P.G AND RESEARCH DEPARTMENT

OF

BOTANY

UG SYLLABUS

From the Academic Year 2017-2018

J.J.COLLEGE OF ARTS AND SCIENCE

(*AUTONOMOUS*)

(Reaccredited at 'A' Grade by NAAC)

PUDUKKOTTAI – 622 422

B.Sc. BOTANY

Programme objectives:

- To understand the basic concept of lower plants and morphology of higher plants
- To know the classification, evolution anatomical and physiological details of higher group of plants
- To analyse the cell organelle and application of genetics, molecular biology and plant breeding
- To identify the bacteria, viruses and fungi are the plant pathogens
- To understand the basic concepts of ecology and conservation
- To perform the procedure of laboratory technique in biochemistry, biotechnology and utilization of plants
- 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 2017-2018 Onwards)

B.Sc. BOTANY

Sem.	Part	Course Code	Course	Course Title	Hrs / Week	Credit	CIA	External	Total Marks
I	I	U1RTL1	Lan -I	Tamil/Hindi/Arabic/French -I	6	3	25	75	100
	II	U1REL1	Lan -II	English –I	6	3	25	75	100
	III	U1RBOCC1	CC	Algae, Fungi, Lichens and Bryophytes	5	5	25	75	100
	III	U1RBOCC2P	CC	Major Practical - I	5	4	40	60	100
	III	U1RCHAC1	AC	Chemistry Theory -I	5	4	25	75	100
	III	-	AC	Allied Practical –I	3	-	-	-	-
				Total	**30**	**19**	**-**	**-**	**500**
II	I	U2RTL2	Lan-I	Tamil/Hindi/Arabic/French -II	5	3	25	75	100
	II	U2REL2	Lan-II	English –II	5	3	25	75	100
	III	U2RBOCC3	CC	Pteridophytes, Gymnosperms and Palaeobotany	5	5	25	75	100
	III	U2RBOCC4P	CC	Major Practical - II	3	4	40	60	100
	III	U2RCHAC2	AC	Chemistry Theory -II	4	4	25	75	100
	III	U2RCHAC3P	AC	Allied Practical –I	3	4	40	60	100
	IV	U2RES	EVS	Environmental Studies	3	2	25	75	100
		U2RVE	VE	Value Education	2	2	25	75	100
				Total	**30**	**27**	**-**	**-**	**800**
III	I	U3RTL3	Lan -I	Tamil/Hindi/Arabic/French -III	5	3	25	75	100
	II	U3REL3	Lan -II	English –III	5	3	25	75	100
	III	U3RBOCC5	CC	Anatomy & Embryology of Angiosperms	6	5	25	75	100
	III	U3RBOCC6P	CC	Major Practical - III	6	4	40	60	100
	III	U3RZOAC3	AC	Zoology Theory - I	5	4	25	75	100
	III	-	AC	Allied Practical - II	3	-	-	-	-
				Total	**30**	**19**	**-**	**-**	**500**
IV	I	U4RTL4	Lan-I	Tamil/Hindi/Arabic/French -IV	5	3	25	75	100
	II	U4REL4	Lan-II	English –IV	5	3	25	75	100
	III	U4RBOCC7	CC	Morphology, Taxonomy of Angiosperms & Economic Botany	4	5	25	75	100
	III	U4RBOCC8P	CC	Major Practical - IV	4	4	40	60	100

	III	U4RZOAC4	AC	Zoology Theory - II	5	4	25	75	100
	III	U4RZOAC5P	AC	Allied Practical - II	4	4	40	60	100
	IV	U4RBOSBE1	SBE	To be Selected from Given List	3	2	25	75	100
				Total	**30**	**25**	-	-	**700**
V	III	U5RBOCC9	CC	Cell Biology and Molecular Genetics	6	5	25	75	100
	III	U5RBOCC10	CC	Biophysics, Plant Physiology and Biochemistry	6	5	25	75	100
	III	U5RBOCC11P	CC	Major Practical - V	5	4	40	60	100
	III	U5RBOMBE1	MBE	To be Selected from Given List	3	4	25	75	100
	IV	U5RBOMBE2	MBE	To be Selected from Given List	4	4	25	75	100
	IV	U5RBOSBE2	SBE	To be Selected from Given List	3	2	25	75	100
	V	U5RBOIDC1	IDC	To be Selected from Given List	3	2	25	75	100
				Total	**30**	**26**	-	-	**700**
VI	III	U6RBOCC12	CC	Ecology and Phyto-geography	5	5	25	75	100
	III	U6RBOCC13	CC	Bioinstrumentation and Biostatistics	5	5	25	75	100
	III	U6RBOCC14P	CC	Major Practical - VI	5	4	40	60	100
	III	U6RBOMBE3	MBE	To be Selected from Given List	5	4	25	75	100
	IV	U6RBOSBE3	SBE	To be Selected from Given List	5	2	25	75	100
	V	U6RBOIDC2	IDC	To be Selected from Given List	4	2	25	75	100
	V	U6RGS	GS	Gender Studies	1	1	25	75	100
	V	-	-	Extension Activity	-	1	-	-	
				Total	**30**	**24**	-	-	**700**
				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

Programme Outcomes:

- ✓ The students would have understood the basic concepts of lower plants and their adaptations.
- ✓ The students could aware as the ecological importance and their protection.
- ✓ They could perform the procedure of laboratory techniques in Plant Physiology, Plant Biochemistry and their utilization.
- ✓ They would realize the facts among the biology that could make them an entrepreneur.
- ✓ They could get employment as lab technician in biological laboratory, field assistant, agriculture and horticulture research centres, seed companies and herbal companies.

SEMESTER I

ALGAE, FUNGI, LICHENS, PLANT PATHOLOGY AND BRYOPHYTES

Course Code : U1RBOCC1 **Course : Core Course**
Hours/Week : 5 **Marks : 25+75=100**
Credit : 5 **Total Hrs: 60**

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

Unit - I: (12 Hours)

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: (12 Hours)

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

Unit - III: (12 Hours)

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: (12 Hours)

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: (10 Hours)

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)

Unit - VI: Latest Learning (2 Hours)

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

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.

Text 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.

References:

1. Singh R.S. (1978) plant Diseases, Oxford and IBH, 66, Janapath, New Delhi - 110 001,
2. Vashishta. B.R. (1970), Botany for Degree students, Fungi, S. Chand & Co, Ramnagar, New Delhi - 110 055,
3. Vashishta. B.R. (1978), Bryophyta, S.Chand & Co, Ram Nagar, New Delhi - 110 001,
4. Watson E.V. (1964), The structure and Life History of Bryophytes Hutchinson University Press, London.
5. Chojnacka, K, Wieczorek, P.P., Schroeder, G. and Michalak, I (Eds.) 2018. Algae Biomass: Characteristics and Applications. Springer.

****

SEMESTER I
MAJOR PRACTICAL - I

Course Code : U1RBOCC2P **Course : Core Course**
Hours/Week : 5 **Marks : 40+60=100**
Credit : 4 **Total Hrs: 60**

Objectives:

- 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 Outcomes:

- 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.

****

SEMESTER II

PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY

Course Code : U2RBOCC3 **Course : Core Course**
Hours/Week : 5 **Marks : 25+75=100**
Credit : 5 **Total Hrs: 60**

Objectives:

- To learn the diversity of higher cryptogams and their evolution
- To understand the vegetative and reproductive features of Gymnosperms
- 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 (12 Hours)

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

Unit - II: Pteridophytes (12 Hours)

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

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

Unit - III: Gymnosperms (12 Hours)

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

Unit - IV: Gymnosperms (12 Hours)

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

Unit - V: Paleobotany (10 Hours)

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.

Unit - VI: Latest Learning (2 Hours)

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- 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

Text 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.

References:

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.
12. Neale, D. B., Wheeler, N. C. (2019). The Conifers: Genomes, Variation and Evolution. Springer. https://www.springer.com/gp/book/9783319468068

****

SEMESTER II
MAJOR PRACTICAL - II

Course Code : U2RBOCC4P **Course: Core Course**
Hours/Week : 3 **Marks : 40+60=100**
Credit : 4 **Total Hrs: 60**

Objectives:

- 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

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.*

Palaeobotany

Study of internal morphology of the following fossils:

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

Course Outcomes:

- 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.

****

SEMESTER III

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Course Code : U3RBOCC5 **Course : Core Course**
Hours/Week : 6 **Marks : 25+75=100**
Credit : 5 **Total Hrs: 72**

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 plant parts
- To know the various types of pollination mechanism

Unit - I: **(14 Hours)**

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

Unit - II: **(14 Hours)**

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: **(14 Hours)**

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: **(14 Hours)**

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: **(14 Hours)**

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.

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

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.

Text 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.

References:

1. Pullaiah, T., Lakshminarayana, K. and Hanumantha Rao, K. 2001. Text Book of Embryology of Angiosperms, Regency Publications, New Delhi.
2. Cuttler, EG. 1969. Plant Anatomy - Part I Cells & Tissue. Edward Arnold Ltd., London.
3. Esau K. 1985. Plant Anatomy (2nd ed.) Wiley Eastern Ltd. New Delhi.
4. www.wooddatabase.com
5. Crang, R., Lyons-Sobaski, S., Wise, R. (2018). Plant Anatomy. Springer. https://www.springer.com/gp/book/9783319772080

****

SEMESTER III
MAJOR PRACTICAL - III

Course Code : U3RBOCC6P **Course : Core Course**
Hours/Week : 6 **Marks : 40+60=100**
Credit : 4 **Total Hrs: 72**

Objectives:

- To observe internal organization of plant body
- To understand primary, secondary and anomalous, anatomical structure of plant parts
- To observe the pollen morphology and types of pollens
- 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.
6. **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.

****

SEMESTER IV

MORPHOLOGY, TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

Course Code : U4RBOCC7 **Course : Core Course**
Hours/Week : 4 **Marks : 25+75=100**
Credit : 5 **Total Hrs: 48**

Objectives:

- To observe the variations among plants, especially angiosperms
- To understand the way of nomenclature and classifying the plants
- To learn about various modification and its purpose in plant parts
- To study the field and native characters of plants

Unit - I: **(9 Hours)**

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: **(9 Hours)**

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

Unit - III: **(9 Hours)**

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: **(9 Hours)**

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

Unit - V: **(9 Hours)**

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

Unit - VI: Latest Learning **(3 Hours)**

Latest development related to the Course during the semester concerned

(CIA purpose only not for question setting)

Course Outcomes:

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.

Text 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.

References:

1. Lawrence, GH. 1955. Taxonomy of Vascular Plants, MacMillan Co., USA.
2. Samuel, BJ & Arlene, EL. 1987. Plant Systematics, Mc Graw Hill Inc. NY.
3. Annie Ragland and V. Kumaresan (2018). Morphology of Angiosperms, Taxonomy and Economic Botany. Saras Publication.

****

SEMESTER IV

MAJOR PRACTICAL - IV

Course Code : U4RBOCC8P **Course: Core Course**
Hours/Week : 4 **Marks : 40+60=100**
Credit : 4 **Total Hrs: 60**

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 preparing Herbarium

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 Outcomes:

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 : U5RBOCC9 **Course : Core Course**
Hours/Week : 6 **Marks : 25+75=100**
Credit : 5 **Total Hrs: 72**

Objectives:

- 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 their interactions

Unit - I: **(14 Hours)**

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: **(14 Hours)**

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

Unit - III: **(14 Hours)**

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: **(14 Hours)**

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: **(14 Hours)**

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

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- 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.
- After completion of this course students can get employment in biology instrumentation labs and Molecular Biology Research Centre.

Text 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.

References:

1. Gardner, EJ., Simmons, MJ. & Snustad, D. 1991. Principles of Genetics, John Wiley & Sons Inc., New York.
2. Sundara Rajan, S. Cytology Anmol Publication, New Delhi, 2004.
3. Varshney, R. K. (Ed), Pandey, M. K. (Ed), Chitikineni, A. (Ed) (2018). Plant Genetics and Molecular Biology. Springer.

****

SEMESTER V

BIOPHYSICS, BIOCHEMISTRY AND PLANT PHYSIOLOGY

Course Code : U5RBOCC10 **Course : Core Course**
Hours/Week : 6 **Marks : 25+75=100**
Credit : 5 **Total Hrs: 72**

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 develop understanding in the plant cells
- To acquired basic knowledge in physiological process

Unit - I: **(14 Hours)**

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 range of spectrum. pH - definition and its biological significance. Buffer : definition, some importance of buffers.

Unit - II: **(14 Hours)**

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 and 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 and key and induced fit. Factors affecting the enzyme action.

Unit - III: **(14 Hours)**

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: **(14 Hours)**

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: **(14 Hours)**

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.

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- 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.
- After completion of this course he students could employment in plant growth centres, plant tissue culture and grafting centre.

Text 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.

References:

1. Verma V. 2007. Tex book of Plant Physiology, Ane Books India, New Delhi.
2. JainV.K. 2006. Fundamentals of Plant Physiology, S. Chand & Co, New Delhi.
3. Pandey, SN & Sinha, BK. 2006. Plant Physiology, 4th Ed. Vikas Publishing, ND.
4. Noggle and Fritz, 1976. Introductory Plant Physiology, Prentice Hall, New Delhi.
5. Baijal, BD & Ravisharma, 1981. A Textbook of Plant Physiology, SL Agarwal, Agra.
6. Salisbury, F.B. & Ross, CN. 1995. Plant Physiology. CBS Publishers, New Delhi.
7. Gerald D Fasman (2017). Handbook of Biochemistry. CRC Press.
8. Bhatla, S. C., A. Lal, M. (2018). Plant Physiology, Development and Metabolism. Springer. https://www.springer.com/gp/book/9789811320224

****

SEMESTER V

MAJOR PRACTICAL - V

Course Code : U5RBOCC11P **Course : Core Course**
Hours/Week : 5 **Marks : 40+60=100**
Credit : 4 **Total Hrs: 60**

Objectives:

- To perform double stained permanent slide mounting
- To have a practical exposure on isolating 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 Outcomes:

- 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

****

SEMESTER-VI

ECOLOGY AND PHYTOGEOGRAPHY

Course Code : U6RBOCC12 **Course : Core Course**
Hours/Week : 5 **Marks : 25+75=100**
Credit : 5 **Total Hrs: 60**

Objectives:

- 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

Unit - I: **(12 Hours)**

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: **(12 Hours)**

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: **(12 Hours)**

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: **(12 Hours)**

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: **(10 Hours)**

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.

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- 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.

Text 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.

References:

1. Margalef, R. (1968) – Perspectives in Ecological Theory – University of Chicago Press, Chicago.
2. Frankel, O.H., A.H.D. Brown and Burdon J.J. 1995. The conservation of Plant Diversity, Cambridge University Press, Cambridg,e UK.
3. Heywood V.H. 1995. Global biodiversity Assessment, UNEP. Cambridge University Press, Cambridge, UK.
4. K.V.Krishnamurthy 2003, An Advanced Text Book on Biodiversity. Oxford and IBH Book Company, New Delhi.
5. Virchow D Conservation of genetic resources, Springer Verlag, Berlin.
6. Ebach, M. C. (2015). Origins of Biogeography. Springer. https://www.springer.com/gp/book/9789401799980
7. Schulze, E., Beck, E., Buchmann, N., Clemens, S., Müller-Hohenstein, K., Scherer-Lorenzen, M. (2019). Plant Ecology. Springer.https://www.springer.com/gp/book/9783662562314

****

SEMESTER-VI

BIOINSTRUMENTATION AND BIOSTATISTICS

Course Code : U6RBOCC13 **Course : Core Course**
Hours/Week : 5 **Marks : 25+75=100**
Credit : 5 **Total Hrs: 60**

Objectives:

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

Unit - I: **(12 Hours)**

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: **(12 Hours)**

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: **(12 Hours)**

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: **(12 Hours)**

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: **(10 Hours)**

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.

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- 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 .

Text 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.

References:

1. Narayanan, P. 2000 Essentials of Biophysics, New Age International Publishers (P) Ltd., New Delhi, Calcutta, Chennai, Mumbai.
2. Kothari, C.R. 2000. Research Methodology - Methods & Techniques. Wishwa Prakashan
3. Misra, R.P, 2000 Research Methodology - a handbook, Concept Publishing Company, New Delhi.
4. Salmah B. Karman and S. Zaleha M. Diah (2016). Principal And Techniques Of Bioinstrumentation. Intelliz Press.

****

SEMESTER VI
MAJOR PRACTICAL - VI

Course Code : U6RBOCC14P **Course : Core Course**
Hours/Week : 5 **Marks : 40+60=100**
Credit : 4 **Total Hrs: 60**

Objectives:

- 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

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

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 Outcomes:

- 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 this course students could get employment in environment forest department, plant tissue laboratory and biotechnology research centre.

****

SEMESTER XXX

MICROBIOLOGY AND IMMUNOLOGY

Course Code : XXX **Course : Major Based Elective**
Hours/Week : 3 **Marks : 25+75=100**
Credit : 4 **Total Hrs: 36**

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

Unit - I: **(7 Hours)**

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: **(7 Hours)**

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

Unit - III: **(7 Hours)**

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: **(7 Hours)**

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

Unit - V: **(6 Hours)**

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

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- 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.

Text 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

References:

1. Purohit, S. S. (1997). Microbiology. Bikanar.
2. Fraziel, N. C. (1974). Food Microbiology (2nd ed). Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Chakravarty, AK. 2000. Immunology, Tata McGraw Hill Publication Co. Ltd., New Delhi.
4. Janeway, CA & Travers, P. 2002. Immunobiology, Gerland Publishing, NY.
5. Bauman Robert W. (2017) Microbiology with Diseases by Body System. Pearson Education; Third edition
6. Banerjee Banerjee (2018). Fundamentals of Microbiology and Immunology. New Central Book Agency.

****

SEMESTER XXX

PLANT BREEDING, HORTICULTURE AND LANDSCAPE DESIGNING

Course Code : XXX **Course : Major Based Elective**
Hours/Week : 5 **Marks : 25+75=100**
Credit : 4 **Total Hrs: 60**

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

Unit - I: **(12 Hours)**

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: **(12 Hours)**

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: **(12 Hours)**

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

Unit - IV: **(12 Hours)**

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

Unit - V: **(10 Hours)**

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.

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- The students could know various methods of selection in plant breeding.
- They could assert 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.

Text 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.

References:

1. Gopalaswami Iyengar K.S., 1970, Complete Gardening in India, Kalyan Press, Bangalore.
2. Debashis Mandal, Amritesh C. Shukla, Mohammed Wasim Siddiqui(2018).Sustainable Horticulture, Volume 1- 3. Apple Academic Press.

****

SEMESTER XXX
PLANT BIOTECHNOLOGY

Course Code : XXX **Course : Major Based Elective**
Hours/Week : 5 **Marks : 25+75=100**
Credit : 4 **Total Hrs: 60**

Objectives:

- 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

Unit - I: **(12 Hours)**

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: **(12 Hours)**

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: **(12 Hours)**

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

Unit - IV: **(12 Hours)**

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: **(10 Hours)**

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

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- 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.
- After completing this course the students could get employment in biotechnology research laboratory.

Text 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.

References:

1. Abdin, M. Z. (Ed), Kiran, U. (Ed), Kamaluddin, M. (Ed), Ali, A. (Ed) (2017). Plant Biotechnology: Principles and Applications. Springer. https://www.springer.com/gp/book/9789811029592
2. Hiru Ranabhatt, Renu Kapor (2018). Plant Biotechnology. WPI Publisher

****

SEMESTER XXX
BIODIVERSITY AND CONSERVATION BIOLOGY

Course Code : XXX **Course : Major Based Elective**
Hours/Week : 5 **Marks : 25+75=100**
Credit : 4 **Total Hrs: 60**

Objectives:

- To study the basic concept and values of biodiversity
- To understand the threads of biodiversity
- To gain knowledge on hotspots
- To know about the RET plants of India
- To study the conservation strategies

Unit - I: Biodiversity - Definition, Concept and Values (12 Hours)

Distribution of biological wealth in our planet, genetic, species and ecosystem diversity. Biogeographically classification of India and glimpses of Indian biodiversity and conservation 8 areas; consumptive use, productive use, social, ethical, aesthetic and option values of biodiversity.

Unit - II: Levels of and Threats to Biodiversity (12 Hours)

Biodiversity at global, regional and local levels. Monitoring & measurement of Biodiversity; useful indices. Threats like overexploitation, fragmentation, habitat loss, poaching of wildlife, man-wildlife conflicts, natural calamities, effect of degeneration of biodiversity on future of evolution.

Unit - III: Hotspots and Megadiversity Countries (12 Hours)

India as a mega-diversity nation; flora & fauna of other Megadiversity countries; hot-spots of biodiversity; wealth of Indian hot-spots.

Unit - IV: Endangered and Endemic species of India (12 Hours)

Scheduled species and their distribution; conservation efforts in Indian flora & fauna - Case studies. Advance technology in service of endangered species, zoos and botanical gardens,

Unit - V: In-situ and Ex-situ Conservation (10 Hours)

Concept and practice; manipulation of wild populations; control of predators, herbivores and competitors; management of problem species; captive breeding; plant propagation; reestablishment and relocation, conservation of plant diversity in seed banks, gene banks or germplasm reserves, conservation beyond park, sanctuaries & reserves: habitat conservation. Marine Protected areas.

Unit - VI: Latest Learning (2 Hours)

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- The student could have studied the basic concept and values of biodiversity.
- They could understand the threads of biodiversity.
- They would gain knowledge on hotspots.
- They could know about the RET plants of India.
- They could study the conservation strategies.

Text Books:

1. Heywood, V. H. and R. T. Watson. 1995. Global Biodiversity Assessment. Cambridge University Press.
2. Odum, E. P. 1983. Basic Ecology. Saunders, Philadelphia.
3. Smith, R. L. 1996. Ecology and Field Biology. Harper Collins, New York.

References:

1. Begon, M., J.L. Harper and C.R. Townsend. 1996. Ecology. Blackwell Science, Cambridge.
2. Chapman, J. L. and M. J. Reiss. 1988. Ecology: Principles and Applications. Cambridge University Press.
3. Hill, MK.1997.Understanding Environmental Pollution. Cambridge University Press.
4. Kormondy, E. J. 1996. Concepts of Ecology. Prentice Hall of India, New Delhi.
5. Ludwig, J. and J. F. Reynolds. 1988. Statistical Ecology. John Wiley & Sons.
6. Mullaer- Dombois, D. and H. Ellenberg. 1974. Aims and Methods of Vegetative Ecology. Willey, New York.
7. Odum, E. P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.

SEMESTER XXX

ECO-TOURISM

Course Code : XXX **Course : Major Based Elective**
Hours/Week : 5 **Marks : 25+75=100**
Credit : 4 **Total Hrs: 60**

Objectives:

- To study the basic concept on eco-tourism
- To understand the resources of eco-tourism
- To gain knowledge on products and components of eco-tourism
- To know about the Community based eco-tourism

Unit - I: **(12 Hours)**

Concept of ecotourism: Ecotourism and related sub-sectors of the tourism industry - Ecotourism criteria - Quebec declaration on ecotourism

Unit - II: **(12 Hours)**

Ecotourism Resources: Identifying, listing, and understanding ecotourism resource categories (natural, built, and events) Protected Areas: Definition, categories and roles

Unit - III: **(12 Hours)**

Identifying and describing ecotourism products Components of ecotourism: Ecotourism and the environment - Ecotourism and conservation - Ecotourism and protected areas

Unit - IV: **(12 Hours)**

Components of ecotourism (Cont.): Ecotourism and economic benefits - Ecotourism and social benefits - Ecotourism and local community - Ecotourism and education

Unit - V: **(10 Hours)**

Community-based tourism: Community-based tourism management - Monitoring the success and impacts of community-based tourism

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- The students could have studied the basic concept on eco-tourism.
- They could understand the resources of eco-tourism.
- They would gain knowledge on products and components of eco-tourism.
- They could know about the Community based eco-tourism.

Text Books:

1. Erlet Cater and Gwen Lowman (1994). Ecotourism: A Sustainable Option? John Wiley & Sons; 1 edition.
2. W. Bruce Campbell and Silvia López Ortíz (2011). Integrating Agriculture, Conservation and Ecotourism: Examples from the Field. Springer
3. David A. Fennell (2007). Ecotourism. Rutledge; 3 edition.

References:

1. Introduction to Tourism : A.K.Bhatia
2. Tourism System : Mill R.C & Morrison
3. Tourism Development : R.Garther
4. Successful Tourism Management : Pran Nath Seth

SEMESTER XXX

MUSHROOM TECHNOLOGY

Course Code : XXX **Course: Skill Based Elective**
Hours/Week : 2 **Marks : 25+75=100**
Credit : 2 **Total Hrs: 24**

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

Unit - I: **(5 Hours)**

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

Unit - II: **(5 Hours)**

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

Unit - III: **(4 Hours)**

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: **(4 Hours)**

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: **(4 Hours)**

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

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- The students could have acquired sufficient academic and practical experience in the field of mushroom cultivation.
- They could become self-employed in the mushroom.
- They could empower with entrepreneurial skill thing production and disease management of mushrooms.

Text 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.

References:

1. Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms Cultivation, nutritional value, medicinal effect and environmental impact. 2nd ed., CRC press.
2. Tavis Lynch (2018). Mushroom Cultivation: An Illustrated Guide to Growing Your Own Mushrooms at Home. https://www.bookdepository.com/publishers/Quarry-Books

****

SEMESTER XXX

BIO-FERTILIZER PRODUCTION AND APPLICATIONS

Course Code : XXX **Course: Skill Based Elective**
Hours/Week : 4 **Marks : 25+75=100**
Credit : 2 **Total Hrs: 48**

Objectives:

- To understand the micro organism 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
- To motivate the students to become as entrepreneurs

Unit - I: (10 Hours)

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: (9 Hours)

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: (9 Hours)

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

Unit - IV: (9 Hours)

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

Unit - V: (9 Hours)

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

Unit - VI: Latest Learning (2 Hours)

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- 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.
- After completing this course the students could get employment in biofertilizers companies and they could become as entrepreneurs.

Text 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

References:

1. H.C. Lakshman, Channabasava A, Biofertilizers And Biopesticides, 2014. Neha Publishers & Distributors.
2. Giri, B. (Ed), Prasad, R. (Ed), Wu, Q. (Ed), Varma, A. (Ed) (2019). Biofertilizers for Sustainable Agriculture and Environment. Springer. https://www.springer.com/gp/book/9783030189327

****

SEMESTER XXX
ORGANIC FARMING

Course Code : XXX **Course: Skill Based Elective**
Hours/Week : 5 **Marks : 25+75=100**
Credit : 2 **Total Hrs: 60**

Objectives:

- To discuss on the impact of products of chemical based agriculture
- To discuss on the importance of sustainable agriculture
- To study the Management of organic wastes and green manures
- To get knowledge on Biofertilizer applications

Unit - I: **(12 Hours)**

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: **(12 Hours)**

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: **(12 Hours)**

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: **(12 Hours)**

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: **(10 Hours)**

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

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

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 the management of organic wastes and green manures.
- They could get knowledge on Biofertilizer applications.

Text 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.

References:

1. http://ec.europa.eu/agriculture/organic/organic-farming/whatorganic_en
2. http://attra.ncat.org/organic.html#list
3. Sarath Chandran, C. (Ed), Thomas, S. (Ed), Unni, M. R. (Ed) (2019). Organic Farming. Springer.
4. https://www.springer.com/gp/book/9783030046569
5. http://www.epa.gov/agriculture/tbio.html

****

SEMESTER XXX

COMPUTER APPLICATIONS IN BIOLOGY

Course Code : XXX **Course: Skill Based Elective**
Hours/Week : 3 **Marks : 25+75=100**
Credit : 2 **Total Hrs: 36**

Objectives:

- To study the basic knowledge and classifications of Computer
- To get knowledge on input and out devices
- To gain knowledge on Operators and expression
- To know about the fundamental of networking
- To understand the bioinformatics tools

Unit - I: **(5 Hours)**

Introduction to Computers: Introduction – Types of Computers – Characteristics of Computers. Generations of Computers - Classification of Computers – Programming Languages: Machine Language – Assembly Language – High level languages.

Unit - II: **(5 Hours)**

Input Devices- Keyboard – Mouse - Types of mice – Connections – Mouse Pad - Trackball – Joystick -Output Devices – Dot Matrix Printer – Inkjet – Laser Printer – LCD and LED Printers– Line Printer Auxiliary Storage Devices : Hard Disk – CD –DVD – primary memory.

Unit - III: **(5 Hours)**

Operators and expression – Evaluation of expressions – Type conversions in expressions – Operator precedence and associatively – Mathematical functions. Managing input and output operations: Reading and writing a character – Formatted input and output.

Unit - IV: **(4 Hours)**

Components of computer - fundamental of networking, internet, intranet, search engines- yahoo, Google, etc. telnet, ftp, introduction to databases.

Unit - V: **(4 Hours)**

Introduction to bioinformatics, scope, biological databases - NCBI, EMBL and DDBJ. Pair-wise sequence analysis, local and global alignment, BLAST and FASTA, DNA sequencing methods. Protein sequencing.

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- The students could have studied the basic knowledge and classifications of Computer.
- They could get knowledge on input and out devices.
- They would gain knowledge on Operators and expression.
- They could know about the fundamental of networking.
- The would understand the bioinformatics tools.

Text Books:

1. Pierluigi Frisco, Marian Gheorghe… in Emergence, Complexity and Computation (2014). Applications of Membrane Computing in Systems and Synthetic Biology. Springer. https://static-content.springer.com/cover/series/10624/book/978-3-319-03191-0.jpg
2. Lou Katz, Cyrus Levinthal (1971). Computer Graphics in Molecular Biology. Springer

References:

1. Lodish.H.Etal 2000 Molecular cell Biology W.H.Freeman & West Company New York.
2. Leon.F.and Lean.M (2004) Fundamentals of Computer Science and communication Engineering Lean Tech World.
3. Parameswaran.R (1997) Computer application in Business, S.Chand & Co., New Delhi.
4. Rajaraman.V (1988) Fundamentals of Computer Practice Prentice Hall of India (P) Ltd. New Delhi.
5. Mittal.C (2003) Fundamentals of Information Technology Pragathi Prakasam, Meerut.

****

SEMESTER XXX

PLANT NANOTECHNOLOGY

Course Code : XXX **Course: Inter Disciplinary Course**
Hours/Week : 3 **Marks : 25+75=100**
Credit : 2 **Total Hrs: 36**

Objectives:

- To study the history and scope of nanometerials
- To get knowledge on bionancomposites
- To gain knowledge on green plastics manufacturing
- To know about the Characterizations of nanoparticles
- To understand the applications of nanotechnology in Agriculture and Food Technology

Unit - I: Nanomaterials for Environmental Protection (5 Hours)

Nano technology processes – Nano Engineering materials for Pollution Prevention, Green Chemistry, Energy efficient resources and materials, Nano technology products- Nanomaterials (nanostructures) Nanodevices and nanosystems. Synthesis of Nanomaterials:

Unit - II: Bionancomposites (5 Hours)

Nano particles and Microorganisms, Microbial Synthesis of Nano materials, Biological Methods for Synthesis of nano-emulsions using bacteria, Fungi and Actinomycetes, Plants based nanoparticle synthesis, Nano composite biomaterials – Fibres, Devices and Structures, Nano Bio systems.

Unit - III: Green Plastics Manufacturing: (4 Hours)

Introduction to commercial plastics and elastomers -Natural Rubber (NR), modified NR and blends -Polyesters from microbial and plant biofactories (polylactic acid and poly hyroxyalkanoates) -Plastics from vegetable oils -Cellulose and starch based materials -Natural fillers, fibers, reinforcements and clay nanocomposites -Biodegradability, life cycle assessment and economics of using natural materials.

Unit - IV: Advanced Characterization Methods: (4 Hours)

Optical Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Scanning Tunneling Microscopy, Optical Absorption and Emission Spectroscopy, Thermo gravimetric Analysis, Differential Scanning Calorimetry, Thermo mechanical Analysis, X-Ray, neutron diffraction.

Unit - V: Nanotechnology in Agriculture and Food Technology (4 Hours)

Nanotechnology in Agriculture -Precision farming, Smart delivery system – Insecticides using nanotechnology – Potential of nano-fertilizers - Nanotechnology in Food industry - Packaging, Food processing - Food safety and biosecurity – Contaminant detection – Smart packaging

Unit - VI: Latest Learning (2 Hours)

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- The students could have studied the history and scope of nanometerials.
- They could get knowledge on bio-nanocomposites.
- They would gain knowledge on green plastics manufacturing.
- They could know about the Characterizations of nanoparticles.
- They would understand the applications of nanotechnology in Agriculture and Food Technology.

Text Books:

1. Pradeep T., A Textbook of Nanoscience and Nanotechnology, Tata McGraw Hill Education Pvt. Ltd., 2012.

2. Hari Singh Nalwa, Nanostructured Materials and Nanotechnology, Academic Press, 2002.

References:

1. Nabok A., Organic and Inorganic Nanostructures, Artech House, 2005.

2. Dupas C., Houdy P., Lahmani M., Nanoscience: Nanotechnologies and Nanophysics, Springer-Verlag Berlin Heidelberg, 2007.

SEMESTER XXX

VERMI-TECHNOLOGY

Course Code : XXX **Course : Inter Disciplinary Course**
Hours/Week : 4 **Marks : 25+75=100**
Credit : 2 **Total Hrs: 48**

Objectives:

- To provide basic understanding of biological, chemical and environmental concepts pertaining to vermin-technology
- To create knowledge on Environmental degradation
- To get the theoretical knowledge on vermin-compost bed preparation
- To create knowledge on Self -Employment Opportunity

Unit - I: **(10 Hours)**

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

Unit - II: **(9 Hours)**

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

Unit - III: **(9 Hours)**

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: **(9 Hours)**

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: **(9 Hours)**

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

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- To students could learn the biology of earthworm and its application.
- They would understand the basic knowledge on vermin-compost bed preparation.
- Graduates could understand has to recycle house made wastes and cattle wastes.
- After completing this course the students could become as entrepreneur.

Text 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.

References:

1. Kalamdhad, Ajay S., Singh, Jiwan, Dhamodharan, Kondusamy (2019). Advances in Waste Management. Springer.
2. Kalamdhad, Ajay S., Singh, Jiwan, Dhamodharan, Kondusamy (2019). Advances in Waste Management. Springer.https://www.springer.com/gp/book/9789811302145
3. Edwards, C. A., Hendrix, P. F., Arancon, N. Q. (2019). Biology and Ecology of Earthworms. Springer. https://www.springer.com/gp/book/9780387749426

****

SEMESTER XXX

PLANT TISSUE CULTURE

Course Code : XXX **Course : Inter Disciplinary Course**
Hours/Week : 4 **Marks : 25+75=100**
Credit : 2 **Total Hrs: 48**

Objectives:

- 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: **(10 Hours)**

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

Unit - II: **(9 Hours)**

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: **(9 Hours)**

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

Unit - IV: **(9 Hours)**

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: **(9 Hours)**

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

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

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.

Text 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

References:

1. Chu, C 1978 Plant Tissue Culture, Peking Science Press, Peking
2. Gamborg O. L and Phillips. G.G. 1975 Plant Cell, Tissue culture and Organ culture Fundamental Methods. Narosa Publishing House, New Delhi.
3. Narayanaswamy, S 1994. Plant Cell and Tissue, Tata –Mc Graw Hill Publishing Co., Ltd., New Delhi.
4. 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.
5. Anis, M. (Ed), Ahmad, N. (Ed) (2016). Plant Tissue Culture: Propagation, Conservation and Crop Improvement. Springer. https://www.springer.com/gp/book/9789811019166

****

SEMESTER XXX

HERBAL BOTANY

Course Code : XXX **Course : Inter Disciplinary Course**
Hours/Week : 3 **Marks : 25+75=100**
Credit : 2 **Total Hrs: 36**

Objectives:

- To study the history and scope of Herbal Medicine
- To get knowledge on Pharmacognosy
- To gain knowledge on Drug adulteration
- To know about the active principles of herbals
- To understand the Medicinal plant banks and their conservations

Unit - I: **(7 Hours)**

Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants.

Unit - II: **(7 Hours)**

Pharmacognosy - systematic position m edicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.

Unit - III: **(7 Hours)**

Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster).

Unit - IV: **(7 Hours)**

Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds)

Unit - V: **(6 Hours)**

Medicinal plant banks micro propagation of important species (*Withania somnifera*, neem and tulsi- Herbal foods-future of pharmacognosy)

Unit - VI: Latest Learning **(2 Hours)**

Latest development related to the Course during the semester concerned (CIA purpose only not for question setting)

Course Outcomes:

- The students could have studied the history and scope of Herbal Medicine.
- They could get knowledge on Pharmacognosy.
- They would gain knowledge on Drug adulteration.
- They could know about the active principles of herbals.
- They could understand the Medicinal plant banks and their conservations.

Text Books:

1. Hildebert Wagner, Rudolf Bauer (2015). Chromatographic Fingerprint Analysis of Herbal Medicines Volume III. Springer.
2. Hildebert Wagner, Rudolf Bauer (2017). Chromatographic Fingerprint Analysis of Herbal Medicines Volume V. Springer
3. Agrawal, Paridhavi (2012). Herbal Drug Technology. Orient Blackswan Private Limited - New Delhi.

References:

1. Ramstad - Modem Pharmacognosy.
2. Biotechnical Applications.
3. Handa S.S. & Kaul. K.L. Supplement to cultivation & utilization of medicinal plants.
4. Gamborg, O.L. and Wetter, L.R., Plant Tissue Culture Methods, National Research Council of Canada, Saskatchewan.
5. HE Street Plant Tissue and Cell Culture, Blackwell Scientific Publication.
6. P.Prave, U.Fause, W. Sittig, and D.A. Sukatsch; Fundamentals of Biotechnology, VCH Publisher.
7. Alan T Bull, Howard Dalton and Murray Mao-Young, Comprehensive Biotechnology. Theprinciples, Application & Regulation of Biotechnology in Industry, Agriculture & Medicine; Vol. 1 to 4
8. Medicinal plants: Alkaloids and Glycosides By Toronto
9. CSIR- Cultivation and Utilization of Medicinal Plants

****