic structure & properties (physical and chemical) and function. Proteins: classification based on shape, solubility and composition. Enzymes: Biocatalysts - definition and characteristics, IUB classification - Mode of action: lock & key and induced fit. Factors affecting the enzyme action.

**UNIT III**

Water, Mineral and Solute: Uptake and Transport of minerals and water -Diffusion and Osmosis - Osmotic pressure, Turgor pressure and wall pressure - Plasmolysis and its importance - Mechanism of absorption of water - Passive and active absorption - Ascent of sap – Theories on absorption. Uptake and transport of Minerals -Translocation of organic solutes - Transpiration: types, mechanism, role of Transpiration factors affecting transpiration.

**UNIT IV**

Photosynthesis and Nitrogen Metabolism: Photosynthetic apparatus and pigment systems – Emerson enhancement Effect and two pigment systems - Hill reaction - Oxygen evolving complex - mechanism of electron transport, cyclic and noncyclic photo phosphorylations - synthesis of ATP by photophosphorylation - mechanism of $CO_2$ fixation in C3, C4 and CAM plants. Importance of nitrogen to plants - sources of nitrogen - nitrogen cycle.

**UNIT V**

Respiration: Aerobic and Anaerobic Respiration - Glycolysis - TCA cycle - Mitochondrial Electron Transport System and its components- Oxidative phosphorylation, Pentose Phosphate Pathway.

Physiological effects of Auxins, Gibberellins, Cytokinins, Ethylene and Absiscic acid. Dormancy: definition, causes of seed dormancy, breaking of seed dormancy, photoperiodism, vernalization

**Course Outcome**

- The students could have learnt analytical and presentation skill on bio-molecular level.
- They would understand and appreciate the plant world we depend on.
- They could know about the basic principles of plant function, metabolism, secondary products, cell physiology and principles of growth and development.
- Students get knowledge in an importance of plant hormones
- After completion of this course he students could employment in plant growth centres, plant tissue culture and grafting centre.

**SUGGESTED BOOKS**

1. Jain, J.L. Jain, S and Jain, N, Fundamentals of Biochemistry. S. Chand and Company Ltd., New Delhi, 2008.
2. Srivastava, H.S, Elements of Biochemistry, Rastogi Publications, Meerut, India, 1990. 3. Veerakumari, L, Biochemistry, MJP Publishers, Chennai, 2004.
3. Stryer, L, Biochemistry, W. H. Freeman and Co., New York, San Francisco, 1989.
4. Ragland, A and Arumugam, N, 2000. Biochemistry Biophysics, Saras Publications, Nagercoil, Tamil Nadu.
5. Narayanan, P. 2000 Essentials of Biophysics, New Age International Publishers (P) Ltd., New Delhi, Calcutta, Chennai, Mumbai.
6. Bose, 1981. Elementary Biophysics, Vijaya Printers, Chennai.
7. Verma V. 2007. Tex book of Plant Physiology, Ane Books India, New Delhi.
8. JainV.K. 2006. Fundamentals of Plant Physiology, S. Chand & Co, New Delhi.
9. Pandey, SN & Sinha, BK. 2006. Plant Physiology, 4th Ed. Vikas Publishing, ND.
10. Noggle and Fritz, 1976. Introductory Plant Physiology, Prentice Hall, New Delhi.
11. Baijal, BD & Ravisharma, 1981. A Textbook of Plant Physiology, SL Agarwal, Agra.
12. Salisbury, F.B. & Ross, CN. 1995. Plant Physiology. CBS Publishers, New Delhi.

**EMESTER V**

**MAJOR PRACTICAL - V**

**Course Code : U5R1BOCC11P** **Course: Core Course**

**Hours/Week : 6** **Credit : 4**

**Objective**

- To perform double stained permanent slide mounting
- To have a practical exposure on violating the DNA from plant materials
- To get knowledge on separating the pigments from plant leaflet
- To perform the experiments on photosynthesis, respiration and growth of plants
- To identify amount of sugar total lipids, free amino acids and total proteins

1. Squash and Smear techniques- Onion root tip and Rheo flower buds.
2. Isolation of DNA from plant source (Onion Bulb, Coconut Endosperm)
3. Extraction and separation of leaf pigments.
4. Aerobic respiration - Ganong's respiroscope.
5. Demonstration experiment
    a. Phototropism.
    b. Geotropism.
    c. Arc Auxanometer.
    d. Dialatometer.
    e. Hydrophonics.
6. Quantitative estimation of sugars.
7. Estimation of total lipids.
8. Estimation of total free amino acids.
9. Quantitative estimation of total protein.
10. Separation of plant pigments by Paper chromatography and TLC.

**Course Outcome**

- The students could learn procedure for isolation the genomic DNA
- They would understand the estimation procedure for the certain phytochemical content of the plant
- They could performed the experiments in plant physiology
- After completion of this course the labs, plant tissue culture labs and plant growth centre
- Students can get employment in pharmaceutical companies

**SEMESTER-VI**

**ECOLOGY AND PHYTOGEOGRAPHY**

**Course Code : U6R1BOCC12** **Course: Core Course**

**Hours/Week : 5** **Credit : 5**

**Objective:**

- To gain advanced knowledge about plants and their environment
- To study the plant ecosystem and their impact on society
- To understand and implement effective measures in biodiversity conservation programmes
- To acquire knowledge on phytogeography of plants
- To study the various types of forests

**UNIT- I**

Ecology - Concepts and dynamics of ecosystems, types of ecosystem, food web, food chain and energy flow tropic level, ecological pyramids, productivity and bio-geochemical cycles (N,P, C, S).

**UNIT- II**

Ecological amplitude of a species and adaptation – Ecads, ecotypes, ecospecies and ecological niche, Raunkiaer's (1934) life forms. Environmental pollution – air, water, soil, thermal, noise and radiation. Cumulative effect of pollution on global environment.

**UNIT- III**

Causes and consequences of Green house effect and Ozone depletion. Sources and characteristics of wastes (Tanneries, Sugar mills and Distilleries, Paper and Pulp mills), Effect of waste on receiving bodies and its treatment. Forest Conservation Act. Wildlife Conservation Act..

**UNIT- IV**

Phytogeography - Types of forests, range, dispersal and migration barriers, continental drift hypothesis – age and area hypothesis, endemism, peninsular, and Island floras. Introduction to Remote Sensing and its uses.

**UNIT – V**

Introduction to various types of forests in world and in India. Forest products: Major and Minor products with special reference to Tamil Nadu. Influence of forests on environment. Forest based industries with special reference to Tamil Nadu.

**Course Outcome**

- The students could learn basic knowledge about environment issues.
- They acquit knowledge about the role of man in protecting the environment.
- They could understand the biodiversity conservation and participation in conservation activities.

- After completion of this course the student could get employment in pollution Board and Environment and forest conservation department.
- Students can get employment in biodiversity boards and biodiversity related NGOs

**SUGGESTED BOOKS**


1. Odum, E.P. (1975) – Ecology (2nd Edn.,) – Oxford & IBH Publishing Co., New Delhi
2. Sharma P.D (2005) – Ecology and Environment –Rastogi Publications, Meerut, India
3. Agrawal, K.C. (1987) – Environmental biology – Agro – botanical Publications, India.
4. Vashista, P.C. (1974) – A text book of Plant Ecology – Vishal Publications, Jullunder City, India.
5. Cain, S.A. (1944) – Foundation of Plant Geography – Harper & Brothers, N.Y.
6. Good, R. (1953) – The Geography of flowering Plants (2nd Edn.,) – Longmans, Green & Co., Inc., London.
7. Margalef, R. (1968) – Perspectives in Ecological Theory – University of Chicago Press, Chicago.
8. Frankel, O.H., A.H.D. Brown and Burdon J.J. 1995. The conservation of Plant Diversity, Cambridge University Press, Cambridg,e UK.
9. Heywood V.H. 1995. Global biodiversity Assessment, UNEP. Cambridge University Press, Cambridge, UK.
10. K.V.Krishnamurthy 2003, An Advanced Text Book on Biodiversity. Oxford and IBH Book Company, New Delhi.
11. Virchow D *Conservation of genetic resources*, Springer Verlag, Berlin.

**SEMESTER-VI**

**BIOINSTRUMENTATION AND BIOSTATISTICS**

**Course Code : U6R1BOCC13** **Course: Core Course**

**Hours/Week : 5** **Credit : 5**

**Objectives**

- To learn the basic principles, producer and application of biological instruments
- To initiate the students into research activities
- To study the instrumentation of various biological instruments
- To acquire basic knowledge about various methods of data collection
- To learn mathematical and statistical techniques for research

**UNIT I**

Microscopy: Simple, Compound, Phase contrast, Fluorescence, Electron (SEM and TEM), Micrometry. Buffers and pH: Characteristics and preparation; pH meter - principle, measurement of pH and pKa. Electrometric determination - glass and reference electrodes. Centrifugation: Principles, types and operation; Rotors, Table top, Low speed, High speed, Cooling and Ultracentrifuge.

**UNIT II**

Principles and applications of Paper, TLC, HPLC, and affinity chromatography. Electrophoresis - basic principles gel electrophoresis - SDS-PAGE and AGE. Colorimeter: principles and instrumentation. Spectrophotometer: principles, instrumentation and types UV/Vis, Flame photometer – principles and instrumentation.

**UNIT III**

Nature of radioactivity, patterns of decay, half life - detection of radiation and measurements - GM Counter, Scintillation Counter, autoradiography, X-ray crystallography and applications of isotopes.

**UNIT IV**

Biostatistics: Definition and scope; primary and secondary data collection discrete and continuous. Sample and population. Sampling techniques: Random and non-random sampling techniques - Presentation of data: Graphical methods, Histogram, Bar Chart and Pie diagram.

**UNIT -V**

Measures of central tendency - Mean, median and mode. Standard Deviation and Standard Error. Correlation: General account and correlation and regression. Distribution types: Probability, normal binomial and Poisson distribution. Probability analysis.

**Course Outcome**

- The students could have understood the principles, procedures and application of certain instruments.
- They would understand data collection and handling methods.
- They could valuate the biostatistics formulas.

- After completing this cause the student could get employment in instrumentation laboratory in research industries.
- Students could get knowledge on basic research.

**SUGGESTED BOOKS**

1. Hawkins, C and Sorgi, M. 2000 Research, Narosa Publishing House, New Delhi.
2. Willard, H.D. et al., 1965, Instrumental Methods of Analysis, D Van Nostrand, New York.
3. Wilson, E. & Goulding, K.H. 2000 A Biologists' Guide to Principles and Techniques of Practical Biochemistry ELBS.
4. Casey, E.J., 1969. Biophysics; Concepts and Mechanisms, East & West Press, New Delhi.
5. Narayanan, P. 2000 Essentials of Biophysics, New Age International Publishers (P) Ltd., New Delhi, Calcutta, Chennai, Mumbai.
6. Kothari, C.R. 2000. Research Methodology - Methods & Techniques. Wishwa Prakashan
7. Misra, R.P, 2000 Research Methodology - a handbook, Concept Publishing Company, New Delhi.

**SEMESTER VI**

**MAJOR PRACTICAL - VI**

**Course Code : U6R1BOCC14P** **Course: Core Course**

**Hours/Week : 5** **Credit : 4**

**Objective**

- To acquire practical knowledge an evaluation the ecological diversity
- To learn preparation of plant tissue culture medium and culturing of plant tissue is it
- To acquire practical exposure on somatic embryo genesis and synthetic seed production
- To gain the demonstrative knowledge an Bio instruments
- To acquire knowledge on internal structure of hydrophytes and xerophytes

**Experiments:**

1. Micro slide preparation of the internal structure of Hydrophytes and Xerophytes (Habitats)
2. Preparation of Culture media and sterilization techniques
3. Micropropagation techniques
4. Embryo culture techniques
5. Callus induction and differentiation from different explants
6. Somatic embryogenesis production
7. Synthetic seeds production
8. **Demonstration of Bioinstrumentations**
    a. UV-Vis Spectrophotometer
    b. Column Chromatography
    c. PCR
    d. Gel Documentation System
    e. Nikon Photo-Microscope
    f. Electrophorator
    g. Bioreactor

**Course Outcome**

- The student could have acquired knowledge on species and genus diversity of plant ecology.
- They could perform the plant tissue culture with various explants by direct and indirect methods.
- Graduates would learn the basic principles, producers and application for certain bio instruments.
- After completion of these course students could get employment in environment forest department, plant tissue laboratory and biotechnology research centre.
- Students can get employment on general instrumentation labs.

**SEMESTER V**

**MICROBIOLOGY AND IMMUNOLOGY**

**Course Code : U5R1BOMBE1** **Course: Major-based Elective**

**Hours/Week : 4** **Credit : 4**

**Objectives:**

- To learn about the basic and applied aspect in microbial biology
- To acquire knowledge on the on the importance of micro organisms
- To understand the basic principles and importance of immune system
- To study the structure and functions of bacterial cell
- To acquire knowledge on antigens and antibodies

**UNIT I**

Brief history of Microbiology and its scope. Outline classification of bacteria based on Berger's Manual. Cell size, shape and arrangement of bacterial cells. Structure and composition of bacterial cell wall.

**UNIT II**

Structure and ultrastructure of a bacterial cell. Plasma (Cytoplasmic) membrane, Movement of Materials across, Membranes, Cytoplasm, Nuclear area, Ribosomes.

**UNIT III**

**Viruses**: General characteristics of Plant and animal viruses. Classification of viruses, isolation. Viral multiplications (Lytic cycle, Lysogenic cycle, specialized transduction). Prions and Virons.

**UNIT IV**

**Immunology**: Immune system - Historical perspective, Innate immunity and adaptive immunity. Antigen - types, general properties, role played by biological system in immunogenicity.

**UNIT V**

**Antibodies**: Immunoglobulin structure and function, antigenic determinants on Immunoglobulin and immunoglobulin classes. Antigen and Antibody interactions.

**Course Outcome**

- The student would understand how to analyse the basic concepts, methods, scope and classification of micro organisms.
- They would learn the classification and replication of viruses.
- Graduates could clear idea about the human immune system and interaction against pathogens.
- After completion of this course students could employments in national virology laboratories.
- They could be a microbiologist in clinical and water plant (RO) industries.

**SUGGESTED BOOKS**

1. Pelczar, J., Chan, E. C. S. and Krieg, R. (1999). Microbiology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Sullia, S. B. and Shantharam, S. (2005). General Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Dubey, R. C. and Maheswari, D. K. (2004). A Textbook of Microbiology. S. Chand & Co. Ltd., New Delhi
4. Purohit, S. S. (1997). Microbiology. Bikanar.
5. Fraziel, N. C. (1974). Food Microbiology (2nd ed). Tata McGraw Hill Publishing Co. Ltd., New Delhi.
6. Chakravarty, AK. 2000. Immunology, Tata McGraw Hill Publication Co. Ltd., New Delhi.
7. Janeway, CA & Travers, P. 2002. Immunobiology, Gerland Publishing, NY.

## PLANT BREEDING, HORTICULTURE AND LANDSCAPE DESIGNING

**Course Code : U6R1BOMBE2** **Course: Major-based Elective**

**Hours/Week : 5** **Credit : 4**

**Objectives**

- To study the basic principles and breeding techniques in horticulture crops
- To acquire knowledge as various vegetative propagation techniques
- To understand concept on various garden making
- To get knowledge on landscaping techniques and implication
- To acquire knowledge on nursery structure and management

**UNIT I**

Introduction -scope and division of Horticulture, History of Gardening some famous gardens in India, Types of Garden-Indoor garden, public garden, kitchen garden. Garden implements and accessories.

**UNIT II**

Nursery structures-Nursery beds, propagating frames, green house and glass house. Nursery Management-cuttage, layerage, graftage potting and reporting. Preparation of soil mixture. Garden operations-planting and transplantation, pinching, disbudding, defoliation, staking, pruning watering, mulching, topiary.

**UNIT III**

Basic principles and Model of Terrace garden, rock garden hydroponics, terrarium, arches, pergolas, Bonsai and lawn.

**UNIT IV**

Cut flowers, Flower arrangements, Commercial floriculture, Cultural practices of Rose, Jasmine, Chrysanthemum and Orchids.

**UNIT V**

Landscaping principles - planning designs for house gardens, institutional and industrial gardens: different grasses, maintenance of lawns and turf in play grounds, gardens and golf courses; special types of gardens: traffic islands, vertical garden, roof / terrace garden, bog garden, water garden, planning parks and public garden; beautification of urban areas.

**Course Outcome**

- The students could know various methods of selection in plant breeding
- They could asserts the mutation and level of ploidy
- Graduate would learn the landscape designing methods
- After completion of this course the student could get employment in agriculture and horticulture centres and plant breeding centre

- They could be an entrepreneur by ornamental plant propagation

**SUGGESTED BOOKS**

1. Kumar N., 1990, Introduction to Horticulture, Rohini agencies, Nagercoil.
2. Prasad, 2005, Principles of Horticulture, International Book Dept., Deharadun.
3. Chauhan, D.V.S., 1968, Vegetable production in India, Ram Prasad sms, Agra.
4. Edmund J.B. Senn T.L Andrews F.S and Halforce R.G., 1990, Funamentals of Horticulture 14th Edn., Tata McGraw Hill Co. Pvt., London.
5. Gopalaswami Iyengar K.S., 1970, Complete Gardening in India, Kalyan Press, Bangalore.

**SEMESTER VI**

**PLANT BIOTECHNOLOGY**

**Course Code : U6R1BOMBE3** **Course: Major-based Elective**

**Hours/Week : 4** **Credit : 4**

**Objective:**

- To understand the Scope and importance application of biotechnology
- To know about the vectors and their mechanisms
- To basic ides on plant genome organization
- To gain the principles of r-DNA technology
- To acquire knowledge on gene silencing in plants

**UNIT I**

History of Plant Biotechnology - Definition - Traditional and Modern. Biotechnology as an interdisciplinary area, global impact and current excitement (health care, agriculture, genomics, proteomics.

**UNIT II**

Vectors and their applications: Cloning vectors – pUC, pBR322 – Agrobacterium based vectors – Binary and cointegrated vectors – GUS and GFP assays – Marker assisted selections – Herbicide and antibiotic resistance markers.

**UNIT III**

r-DNA technology: Isolation of RNA – Reverse Transcription PCR – Cdna collections – rDNA technology - Enzymes involved – Restriction enzymes – types – exonucleases and endonucleases – Ligases.

**UNIT IV**

Plant genome organization: Functional organization (nuclear, chloroplast and mitochondria) - physical nature of gene – (promoters, enhancers, transcription factors – (zinc finger and Lusine zipper models) and their applications in modern Biotechnology.

**UNIT V**

Gene Silencing in plants: Transctiptional and Post - Transcriptional Gene Silencing (TGS & PTGS) – RNAi in general – Flower colour modulations with RNAi – Delay of fruit ripening.

**Course Outcome**

- The students could understand importance of applications of biotechnology day to day life.
- They world learn handling methods of vectors in plant genome.
- Graduates would gain the uses of r-DNA technology.
- Students can understand the importance of gene silencing in plants
- After completing this course the students could get employment in biotechnology researchlaboratory.

**SUGGESTED BOOKS**

1. Bernard R Glick Jack J Pasterank, Molecular Biotechnology, American Society for Microbiology; 4th Edition 2010.
2. R.C. Dubey, Text book of Biotechnology, S. Chand publication, 2010.
3. C. B. Nirmala, G Rajalakishmi and Chandakarthick, Plant Biotechnology, MJP Publication, 2009.
4. H.D. Kumar, Modern concept of Biotechnology, Vikas Publiation, 1998.

**SEMESTER IV**

**MUSHROOM TECHNOLOGY**

**Course Code : U4R1BOSBE1** **Course: Skill-based Elective**

**Hours/Week : 4** **Credit : 2**

**Objectives**

- To learn basic knowledge on mushroom
- To develop the skills to differentiate the edible and poisonous mushrooms
- To understand the values and value added products of mushroom
- To know the various steps in mushroom cultivation
- To acquire knowledge on cultivation of mushrooms

**UNIT I**

Introduction – History of mushroom cultivation; Classification and distribution of mushroom; life cycle of mushroom. Identification of poisonous mushrooms – Layout for mushroom cultivation

**UNIT II**

Spawn preparation - Isolation of pure culture; Nutrient media for pure culture; raw material of spawn; sterilization; preparation of mother spawn and multiplication.

**UNIT III**

Cultivation of mushroom - small scale and large scale production unit. Types of raw material – preparation and sterilization; Mushroom bed preparation – maintenance of mushroom shed; harvesting method and preservation of mushrooms.

**UNIT IV**

Nutrient values of mushroom: protein, carbohydrate, fat, fibre, vitamins and amino acids; short and long term storage of mushroom; preparation of various dishes from mushroom. Medicinal value of mushroom – cultivation, extraction, isolation and identification of active principle from mushroom. Pharmacological and economic values of mushroom.

**UNIT V**

Cultivation of following types of mushroom – milky mushroom; oyster mushroom, button mushroom and any one medically valuable mushroom.

**Course outcome:**

- The students couldhave acquired sufficient academic and practical experience in the field of mushroom cultivation.
- Students can understand the nutritional value of mushroom and its products
- They could get knowledge in spawn preparation techniques.
- They could become self-employed in the mushroom.
- They could empower with entrepreneurial skill thing production and disease management of mushrooms.

**SUGGESTED BOOKS**

1. Paul Stamets, J.S. and Chilton, J.S. 2004. Mushroom cultivation A practical guide to growing mushrooms at home, Agarikon Press.
2. Tewan and Pankaj Kapoor S.C. 1993. Mushroom cultivation. Mittal Publication. Delhi.
3. Marimuth et al., 1991. Oyster Mushrooms. Dept. of Plant pathology, TNAU, Coimbatore.
4. Nita Bahl. 1988. Hand book of Mushrooms, 2nd Edition, Vol I & II.
5. Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms Cultivation, nutritional value, medicinal effect and environmental impact. 2nd ed., CRC press.

**SEMESTER V**

**BIO-FERTILIZER PRODUCTION AND APPLICATIONS**

**Course Code : U5R1BOSBE2** **Course: Skill-based Elective**

**Hours/Week : 4** **Credit : 2**

**Objective**

- To understand the microorganisms can be used as bio fertilizers
- To learn the technology of inoculum to the bio fertilizers production
- The acquire knowledge to produce the some bio fertilizers in large scale
- They acquire knowledge on symbiotic association in plants
- To motivate the students to become as entrepreneurs

**UNIT I**

An introduction to Biofertilizers – Microbes used as bio-fertilizer – Classification. Symbiotic $N_2$ Fixers: Rhizobium – Isolation, Identification and characterization - large scale production and field application.

**UNIT II**

Symbiotic $N_2$ fixers: Isolation, Identification large scale production, crop response, and field application of *Cyanobacteria and Azolla*. Isolation and characterization of Frankia – Actinorhizal nodules – non-leguminous crop symbiosis.

**UNIT III**

Non symbiotic $N_2$ fixers: Isolation, Identification large scale production, crop response, and field application of *Azospirillium* and *Azotobacter*.

**UNIT IV**

Phosphate solubilizers: Isolation, characterization, mass inoculums production, field application of *Bacillus firmus* and *Pseudomonas* - Phosphate solublization mechanism.

**UNIT V**

Mycorrhizal Biofertilizers: Classification, Isolation, Identification, Mass inoculum production, field application of Ecto and Endo mycorrhizae

**Course Outcome**

- The students could understand bio fertilizers are only source for recovery the soil fertility.
- They could know the organism identity and their applications.
- Graduate world learn the methods for large scale production of bio fertilizers.
- The students get knowledge in Mycorrihzalbiofertilizers
- After completing this course the students could get employment in bio fertilizers companies and they could become as entrepreneurs.

**SUGGESTED BOOKS**

1. Kannaiyan S, 2003. Biotechnology of Biofertilizers, CHIPS, Texas.
2. Subbu Rao, N.S, 2000. Biofertilizers in Agriculture, Oxford & IBH Publishing Co, New Delhi.
3. http://www.fnca.mext.go.jp/english/bf/bfm/pdf/4_4_Phosphate_Solubilizers0403.pdf
4. H. A. Modi, 2012. Microbial Inoculants And Biofertilizer Technology, Neha Publishers & Distributors
5. H.C. Lakshman, Channabasava A, Biofertilizers And Biopesticides, 2014. Neha Publishers & Distributors.

**SEMESTER VI**

**ORGANIC FARMING**

**Course Code : U6R1BOSBE3** **Course: Skill-based Elective**

**Hours/Week : 3** **Credit : 2**

**Objectives**

- To discuss on the impact of products of chemical based agriculture
- To discuss on the importance of sustainable agriculture
- To acquire knowledge on concepts of organic forming
- To study the Management of organic wastes and green manures
- To get knowledge on Bio fertilizer applications

**UNIT I**

Soil - physical, chemical properties. Soil pollution - oil, chemicals - fertilizers, pesticide and herbicide - non-degradable solids, biomagnification, consequences of land pollution - damage to soil and crops, heavy metal contamination. Soil residues and impact of monoculture.

**UNIT II**

Organic farming - definition, basic concept of organic farming, integrated plant nutrient supply management, integrated insect pest and diseases management, integrated soil and water management. Sustainable agriculture practice - crop rotation, crop diversification, mixed cropping, biological nitrogen fixation.

**UNIT III**

Management of organic wastes and green manures: Farm manures, Composts, Mulches, Tillage and Pest control. Organic manures - organic residue, chemical nature of organic manure, green manure, importance of green manure, crops of green manure, oil cake. Animal based organic manure – cow dung, poultry waste, vermicompost - methods, production and utilization.Preservation of Panchakavya.

**UNIT IV**

Biofertilizers - classification, nitrogen fixers - Rhizobium, Azotobacter, cyanobacteria, Azolla, Frankia. Azospirillum and Vasicular Mycorrhizae. Pest and disease management: classification of pest, integrated pest management - components; cultural, mechanical, physical control of pest. Biopesticides against microbial parasites, predators and insects.

**UNIT V**

GMO and regulations; organic produce - consumer confidence, conversion period. Inspection and certification. Accredited certifying agents (natl and intl), Equality assurance - logo and labeling.

**Course Outcomes:**

- The students could have understood the impact of products of chemical based agriculture.
- They could know the importance of sustainable agriculture.

- They would understand themanagement of organic wastes and green manures.
- They could get knowledge on Bio fertilizer applications.
- Students can get knowledge on regulations of GMO, inspection and certification.

**SUGGESTED BOOKS**

1. Sharma, A.K., 2003, Biofertilizers for sustainable agriculture, Agrobios.

2. NIIR Board, 2004, The Complete Technology Book on Biofertilizer and Organic Farming, National Institute of Industrial Research.

**Online Resources**

1. http://ec.europa.eu/agriculture/organic/organic-farming/whatorganic_en
2. http://attra.ncat.org/organic.html#list
3. http://www.epa.gov/agriculture/tbio.html

**SEMESTER V**

**VERMI-TECHNOLOGY**

**Course Code : U5R1BOIDC1** **Course: Inter-disciplinary Course**

**Hours/Week : 4** **Credit : 2**

**Objectives**

- To provide basic understanding of biological, chemical and environmental concepts pertaining to vermi technology
- To create knowledge on Environmental degradation
- To get the theoretical knowledge on vermicompost bed preparation
- To study the marketing techniques of vermicompost
- To study the types and physiology of earthworms
- To create knowledge on Self -Employment Opportunity

**UNIT-I**

Vermiculture: definition, scope and importance - common species for culture - Environmental requirements - culture methods – Benefits and constraints of vermicomposting.

**UNIT-II**

Earthworms: Taxonomic position and diversity – Types - morphology and physiology of earthworm - Ecological roles and needs for earthworm culture- wormery breeding techniques - indoors and out door cultures - monoculture and polyculture - relative merits and demerits.

**UNIT-III**

Applications of Vermiculture: Vermin-composting, use of vermicastings in organic farming / horticulture - earthworms for management of biomedical solid wastes - feed / bait for capture / culture fisheries – forest regeneration.

**UNIT-IV**

Marketing the products of vermiculture - quality control, market research, marketing techniques - creating the demand by awareness, demonstration, and advertisements - packaging and transport - direct marketing.

**UNIT-V**

Future perspectives - Predator / pathogen control in wormeries - Cost-benefit analysis of vermi-composting - Potentials and constraints for vermiculture in India.

**Course Outcome**

- To students could learn the biology of earthworm and its application.
- They would understand the basic knowledge on vermicompost bed preparation.
- Graduates could understand has to recycle house made wastes and cattle wastes.
- They can understand the importance of organic agriculture

- After completing this course the students could become as entrepreneur.

**SUGGESTED BOOKS**

1. Sultan Ahmed Ismail, 2005, The Earthworm Book, Second Revised Edition. Mother India Press, Goa.
2. Edwards, C.A. and Bohlen, P.J 1996, ecology of earthworms – 3 rd Edition, Chapman and hall.
3. Jsmail, S.A., 1970, Vermicology, The biology of earthworms, Orient Longman, London.
4. Lee, K.E., 1985. Earthworms - Their ecology and Relationship with Soil and Land use, Academic Press, Sydney.
5. Shukla, G.S 1994. Economic Zoology. Meerut Rastogi publication.

**SEMESTER VI**

**PLANT TISSUE CULTURE**

**Course Code : U6R1BOIDC2** **Course: Inter-disciplinary Course**

**Hours/Week : 3** **Credit : 2**

**Objective:**

- To understand the organization and functioning of tissue culture laboratory
- To know the principles of Totipotency
- To get knowledge on methods of Micro-propagation
- To gain the Bio-transformation techniques
- To understand the role of Plant growth regulators

**UNIT I**

Introduction - History of plant culture - Laboratory organization - Tools and instruments used in plant tissue culture.

**UNIT II**

Sterilization: methods of sterilization; medium and its preparation; Plant Growth Regulators (PGR), Macro & Micro nutrients, Vitamins and its role in tissue culture. Inoculation - Methodology & precautions.

**UNIT III**

Culture initiation, Explant, Totipotency, Dedifferentiation – Redifferentiation, Various types of culture, Callus culture, Cell culture, Anther culture, Meristem culture. Organogenesis - Direct & Indirect.

**UNIT IV**

Micro propagation: Methods of micro propagation, somatic embryogenesis; Plant protoplast - isolation, culture and somatic hybridization - Somaclonal variation. Secondary plant products - Secondary metabolites of plants, origin, factors affecting the production in culture, elicitors and roots.

**UNIT V**

Bio-transformation- Bio reactor- Cell immobilization, Synthetic seed technology, Importance and application of tissue culture - impacts on industry, forestry, agriculture and horticulture.

**Course Outcomes:**

- The students could have understood the organization of tissue culture laboratory.
- They could know the principles of Totipotency.
- They would get knowledge on methods of Micro-propagation.
- They could gain the Bio-transformation techniques.
- They could understand the role of Plant growth regulators.

**SUGGESTED BOOKS**

1. 1 Mahipal Shingh Shekawat, Plant cell and Tissue culture, Saras Publication, 2010.
2. 2 R. C. Dubey A text book of Biotechnology, S. Chand and Company, 2006.
3. 3 Kalyan Kumar De, Plant tissue culture, New central book agency, 2008.

4. Brown C. W and Thorpe T. A 1984 Cell culture and Somatic Cell Genetics of plants, Academic Press Orlando
5. Chu, C 1978 Plant Tissue Culture, Peking Science Press, Peking
6. Gamborg O. L and Phillips. G.G. 1975 Plant Cell, Tissue culture and Organ culture Fundamental Methods. Narosa Publishing House, New Delhi.
7. Narayanaswamy, S 1994. Plant Cell and Tissue, Tata –Mc Graw Hill Publishing Co., Ltd., New Delhi.
8. Reinert J and Bajaj Y. B. S 1977 (Ed) Applied and Fundamental Aspects of Plant cell, Tissue and Organ culture , Springer Verlag, Berlin Ronald Press, New York.