

**GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS)
KUMBAKONAM**

DEPARTMENT OF BOTANY



Programme : B.SC., BOTANY

Programme Code : USB0

SYLLABUS

2020 – 2021 – I YEAR

2021 – 2022 – II YEAR

2022 – 2023 – III YEAR

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS) KUMBAKONAM
(Curriculum – B.Sc., BOTANY – 2021 - 2022)

Department : BOTANY

Programme Code: USBO

SEMESTER – I

Part	Course Type	Course Code	Title of the Course	Hrs/Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
I	LC	U211T1	Tamil	6	3	3	25	75	100
II	ELC	U211E1	English	6	3	3	25	75	100
III	CC – I	U21BOC101	Algae, Fungi and Lichens	6	5	3	25	75	100
III	CC – II	U21BOC102P	Practical II - Algae, Fungi and Lichens(P)	3	2	3	40	60	100
III	AC - I	U211AZ1	Biology of Invertebrates and Chordates	5	4	3	25	75	100
III	AC – II	U212AZ2P	Allied Zoology – Practical II	2	--	--	--	--	---
IV	AEC	U211VE	Value Education	2	2	3	25	75	100
Total				30	19				600

SEMESTER – II

Part	Course Type	Course Code	Title of the Course	Hrs/Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
I	LC	U212T2	Tamil	6	3	3	25	75	100
II	ELC	U212E2	English	6	3	3	25	75	100
III	CC – III	U21BOC203	Microbiology ,Plant Pathology and Plant Protection	6	5	3	25	75	100
III	CC – IV	U21BOC204P	Practical IV- Microbiology, Plant Pathology and Plant Protection(P)	3	2	3	40	60	100
III	AC -II	U212AZ3	General Principles and Applied Zoology	5	4	3	25	75	100
III	AC - III	U212AZ2P	Allied Zoology - Practical II	2	4	3	40	60	100
IV	AEC	U212ES	Environmental Studies	2	2	3	25	75	100
IV	NMC-I	U23NM2LP	Language Proficiency for Employability	2	2	-	-	-	100
Total				32	25				800

SEMESTER – III

Part	Course Type	Course Code	Title of the Course	Hrs/Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
I	LC	U213T3	Tamil	6	3	3	25	75	100
II	ELC	U213E3	English	6	3	3	25	75	100
III	CC - V	U21BOC305	Bryophytes, Pteridophytes, Gymnosperms and Paleobotany	6	5	3	25	75	100
III	CC - VI	U21BOC306P	Practical VI - Bryophytes, Pteridophytes, Gymnosperms, and Paleobotany(P)	3	2	3	40	60	100
III	AC – IV	U213ACH1	Allied Chemistry - I	5	4	3	25	75	100
III	AC – V	U214ACH2P	Allied Chemistry Practical-II	2	--	--	--	--	--
IV	NMEC–I	U21BO3NME1:1	Biofertilizers and Biopesticides.	2	2	3	25	75	100
		U21BO3NME1:2	Laboratory Techniques						
Total				30	19				600
	SSC - I	U213SS1	Mathematics Aptitude for Recruitment Board Examinations	-	2	2	-	100	100

SEMESTER – IV

Part	Course Type	Course Code	Title of the Course	Hrs/Week	Credits	Exam Hrs	Marks			
							CIA	ESE	Total	
I	LC	U214T4	Tamil	6	3	3	25	75	100	
II	ELC	U214E4	English	6	3	3	25	75	100	
III	CC -VII	U21BOC407	Anatomy ,Embryology and Micro technique	5	5	3	25	75	100	
III	CC – VIII	U21BOC408P	VIII – Practical Anatomy, Embryology and Micro technique	3	2	3	40	60	100	
III	AC - IV	U214ACH2P	Allied Chemistry Practical	2	4	3	40	60	100	
III	AC - V	U214ACH3	Allied Chemistry - III	4	4	3	25	75	100	
IV	NMEC– II	U21BO4NME2:1	Horticulture	2	2	3	25	75	100	
		U21BO4NME2:2	Seed Pathology							
IV	SEC – I	U214BOSE1	Mushroom Technology	Theory	1	1	-	20	-	100
				Practical	1	1	2	20	60	
IV	NMEC– II	U23NM4DS	Digital Skills for Employability	2	2	-	-	-	100	
Total				30	25				900	
	SSC – II	U214SS2	Social Study for Competitive Examinations		2	2	-	100	100	

SEMESTER – V

Part	Course Type	Course Code	Title of the Course	Hrs/Week	Credits	Exam Hrs	Marks			
							CIA	ESE	Total	
III	CC – IX	U21BOC509	Cell and Molecular Biology.	5	5	3	25	75	100	
III	CC – X	U21BOC510	Genetics, Biostatistics and Evolution	5	5	3	25	75	100	
III	CC – XI	U21BOC511	Morphology, Taxonomy and Economic Botany	5	5	3	25	75	100	
III	CC – XII	U21BOC512P	Practical XII Cell and Molecular Biology, Genetics, Biostatistics and Evolution, Morphology, Taxonomy and Economic Botany	6	4	3	40	60	100	
III	MBEC – I	U21BO5MBE1:1	Bio-resource and Human Welfare	5	5	3	25	75	100	
		U21BO5MBE1:2	Applied Microbiology							
		U21BO5MBE1:3	Biological Control							
IV	SEC – II	U215BOSE2	Medicinal and applied Botany	Theory	1	1	-	20	-	60
				Practical	1	1	2	20	60	40
IV	SEC –III	U215BOSE3P	Basics of computer Applications - Practical	2	2	2	40	60	100	
Total				30	28				700	

SEMESTER – VI

Part	Course Type	Course Code	Title of the Course	Hrs/Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
III	Core –XIII	U21BOC613	Plant Physiology, Biochemistry and Biophysics.	6	5	3	25	75	100
III	CC – XIV	U21BOC614	Plant Ecology and Conservation.	6	5	3	25	75	100
III	CC – XV	U21BOC615P	Practical XV- Plant Physiology Biochemistry, Biophysics, Plant Ecology and Conservation.	6	4	3	40	60	100
III	MBEC – II	U21BO6MBE2:1	Plant breeding, Landscaping and Horticulture	6	5	3	25	75	100
		U21BO6MBE2:2	Presentation of Fruits and Vegetables						
		U21BO6MBE2:3	Biotechnology						
III	MBEC– III	U21BO6MBE3:1	Plant Biotechnology and Bioinformatics.	5	5	3	25	75	100
		U21BO6MBE3:2	Environmental Biotechnology						
		U21BO6MBE3:3	Plant Tissue Culture						
V	AEC	U216GS	Gender Studies	1	1	3	25	75	100
V		U21EA	Extension Activities	-	1	-	-	-	-
Total				30	26				600
				180	144				4400

COURSE OFFERED BY THE DEPARTMENT OF BOTANY

Part	CourseType	Course Code	Title of the Course	Hrs/Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
III	AC -I	U213AB1	Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms, Taxonomy and Horticulture	5	4	3	25	75	100
III	AC - II	U214AB2P	Allied Botany - Practical II	2	4	3	40	60	100
III	AC – III	U214AB3	Anatomy, Embryology, Physiology and Phytotherapy	5	4	3	25	75	100

I. PROGRAMME OUTCOMES (POS):

PO1: Critical Thinking: Apply the knowledge of biology to make scientific queries and understanding about plant diversity.

PO2: Effective Communication: Successful transfer of scientific knowledge both orally and in writing.

PO3: Practical skills in the field and laboratory experiments.

PO4: Presentation skills (oral & writing) in Botany

PO5: Scientific knowledge in Botany and fundamental metabolism of plants.

PO6: Knowledge about biodiversity exploration, estimation and conservation.

PO7: Effective Citizenship: Responsible for learning, develop honesty in work and respect for self and others.

PO8: Ethics: Convey and practice social, environmental and biological ethics.

PO9: Self-directed and Life-long Learning: study incessantly by self to cope with growing competition for higher studies and employment

II. PROGRAMME SPECIFIC OUTCOMES (PSOS):

PSO1: Educate students in and around Kumbakonam, a prime area of Cauvery Delta, about plant science.

PSO2: Inculcate strong fundamentals on modern and classification aspects of Botany.

PSO3: Build life skills in Edible mushroom cultivation, Biofertilizer production, Greenhouse maintenance and Seed technology through value-added courses.

PSO4: Understand the nature and basic concepts of cell biology, Taxonomy and ecology.

PSO5: Analyse the relationships among plants and microbes.

PSO6: Career opportunities and job opportunities.

PSO7: Create platform for higher studies in Botany.

PSO8: Facilitate students to take-up successful career in Botany.

SEMESTER – I

CORE COURSE- I ALGAE, FUNGI AND LICHENS

Theory Hours : 6	Course code: U21BOC101
Practical Hours :-	Credit:5
Exam Hours : 3	Marks:100

Objectives:

1. To study the classification, ecology, distribution, morphology, life-cycle and economic importance of Algae and Fungi.
2. To study the classification, ecology, distribution, morphology, life-cycle and economic importance of Bryophytes
3. To impart knowledge on distribution, classification, structure, physiology, reproduction and function of lichens and significance of ectomycorrhiza and endomycorrhiza.

Unit I Algae

General characteristics of various divisions; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae (F. E. Fritsch); alternation of generation, Economic importance Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Diatoms*, *Ectocarpus*, *Dictyota*, *Polysiphonia*. Economic importance of algae.

Unit II Fungi

General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification (Alexopolous, 1962);

Unit III

True Fungi – General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota) *Penicillium*, *Alternaria* (Ascomycota), *Puccinia*, *Agaricus*(Basidiomycota); Economic importance.

Unit IV Lichens

Symbiotic Associations – Lichens: General account, occurrence, thallus organization, classification, structure, physiology, reproduction, and role in environmental pollution and uses; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.

Unit V Economic importance of Algae, Fungi and Lichen

- A) **Algae** - Algae as food and source of phycocolloid (Agar-agar, Algin, Carrageenan), Diatomite, Algal parasites and Algal blooms. Potential of microalgae for SCP, β -carotene, Biodiesel.
- B) **Fungi** - Fungi as food, medicines, growth regulators (GA), industrial application (enzyme production), agriculture application of *Mycorrhizae*, decomposers, harmful effects (Food spoilage, Mycoses).
- C) **Lichens** - Economic importance – food, Ecological importance - role in succession and indicator of pollution.

Unit VI (Not for Semester Examination)

Current trends in plant diversity, anthropogenic effects on plant distribution, food and medicinal values of algae, environmental monitoring effect of lichens, biomass and biofuel production.

Books:

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). *Introductory Mycology* (4th edition). John Wiley and Sons (Asia), Singapore.
2. Kumar, H.D. (1999). *Introductory Phycology* (2nd edition). Affiliated East-West Press Pvt. Ltd. Delhi.
3. Pandey, B.P. (2001). *College Botany Vol. I:Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta*. S. Chand & Company Ltd., New Delhi.
4. Sambamurthy, A.V.S.S. (2006). *A Textbook of Algae*. I.K. International Pvt. Ltd., New Delhi.
5. Sethi, I.K. and Walia, S.K. (2011). *Text book of Fungi & Their Allies*. MacMillan Publishers Pvt. Ltd., Delhi.
6. Tortora, G.J., Funke, B.R., Case, C.L. (2010). *Microbiology: An Introduction* (10th edition). Pearson Benjamin Cummings, U.S.A.
7. Vashishta, B.R. (1990). *Botany for Degree Students: Fungi*. S. Chand & Company Ltd., New Delhi.
8. Vashishta, B.R., Sinha, A.K. and Singh, V.P. (2008) *Botany for Degree Students: Algae*. S. Chand & Company Ltd., New Delhi.

Course Outcomes:-

Students could be able to

1. Acquire knowledge about the general Characteristics cell, structure and nutritional types of bacteria.
2. Identify the morphology and life cycles of different algae.
3. Describe the general characteristics thallus organization, nutrition, reproduction and life cycles of various fungi.
4. Understand the symbiotic association of lichens, it the thallus organization structure, reproduction and uses.
5. Learn about the economic importance of algae, fungi, bryophytes and lichen

U.G Question pattern (SEM: 75 mark +CIA: 25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

CORE – II (PRACTICAL)
PRACTICAL - I : ALGAE, FUNGI AND LICHENS

Theory Hours : -
Practical Hours :3
Exam Hours : 3

Course code: U21BOC102P
Credit:3
Marks:100

Objectives:

1. Study about the microbiological techniques and tools.
2. To study about bacteria structure and Reproduction and types.
3. To know about that Morphology of algae and Reproduction and types.
4. Study about the Morphology structure and Reproduction of fungi.

Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Diatoms*, *Ectocarpus*, *Dictyota* and *Polysiphonia* through temporary preparations and permanent slides.

Rhizopus and *Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.

Alternaria: Specimens/photographs and tease mounts.

Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.

Agaricus: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.

Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)

Display of Photographs and news paper clippings related with economic important of algae, fungi and lichens as spotters (SCP capsules, biofertilizer pocket, agar stripes, antibiotics vials, photographs of VAM, food spoilage, mycoces, lichen specimens and photographs, photos of different kinds of pollution)**Field visit**

1. Make suitable micropreparations and identify the fungal diseases mentioned theory with due emphasis on symptoms and causative organisms.
2. A detailed study of diseased specimens included in the theory.
3. Identification of various economic products mentioned in the syllabus.

Course Outcomes:-

Students could be able to

1. identify vegetative and reproductive structures of some algae through temporary preparations and slides.
2. Differentiate, the fungi such as *Rhizopus*, *penicillium*, *Alternaria*, *Puccinia*, *Agarecus* through slides, specimens, photographs, Herbariums and mounts.
3. Illustrate the different growth forms of lichens (Crustose, foliose and fruticose)
4. Distinguish the types of mycorrhiza – Ectomycorrhiza, and endomycorrhiza through photographs.

U.G Question Paper Patten (SEM: 60 Mark+ CIA: 40 Marks=Total: 100 marks)

CORE COURSE - III
MICROBIOLOGY & PLANT PATHOLOGY AND PLANT PROTECTION

Theory Hours : 6	Course code: U21BOC203
Practical Hours :-	Credit:5
Exam Hours : 3	Marks:100

Objectives:

1. To understand plant pathogenesis, classification and host-parasite interaction.
2. To study plant diseases in crops and their management, significant contributions of plant pathologists and usage of various techniques in plant protection.
3. To impart knowledge on distribution, classification, structure, physiology, reproduction and function of lichens and significance of ectomycorrhiza and endomycorrhiza.

Unit I Bacteriology

Bacteria – Discovery, General characteristics and cell structure; Nutritional types of bacteria (based on carbon, nitrogen and energy sources); Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); techniques in sterilization, bacterial culture and staining (simple and differential); Economic importance.

Unit II Virology

Viruses – Discovery, general structure, Symptoms of virus infection in plants; transmission of plant viruses; genome organization, replication of plant virus (tobacco mosaic virus); techniques in plant viruses – purification; structure and multiplication of bacteriophages; structure and multiplication of viroids. Economic importance.

Unit III

Plant Pathology: Classification of plant diseases based on; (a) Major causal agents - biotic and abiotic, (b) General Symptoms. Process of infection and pathogenesis, Study of plant diseases with respect to symptoms, causal organism, disease cycle and their management:(a) Cereals: Rice – blast disease; (b) Vegetables: Brinjal – Little leaf; (c) Fruits: Banana – bacterial leaf blight, Citrus – bacterial canker; (d) Oil seeds: Groundnut – Tikka disease; (e) Sugar yielding: Sugarcane - red rot, f) insect - Crown gall

Unit IV Plant Protection and Disease management

Scope, Importance, equipments and techniques used in plant protection Traditional and modern methods of seed treatment. Soil sterilization: Objectives, Traditional and modern methods of soil sterilization. Chemical means of disease control: Fungicides - Definition, classification, characters of an ideal fungicide; antibiotics and nematicides. Biological Control of Plant Diseases– Definition, Importance, Biological control agents and their role in plant disease control, IPM

Unit V Methods of Plant Protection

- a) Cultural – Tillage, sowing and planting dates, crop hygiene, crop rotation, trap crops, fertilizer.
- b) Mechanical – Field sanitation: For diseases – collection and destruction of diseased plant-debris; For pests – hand picking and destruction of egg masses; shaking of plants, rope

dragging, netting, bagging, physical barriers, use of sticky bands, tin-bands and light traps.

- c) Physical – Heat and soil solarizations.
- d) Chemical– Brief account and uses of Bactericides, Fungicides, Insecticides, Nematicides, Acaricides, Molluscicides, Rodenticides and Herbicides.
- e) Biological– Introduction, biological control of Insect pests and diseases
- f) Legal (Plant Introduction, domestic quarantine, need of plant quarantine) quarantine in India

Unit VI (Not for Semester Examination)

Current trends in plant diseases of India, weed and weed management, IPM, antimicrobial assays, Hospital prone infections, Allelopathic effects of weeds, tools and methods in plant protection

Books:

1. Bap Reddy, D. and Joshi, N.C. (1991). *Plant Protection in India* (Second Edition). Allied Publishers Ltd., New Delhi.
2. Bilgrami, K.S. and Dubey, R.C. (1985). *Text book of Modern Plant Pathology*. Vikas Publishing House Private Limited, New Delhi.
3. Mehrotra, R.S. (2003). *Plant Pathology* (Second edition). Tata McGraw-Hill Education, New Delhi.
4. Pandey, B.P. (2001). *Plant Pathology*. S. Chand & Company Limited, New Delhi.
5. Rangasami, G. and Mahadevan, A. (1998). *Diseases of Crop Plants in India*. Prentice Hall of India Ltd. New Delhi.

Course Outcomes:-

Students could be able to

1. Get more knowledge about the history and importance of plant pathology.
2. Realize the classification of plant diseases its symptom, process of infection and pathogenesis.
3. Understand the various types of chemical and biological control of plant diseases.
4. Identify the symptoms, causal organism, disease cycle and their management in some plant diseases.
5. Know the contribution of Indian plant pathologists and various research institutes.
6. Learn about the scope, importance and equipments used in plant protection.
7. Describe the objectives and methods of seed treatment and soil sterilization.
8. Understand the different techniques and methods of plant protection.

U.G Question pattern (SEM: 75 mark +CIA: 25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

CORE –IV (PRACTICAL)
MICROBIOLOGY & PLANT PATHOLOGY AND PLANT PROTECTION (P)

Theory Hours :-
Practical Hours :3
Exam Hours : 3

Course code: U21BOC214P
Credit:3
Marks:100

Objective:-

1. Students to learn about the plant pathology and plant protection
2. To learn identify the plants disease.
3. To know plant protection Equipment like Sprayer, dusters

Tools and equipments used in microbiology: Spirit lamp, Inoculation loop, Hotair oven, Autoclave, Pressure cooker, Laminar air flow chamber, Incubator, etc.

Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.

EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.

Preparation of Nutrient Agar, Agar plates, Slants, Potato Dextrose Agar medium – PDA

Sterilization of Glassware and Media

Isolation of Bacteria, Fungi from Soil and water samples

Isolation of Pure Cultures of Bacteria by streak, Pour and Spread plate Techniques

Microscopic Observation of Bacteria, yeast and Molds using permanent slides

Motility of Bacteria – Hanging Drop Technique

Simple (Methylene Blue) and Differential Staining (Gram Stain) of Bacteria

Viable count of Bacteria by serial Dilution Technique

Dye Reduction test for assessing the quality of Milk

Plant protection

Observation of crop plants infected by the pathogens included in the syllabus and study of symptoms, causative agents and etiology.

Tools and techniques in plant disease management

Field visit

4. Make suitable micropreparations and identify the diseases mentioned theory with due emphasis on symptoms and causative organisms.
5. A detailed study of diseased specimens included in the theory.
6. Identification of various plant protection appliances mentioned in the syllabus and their working mechanism.

Course Outcomes:-

Students could be able to

1. Identify the various tools and equipments used in microbiology
2. Realize the various types of bacteria and viruses through photographs and slides.
3. Get the clear identification of vegetative and reproductive structures of some algae through temporary preparations and slides.

4. Differentiate, the fungi such as *Rhizopus*, *penicillium*, *Alternaria*, *Puccinia*, *Agarecus* through slides, specimens, photographs, Herbariums and tease mounts.
5. Illustrate the different growth forms of lichens (Crustose, foliose and fruticose)
6. Distinguish the types of mycorrhiza – Ectomycorrhiza, and endomycorrhiza through photographs.
7. Analyse the various plant diseases – Rice – Blast disease, Brinjal – Little leaf, Banana – bacterial leaf blight, Citrus – Bacterial canker, Groundnut – Tikka disease (&) Sugarcane – red rot, through specimens, spotters and herbariums.
8. Identify the various plant protection appliances – sprayers, dusters, soil injector, seed dressing drums through photographs and models.

U.G Question Paper Patten (SEM: 60 Mark+CIA:40Marks=Total:100 marks)

CORE COURSE- V

BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

Theory Hours : 6

Practical Hours :-

Exam Hours : 3

Course code:U21BOC305

Credit:5

Marks:100

Objectives:

1. To understand the salient features of Bryophytes, Pteridophytes and Gymnosperms.
2. To study the structure and reproduction of various genera mentioned in the syllabus.
3. To understand the salient features and importance of fossils and fossilization process in tracing evolution.

Unit I Bryophytes-General Characteristics, Classification – Liverworts (Stotler *et al.*, 2009), hornworts (Renzaglia *et al.*, 2009) and Mosses (Goffinet *et al.*, 2009); Morphology, Structure, Reproduction and life history of the following genera: *Riccia*, *Marchantia*, *Anthoceros*, *Polytrichum* and *Funaria*.

Unit II Pteridophytes– General characteristics and classification by Smith; Morphology, Structure, Reproduction and life-history of the following genera: *Psilotum*, *Lycopodium*, *Selaginella* and *Equisetum*.

Unit III

Morphology, structure, Reproduction and life-history of *Adiantum*, *Marsilea*; Stellar evolution in Pteridophytes; Heterospory and origin of seed habit.

Unit IV

Gymnosperms– General characteristics and classification of Gymnosperms by Sporne; Morphology, structure, mode of reproduction and life-history of the following genera:*Cycas*, *Pinus* and *Gnetum*.

Unit V

Paleobotany– fossils and methods of fossilization – Geological time–scale – an elementary knowledge of the computation of the age of fossils – Radio-Carbon dating technique. Contributions of Birbal sahani. A brief study of the following fossil plants:

- a) *Rhynia*, b) *Lepidodendron*, c) *Pentoxylon* and d) *Williamsonia*.

Unit VI (Not for Semester Examination)

Current trends in plant diversity, evolution of wood in gymnosperm, fossil evidences in Tamilnadu and India and keeladi paleontological study, Autoradiography, carbon dating, geological studies related to botany

Books:

BRYOPHYTES

1. Chopra, R.N. and Kumara, P.K. (1988). *Biology of Bryophytes*. Wiley Eastern Ltd., New Delhi.
2. Jeyaraman, (1978). *Indiyavinliverwortugal* (In Tamil). Tamil Nadu Textbook society, Madras.
3. Palaniyappan, S. (1988). *Bryophyta* (In Tamil). T.K. Publishing House, Chennai.
4. Prem, P. (1981). *Bryophytes: Morphology, Growth and differentiation*. Atma Ram and Sons, New Delhi.
5. Rashid, A. (1998). *An Introduction to Bryophyta*. Vikas Publishing House (P) Ltd., New Delhi.
6. Smith, G.M. (1955). *Cryptogamic Botany Vol. II Bryophytes and Pteridophytes*(2ndedn.). Tata McGraw Hill Publishing Co., New Delhi.
7. Srivastava, N.N., (1996). *Bryophyta*. PradeepPrakashan, Meerut.
8. Vashista, B.R. (1983). *Botany for Degree Students – Bryophyta*. S. Chand and Company Ltd., New Delhi.

PTERIDOPHYTES

1. Rashhed, A. (1999). *An Introduction to Pteridophyta*. Vikas Publishing House (P) Ltd., New Delhi.
2. Sharma, O.P. (1990). *Textbook of Pteridophyta*. MacMillan India Ltd., New Delhi.
3. Smith, G.M. (1955). *Cryptogamic Botany Vol. IIBryophytes and Pteridophytes* (2ndEdn.). Tata McGraw-Hill Publishing Co., New Delhi.
4. Sporne, K.R. (1970). *The Morphology of Pteridophytes* (The Structure of Ferns and Allied Plants). Hutchinson University Library, London.
5. SundaraRajan, S. (1994). *Introduction to Pteridophyta*. New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi.
6. Vashista, P.C. (1997). *Botany for Degree StudentsPteridophyta*. S. Chand and Company Ltd., New Delhi.

GYMNOSPERMS

1. Bhatnagar, S.P. and Alok M. (1997). *Gymnosperms*. New Age International (P) Ltd., Publisher, New Delhi.
2. Coulter, J.M. and Chamberlain, C.J. (1964). *Morphology of Gymnosperms*. Central Book Depot, Allahabad.
3. Sharma, O.P. (1997). *Gymnosperms*. PragatiPrakashan, Meerut.
4. Sporne, K.R. (1971). *The Morphology of Gymnosperms* (The Structure and Evolution of Primitive seed Plants). Hutchinson University Library, London.
5. Srivastava, H.N. (1998). *Gymnosperms*. Pradeep Publications, Jalandhar.
6. Vashishta, P.C. (1996). *Botany for Degree Students-Gymnosperms* (2ndEdn.,). S. Chand and Company Ltd., New Delhi.

PALEOBOTANY

1. Delavoryas, T. (1962). *Morphology and Evolution of Fossil Plants*. Holt, Rinehart and Winston, New York.
2. Scott, D.H. (1962). *Studies in Fossil Botany* (Vol.I and Vol.II). Hafner Publishing Co., New York.
3. Seward, A.C. (1959). *Plant Life Through the Ages*. Hafner Publishing Co., New York.
4. Shukla, A.C. and Misra, S.P. (1975). *Essentials of Paleobotany*. Vikas Publishing House (P) Ltd., New Delhi.
5. Stewart, W.N. (1983). *Paleobotany and the Evolution of Plants*. Cambridge University Press, Cambridge, London.
6. Venkatachala, B.S., Shukla, M. and Sharma, M. (1992). *Plant Fossils-a Link with the Past (A BirbalSahni Birth Centenary Tribute)*. BirbalSahni Institute of Paleobotany, Lucknow.

Course Outcomes:-

Students could be able to

1. Describe the general characteristics and classification of liver worts and mosses
2. Understand the morphology, reproduction and life – history of the following genera,
1. Riccia 2. Marchantia 3. Anthoceros and polytrichum.
3. Explain the general characteristics and classification of pteridophytes by Smith.
4. Learn more about the structure, reproduction and life history of the following genera:-
1. Psilotum 2. Lycopodium 3. Selaginella 4. Equisetum 5. Adiantum and 6. Marsilea
5. Acquire knowledge about stellar evolution in pteridophytes, Heterospory and origin of seed habit.
6. Know the general characteristics and classification of Gymnosperms by Sporne.
7. Realize morphology, mode of reproduction and life history of the following genera :-
1. Cycas 2. Pinus 3. Gnetum.
8. Analyse the types of fossils and methods of fossilization.

U.G Question pattern (SEM: 75 mark +CIA: 25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

CORE – VI (PRACTICAL)
BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

Theory Hours :-
Practical Hours :3
Exam Hours : 3

Course code: U21BOC306P
Credit:3
Marks:100

Objectives:

1. To learn about bryophytes, its classification, morphology and reproduction.
2. To study the pteridophytic plants classification, morphology and reproduction.
3. To learn about to demonstrate the plant section Eg- sorus, stem, cone, rachis.

BRYOPHYTES

Riccia - Thallus –T.S, antheridium, archegonium and capsule- L.S
Marchantia -Thallus –T.S, antheridium, archegonium and capsule- L.S
Anthoceros - Antheridium, archegonium and sporophyte
Polytrichum - Rhizome, stem and leaf -T.S, antheridium, archegonium and capsule- L.S

PTERIDOPHYTES

Psilotum - Demonstration only
Lycopodium - Stem and Cone only
Selaginella - Stem and Cone only
Equisetum - Stem, cone slide Demonstration only
Adiantum - Rachis, Sorus
Marsilea - Stem, Sporocarp slides

GYMNOSPERMS

Cycas Rachis, Leaflet – T.S.; Coralloid root, male cone
microsporophyll, Megasporephyll – Demonstration only
Pinus - Needle –T.S., Young stem – T.S.;
Male & Female cone – Demonstration only
Gnetum - Stem – T.S.;
Male & Female Strobilus – Demonstration only

PALEOBOTANY

Rhynia, *Lepidodendron*, *Lepidocarpon*, *Calamites* (slides), *Williamsonia*

Course Outcomes:-

Students could be able to

1. Observe the following Bryophytes - *Riccia*, *Marchantia*, *Anthoceros* and *Polytrichum* through specimens and slides
2. Identify the stems and cones of pteridophytes – 1.*Psilotum* 2.*Lycopodium*
3. *Selaginella* 4.*Equisetum* 5. *Marsilea* and 6. *Adiantum*. Sorus of *Adiantum* through slides and specimens.
3. Identify the Rachis, Coralloid root, Leaf let, Needle, Young stem, T.S of *cycas*, *pinus* and *gnetum* through slides.
4. Analyse the male and female cones, of *Cycas*, *Pinus* and *Gnetum*.
5. Identify the following genera come under paleobotany - **Ryinea**, **Lepidodentron**, **Lepidocarpon**, *Calamites* and *William Sonia* through slides and models.
6. Compare the primary structure of root, stem and leaf in Dicots and monocots through slides.
7. Differentiate the anomalous secondary growth in dicot and monot stems through slides
8. Deseect the embryo from a plant – *Tridax*
9. Identify the structure and development of anther and ovules through slides.

U.G Question Paper Patten (SEM:60 Mark+CIA:40Marks=Total:100 marks)

NON-MAJOR ELECTIVE I
1.BIOFERTILIZERS AND BIOPESTICIDES

Theory Hours :2
Practical Hours :-
Exam Hours : 3

Course code: U21BO3NME1:1
Credit:2
Marks:100

Objectives:

1. To understand the basics of biofertilizers and their cultivation
2. To study about mycorrhiza and their isolation and production
3. To impart knowledge on pesticides and their control by biopesticides, including their production and commercialization.

Unit I

Biofertilizers – Definition, kinds of microbes as biofertilizers, Rhizobium-legume Symbiotic association – mass cultivation and carrier materials.

Unit II

Cultural method of *Azospirillum*, *Azotobacter*, *Azolla* and *Anabaena*, carrier materials.

Unit III

Mycorrhiza– VAM association, types, isolation and inoculum production.

Unit IV

Pesticides – Introduction – Biological Magnification concept. Biopesticides – Viral origin, fungal origin.

Unit V

Biopesticides – Bacterial origin, *Bacillus thuringiensis* mechanism of action and application. Advantages of biopesticides and commercialization.

Books:

1. SubbaRao, N.S. (2000). *Soil Microbiology*. Oxford and IBH Publishing Co. Ltd., New Delhi.
2. Varma, A. and Hock, B. (1995). *Mycorrhiza*. Springer-Verlag, Berlin.
3. Wicklow, D.T. and Soderstrom, B.E. (1997). *Environmental and Microbial Relationships*. Springer-Verlag, Berlin.
4. YaacoVokan (1994). *Azospirillum/Plant Associations*. CRC Press, Boca Raton, FL.

Course Outcomes:-

Students could be able to

1. Learn the biofertilizers and kinds of microbes used as biofertilizers
2. Acquire knowledge about the rhizobium – legume symbiotic association – mass cultivation and carrier materials used in soil inoculum.
3. Understand the cultural methods of various biofertilizers – *Azospirillum*, *Azotobacter*, *Azolla* and *Anabaena*.
4. Describe the types of micorrhiza, Isolation and inoculum production.
5. Differentiate the pesticides and biopesticides
6. Realize the biopesticides – viral, fungal and bacteria origin, mechanism of action and application.
7. Explain the advantages of bio-pesticides and commercialization.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Five Question (Two Question from each unit –Either or type)	5×15=75 marks
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2. LABORATORY TECHNIQUES

Theory Hours :2	Course code: U21BO3NME1:2
Practical Hours :-	Credit:2
Exam Hours : 3	Marks:100

Objectives:

- To make the students to understand the various techniques and engage themselves in self-employment.

Unit I : Preservation of plant materials Fixation, Stains, preparation of medium for culture, PDA, MS Media.

Unit II : Sectioning of plant material Hand sectioning, microtome sectioning. Double staining, Permanent and semi permanent mounts.

Unit III : Extraction and purification methods Batch extraction, solvent extraction, filtration- Electrophoresis principles and techniques of Agarose and SDS-PAGE.

Unit IV : Cytochemical test for identification of proteins, lipid, starch & sugar in plant tissues. Suspension culture, callus culture ue of rotary shakers.

Unit V : Biostatistics Mean, Median, Mode, Standard deviation, Standard error, Student test and Chisquare test.

Books for Reference:

1. Berlyn, G.P., Botanical Microtechniques and Cytochemical, M/S. IBD Publisher and Distribution.
2. Khanirjan, A., Fundamentals of Biostatistics, M/S. IBD Publishers, New Delhi.
3. Srivastava Meena, (2007). Principles of Laboratory Techniques and Methods, IBD Publishers, New Delhi.
4. Jayaram, J., (1988). Techniques in Biology A College level study.
5. Johansen, Laboratory Techniques. 6. Jensen, W.A., (1962) Botanical Histochemistry, Tata McGraw Hill.
6. Harborne, J.B., Phytochemical Methods, International Book Dist., Dehradum. 8. Sass, J.E., (1958). Botanical Microtechnique, State College Press Amer. IOWA.

Course Outcomes:-

Students could be able to

1. Understand the various Laboratory Techniques

U.G Question pattern (SEM: 75 mark +CIA: 25 mark =Total:100 marks)

Five Question (Two Question from each unit –Either or type)	5×15=75 marks
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ALLIED BOTANY –PAPER –I
SEMESTER:III-ALGAE, FUNGI, BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS,
TAXONOMY AND HORTICULTURE

Theory Hours : 4	Course code: U211AB1
Practical Hours :-	Credit:
Exam Hours : 3	Marks:100

Objectives:

- 1.To understand the structure, reproduction, characters and economic importance of Various Algal species.
- 2.To study the classification, ecology, distribution, morphology, life cycle and economic importance of Fungi.
- 3.To import knowledge on distribution, classification, structure and pteridophytes.
- 4.To study the classification, Binomial Nomenclature, distribution, Morphology and economic importance of Angiosperms.

Unit :I Algae

General Characters, Structures, Life Cycles and Economic Importance of the following Genera: Volvox, Ectocarpus, Chara and Polysiphonia.

Unit:II Fungi

General Characters, Structure and Life Cycle and Economic Importance of the following Genera:-Albugo, Penicillium, Polyporus and Collectotrichum.

Unit:III Bryophytes, Pteridophytes, Gymnosperms

General Characters ,Structure, Reproduction and Life Cycle of following genera: Bryophytes, Funaria, Pteridophytes-Lycopodium,Gymnosperms-Cycas.

Unit:IV Taxonomy of Angiosperms

General Characters of Taxonomy, Binomial Nomenclature, Outline of Bentham Hookers system of Classification. Study of the following families and their economic Importance. **Rutaceae,Leguminaceae, Cucurbitaceae, Apocynaceae, Lamiaceae, Euphorbiaceae and Poaceae.**

Unit:V Horticulture

Importance of Horticulture, propagation method of Horticultural plants-cutting, layering, grafting, preservation method of fruits. Indoor and terrace gardening, Lawn making, Bonsai.

Reference:-

- 1 .VashistaB.R.1981 Botany for degree students S. Chand & company Ltd., Ram Nagar. New Delhi-110055.
- 2 .Gilbert M.Smith:1986 Cryptogamic botany-Volume I Algae and Fungi. Tata McGraw- Hill publishing Company Ltd., New Delhi.
- 3 .Annie Ragland;1998-1999.Algae and Bryophytes. Saras publication.Kanyakumari-Dt 629002.
4. Parihar. N.S 1982 An Introduction to Embryophyta, Volume –I Bryophytes. Central Book

Depot. Allahabad.

- 5 .Fritish F.E.1956 The structure and reproduction of the Algae, Volume –II. Cambridge, At thre University Press.
6. The text Book of Algae. Venkateswaralu. V. The Hindu college, Masulipatiam 1975.
- 7 .Parihar .N.S. 1981 An Introduction to Embryophyta volume – II Pteridophytes. Central Book Dept. Allahabad.
8. Maheshwari. P. 1975 An Introduction to the Embryology of Angiosperms Tata McGraw – Hill Publishing Company Ltd., Bombay-New Delhi.
9. Singh .V. and D. K. Jain 1997 Taxonomy of Angiosperms.
10. Jhon M. Coulter and Chamberlaid, Central book depot Allahabad.
- 11.Vasishta- P.C. 1981. Botany for degree students volume –V.S. Chand & Company, Ltd., Ram Nagar, New Delhi-110055.
12. Divya Darshan Pant 1973.Cycas and the Cycadales. Central Book Depot. Allahabad.
13. Alexopoulos. C.J. and C.W.Mins.1986 Introductory Mycology Wiley Eastern Limited.
14. Robinson. R.K. Ecology of Fungi 1967.The English University press Limited.

Course Outcome:-

Students could be able to

1. To acquire basic knowledge on classification of plants.
2. Study the Morphology and Taxonomy of various plants.
3. To acquire knowledge on differences between the functions of various plants.
4. Study the salient features of all species of plant kingdom.
- 5.To learn about the economic importance of algae and fungi.
- 6.Study about the morphology and reproduction of bryophyte, pteridophyte and gymnosperms plant.
- 7.Identify the plants name and families name by using the plant character
8. Study the cutting, layering and grafting.

U.G Question pattern (SEM: 75 mark +CIA: 25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

ALLIED PRACTICAL – II

Theory Hours :-
Practical Hours :3
Exam Hours : 3

Course code:
Credit:
Marks:100

Objectives:

1. Students to learn about the Taxonomy of plants.
 2. To practice identification of families and plants name.
 3. To learn to practice about plant physiological Experiment
- ❖ To describe in technical terms plants belonging to any of the families prescribed and identify the family
 - ❖ To make dissection of the flower and construct floral diagrams
 - ❖ To make suitable microscopic preparation, description and identification of cryptogams gymnosperms and Angiosperms, Examples for anatomy and ecology included in the syllabus.
 - ❖ To submit a record of work done by the candidate during the course of study in practical classes, duly certified and bona fide.
 - ❖ To describe simple experimental setups in plant physiology.

List of Experiments in Plant physiology;

- Osmosis.
- Root pressure experiment.
- Bell Jar experiment.
- Ganong's Photometer
- Transpiration Pull experiment.
- Ganong's light screen experiment.
- Photosynthesis experiment.
- Kinostat.
- Ganong's respiroscope

Course Outcome:-

Students could be able to

1. Study about Taxonomy of the given families in syllabus.
2. To identify the plants and make suitable plant section.
3. Learn to make plant section preparation.
4. To study about the plant physiology and its experiments.
5. Experiments –Osmosis ,Root pressure experiment.
6. To know about working mechanism of Ganongs photometer.
7. Practice about the experiment Bell Jar and Transpiration pull experiment.
8. Working mechanism of Ganong's Respiroscope.

U.G Question Paper Pattern (SEM:60 Mark+CIA:40Marks=Total:100 marks)

CORE COURSE -VII
ANATOMY, EMBRYOLOGY AND MICROTECHNIQUE

Theory Hours :6	Course code :U21BOC407
Practical Hours :-	Credit:3
Exam Hours : 3	Marks:100

Objectives:

1. To inculcate the basics of tissues and anatomical features of plants.
2. To impart the knowledge about the various aspects of morphogenesis.
3. To understand the key aspects of embryology of Angiosperms.

Unit I

Anatomy: Plant tissue– classification, Meristems, definition, differentiation, redifferentiation and dedifferentiation. Classification of meristems- apical meristems and lateral meristems intercalary meristem, various Concepts of apical meristem theories, apical cell theory, Tunica – Corpus and Histogen theory.

Unit II

Epidermal tissue system, stomatal types. Permanent tissue – simple – Parenchyma, collenchyma and sclerenchyma. Complex Permanent Tissues: Xylem – Components, Ontogeny and Phylogeny; Phloem – Components, Ontogeny and Phylogeny. Laticifer types.

Unit III

Primary structure of root, stem and leaf in dicots and monocots. Normal Secondary growth in stem and root-annual rings – heart Wood, sapwood. Periderm formation.

Anomalous secondary growth in dicot stems: *Nyctanthes* and *Boerhaavia* and monocot stem-*Dracaena*. Nodal anatomy – uni and trilacunar types.

Unit IV

Embryology – Structure and development of anther. Microsporogenesis; Microgametogenesis; Ultrastructure of pollen wall – structure, development and types of ovules, megasprogenesis, Megagametogenesis (*Polygonum* type of embryosac development), Fertilization. Endosperm types, Development of embryo – dicot and Monocot. Basic concepts of apomixis, apospory, Polyembryony and Parthenogenesis

Unit V Microtechniques

Micrometry, Fixation, dehydration, embedding, hand sectioning, microtome sectioning, stain types, staining and mounting. Preparation of double staining using saffranin and fast green. whole mounts, temporary mounts, maceration and epidermal peeling.

Unit VI (Not for Semester Examination)

Current trends in histological studies, Microphotography, measuring cell size, leaf thickness, advances in microscopic techniques, anatomy in relation to plant taxonomy, advances and disadvantages of parthenocarpy

Books:**ANATOMY**

1. Cutter, E.G. (1978). *Plant Anatomy Part-I: Cells and Tissues* (2ndEdn.), *Plant Anatomy Part-II: Experiments and Interpretations*. Edward Arnold, London.
2. Esau, K. (1965). *Vascular Differentiation in Plants*. Holt, Rinehart and Winston, New York.
3. Esau, K. (1980). *Plant Anatomy* (2nd Edition). Wiley Eastern Ltd., New Delhi.
4. Fahn, A. (1997). *Plant Anatomy*. Pergamon Press, Oxford.
5. Foster, A.S. (1960). *Practical Plant Anatomy*. Van Nostrand and East–West Press, New Delhi.
6. Govindarajulu, A. (1980). “*Marangal*” (*Trees*) (In Tamil). Tamilnadu Textbook Society, Chennai.
7. Krishnamurthy, K.V. (1980). *Wood*. Tetrahedron Publications, Tiruchirappalli.
8. Vasishta, P.C. (1977). *A Text Book of Plant Anatomy*. S. Nagin and Co., New Delhi.

EMBRYOLOGY

1. Bhojwani, S.S. and Bhatnagar, S.P. (2000). *The Embryology of Angiosperms*. Vikas Publishing House (P) Ltd., UBS Publisher’s Distributors, New Delhi.
2. Johri, B.M. (1982). *Experimental Embryology of Vascular Plants*. Springer –Verlag, Heidelberg.
3. Maheswari, P. (1985). *An Introduction to the Embryology of Angiosperms*. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Maheswari, P. (1963). *Recent Advances in the Embryology of Angiosperms*. International Society of Plant Morphologists, University of Delhi.
5. Rogland, A. (2000). *Developmental Botany (Embryology of Angiosperms)*. Saras Publications, Nagercoil.
6. Swamy, B.G.L. and Krishnamoorthy, K.V. (1980). *From Flower to Fruit*. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Course Outcomes:-

Students could able to

1. Distinguish the various types of tissue system and stomata types.
2. Identify the primary structures of roots, stem, and leaf in dicots and monocots.
3. Acquire more knowledge about the normal secondary growth in stem and root.
4. Differentiate the annual rings and periderm formation.
5. Compare the anomalous secondary growth in dicot stem and monocot stem.
6. Learn the structure and development of anther, pollen wall and ovules.
7. Understand the types of ovules and Endosperms.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

CORE –VIII (PRACTICAL)
ANATOMY, EMBRYOLOGY AND MICROTECHNIQUE

Theory Hours :-
Practical Hours :3
Exam Hours : 3

Course code: U21BOC408P
Credit:3
Marks:100

Objective:

1. To study about plant anatomy and embryology.
2. To practice cross section for monocot stem, root, leaf and dicot stem, root and leaf.
3. To learn about the structure and development of ovule and anther.
4. To study about types of ovule and mature anther.
5. To study understand the polygonal type of embryosac.

ANATOMY

Cross section of monocot root, stem, leaf

Cross section of dicot root, stem, leaf and microscopic observation of anomalous secondary growth in monocot and dicot stems through slides

Nodal anatomy (*Uni-Justicea*, *Tri-Azhadirecta* and *Multi-Aralea*)

Stomatal studies

EMBRYOLOGY

Identify the structure of development of Anther and Ovules through slides.

Dissect the flower buds and observe the embryo.

1. To dissect out and mount Dicot embryo (*Tridax*)
2. To study and write critical notes on permanent micro preparations showing development of anther, types of ovules, Embryosac, Dicot embryo and Monocot embryos.
3. Take T.S of anther (*Datura/Cassia*)
4. Type of endosperm

MICROTECHNIQUE

Measurement of cell size (Ocular and stage micrometer)

Preparation of Temporary and Permanent slides, Microtome sectioning

Micropreparation of cystolith (*Ficus* leaf), Raphides (*Araceae* members eg: *Arum* petiole) and starch grains(Potato and Rice grains)

Course Outcomes:-

Students could be able to

1. Compare the primary structure of root, stem and leaf in Dicots and monocots through slides.
2. Differentiate the anomalous secondary growth in dicot and monocot stems through slides
3. Dissect the embryo from a plant – *Tridax*
Identify the structure and development of anther and ovules through slides.

U.G Question Paper Pattern (SEM:60 Mark+CIA:40Marks=Total:100 marks).

NON-MAJOR ELECTIVE - II

1.HORTICULTURE

Theory Hours : 2

Practical Hours :-

Exam Hours : 3

Course code: U21BO4NMEC2:1

Credit:2

Marks:100

Objectives:

1. To study the importance of horticultural crops and their propagation methods
2. To understand the types of gardens and their establishment
3. To educate floriculture and fruit culture, greenhouse and nursery management

Unit I

Horticulture: Importance and scope of Horticulture, Classification of horticultural crops – fruits, vegetables crops, climate, soil, water, nutrition needs of horticultural crops,

Unit II

Plant propagation methods, cutting, layering, grafting, budding, stock-scion relationship. Use of plant regulators in horticulture.

Unit III

Garden designs, types of gardens – formal, informal and kitchen garden, units of garden, hedge, border, popiary arches and lawn maintenance.

Unit IV

Floriculture, cultivation of commercial flowers – rose and jasmines. Cultivation of important fruit trees – Mangoes and Banana.

Unit V

Green house, Indoor gardening – Bonsai – flower arrangements – nursery management and maintenance.

Books:

1. Bose, T.K. and Mukherjee, D. (1972). *Gardening in India*. Oxford & IBH Publishing Co., Kolkatta.
2. Edmond, J.B., Musser, A.M. and Andrews, F.S. (1951). *Fundamentals of Horticulture*. McGraw-Hill Book Company, Inc., New York.
3. Jitendra Singh. (2014). *Basic Horticulture*. Kalyani Publishers, Chennai.
4. Kumar, N. (1997). *Introduction to Horticulture*. Rajalakshmi Publications, Nagercoil.
5. LexLauries and Victor, H.R. (1950). *Floriculture – Fundamental and Practices*. McGraw Hill Publishers, New York.
6. Naik, K.C. (1963). *South Indian Fruits and Their Culture*. Vardhachary & Co., Madras.
7. Randhawa, G.C. (1973). *Ornamental Horticulture in India*. Today & Tomorrow Publishers, New Delhi.
8. Sandhu, M.K. (1989). *Plant Propagation*. Wiley Eastern Ltd., New Delhi.
9. Sundararajan, J.S., Muthuswamy, J., Shanmugavelu, K.G. and Balakrishnan, R. *A Guide to Horticulture*. Thiruvankadam Printers, Coimbatore.

Course Outcomes:-

Students could able to

1. Understand the scope and importance of Horticulture
2. Learn the classification of horticultural crops such as fruits and vegetables.
3. Explain the needs of horticultural crops – climate, soil, water and nutrition.

4. Know the different methods of plant propagations-Cutting, Layering, Grafting and Budding.
5. Identify the stock – scion relationship.
6. Describe the designs types and units of garden
7. Realize the floriculture, cultivation of commercial flowers and fruit trees.
8. Differentiate. about the Green house, Indoor – gardening, Bonsai and Flower arrangements.
9. Acquire more knowledge about the nursery management and its maintenance.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Five Question (Two Question from each unit –Either or type)	5×15=75 marks
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NON-MAJOR ELECTIVE - II
2. SEED PATHOLOGY

Theory Hours : 2
Practical Hours :-
Exam Hours : 3

Course code: U21BO4NMEC2:2
Credit:2
Marks:100

Objectives:

- To know the seed borne microbes and diseases.
- To know the methods of seed health testing.
- To learn the process of seed borne disease development.
- To know the quarantine for seed and organization for plant protection at various levels.

Unit I :History of Seed Pathology-Importance in agriculture -losses caused by seed borne diseases. Seed health testing for fungi, bacteria and viruses: Principles and methods.

Unit II:Seed borne fungi, bacteria and viruses and diseases caused by fungi blast of paddy, red rot of sugarcane; bacteria Blight of paddy, black arm of cotton; viruses: leaf roll of potato, bean, Mosaic virus.

Unit III:Seed infection and establishment avenues, factors and its establishment location in seed -Epiphytotics due to seed borne inoculums.

Unit IV :Controls of seed-borne diseases physical, chemical and biological treatment; post-entry control. Storage fungi and mode of seed deterioration. Mycotoxins, plant variety protection act, legal protection of crop varieties and seed legislation in developing countries.

Unit V:Seed Quarantine, history and importance, principles and regulations of plant quarantine in India. Seed certification history, scheme, eligibility procedure (Organization, Economic Co-operation and Development) Changing concepts, Applying quarantine provisions for seed.

Books for Reference

1. Agrios, George, N., (1998). Plant Pathology, Academic Press, San Diego, London. Bilgrami, K.S. and Dubey, H.C., (1980).
2. A text book of modern Plant Pathology, Vikas Publishing House, New Delhi.
3. Mehrotra, R.S., (1980). Plant Pathology, Tata McGraw Hill Publishing Company Limited New Delhi. Major E

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Five Question (Two Question from each unit –Either or type)	5×15=75 marks
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**SKILL ENHANCEMENT -I (SBS I)
MUSHROOM TECHNOLOGY**

Theory Hours : 1	Course code: U214SE1
Practical Hours :-	Credit:1
Exam Hours : 2	Marks:20

Objectives:

1. To acquire knowledge on various types of mushrooms.
2. To understand cultivable species of mushrooms.
3. To learn the culture techniques of edible mushrooms.
4. To study the economic of mushroom.

Unit I

History of Mushroom cultivation – economic importance of Mushroom as food – selection ‘starter’ – preparation of spawn – preparation of Compost (outdoor and indoor beds – incubation – Harvesting and marketing.

Unit II

Life cycle of Mushrooms – identification – edible and poisonous Mushrooms – external factors for growth.

Unit III

Spawn production – grain, powder and granular spawn – mother spawn – planting spawn – preparation of cultures and spore culture), preservation and storage of culture – various media (PDA, malt extract, Wheat extract, Compost extract)

Unit IV

Cultivation of White Button Mushrooms (*Agaricusbisporus*) and Oyster Mushrooms (*Pleurotus* spp) – materials – sterilization – spawning and fruiting – house design for *Pleurotus* preservation, canning drying.

Unit V

Control of major diseases of microbes (green moulds, dry bubble, wet bubble, bacterial spot, viral brown disease) – pests (Sciarid flies, phorid flies, beetles) – nematodes (*Mycophages*)

References:

1. Kanaiyan. S and Ramasamy.K, 1980.A Handbook of Edible Mushroom.Today and Tomorrows.Printers and Publishers, New Delhi, 104 p.
2. Pathak V.N, NagendraYadav and Maneesha Gaur, 1998.Mushroom Production and Processing Technology, Agrobios (India) Jodhpur, 179 p.

Course Outcomes:-

Students could be able to

1. Describe the history economic importance and different steps of cultivation of mushroom.
2. Identify the edible and poisonous mushrooms.
3. Explain the life cycle of mushroom and external factor's need for its growth
4. Understand the different types of spawn and the various steps involve in spawn productions.
5. Learn the various steps involve in the cultivation of white buden mushroom and oyester mushroom.
6. Know the controlling measures of the disease caused by microbes, pests and nematode.

**SKILL ENHANCEMENT -I (PRACTICAL)
MUSHROOM TECHNOLOGY**

Theory Hours :-	Course code: U214SEP1
Practical Hours :1	Credit:1
Exam Hours : 2	Marks:60

Objectives:

1. To acquire knowledge on various types of mushrooms.
 2. To understand cultivable species of mushrooms.
 3. To learn the culture techniques of mushrooms.
-
- Selection 'starter' preparation.
 - Preparation of spawn.
 - Preparation of Compost
 - Beds preparation.
 - Mother spawn.
 - Various media (PDA, malt extract, Wheat extract, Compost extract) preparation.
 - Materials sterilization.
 - preservation and storage

Course Outcomes:-

Students could be able to

1. Describe different steps of cultivation of mushroom.
2. Identify the edible and poisonous mushrooms.
3. Explain the life cycle of mushroom and external factor's need for its growth
4. Understand the different types of spawn and the various steps involve in spawn productions.
5. Learn the various steps involve in the cultivation mushroom

U.G Question pattern (SEM:20mark+SEM PRACT:60mark+CIA:20mark = Total :100 marks)

ALLIED-V
ALLIED BOTANY PRACTICAL – II

Theory Hours :-	Course code:
Practical Hours :3	Credit:
Exam Hours : 3	Marks:100

Objective:

1. Students to learn about the Taxonomy of plants.
 2. To practice identification of families and plants name.
 3. Learn to practice about plant physiological Experiment
-
- ❖ To describe in technical terms plants belonging to any of the families prescribed and identify the family
 - ❖ To make dissection of the flower and construct floral diagrams
 - ❖ To make suitable microscopic preparation, description and identification of cryptogams gymnosperms and Angiosperms, Examples for anatomy and ecology included in the syllabus.
 - ❖ To submit a record of work done by the candidate during the course of study in practical classes, duly certified and bona fide.
 - ❖ To describe simple experimental setups in plant physiology.

List of Experiments in Plant physiology:

- Osmosis.
- Root pressure experiment.
- Bell Jar experiment.
- Ganong's Photometer
- Transpiration Pull experiment.
- Ganong's light screen experiment.
- Photosynthesis experiment.
- Kinostat.
- Ganong's respiroscope

Course Outcome:-

Students could be able to

1. Study about Taxonomy of the given families in syllabus.
2. To identify the plants and make suitable plant section.
3. Learn to make plant section preparation.
4. To study about the plant physiology and its experiments.
5. Experiments –Osmosis ,Root pressure experiment.
6. To know about working mechanism of Ganong's photometer.
7. Practice about the experiment Bell Jar and Transpiration pull experiment.
8. Working mechanism of Ganong's Respiroscope.

U.G Question Paper Pattern (SEM:60 Mark+CIA:40Marks=Total:100 marks)

ALLIED-VI
ALLIED BOTANY –PAPER –III

SEMESTER: IV- ANATOMY, EMBRYOLOGY, PHYSIOLOGY AND PHYTOTHERAPY

Theory Hours :	Course code:
Practical Hours :-	Credit:
Exam Hours : 3	Marks:100

Objective:

1. To inculcate the basics of tissues and anatomical features of plants.
2. To understand the key aspects of embryology of Angiosperms.
3. To realize the values of plants and animals of the ecosystem.
4. To know the details on various types of vegetation.
5. To understand the metabolic activities of plants.

Unit: I Anatomy

Simple permanent tissues – Complex permanent tissues, primary structure of stem and root, leaf in Dicot and Monocot plants, secondary growth of dicot stem and root.

Unit: II Embryology

General characters, Structure and Development of Anther – Male gametophyte – Structure of ovule, development of female gametophyte (polygonum type) structure of endosperms, types of endosperms.

Unit: III Ecology and Phytotherapy

Adaptations of following (Morphological and Anatomical Adaptation).

1. Hyrophytes- Hydrilla, Nelumbium.
2. Mesophytes- Helianthus, Hibiscus.
3. Xerophytes- Nerium, Opuntia.
Photogeography- Vegetation of Tamilnadu, Evergreen, Shrub, Jungle and Mangrove.

Unit: IV Plant Physiology

Absorption of water, Role of Mineral elements, transpiration, photohormones Auxin, Gibberellins, and cytokinins, photosynthesis light reaction, path of carbon, nitrogen cycle, respiration – Aerobic- Glycolysis and Krebs's Cycle, Anaerobic –fermentation.

Unit: V Phytotherapy:

1. Preparation of Herbal Medicine, Oil, Decoction, Induction and disorders.
2. Herbal Medicine for some diseases Jaundice, Headache, Diabetes, Anemia and Blood pressure.

References:

1. Subbash Chandru Satta, 1980 Plant physiology, Publishing for one world. Willey Eastern Limited.
2. Ray Noggle G. and George J Fritz. 1974 Introductory plant physiology.
3. Laawrences H.M. Taxonomy of Vascular plants. oxford & IBH publishing co.
4. Rajarathinam.K. 1998 plant physiology saras publication Kollar P.O. Nagercoil.
5. Carl L. Wilson Walter E. Lomis and Hannah.T. Croasdale May:1966.
6. Gupta P.K. 1994. Cytology genetics and Evolution.
7. Dutta A.C. 1976 – Class – Book of Botany.

8. Darlington, C.D & K. Mather. K 1961. The Elements of Genetics.
9. Arya Vaidhya sala: 2006 Indian Medicinal plants.
10. Katherine Esaw : 1965 plant Anatomy second edition.
11. Adriance S. Foster 1960. Practical Plant Anatomy.
12. Chadurkar .P.J. 1983. Plant Anatomy oxford & IBH publishing co.
13. Lyman Benson 1982 Plant Classification. oxford and IBH, publishing co.
14. Douglas Houghton Cambell. The Evolution of the land plants (Embryophyta).
15. Garoner. J. Eldon. 1972. Principles of Genetics third edition Willey E.A. Stern private Limited.
16. Sharma P.D. 1986. Clements 1986 Plant Ecology.
17. Kochhar P.T. 1969. Plant Ecology Genetics and Evolution.

Course outcome:

Students could be able to

1. To acquire knowledge on plant tissues.
2. To study the structure and Development of Anther.
3. To understand the ecology and phytogeography.
4. To study the photosynthesis light and dark reactions.
5. To learn about phytotherapy and its plants.
6. To study the preparation of herbal medicine and its uses.
7. To understand the mode of action of various photo hormones.
8. To understand xylem, phloem and components.
9. To study the mechanism of water movements.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

SEMESTER – V

CORE COURSE-IX CELL AND MOLECULAR BIOLOGY

Theory Hours : 5

Practical Hours :-

Exam Hours : 3

Course code: U21BOC509

Credit:5

Marks:100

Objectives:

To enable the students

1. To study microscopy, cell organelles of Prokaryotic and Eukaryotic cells, chromosomes, cell divisions, DNA and RNA.
2. To understand gene regulation and chloroplast and mitochondria genome organization.

Unit I

Basic principles of microscopy. Differentiating features of Prokaryotic and Eukaryotic cells – Ultra structure and functions of plasma membrane – Ultra structure of cell organelles – Plastids, Mitochondria, Golgi bodies, Endoplasmic Reticulum, Lysosomes, Cell Inclusions.

Unit II

Nucleus – Nucleolus - Structure of euchromatin and heterochromatin – Special types of chromosomes – Lamp brush chromosomes and polytene chromosomes. Cell cycle, Cell Division: Mitosis and meiosis.

Unit III

Nucleic acids – DNA and RNA – Differentiating features – Griffith Experiment -Structure, properties (C-Value Paradox) & replication of DNA- Hershey and Chase experiment – RNA – Structure and functions of rRNA, mRNA and tRNA.

Unit IV

Gene regulation in Prokaryotes (*Lac* operon concept) and Eukaryotes – Initiation, Elongation and termination of Transcription and Translation. Gene regulation in prokaryotes and eukaryotes – Differences.

Unit V

Chloroplast and mitochondrial genome organization – Microbial genetics – PCR, Basic mechanism of signal transduction – principles of cell communication - Programmed Cell Death (PCD).

Unit VI (Not for Semester Examination)

Current trends in molecular biology, cell communication, cell signaling, mechanism and significance of mutation, post translation changes, gene mapping and sequencing, genetic variation in plants

Books:

1. De Robertis, E.D.P. and De Robertis, E.M.F. Jr. (1980). Cell and Molecular Biology (7th Ed). Saunders College/Holt, Rinehart and Winson, Philadelphia.
2. Grierson, D. and Convey, S.N. (1989). *Plant Molecular Biology*. Blackie Publishers, New York.
3. Lea, P.J. and Leegood, R.C. (1999). *Plant Biochemistry and Molecular Biology*. John Wiley and Sons, London.
4. Old, R.W. and Primrose, S.B. (1994). *Principles of Gene Manipulation*. Blackwell Science, London.
5. Power, C.B. (1984). *Cell Biology*. Himalaya Publishing Co., Mumbai.
6. Sharma, N.S. (2005). *Molecular Cell Biology*. International Book distributors, Dehradun.
7. Verma, P.S. and Agarwal, V.K. (1986). *Cell Biology and Molecular Biology (Cytology)*. S. Chand and Company Ltd., New Delhi.

Course Outcomes:-

Students could able to

1. Describe the basic principles of microscopy, ultra structure and functions of plasma membrane and cell inclusions.
2. Differentiate the prokaryotic and Eukaryotic cells.
3. Learn the structure of nucleolus, Euchromatin and Heterochromatin.
4. Familiarize the special types of chromosomes – Lamp brush chromosomes and polytene chromosomes.
5. Analyse the cell cycle and types of cell division: 1. Mitosis and 2. Meiosis
6. Differentiate the features of nucleic acids DNA and RNA
7. Understand the structure, properties and replication of DNA.
8. Learn Griffith Experiment and Hershey – Chase experiment.
9. Explain the structure, functions and types of RNA
10. Distinguish gene regulation in prokaryotes and Eukaryotes
11. Analyse the various techniques – initiation elongation termination, transcription and translation.
12. Learn the genome organization of chloroplast and mitochondria.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

CORE COURSE - X
GENETICS, BIOSTATISTICS AND EVOLUTION

Theory Hours : 5

Practical Hours :-

Exam Hours : 3

Course code: U21BOC510

Credit:5

Marks:100

Objectives:

1. To study Mendelian genetics, recombination of chromosomes, structure and function of genes and their various units
2. To educate on mutation
3. To impart knowledge on biostatistics and its applications biological experiments
4. To understand the mechanism of evolution and study of population genetics

Unit I

Genetics: Mendel's laws, monohybrid, dihybrid, back cross and test cross. Allelic interactions: Incomplete dominance and co-dominance – complementary factor hypothesis, epistasis (Dominant and recessive), Non-allelic interaction – Lethal factor, Multiple factor hypothesis

Unit II

Recombination – Linkage & crossing over in *Lathyrus odoratus*, eye colour in *Drosophila* and colour blindness in man. Cytoplasmic inheritance. Sex determination in plants and *Drosophila*.

Functional units of gene – cistron, recon, muton, codon and operon concept (lac). Mutation – classification, types, mechanism (physical and chemical mutagens) and application (role of mutation in evolution)

Unit III

Biostatistics: Definition and scope. Sampling techniques: Sample, population, Random and non – random sampling techniques. Data – Types of data. Presentation of data – Graphical methods: Histogram, Bar and Pie diagrams.

Unit IV

Measures of central tendency – Mean, median and mode. Measures of dispersion – range, variance, Standard Deviation and Standard Error. Chi Square analysis. Correlation and its types: Probability Distribution – normal, binomial and Poisson distribution.

Unit V

Evolution – Evolutionary concepts – Theories of Lamarck, Charles Darwin and the modern synthetic theories. Population genetics – gene pool, gene frequency and Hardy–Weinberg law. Factors affecting gene frequencies.

Unit VI (Not for Semester Examination)

Current trends in modern genetics, genetic disorder, non mendalian genetics, role of statistics in botany, physical and chemical means of mutation, modern trends of evolution

BOOKS:

GENETICS

1. Adrin, M.S.R.B., Owen, R.D. and Edger, R.S. (1979). *General Genetics*. In: Mendelism. Eurasia Publishing House (P) Ltd., New Delhi.
2. Agarwal, V.K. (2000). *Simplified course in Genetics* (B.Sc., Zoology). S. Chand & Company Ltd., New Delhi.
3. Ahluwalia, K.B. (1990). *Genetics*. Wiley Eastern Ltd., Madras.
4. Chandrasekaran, S.N. and Parathasarathy, S.V. (1965). *Cytogenetics and Plant Breeding*. P. Varadhachari & Co., Madras.
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6. Gardner, E.J. and Snusted, D.P. (1984). *Principles of Genetics* (7th edition). John Wiley & Sons, New York.
7. Gupta, P.K. (2000). *Genetics*. Rastogi Publishers, Meerut.
8. Herskowitz, I.H. (1977). *Principles of Genetics* (2nd Ed.). MacMillan Publishing Co. Inc., New York.
9. Hexter, W. and Yost, H.T. Jr. (1977). *The Science of Genetics*. Prentice Hall of India (P) Ltd., New Delhi.
10. Jain, H.K. (1999). *Genetics-Principles, Concepts & Implications*. Oxford & IBH Publishing Co., (P) Ltd., New Delhi.
11. Lewin, B. (1990). *Genes IV*. Oxford University Press, Oxford.
12. Meyyan, R.P. (2000). *Genetics & Evolution*. Saras Publication, Nagercoil.
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14. Pandey, B.P. (2012). *Cytology, Genetics and Molecular Genetics*. Tata McGraw-Hill Education Private Ltd., New Delhi.
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16. SandhyaMitra (1994). *Genetics - A Blue Print of Life*. Tata McGraw-Hill Education Private Ltd., New Delhi.
17. Sarin, C. (1994). *Genetics*. Tata McGraw-Hill Education Private Ltd., New Delhi.
18. Singleton, R. (1963). *Elementary Genetics*. D. Van Nostrand Co., Ltd. Inc., New York.
19. Sinha, U. and Sinha, S. (1989). *Cytogenetics, Plant Breeding & Evolution*. Vikas Publishing House, New Delhi.
20. Sinnott, E.W., Dunn, L.C. and Dobshansky, J. (1958). *Principles of Genetics* (5th Edition) McGraw Hill Publishing Co., New York.
21. Strickberger, M.W. (1976). *Genetics* (2nd Ed.). MacMillan Publishing Co. Inc., New York.
22. Watson, J.D. (1977). *Molecular Biology of the Gene*. W.A. Benjamin Inc., California.
23. Winchester, A.M. (1958). *Genetics* (3rd Ed.). Oxford & IBH Publishing House, Calcutta.

24. Winter, P.C., Hickey, G.I. and Fletcher, H.L. (1999). *Instant Notes in Genetics*. Viva Books (P) Ltd., New Delhi, Mumbai, Chennai.

BIOSTATISTICS

1. NageswaraRao, G. (1983). *Statistics for Agricultural Science*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Olive, J.D. (1995). *Basic Statistics - A Primer for the Biomedical Sciences*. John Wiley and Sons, New Delhi.

EVOLUTION

1. Gottlieb, LD. and Jain, S.K. (1988). *Plant Evolutionary Biology*. Chapman & Hall, London.
2. Savage, J.M. (1969). *Evolution* (2nd Ed.). Amerind Publishing (P) Ltd., New Delhi.
3. Shukla, R.S. and Chandel, P.S. (1996). *Cytogenetics, Evolution & Plant Breeding*. S. Chand & Company Ltd., New Delhi.
4. Sproule, A. (1998). *Charles Darwin Scientists who have changed the world*. Orient Longmans, Hyderabad.
5. Verma, P.S. and Agarwal, V.K. (1999). *Concepts of Evolution*. S. Chand & Company Ltd., New Delhi.

Course Outcomes:-

Students could be able to

1. Apply the Mendel law's in monohybrid, Dihybrid, Backcross and test cross.
2. Differentiate allelic and non – Allelic interactions.
3. Learn about the recombination, linkage and crossing over, cytoplasm inheritance and sex determination.
4. Describe the different functional units of gene and operon concept.
5. Understand the classification, types, mechanism and application of mutation.
6. Know the definition and scope of Bio-statistics
7. Explain the sampling and random sampling techniques.
8. Analyse the types of data, presentation of data and graphical methods.
9. Evaluate the measures of central tendency, dispersion and probability distributions.
10. Understand the different concepts, theories of evolution and population genetics.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	10×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

CORE COURSE –XI

MORPHOLOGY, TAXONOMY OF ANGIOSPERM AND ECONOMIC BOTANY

Theory Hours : 5

Practical Hours :-

Exam Hours : 3

Course code: U21BOC511

Credit:5

Marks:100

Objectives:

To enable the students

1. To study morphological features of vegetative, inflorescence, fruits and seed characters.
2. To impart knowledge on botanical nomenclature, classifications, merits and demerits of various systems of classifications.
3. To understand the systematics of the selected families of the flowering plants with their economic importance.
4. To have knowledge on the economically important plants with their systematic treatment.

Unit I

Morphology: vegetative, floral and fruit parts – Inflorescence – Types – racemose, cymose, mixed and special types. Fruit - simple, fleshy, dry dehiscent and dry indehiscent, aggregate and multiple fruits.

Unit II

Binomial nomenclature – ICBN rules – taxonomic types. Systems of Classification – Bentham and Hooker classification – Merits and demerits. Phylogenetic classification – anatomical, embryological, biochemical and palynological evidence for taxonomy, numerical taxonomy, Herbarium techniques.

Unit III

A detailed study of the following families with their economic importance – Annonaceae, Capparidaceae, Tiliaceae, Rutaceae, Anacardiaceae, Leguminosae (Papilionaceae, Cesalpinaceae and Mimosaceae) and Cucurbitaceae.

Unit IV

A detailed study of the following families with their economic importance – Rubiaceae, Asteraceae, Apocynaceae, Asclepiadaceae, Solanaceae, Verbenaceae, Euphorbiaceae, Orchidaceae and Poaceae.

Unit V

Economic Botany: A brief study of the following economically important plants:

Food – Cereals (*Oryza sativa*, *Eleusinecoracana*); Pulses – Black gram (*Phaseolusmungo*), Edible – Gingelly oil (*Sesamumindicum*); Root tubers – Tapioca (*Manihotesculenta*); Sugar – Sugarcane (*Saccharumofficinarum*).

Fibres – Textiles (*Gossypium*); Others– *Crotalaria*, *Agave*.

Medicinal Plants – *Ocimum*, *Phyllanthus*, *Solanum*.

Forest Products – Timber: Teak (*Tectonagrandis*), Jack (*Artocarpusheterophyllus*). Tannins, Gums, Resins, Turpentine.

Unit VI (Not for Semester Examination)

Current trends in plant taxonomy, floristic studies, evidences for plant taxonomic classification, palynology and systematics, Economic products and forest products of India

BOOKS:

TAXONOMY

1. Gurcharan Singh (1999). *Plant Systematics - Theory & Practice*. Oxford & IBH Publishing Co. (P) Ltd., New Delhi.
2. Jaques, H.E. (1999). *Plant Families-How to know them?*. Agro Botanical Publishers (India), Bikaner.
3. Jefferey, C. (1968). *An Introduction to Plant Taxonomy*. J.A. Churchill, London.
4. Lawrence, G.H.M. (1953). *Taxonomy of Vascular Plants*. Oxford & IBH Publishers, New Delhi.
5. Lawrence, G.H.M. (1955). *An Introduction to Plant Taxonomy*. The Central Book Depot, Allahabad.
6. Mathews, K.M. (1987-90). *Flora of Tamilnadu Carnatic (1-4vols.)* Rapinat Herbarium, Trichy.
7. Mathur, R.C. (1970). *Systematic Botany (Angiosperms)*. Agra Book Stores, Lucknow.
8. Mitra, J.N. (1964). *An Introduction to Systematic Botany & Ecology*. The World Press (P) Ltd., Calcutta.
9. Naik, V.N. (1996). *Taxonomy of Angiosperms (9th Ed.)*. Tata McGraw-Hill Publishing Co., (P) Ltd., New Delhi.
10. Narayanaswamy, R.V. and Rao, K.N. (1976). *Outlines of Botany*. S. Viswanathan Printers & Publishers, Chennai.
11. Palaniyappan, S. (2000). *AngiospermgalinVagaippadu (Taxonomy of Angiosperms)*. V.K. Publishing House, Chennai.
12. Pandey, B.P. (1997). *Taxonomy of Angiosperms*. S. Chand & Company Pvt. Ltd., New Delhi.
13. Porter, C.L. (1967). *Taxonomy of flowering Plants*. Eurasia Publishing House, New Delhi.
14. Ramaswami, S.N., Lakshminarayana, S. and Venkateswaralu, V. (1976). *Taxonomy (Systematic Botany) for Degree Course*. Maruthi Book Depot, Guntur, Hyderabad.
15. Sharma, O.P. (2007). *Plant Taxonomy*. Tata McGraw-Hill Publishing Co., New Delhi.
16. Singh, V. and Singh, D.K. (1983). *Taxonomy of Angiosperms*. Rastogi Publications, Meerut.
17. Sivarajan V.V. (1993). *Introduction to the Principles of Plant Taxonomy (2ndEdn.)*. N.K.P. Robson (Ed.). Oxford & IBH Publishing Co. (P) Ltd., New Delhi.
18. Subramaniyan, N.S. (1999). *Laboratory Manual of Plant Taxonomy (2nd Ed.)*. Tata McGraw-Hill Publishing Co., New Delhi.
19. Vashista, P.C. (1997). *Taxonomy of Angiosperms*. S. Chand & Company Pvt. Ltd., New Delhi.

ECONOMIC BOTANY

1. Ashok Bendre and Ashok Kumar (1998-99). *Economic Botany*. Rastogi Publications, Meerut.
2. GovindaPraksh and Sharma, S.K. (1975). *Introductory Economic Botany*. Jai PrakashNath, Meerut.

3. Gupta, S.K. and Kaushik, M.P. (1973). *An Introduction to Economic Botany*. K. Nath & Co., Meerut.
4. Hill, A.W. (1952). *Economic Botany*. Tata McGraw–Hill Publishing Co., New Delhi.
5. Pandey, B.P. (2000). *Economic Botany*. S. Chand & Company Ltd., New Delhi.
6. Sambamurthy, A.V.V.S. and Subrahmanyam, N.S. (1989). *A Text Book of Economic Botany*. Wiley Eastern Ltd., Madras.
7. Sen, S. (1992). *Economic Botany*. New Central Book Agency, Calcutta.
8. Verma, V. (1974). *A Text Book of Economic Botany*. Emkay Publications, New Delhi.

Course Outcomes:-

Students could be able to

1. Describe the morphological features of vegetative, floral and fruit parts.
2. Explain the types of inflorescence and fruits.
3. Understand the binomial nomenclature and ICBN Rules.
4. Illustrate the systems of classification (Bentham and Hooker's) its merits and demerits and various techniques of Herbarium.
5. Describe the detailed study of selected families and their economic importance.
6. Acquire knowledge about the economic importance of plants Fruits, Edible, Sugar, Fibres, Medicinal plants and Forest products.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

CORE – XII (PRACTICAL)

CELL AND MOLECULAR BIOLOGY ,GENETICS, BIOSTATISTICS AND EVOLUTION MORPHOLOGY, TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

Theory Hours : -

Course code: U21BOC512P

Practical Hours :6

Credit:3

Exam Hours : 3

Marks:100

Objective:

1. To study about the cell and molecular biology to know about the cell structure, cell division like mitosis and meiosis
2. To know about the genetics, monohybrid, dihybrid ratios with problems
3. To Training in dissection the plant and study about the morphology, classification and economic Botany

CELL AND MOLECULAR BIOLOGY

1. Observation of plant cells in Onion peeling and *Rheo* leaf
2. Non-living inclusions: Raphides, cystolith and Starch grains
3. Cell division: Mitosis and Meiosis – Squash technique in onion toot tips and *Tradescantia/Rheo* flower bud respectively
4. Isolation of cell organelles through differential centrifugation
5. Photographs: Ultra Structure of cell organelles.

GENETICS, BIOSTATISTICS & EVOLUTION

- Problems on simple monohybrid and dihybrid ratios. Simple problems on interaction on factors included in the theory.
- Simple experiments to determine the mean, median and mode. Illustration of graphic representation of data using simple analysis.

MORPHOLOGY, TAXONOMY & ECONOMIC BOTANY

Training in dissection, observation, identification and sketching of floral parts of plants belonging to the families mentioned in the syllabus along with floral diagrams and floral formula.

Description of plants in technical terms.

Field study flora.

Submission of 25 Herbarium specimens.

Economic plants covered in theory part in taxonomy and economic botany and their importance.

Course Outcomes:-

Students could be able to

1. Observe the plant cells and types of cell division by peeling method and squash technique.
2. Identify the Ultra-structure of cell organelles and living inclusions through slides and photographs.
3. Isolate the *cell organelle* through differential centrifugation
4. Evaluate the simple problems on monohybrid, Dihybrid ratios and interaction of factors.
5. Determine the mean, median and mode by simple experiments.
6. Illustrate the graphic represented data using simple analysis.
7. Describe the plants in technical terms.
8. Deseect and draw the floral parts, floral diagrams and formulas of the plants belong to the families mentioned in the syllabus.
9. Learn the economically important parts of the plants.

U.G Question Paper Patten (SEM:60 Mark+CIA:40Marks=Total:100 marks)

MAJOR-BASED ELECTIVE- I
1.BIO-RESOURCES AND HUMAN WELFARE

Theory Hours : 5
Practical Hours :-
Exam Hours : 3

Course code: U21BO5MBE1:1
Credit:4
Marks:100

Objective:

1. Students to learn about the uses of microorganisms eg Single cell protein, Antioxidants, Vitamins, Enzyme.
2. To know about the plant sources like Coffee, Poppy, Cotton, Oil, and Rubber.
3. Understand the Traditional Medicines and their Economic Importance.

Unit I

Useful products from microorganisms – Single cell proteins from fungi (yeast), algae (Spirulina), antioxidants from Dunaliellasalina, Vitamins, enzymes, organic acids, antibiotics and alcohol (With one example each)

Unit II

Useful products from Gymnosperms – Wood (Pine), Drugs (Turpentine, taxol, Ephedrine)

Unit III

Study of plants for the source and application of the following products, beverage (coffee), narcotics (poppy) fiber (Cotton), oil-seeds (sesame), latex (rubber), start up for plant based industries in Tamilnadu

Unit IV

Importance and application areas: biomass production - food (single cell proteins); bio-fertilizers. Environmental Biotechnology: Waste treatment – solid (compost), Liquid (industrial effluents), sewage treatment (domestic sewage).

Unit V

Traditional and economically important wood plant species of India. Acacia, Albizjia, Bambusa, Dalbergia, Tectonagrandis, Terminalia

References:

1. Sambamurthy, A.V.V.S. and Subrahmanyam, N.S. 1989. A Textbook of Economic Botany Wiley Eastern Ltd., New Delhi, Bangalore, Bombay, Calcutta, Guwahati Hyderabad, Lucknow, Madras, Pune.
2. Pandey, B.P. 2000. Economic Botany, S. Chand & Co., New Delhi.
3. Verma, V. 1974. A Text Book of Economic Botany, Emkay Publications, New Delhi
4. Hill, A.W, 1952. Economic Botany, McGraw Hill Book Co., New York.
5. Gupta, S.K and Kaushik, M.P., 1973. An Introduction to Economic Botany, K. Nath & Co., Meerut, India.

Course Outcomes:-

Students could be able to

1. Describe the useful product from different micro organizer SCP, anti-oxidant, Vitamin, Enzyme, Organic acid, antibiotic and alcohol.
2. Explain the useful product from given Gymnosperms (Wooden drugs)
3. Know the plants for the source and application of the product give in the syllabus.
4. Learn the edible plants and their important creals, Beverages, Spices and Fruits.
5. Understand traditional and economically used wooden plants in India.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Five Question (Two Question from each unit –Either or type)	5×15=75 marks
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MAJOR-BASED ELECTIVE I
2.Applied Microbiology

Theory Hours : 5
Practical Hours :-
Exam Hours : 3

Course code: U21BO5MBE1:2
Credit:4
Marks:100

Objectives :

- To understand the fundamental of fermentation process. To know the microbial based industries .
- To gain knowledge about Industrial fermentations and products.

Unit I :Introduction - general information on microbe based industries - Substrate for industrial fermentation.

Unit II :Food and Dairy Industries: Single Cell Protein (SCP) advantages Microbes as source of SCP (Algae, Fungi, Bacteria) - Mass production of SCP (Spirulina, Bacterial SCP) - Yogurt and Cheese production.

Unit III :Pharmaceutical and related industries - Antibiotics - Sources and types - production of Penicillin and Streptomycin; Recombinant drugs and vaccines - insulin and Hep B Vaccine; advantages of vaccine, Vitamins - Vitamins B12.

Unit IV:Alcohol and organic acid industries-Industrial production of Alcohol (Ethanol) Organic acids: Citric acid and Acetic acid production - Vinegar production. Lactic acid production, Glutamic acid.

Unit V :Microbial Enzymes - Amylase, Protease, Microbes used for amino acid production - production of Hormones. Commercial production of L- Glutamic acids and Application of enzymes.

Books for Reference:

1. Adams, M.R. and Moss, M.O., (1995). Food Microbiology Tata McGraw Hill.
2. Agarwal, (2006). Industrial Microbiology: Fundamentals and Application. M/S. IBP Publishers and Distributes, New Delhi.
3. Crueger, F. and Anneliese Cruger, (2000). Biotechnology: Industrial Microbiology, Panima Publications.
4. Dubey, R.C. and Maheswari, D.K., (2003). A text book of Microbiology. S.Chand and Campus, New Delhi.
5. Kumaresan, V., (2001). Biotechnology Saras Publications, Nagarcovil. 6th Ed.,
6. Purohit, (2005). Microbiology Fundamentals and Applications. International Book Distributors, Dehradun. 7. Ratledge and Kristenson, (2001). Basic Biotechnology. Oxford University Press.

Course Outcomes:-

Students could be able to

- Understand microbe based industries.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Five Question (Two Question from each unit –Either or type)	5×15=75 marks
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MAJOR-BASED ELECTIVE
3. BIOLOGICAL CONTROL

Theory Hours : 5	Course code: U21BO5MBE1:3
Practical Hours :-	Credit:4
Exam Hours : 3	Marks:100

Objectives:

- To understand the importance of biological control.
- To understand the role of microorganisms in various types of interaction.
- To enable the students to acquire knowledge on biocontrol agents.

Unit I : Role of Biological control in plant pathology. Inoculum, Historical back ground, phyllophere phylloplane, rhizosphere, Rhizoplane regions. Tests with individual antagonist. Methods of isolation of microorganisms- isolation from soil by dilution plates.

Unit II : Interactions between microorganisms - Definition - Factors involved in Biological control - The host, The pathogen or parasite, physical environment, The antagonists- Applications.

Unit: III : Biological control of pathogens of aerial parts - Microorganism on aerial parts pathogens on aerial parts Infection through unbroken plants surfaces or Natural opening-wounds dead plants parts - latent infection.

Unit: IV : Role of antagonist in biological control- kinds of antagonists-Bacteria, Fungi, Actinomycetes, Viruses - Forms of Antagonism-Antagonism, Ammensalism, competition predation and Parasitism, mycoparasitism and nematophage and mycophage.

Unit: V : Role of the host in Biological control- Root dynamics structure, Root hairs, mycorrhizal, relationship, uses Root exudation and the rhizosphere effect -Microbial pesticides Bacterial, Viral, Fungle-Insect as biocontrol agent.

Books for Reference:

1. Kenneth F.Baker and R.James Cook(19)79. Biological control of plants pathogens S.Chand & company Ltd,Ram Nagar New Delhi-110055.
2. S.C. Bhandari and L.Somani (2006) Ecology and biology of soil organism Agrotech publishing Academy, Udaipur.
3. Debajit Borah, (2012) Biotechnology Lab Practices, Global vision publishing house, 20. Ansari Road,Darayagani, NewDelhi.
4. C.B Paun and A.F.Daginawala 2017 General Microbiology vol.II Himalaya publishing house NEW Delhi.
5. G.Prabakaran (2004) Introduction to soil and agriculture microbiology Himalaya publishing house -Mumbai.

Course Outcomes:-

Students could be able to

- Know the role of microorganisms in various types of interaction.
- Learn Role of the host in Biological control

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Five Question (Two Question from each unit –Either or type)	5×15=75 marks
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SKILL ENHANCEMENT -II (SBS II)
MEDICINAL AND APPLIED BOTANY

Theory Hours :1
Practical Hours :-
Exam Hours : 2

Course code: U215SE2
Credit:1
Marks:60

Objectives:

1. To understand the importance of the medicinal plant wealth in India and the role of Medicinal plants in human health care.
2. To know the medicinally useful plants, Herbal medicine preparation for common diseases and adulterants.
3. To understand the importance of biofertilizers and biopesticides

Unit I

Medical Botany: Importance and relevance of herbal drugs in Indian Systems of Medicine. Pharmacognosy – aim, scope and branches. Phytochemicals – reserve materials, secretory materials and excretory materials.

Unit II

Cultivation and marketing of Medicinal plants: *Aloe vera*, *Cassia senna*, *Catharanthus roseus*, *Gloriosa superba* and *Withania somnifera*.

Poisonous plants – action and treatments for different types of plant poisons, rejuvenating herbs and medicinal uses of non-flowering plants

Unit III

Adulteration and substitution of crude drugs – methods, types and identification; botanical description and active principles in the drugs of roots, rhizomes, woods and bark, leaves, flowers and seeds (two examples each/plant part).

Unit IV

Biofertilizer Technology: biofertilizers – types and importance. Mass cultivation of *Azospirillum*, *Azolla* and *Anabaena*. Rhizobium-legume symbiotic association – mass cultivation and carrier materials. Mycorrhiza – types and importance.

Biopesticides – importance; bacterial (*Bacillus thuringiensis*); Viral (NPV); Fungal (*Trichoderma*).

Unit V

Microbial Technology: Analysis of Drinking water for coliforms – MPN test – Sewage treatment – Primary, Secondary and Tertiary treatments – Bioremediation and Biomagnifications.

BOOKS:

1. Agarwal, O.P. (2014). *Organic Chemistry Natural Products, Vol. II*. Krishna Prakashan Media (P) Ltd., Meerut.
2. Alice, D., Muthusamy and Yesuraja, M. (1999). *Mushroom Culture*. Agricultural College, Research Institute Publications, Madurai.
3. Chopra, R.N., Badhuvar, R.L. and Gosh, G. (1965). *Poisonous Plants of India*. CSIR Publications, New Delhi.
4. Chopra, R.N., Chopra, I.C., Handa, K.L. and Kapur, L.D. (1994). *Indigenous Drugs of India*. IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Gamble, J. S. and Fisher, C.E.C. (1915-1938). *Flora of the Presidency of Madras*. Adlard & Son Ltd., London.
6. Marimuthu, T. (1991). *Oyster Mushroom*. Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
7. Mathew, K.M. (1988). *Flora of the Tamilnadu Carnatic*. Rapinat Herbarium, Tiruchirappalli.
8. Nair, N.C. and Henry, A.M. (1983). *Flora of Tamil Nadu, India*. Botanical Survey of India.
9. Nita Bhal (2000). *Handbook on Mushrooms Vol. I and II* (2nd Ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
10. Pathak, V.N. and Yadav, N. (1998). *Mushroom Production and Processing Technology*. Agrobios, Jodhpur.
11. Somasundaram, S. (1997). *Medicinal Botany (MaruthuvaThavaraviyal)* (Tamil Medium Book). Elangovan Publishers, Tirunelveli.
12. Srivastava, A.K. (2006). *Medicinal Plants*. International Book distributors, Dehradun.
13. SubbaRao, N.S. (2000). *Soil Microbiology*. Oxford and IBH Publishing Co. Ltd., New Delhi.
14. Tripathi, D.P. 2005. *Mushroom Cultivation*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
15. Varma, A. and Hock, B. (1995). *Mycorrhiza*. Springer-Verlag, Berlin.
16. YaacoVokan (1994). *Azospirillum/Plant Associations*. CRC Press, Boca Raton, FL.

Course Outcomes:-

Students could be able to

1. Know the importance of herbal drugs in Indian medicine.
2. Learn pharmacocancy and phytochemicals
3. Realize the cultivation and marketing of medicinal plants.
4. Describes the actions types and treatments for plant poisons.
5. Explain adulteration and substitution of crude drugs.
6. Identify the methods, types, the botanical description of and active principles in the drugs of various plant parts.
7. Familiarise with important, types and mass cultivation of various Biofertilizers.
8. Explain the importance and types of micorrhiza and Biopesticides.

**SKILL ENHANCEMENT -II (PRACTICAL)
MEDICINAL AND APPLIED BOTANY**

Theory Hours :-	Course code: U215SEP2
Practical Hours :1	Credit:1
Exam Hours : 2	Marks:40

Objectives:

1. To understand the importance of the medicinal plant wealth in India and the role of Medicinal plants in human health care.
2. To know the medicinally useful plants, Herbal medicine preparation for common diseases and adulterants.
3. To understand the importance of biofertilizers and biopesticides.

- Cultivation of Medicinal plants:

Aloe vera,

Cassia senna,

Catharanthus roseus,

Gloriosa superba and *Withania somnifera.*

- Poisonous plants – action and treatments
- Mass cultivation of *Azospirillum*, *Azolla* and *Anabaena*
- Sewage treatment

Course Outcomes:-

Students could be able to

1. Realize the cultivation and marketing of medicinal plants.
2. Describes the actions types and treatments for plant poisons.
3. Explain adulteration and substitution of crude drugs.
4. Identify the methods, types, the botanical description of and active principles in the drugs of various plant parts.
5. Familiarise with important, types and mass cultivation of various Biofertilizers.

U.G Question pattern (SEM: 20 mark + SEM Pract:20 markCIA:40 mark =Total:100 marks)

**SKILL ENHANCEMENT -III (PRACTICAL)
BASICS OF COMPUTER APPLICATIONS**

Theory Hours :1	Course Code : U215BOSE2
Practical Hours : -	Credits : 1
Exam Hours : 2	Marks :60

Objective

The aim of the value added Course is to provide the Students an opportunities to understand the basic operations of a computer system.

Theory:

Components of Computer – Operating Systems – information Technology .Social Media usefulness and limitations.

Learning Outcome:

Students can able to demonstrate functional skills on basic computing using software packages.

References:

- 1.Stefano Ceri ,Dino Mandrioli & shattella,(1998) The Art and Craft of Computing.Addison Weasley.
- 2.User Manual of Microsoft Office Packages

U.G Question pattern (SEM: 45 mark +CIA:15 mark =Total:60 marks)

Five Question (Two Question from each unit –Either or type)	5×15=75 marks
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**SKILL ENHANCEMENT -III
BASIC COMPUTER APPLICATIONS**

Theory Hours :-	Course Code:U215BOSE3P
Practical Hours : 1	Credits :1
Exam Hours : 2	Marks :40

Objective:

The aim of the this value added course is to provide the students an opportunities understand the basic operations of a computer system.

Practical

I Word Processor

- a. Create and Savea Word Document
- b. Paragraph Editing
- c. Table Preparation
- d. Header and Footer

II Spreadsheet

- a. Create and Savea Excel sheet
- b. Prepare a table
- c. Calculate Basic Statistics
- d. Prepare Charts and Diagrams

III Power Point

- a. Create and Savea Presentation
- b. Insert Different Layout
- c. Apply Custom Animation and Slide Show

Learning Outcome:

Students can able to demonstrate functional skills on basic computing using Software packages

References:

1. Stefano Ceri, Dino Mandrioli & shattella,(1998) The Art and Craft of Computing. Addison Weasley.
2. User Manual of Microsoft Office Packages.

U.G Question pattern (SEM: 30 mark +CIA:10 mark =Total:40 marks)

Five Question (Two Question from each unit –Either or type)	5×15=75 marks
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SEMESTER – VI

CORE COURSE-XIII PLANT PHYSIOLOGY , BIOCHEMISTRY AND BIOPHYSICS

Theory Hours :6

Practical Hours :-

Exam Hours : 3

Course code: U21BOC613

Credit:5

Marks:100

Objectives:

To enable the students

1. To understand the metabolic activities of plants
2. To understand the role of enzymes in various metabolic activities of plants
3. To know the application of the laws of physics in biological phenomena

Unit I

Plant - Water relationship: structure and properties and significance of water - osmotic and non-osmotic uptake of water. Ascent of sap-cohesion theory: root pressure, transpiration, physiology of stomatal action, Translocation of solutes and assimilates. Mass flow, Membrane permeability mineral uptake: Passive and active. Role of major and Minor elements, mineral deficiency symptoms.

Unit II

Photosynthesis: Absorption spectrum, Action spectrum, role of pigments, enhancement effect, photosystems I & II, Photophosphorylation, Carbon Assimilation: Calvin cycle, Hatch & Slack pathway, CAM pathway. photorespiration.

Respiration: Aerobic and anaerobic. Glycolysis, Krebs's Cycle and oxidative phosphorylation, energetics of respiration.

Unit III

Plant Growth regulatory substances; auxins, gibberellins, cytokinins, ethylene and abscisic acid - their chemical nature, physiological effects and function. Role of hormones in flowering, senescence and abscission- Photoperiodism, vernalization and seed dormancy. Nitrogen cycle, nitrogen fixation.

Unit IV

Biochemistry: Enzymes - Nature and properties. Mechanism of enzyme action-factors affecting Enzyme action, substrate concentration – inhibitors, cofactors. Structure, classification and functions of carbohydrates, lipids and Proteins. Secondary metabolites – alkaloids, flavonoids, terpenoids and anthocyanins.

Unit V

Biophysics-physical forces and chemical bonds, biological effect of ionising radiations, basic principles of spectroscopy, Laws of Thermodynamics and entropy-electron transfer processes-a) Definition of pH -its determination; b) Buffers and electrolytes and their functions. c) Fractionation of biomolecules by paper chromatography, d) Centrifugation. Bioenergetics – free energy, chloroplast and mitochondrial bioenergetics

Unit VI (Not for Semester Examination)

Current trends in plant function, thermodynamic principles, nature of solar radiation, biophysics of bioluminescence, determination of basic physiological parameters, circadian rhythm, biological clock

BOOKS:

PLANT PHYSIOLOGY

1. Devlin, R.M. (1969). *Plant Physiology*. Holt, Rinehart & Winston & Affiliated East West Press (P) Ltd., New Delhi.
2. Dulsy Fatima, R.P. et. al., (1994). *Elements of Biochemistry*. Saras Publications, Nagercoil, Tamilnadu.
3. Jain, V.K. (1990). *Fundamentals of Plant Physiology*. S. Chand & Co., New Delhi.
4. Noggle, R. and Fritz (1989). *Introductory Plant Physiology*. Prentice Hall of India.
5. Pandey, S.N. (1991). *Plant Physiology*. Vikas Publishing House (P) Ltd., New Delhi.
6. Periyasamy, K. (1978). *Cell Iyakkaviyal* (Cell Physiology). Tamilnadu text Book Society, Chennai.
7. Salisbury, F.B. and Ross, C.W. (1999). *Plant Physiology*. CBS Publishers and Printers, New Delhi.
8. Saraswathy and Rangamannar (1973). *ThaavaraValarchithaiMartram* (Metabolism & Biosynthesis). Tamilnadu Text Book society, Chennai.

BIOCHEMISTRY

1. Day, P.M. and Harborne, J.B. (2000). *Plant Biochemistry*. Harcourt Asia (P) Ltd., India & Academic Press, Singapore.
2. Jain, J.L. (1998). *Fundamentals of Biochemistry*. S. Chand & Co., New Delhi.
3. Jayaraman, J. (1981). *Laboratory Manual of Biochemistry*. Wiley Eastern Ltd., New Delhi.
4. Lehninger, A.L. (1984). *Biochemistry* (2nd Edition). Kalyani Publishers, Ludhiana, New Delhi.
5. Plummer, D.T. (1988). *An Introduction to Practical Biochemistry* (3rdEdn.). Tata McGraw Hill Publishing Co., Ltd., New Delhi.
6. Srivastava, H.S. (1990). *Elements of Biochemistry*. Rastogi Publications, Meerut, India.
7. Stryer, L. (1989). *Biochemistry*. W.H. Freeman & Co., New York, San Francisco.
8. Wilson, K. and Walker, J. (1994). *Principles and Techniques of Practical Biochemistry* (4th Edition). Cambridge University Press, U.K.

BIOPHYSICS

1. Annie and Arumugam, N. (2000). *Biochemistry&Biophysics*. Saras Publications, Nagercoil, Tamilnadu.
2. Casey, E.J. (1969). *Biophysics-Concepts and Mechanisms*. Van Nostrand Reinhold Co.,& Affiliated East West Press (P) Ltd., New Delhi.
3. Narayanan, P. (2000). *Essentials of Biophysics*. New Age International Publishers (P) Ltd., New Delhi, Bangalore, Calcutta, Chennai, Guwahati, Hyderabad, Lucknow, Mumbai.
4. Salil Bose, S. (1982). *ElementaryBiophysics*. Vijaya Printers, Madurai.

Course Outcomes:-

Students could be able to

1. Understand the plant – Water relationship with various physiological activities and theories.
2. Explain the Translocation of solutes by means of various theory role and deficiency symptoms of minerals.
3. Know the types of spectrum and the role of pigments in photosynthesis.
4. Describe the photosynthesis by different pathways and cycles.
5. Learn the respiration by means of various cycles and its types.
6. Identify the various plant growth hormones, its chemical nature, physiological effects and functions.
7. Understand the physiological effects such as senescence, abscission – and photoperiodism, Vernalization and seed dormancy.
8. Explain the nature, properties and mechanism of enzyme actions.
9. Describe the structure, classification and functions of carbohydrates, lipids and proteins.
10. Apply the laws of physics in biological phenomena.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit – Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

CORE COURSE- XIV
PLANT ECOLOGY AND CONSERVATION

Theory Hours : 6
Practical Hours :-
Exam Hours : 3

Course code: U21BOC614
Credit:5
Marks:100

Objectives:

To enable the students

1. To realize the values of plants and animals of the ecosystem
2. To know about the hazards of pollution and the importance of keeping his/her environment clean
3. To know in detail on various types of vegetation
4. To know about his/her environment and mould the students to become managers of various ecological systems

Unit I

General Ecology – Approaches to the study of Ecology, Autecology – Synecology, Plant environment – climatic, edaphic and Biotic factors (interference on Plant habitat by animals – Grazing and browsing, by humans – deforestation, Agriculture), Allelopathy.

Unit II

Ecosystem concept – components abiotic-biotic-autotrophic producers & heterotrophic consumers, biomass-ecological pyramids, Productivity – primary, secondary & gross; food chain – food web & energy flow – pond ecosystem.

Unit III

Vegetation – Units of vegetation – formation, association, consociation, society – Development of vegetation: Migration – colonization, ecesis, Methods of study of vegetation (Quadrat & transect). Plant succession – Hydrosere & xerosere. Ecological classification of Plants; Morphological and anatomical features of plants and their correlation to the habitat. Floristic studies – IVI, Shannon index, vegetation analysis

Unit IV

Pollution and its control: Air pollution, Radiation pollution, Noise pollution, Thermal pollution-Soil pollution: Industrial, agrochemicals (insecticides, pesticides, fungicides, herbicides). Water pollution – Industrial effluents. Marine pollution.

Unit V

Phytogeography-Approaches to Phytogeography – Climate of India & its climatic zones, Botanical regions (provinces) of India – Vegetational types of Tamil Nadu: Evergreen, deciduous, scrub & Mangrove, Continuous and discontinuous distribution. Endemism. *In situ* and *ex situ* conservation. Application of remote sensing in conservation.

Unit VI (Not for Semester Examination)

Current trends in biodiversity, ecophysiology of halophytes, global warming, zero day, GPRS, spectral vegetation studies, biodiversity hot spots, conservation methods.

BOOKS:

PLANT ECOLOGY & PHYTOGEOGRAPHY

1. Agrawal, K.C. (1987). *Environmental Biology*. Agro Botanical Publisher, India.
2. Arumugam, N. (1994). *Concepts of Ecology* (Environmental Biology). Saras Publications, Nagercoil, Tamilnadu.
3. Chandrasekaran, P. (1996). *ChutruchoozhalMaasupadu* (Environmental Pollution) T.K. Printers, Pudukkottai, Tamilnadu.
4. Kumar, H.D. (1992). *Modern Concepts of Ecology* (7thEdn.). Vikas Publishing Co., New Delhi.
5. Odum, E.P. (1971). *Fundamentals of Ecology* (2ndEdn.). Saunders & Co., Philadelphia & Natraj Publishers, Dehradun.
6. Sharma, P.D. (2000). *Ecology & Environment*. Rastogi Publications, Meerut, India.
7. Sundaram, R. (1972). *ThaavaraChuyachChoozhnilaiyiyal*. Tamilnadu Text Book Society.
8. Vashishta, P.C. (1990). *Plant Ecology*. Vishal Publications, Delhi, Jalandhar.
9. Verma, P.S. and Agarwal, V.K. (1999). *Concept of Ecology* (Environmental Biology). S. Chand & Co., New Delhi.

PHYTOGEOGRAPHY

1. Cain, S.A. (1944). *Foundations of Plant Geography*. Harper & Brothers, N.Y.
2. Good, R. (1997). *The Geography of flowering Plants* (2ndEdn.). Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi.
3. Mani, M.S. (1974). *Ecology & Biogeography of India*. Dr. W. Junk Publishers, TheHaque.

Course Outcomes:-

Students could be able to

1. Know the types of ecology, its relationship with flora plants environment.
2. Understand cause of deforestation and alleopathy.
3. Learn the concepts, components and types ecosystem.
4. Describe the food chain, food web and energy flow.
5. Explain the methods, developments and units of vegetation.
6. Differentiate the plant succession and ecological classification of plants.
7. Realize the different types of pollution and its controlling measures
8. Familiar with phyto geography, climatic conditions and botanical regions of India.
9. Discuss the various vegetational types of Tamil Nadu - Evergreen, Deciduous, Scrub& Mangrove.
10. Identify the types of distribution, endemism and conservation.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

CORE –XV (PRACTICAL)
BIOPHYSICS, BIOCHEMISTRY AND PLANT PHYSIOLOGY &
PLANT ECOLOGY AND CONSERVATION

Theory Hours :	Course code: U21BOC615P
Practical Hours :6	Credit:3
Exam Hours : 3	Marks:100

Objective:

1. To study about the plant physiology and train for experiments and know about the physiological apparatus
2. To study the plant ecology and types of plants like hydrophytes, xerophytes and mesophytes
3. To learn about the vegetation and conservation of plants and study about aquatic ecosystem

PLANT PHYSIOLOGY, BIOCHEMISTRY & BIOPHYSICS

For demonstration only

1. Enzyme activity using amylase.
2. Colorimeter – Operation and working principle
3. pH meter – Operation and working principle
4. Centrifuge – Operation and working principle

To be performed by each student

1. Colorimetric estimation of sugars
2. Gravimetric estimation of Starch
3. Determination of osmotic pressure of onion/Rheo leaf.
4. Effect of light intensity on transpiration using Ganong's potometer.
5. Determination of stomatal frequency and estimation of transpiration rate.
6. Determination of absorption and transpiration ratio in plants.
7. Measurement of respiration rate using germinating seeds and flowerbuds with simple respiroscope.
8. Separation of plant pigments by paper chromatography.
9. Determination of photosynthetic rate in water plants under different CO₂ concentrations.
10. Measurement of oxygen evolution under different colours using Wilmott's bubbler.

PLANT ECOLOGY AND CONSERVATION

1. Study of morphological and anatomical features of hydrophytes and xerophytes.
2. Study of morphological features of epiphytes, parasites and halophytes.
3. Study of vegetation by the quadrat and line transect method.
4. Estimation of frequency, density & Dominance.
5. Determination of soil & water pH.
6. The light and dark bottle experiment for primary productivity study in the aquatic ecosystem.

Course Outcomes:-

Students could be able to

1. Demonstrate the enzyme activity using amylase.
2. Understand the operation and working principles of
 1. Colorimeter, 2. PH metre and 3. Centrifuge
3. Estimate the sugar and starch by Colorimetric and gravimetric methods.
4. Determine the osmotic pressure, the light density of transpiration, stomatal frequency, transpiration rate, absorption and transpiration ratios and photosynthetic rate in water plants under different carbondioxide concentrations.
5. Measure the respiration rate using germinating seeds and flower buds – and oxygen evolution under different colors using respiroscope and Wilmott's bubbler.
6. Separate the plant pigments by paper chromatography.
7. Identify the morphological and anatomical features of Hydrophytes, Xerophytes, Epiphyte, parasite and Halophytes through spotters and photographs.
8. Observe the types of the vegetation methods
9. Estimate frequency, density and dominance.
10. Analyse the PH of soil and water.

U.G Question Paper Patten (SEM: 60 Mark+CIA:40Marks=Total:100 marks)

MAJOR-BASED ELECTIVE II
1.PLANT BREEDING, LANDSCAPING AND HORTICULTURE

Theory Hours : 6	Course code: U21BO6MBE2:1
Practical Hours :3	Credit:5
Exam Hours : 3	Marks:100

Objectives:

This course introduces

1. the various methods of plant breeding and plant propagation
2. teaches students the art of growing plants for a pre-defined purpose and pleasure and facilitates students to become an entrepreneur

PLANT BREEDING

Unit I

Methods of crop improvement – Introduction, acclimatization, selection methods (Mass, pure line and clonal).Hybridization techniques – interspecific and Intergeneric hybridization, Heterosis.

Unit II

Back crossing, Mutation breeding, Polyploidy and its application in plant breeding, Role of auto- and allopolyploid, breeding for crop improvement with reference to Paddy, Wheat, Sugarcane and Groundnut.

HORTICULTURE

Unit III

Horticulture - scope and importance. Horticultural crops - climate, soil, water and nutritional needs. Plant propagation methods – cutting, layering, grafting and budding.Plant growth regulators in horticulture.

Unit IV

Classification of horticultural crops- Pomology, Olericulture, Floriculture, Spices and Plantation crops. Green house, Indoor gardening, Bonsai. Flower arrangements – Nursery management and Maintenance.

Unit V

Landscaping: Principles, elements and design and layout - formal garden, Informal garden, Special types of gardens (bog garden, sunken garden, terrace, rock garden), and specific areas.

BOOKS:

1. Allard, R.W. (1960). *Principles of Plant Breeding*. John Wiley & Sons, New York.
2. Bose, T.K., Maiti, R.G., Dhua, R.S. and Das, P. (1999). *Floriculture and Landscaping*. NayaPrakash, Calcutta.
3. Chopra, V.L. (1989). *Plant Breeding*. Oxford IBH, New Delhi.
4. Jenson, N.F. (1988). *Plant Breeding Methodology*. Wiley Inercience Publication, New York.
5. Kumar, N. (1997). *Introduction to Horticulture*. Rajalakshmi Publication, India.
6. ManibhushanRao, K. (1991). *Text Book of Horticulture*. Macmillan Publications, New Delhi.
7. Mukherjee, D. (1972). *Gardening in India*. Oxford & IBH Publishing Co., Kolkatta, Mumbai, New Delhi.
8. Roy Choudhry, N. and Mishra, H.P. (2001). *Text book on Floriculture and Landscaping*. Raja Infotech Enterprise, India.
9. Sandhu, M.K. (1989). *Plant Propagation*. Wiley Eastern Ltd., New Delhi.
10. Sharma, J.R. (1994). *Principles and Practice of Plant Breeding*. Tata McGraw Hill, New Delhi.

Course Outcomes:-

Students could be able to

1. Describe the different methods of crop improvement such as introduction, acclimatization and selection.
2. Learn the various techniques of hybridization
3. Understand the Mutation breeding and its application in plant breeding.
4. Know the types polyploidy and its role for crop improvement.
5. Explain the scope and importance of Horticulture.
6. Acquire knowledge about the different methods of plant propagation and plants growth regulator in Horticulture.
7. Realize classification of horticultural crops.
8. Create interest in different Horticultural techniques such as Green House, Indoor Gardening, Bonsai, Flower arrangement and Nursery management.
9. Understand the principle, Elements, designe and layout of landscaping.
10. Describe the special types of Gardens in specific area.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

MAJOR-BASED ELECTIVE II
2.Preservation of Fruits and Vegetables

Theory Hours : 6
Practical Hours :3
Exam Hours : 3

Course code: U21BO6MBE2:2
Credit:5
Marks:100

Objectives :

- To understand the fundamentals of food processing.
- To know the fruits and vegetable products microbial based industries.
- To gain knowledge about preservation of fruits and vegetable.

Unit I:Principles of preservation, Methods of preservation - refrigeration, freezing, canning, drying and dehydration, chemical preservatives.

Unit II:Food spoilage causes and factors. Causes physical, chemical and biological factors pH, temperature, available moisture.

Unit III :Canning of Fruits: mango, apple and banana. Canning of vegetables: bean, carrot and tomato.

Unit IV: Processing methods of the following fruits. Banana, dates, grape, fig and mango Preparation of jam, jelly juice squash, pickles, marmelods.

Unit V:Asepsis- packing and packing materials, metal, glass, papers, plastics and films, laminates, Edible films and wooden packaging.

Books for Reference:

1. Siddappa, G.S. and Tandon, G.L., (1998). Preservation of Fruits and Vegetables S Lal G., Indian Council of Agricultural Research, New Delhi. 2006. M/s. IRD
2. Preservation and Canning of Fruits and Vegetable (EIRI), Publishers, New Delhi.
3. Frazier, w.C. and West Holf, D.C., (1995). Food Microbiology. Tata McGraw Hill Publishing Col. Ltd., New Delhi.
4. Kulshrestha, S.K., (1994). Food Preservation, Vikas Publishing House, New Delhi.
5. Swaminathan, M., (1992). Handbook of food Science and Experimental foods, the Bangalore printing and Publishing Col. Ltd., Bangalore.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

MAJOR-BASED ELECTIVE- II

3. Biotechnology

Theory Hour : 6
Practical Hours :3
Exam Hours : 3

Course code: U21BO6MBE2:3
Credit:5
Marks:100

Objectives:

- To know the outlines of Biotechnology.
- To understand the application of genetic engineering.
- To understand the mechanism of biological nitrogen fixation.
- To know the various aspects of fermentation.
- To study the basic aspects of various biofuels.

Unit I : Scope and importance of biotechnology. Basic of genetic engineering foreign DNA preparation, insertion of DNA into vectors. Enzymes of genetic engineering: restriction endonucleases & ligases Gene cloning vectors plasmids (pBR322) and cosmids (PLFR5).

Unit II : Selection of recombinants - using antibiotic markers, radio labeling replica plating Transgenic plants for herbicide resistant - applications of genetic engineering.

Unit III : Biological nitrogen fixation- mechanism, use of Azotobacter, Anabaena and Rhizobium as biofertilizer organisms.

Unit IV : Biological waste treatments sewage and reuse of wastes, primary and secondary treatments. Oxidation ponds. AnaerODIC digestion and reuse of sewage.

Unit V : Fermentation: Types of fermentor, media - Production of enzymes; (protease), alcohol (ethanol) and antibiotics (Penicillin).

Books for Reference:

1. Dubey, R.C. and Maheswari, D.K., (2003). A text book of Microbiology. S.Chand and Campus, New Delhi.
2. Kumaresan, V., (2001). Biotechnology Saras Publication, Nagarcoil.
3. Ratledge and Kristenson, (2001). Basic Biotechnology, Oxford University Press.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

MAJOR-BASED ELECTIVE - III
PLANT BIOTECHNOLOGY AND BIOINFORMATICS

Theory Hours :5
Practical Hours :-
Exam Hours : 3

Course code: U21BO6MBE3:1
Credit:4
Marks:100

Objectives:

1. To comprehend the advances made in the field of plant biotechnology; and bioinformatics
2. To understand how mere jumbling of genes results in the creation of new organisms

Unit I

Biotechnology: definition and scope. Tissue culture: sterilization methods, media preparation (MS basal medium); use of different explants types; materials and callus growth; differentiation; subculturing and hardening.

Unit II

Plasmids: general features and types; plasmids as vectors - pBR 322, Ti-plasmid; cosmids, phagemids, Lambda-phage; transposons; site directed mutagenesis.

Unit III

Steps involved in genetic engineering: generation of desired foreign genes by restriction enzymes and cDNA synthesis; joining DNA molecules; transfer of rDNA molecules into bacteria and plants. Southern and Western blotting. PCR technique. Role of *Agrobacterium* in plant genetic engineering.

Unit IV

Importance and application areas: biomass production - food (single cell proteins); bio-fertilizers. Environmental Biotechnology: Waste treatment – solid (compost), Liquid (industrial effluents), sewage treatment (domestic sewage).

Unit V

Bioinformatics: History, scope and applications. Types of biological databases. Nucleic acid databases - Genbank, NCBI, EMBL, DDBJ; Primary protein databases - SWISSPROT, TrEMBL; Secondary protein databases - PROSITE, PROFILES, PRINTS, Pfam; Structural classification databases - SCOP, CATH; Literature databases - PubMed, Medline.

BOOKS:

1. Arthur, M.L. (2005). *Introduction to Bioinformatics* (Ed:2). Oxford University Press, New York.
2. Attwood, T.K. and Parrysmith, D.J. (2001). *Introduction to Bioinformatics*. Pearson Education, New Delhi.
3. Chatterji, A.K. (2011). *Introduction to Environmental Biotechnology*. Prentice Hall India Pvt., Ltd., New Delhi.
4. Dubey, R.C. (2013). *A Textbook of Biotechnology*. S. Chand & Company Ltd., New Delhi.

5. Gupta, P.K. (1994). *Elements of Biotechnology*. Restogi Publications, Meerut.
6. Ignacimuthu, S. (1997). *Plant Biotechnology*. Oxford & IBM Publishing Co., New Delhi.
7. Kalyan Kumar De. (1997). *Plant Tissue culture*. New central Book Agency, Calcutta.
8. Kumar, H.D. (1991). *A Textbook on Biotechnology*. East west press, New Delhi.
9. Parihar, P. (2014). *A Textbook of Biotechnology*. Argobios Publications, Jodhpur
10. Purohit, S.S. (2003). *Agricultural Biotechnology*. Agrobios Publications, Joshpur.
11. Trevan, M.D., Boffey, S., Goulding, K.H. and Stanbury, P. (1988). *Biotechnology – The Biological Principles*. Tata McGraw Hill Publishing Co., New Delhi.

Course Outcomes:-

Students could be able to

1. Definition and scope of Biotechnology.
2. Describe the different techniques use in tissue culture.
3. Explain general feature, types of the varies plasmid are used in vector.
4. Understand the steps, techniques and involved in Genetic Engineering.
5. Realize the role of Agro bacterium in plant genetic engineering.
6. Analysis the importance and application of bio-mass production and Biofertilizers.
7. Know types of waste treatment, solid, liquid and sewage.
8. Familiar the history scope and application of bio-informatics
9. Learn the different types of data-base-biological nucleic acid primary and secondary protein.
10. Identify the structural classification and literature databases.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Two Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

MAJOR-BASED ELECTIVE - III

3. Environmental Biotechnology

Theory Hours :5

Practical Hours :-

Exam Hours : 3

Course code: U21BOMBE3:2

Credit:4

Marks:100

Objectives:

- To give an insight into environmental pollution and microbial processes in the environment. The paper is also mainly focused to provide knowledge on the use of microbes for a safe of environment and to treat hazardous waste using biotechnological processes.

Unit I: Introduction The environment - soil, water and air. Pollution and its causes (Outline only) Nonconventional energy sources biogas production, methane and hydrogen production. Recycling of solid waste products composting and silaging.

Unit II: Source and treatment of polluted water and effluents Biological treatment of sewage characteristics of sewage and objectives in sewage treatment Activated sludge process - trickling filters Anaerobic digestion. Treatment of industrial effluents using bioreactors.

Unit III: Soil and air pollution and their treatment Soil pollution by Xenobiotics. Degradation of Xenobiotics pathways of phenol, penta chlorophenol and poly chlorinated biphenyl degradation. Purification of polluted air.

Unit IV: Introduction to bioremediation, ex situ and in situ bioremediation. Types of reactors used in bioremediation. Unit V Biomineralization- bioleaching - Metal transformation biofilms and biocorrosion. Pollution by radionuclides uptake of radionuclides from polluted sites. Future prospects.

Books for Reference:

- Alan Scrag, (1999). Environmental Biotechnology, Pearson Education Limited. Dubey, R.C.,(2004). A text Book of Biotechnology aspects of Microbiology, British sun Publication.
- Joseph,C.Daniel,(1996).Environmental aspects of Microbiology,British Sun Publication.
- Keeshav Thehan, (1997).Biotechnology, New age International (P) Limited, New Delhi.
- Sharma, P.D., (2005).Environmental Microbiology, Narosa Publishing House Pvt. Ltd., New Delhi.
- Raina Maier, M., Iran Pepper, L., Charles, P. and Gerba, (2000). Environmental Microbiology, Academic Press UK.
- Alexander, N., Glazer and Hiroshi Nikaido, (1994). Microbial Biotechnology. Special issue on bioremediation and biodegradation. Indian Journal of Experimental Biology, September 2003. Vol. 41(9). National Institute of Science Communication and Information Resources, CSIR New Delhi.

Course Outcomes:-

Students could be able to

- Know types of waste treatment, solid, liquid and sewage.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Two Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

MAJOR-BASED ELECTIVE - III

4. Plant Tissue Culture

Theory Hours :5

Practical Hours :-

Exam Hours : 3

Course code: U21BO6MBE3:3

Credit:4

Marks:100

Objectives:

To know the scope of plant tissue culture. To learn the tissue and organ culture. To learn the protoplast culture.

Unit I: Introduction - History, Scope and Concepts of basic techniques in plant tissue culture. Laboratory requirements. Sterilization, Media preparation - inorganic nutrients, organic supplements, carbon source, gelling agents, growth regulators and composition of MS medium.

Unit II: Cell, tissue and organ culture Explants and organs for culture - cell suspension cultures - batch, continuous, chemostat culture.

Unit III; Organogenesis - formation of shoots and roots Role of growth regulators Somatic embryogenesis factors affecting somaclonal and gametoclonal variations embryogenesis.

Unit IV: Haploid production anther culture - Utilization of haploids in plant breeding. In vitro pollination ovule and embryo culture- and its importance.

Unit V: Protoplast culture: Isolation of protoplasts culture of protoplasts viability. Protoplast fusion Spontaneous, mechanical, induced electrofusion - importance.

Books for Reference :

1. Bhojwani, S. S. and Razdan, M. K. (1983). Plant Tissue Culture: Theory and Practice. Elsevier Science Publishers, Netherlands.
2. Dodds, J. H. and Roberts, I. W. (1985). Experiments in Plant Tissue Culture. Cambridge University Press, UK.
3. Hammond, J., McGarvey, P. and Yusibov, V. (2000). Plant Biotechnology. Springer Verlag, New York.
4. Johri, B. M. (1982). Experimental Embryology of Vascular Plants. Narosa Publishing House, New Delhi.
5. Ramawat, K. G. (2000). Plant Biotechnology. S. Chand & Co., New Delhi.
6. Reinert, J. and Bajaj, Y. P. S. (1977). Plant Cell Tissue and Organ Culture: A Laboratory Manual, Narosa Publishing House, New Delhi. K.Karthikeyan. C. Chandran and S.Kulothungan plant Biotechnology.

Course Outcomes:-

Students could be able to

1. Definition and scope of plant tissue culture.
2. Describe the different techniques use in tissue culture.
3. Explain general feature, types of the Protoplast culture.
4. Understand the steps, techniques plant tissue culture.
5. Realize the role of Agro bacterium in plant genetic engineering.
6. Analysis the importance and application of tissue and organ culture Explants.

U.G Question pattern (SEM: 75 mark +CIA:25 mark =Total:100 marks)

Section-A	Twenty multiple choice question (Four Question from each unit)	20×1=20marks
Section-B	Five Question (Two Question from each unit –Either or type)	5×5=25 marks
Section-C	Three Question (Out of five one question from each unit)	3×10=30marks

THANKING YOU