

# **SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN**

**(Autonomous)**

**Madurai - 625 002.**



## **DEPARTMENT OF BOTANY**

### **Syllabus for B.Sc. Botany**

**June 2022 Onwards**

## **DEPARTMENT OF BOTANY**

Study of plants has always been a fascination of the human kind for all life will have to essentially depend on floral elements for both nutritional and survival needs. From such a fundamental understanding of life and life's processes, to reach to an aesthetic appreciation of nature and its constituent biotic elements interacting with the abiotic material world, one needs a systemic approach and a critical study of the plant world. The idea of development and conservation will have to be pragmatically addressed for a comprehensive understanding and an active engagement at different levels. The Department of Botany dedicating its efforts, grit and the single-minded focus on this exciting mission, functions as a humble but active constituent of the noble institution Sri Meenakshi Government Arts College for Women that has envisioned and committed itself to the cause of emancipation of the womanhood in this part of our nation. The crew in Botany dedicates dearly for the noble endeavor by finding viable and practical solutions, infusing interest and imparting relevant skills in every possible way that a holistic education is made available in its portal.

The credibility and trust that the college and the department have earned over the years make the women folk of this region to come into its fold for pursuing professional training for career prospects. The need for updated knowledge in Botany to deal with the issues of this predominantly agrarian backdrop and the modest household from where the students hail, but the immense energy and potential that they hone could suffice to find relevance in these students to go after their personal and professional dreams and aspirations. The programs, courses and the training offered in the department by its committed faculty help learners to equip with vocational skills and leadership traits that the two academic programs, offered at the bachelors' and masters' level to promptly meet the task cut out (Specific Vision, Mission statements) with appropriate outcomes (listed course-wise), embed effective exposure and ensure training on plant based knowledge and resources for self actualization and upholding common good.

### **Programs offered by the Department:**

1. B.Sc. Botany since 2008-09
2. M.Sc. Botany since 2013-14

**Object of the Department:**

***To explore nature and the plant world and translate the experience in organic terms for empowering self and womanhood***

**Vision**

- To help learners gain insights on the intricacies of variations in plant forms from common ancestral stocks to appreciate the grand unification of life
- To appreciate the robustness of Indian floristic wealth to cherish and own with pride the rich heritage of the motherland
- To provide understanding on effective management and use of plant resources with ecological fairness
- To enable a thorough study of the constituent structure and functions of plant paving way for sustained utilization
- To make students life-long learners with skilled expertise to find botanical solutions and face challenges in real-life situations

**Mission**

- To inculcate confidence and entrain women folk to hone life and career skills for self reliance and inclusive development
- To provide updated knowledge to handle professional and vocational tasks in this agrarian district in consonance with the subject-based training
- To provide ample chances for students to inculcate leadership traits and provide the grit to deal with the challenges that one would face in life
- To entrain students to identify plants at different locations and impart the idea of sustainable use and conservation for ideal plant resource management
- To offer entrepreneurial insights in plant-based vocations and make learners to secure placement in private and public sector or kickstart their own business

## **PROGRAMME OBJECTIVES FOR ALL UNDERGRADUATE PROGRAMMES**

**PO1:** Inculcate a sustained interest to learn new concepts, techniques and acquire discipline based knowledge

**PO2:** Relate their knowledge to design problem solving strategies addressing the demands in the society

**PO3:** Involve themselves in capacity building and hone their skills for technical, conceptual and creative excellence

**PO4:** Perceive a plan to take up Post Graduate programmes leading to research within and outside their disciplines

**PO5:** Contribute to the ecological space and be sensitive to the multi dimensional aspects of our country and strive for harmonious existence through environment –friendly academic involvement

## **PROGRAMME SPECIFIC OUTCOMES (PSO) FOR B.Sc. BOTANY**

**PSO 1:** Enabling the exploration of nature and plant world without any bias and to acquire vast intellectual knowledge about the biology of living plants.

**PSO 2:** To integrate the analytical skills and to develop the innovative approaches in the field of plant sciences to strengthen the dependent community.

**PSO 3:** Building core competence in developing cognitive, affective and psychomotor domains of learning and to acquire analytical and professional skills to pursue as a trained Botanist.

**PSO 4:** Providing a platform with strong understanding of the plant world with further training and specialization to turn up as an avid learner competent researchers and a successful entrepreneur.

**PSO 5:** Catering to foresee climate risks, interpret policies of governance in protecting Environment and to become stewards of common good.

**SRI MEENAKSHI GOVT ARTS COLLEGE FOR WOMEN (A), MADURAI**

**PROGRAMME: B.Sc. BOTANY**

**Semester- I**

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Credits	Exam hrs	Marks		
							Int	Ext	Total
I	LC	U221A1/ U221A1	Tamil/Hindi	6	3	3	25	75	100
II	ELC	U222A1	English	6	3	3	25	75	100
III	CC 1	U22CB1	Algae, Fungi And Lichens	6	5	3	25	75	100
III	CC II	U22CB2P	Practical I	3	3	3	40	60	100
III	AC I	U22ABB1	Introduction to Ecobiology	4	3	3	25	75	100
III	AC II	U22ABB2P	Allied Practical – I	3	-	-	-	-	-
IV	AEC 1	U22AE1	Value Education	2	2	3	25	75	100
			<b>Total</b>	<b>30</b>	<b>19</b>				<b>600</b>

## Semester- II

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Cdts	Exam hrs	Marks		
							Int	Ext	T
I	LC	U221A2/ U221A2	Tamil/Hindi	6	3	3	25	75	1
II	ELC	U222A2	English	6	3	3	25	75	1
III	CC III	U22CB3	Bryophytes, Pteridophytes, Gymnosperms And Paleobotany	6	5	3	25	75	1
III	CC IV	U22CB4P	Practical II	3	3	3	40	60	1
III	AC III	U22ABB3	Ancillary Paper II Energy Resources	4	4	3	25	75	1
III	AC II	U22ABB2P	Allied Practical – I	3	3	3	40	60	1
IV	AEC 1I	U22AE2	Environmental Studies	2	2	3	25	75	1
			<b>Total</b>	<b>30</b>	<b>23</b>				<b>7</b>

### Semester- III

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Cdts	Exam hrs	Marks		
							Int	Ext	Total
I	LC	U221A3/ U221A3	Tamil/Hindi	6	3	3	25	75	100
II	ELC	U222A3	English	6	3	3	25	75	100
III	CC V	U22CB5	Plant Anatomy and Embryology of Angiosperms	6	5	3	25	75	100
III	CC VI	U22CB6P	Practical III	3	3	3	40	60	100
III	AC IV	U22ACT1	Chemistry- Theory	4	3	3	25	75	100
III	AC V	U22ACP	Chemistry- Practical	3	-	-	-	-	-
IV	NMEC 1	U22NMB1	Horticulture	2	2	3	25	75	100
V			NCC/NSS/Extension Activity	-	1	-	100	-	100
	<b>Total</b>			<b>30</b>	<b>20</b>				<b>700</b>

### Semester- IV

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Cdts	Exam hrs	Marks		
							Int	Ext	Total
I	LC	U221A4/ U221A4	Tamil/Hindi	6	3	3	25	75	100
II	ELC	U222A4	English	6	3	3	25	75	100
III	CC VII	U22CB7	Taxonomy of Angiosperms	4	4	3	25	75	100
III	CC VIII	U22CB8P	Practical IV	3	3	3	40	60	100
III	AC VI	U22ACT2	Chemistry- Theory	4	4	3	25	75	100
III	AC V	U22ACP	Chemistry- Practical	3	3	3	40	60	100
IV	NMEC II	U22NMB2	Medicinal Botany	2	2	3	25	75	100
IV	SEC I	U22SEB1	Horticulture	2	2	3	25	75	100
	<b>Total</b>			<b>30</b>	<b>24</b>				<b>800</b>

### Semester- V

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Cdts	Exam hrs	Marks		
							Int	Ext	Total
III	CCIX	U22CB9	Cell Biology, Genetics and Evolution	5	4	3	25	75	100
III	CCX	U22CB10	Plant Physiology	5	5	3	25	75	100
III	CCXI	U22CB11	Biochemistry and Biophysics	5	5	3	25	75	100
III	CCXII	U22CB12P	Practical V	6	5	3	40	60	100
III	DSEC1	U22DSB1A/	Forestry and Economic Botany	5	4	3	25	75	100
		U22DSB1B	Environmental Biotechnology						
III	GEC1	U22GEB1A/	Organic Farming	2	2	3	5	75	100
		U22GEB1B	Medicinal Botany						
IV	SECII	U22SEB2	Mushroom Cultivation	2	2	3	25	75	100
	<b>Total</b>			<b>30</b>	<b>27</b>				<b>700</b>

## Semester -VI

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Cdts	Exam hrs	Marks		
							Int	Ext	Total
III	CCXIII	U22CB13	Microbiology and Plant Pathology	5	5	3	25	75	100
III	CCXIV	U22CB14	Plant Biotechnology and Bioinformatics	5	5	3	25	75	100
III	CCXV	U22CB15P	Practical-VI	6	5	3	40	60	100
III	DSEC II	U22DSB2A/ U22DSB2B	Industrial Microbiology	5	4	3	25	75	100
			Molecular Biology and Recombinant Technology						
III	DSECIII	U22DSB3A/ U22DSB3B	Biodiversity	5	4	3	25	75	100
			Environmental Related Occupational Hazards						
IV	SECIII	U22SEB3	Biological Techniques	2	2	3	25	75	100
IV	AECIII	U22AE3	General Knowledge	2	2	3	25	75	100
	<b>Total</b>			<b>30</b>	<b>27</b>				<b>700</b>

**B.Sc. BOTANY – THEORY CORE PAPERS**

S.NO	SEM	NAME OF THE SUBJECT	HRS/ WEEK	CREDIT	HRS/ SEM
1	I	Algae, Fungi and Lichens	6	5	90
2	I	Practical-I	3	3	45
3	II	Bryophytes, Pteridophytes, Gymnosperms and Paleobotany	6	5	90
4	II	Practical-II	3	3	45
5	III	Plant Anatomy and Embryology of Angiosperms	6	5	90
6	III	Practical-III	3	3	45
7	IV	Taxonomy of Angiosperms	4	4	60
8	IV	Practical-IV	3	3	45
9	V	Cell Biology, Genetics and Evolution	5	4	75
10	V	Plant Physiology	5	5	75
11	V	Biochemistry and Biophysics	5	5	75
12	V	Practical-V	6	5	90
13	VI	Microbiology and Plant Pathology	5	5	75
14	VI	Plant Biotechnology and Bioinformatics	5	5	75
15	VI	Practical- VI	6	5	75

**B.Sc. BOTANY**

**Major Theory - Scheme of Examination  
From 2022 onwards**

Year	Sem No	Paper No	Subject	Duration of Exam	Passing Minimum 40%		
					Int	Ext	Total
I	I	I	Algae, Fungi and Lichens	3	25	75	100
I	I	II	Practical-I	3	40	60	100
I	II	III	Bryophytes, Pteridophytes, Gymnosperms and Paleobotany	3	25	75	100
I	II	IV	Practical-II	3	40	60	100
II	III	V	Plant Anatomy and Embryology of Angiosperms	3	25	75	100
II	III	VI	Practical-III	3	40	60	100
II	IV	VII	Taxonomy of Angiosperms	3	25	75	100
II	IV	VIII	Practical-IV	3	40	60	100
III	V	IX	Cell Biology, Genetics and Evolution	3	25	75	100
III	V	X	Plant Physiology	3	25	75	100
III	V	XI	Biochemistry and Biophysics	3	25	75	100
III	V	XII	Practical-V	3	40	60	100
III	VI	XIII	Microbiology and Plant Pathology	3	25	75	100
III	VI	XIV	Plant Biotechnology and Bioinformatics	3	25	75	100
III	VI	XV	Practical-VI	3	40	60	100

#### ABILITY ENHANCEMENT COURSE

<b>S.No</b>	<b>Semester</b>	<b>Subject Code</b>	<b>Subject</b>	<b>Hours/week</b>	<b>Credit</b>
1	I	U22AE 1	Value Education	2	2
2	II	U22AE 2	Environmental Studies	2	2
3	VI	U22AE3	General Knowledge	2	2

#### **DISCIPLINE SPECIFIC ELECTIVE COURSE**

S.No	Semester	Subject Code	Subject	Hrs/week	Credit
1	V	U22DSB1A/ U22DSB1B	Forestry and Economic Botany	5	4
			Environmental Biotechnology		
2	VI	U22DSB2A/ U22DSB2B	Industrial Microbiology	5	4
			Molecular Biology And Recombinant Technology		
3	VI	U22DSB3A/ U22DSB3B	Biodiversity	5	4
			Environment Related Occupational Hazards		

**NON MAJOR ELECTIVE COURSE**

<b>S.No</b>	<b>Semester</b>	<b>Course Code</b>	<b>Subject</b>	<b>Hours/week</b>	<b>Credit</b>
1	III	U22NMB1	Horticulture	2	2
2	IV	U22NMB2	Medicinal Botany	2	2

#### **SKILL ENHANCEMENT COURSE**

<b>S.No</b>	<b>Semester</b>	<b>Subject Code</b>	<b>Subject</b>	<b>Hours/ week</b>	<b>Credit</b>
1	IV	U22SEB1	Horticulture	2	2
2	V	U22SEB2	Mushroom Cultivation	2	2
3	VI	U22SEB3	Biological Techniques	2	2

**Programme: B.Sc.**

**Semester : I**

**Sub. Code : U22CB1**

**Part III: Core Paper I**

**Hours: 6 hrs/week 90hrs/sem**

**Credits: 5**

**TITLE OF THE PAPER: ALGAE, FUNGI AND LICHENS**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	5	3	-	1	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li>□ As the first course opening up the learning in Botany, this paper sets the tone for courses in plant sciences by offering an introduction to the plant way of life.</li><li>□ Serving as curtain raiser, it focuses on the early cryptogams and introduces the structural variations, reproductive processes and life cycle changes seen in representative forms of different plant groups.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the students will be able to						
<b>UNIT 1 CO1:</b> Spot, collect, identify algal forms, and recognize the ways of utilizing the algal resources for their vocation and livelihood					1	20
<b>UNIT 2 CO2:</b> Compare the similarities and contrast differences between the chosen groups and eventually be able to build logic for understanding and appreciating plant evolution					2	15
<b>UNIT 3 CO3:</b> Learns the characteristic feature and habitat of fungal groups					3	20
<b>UNIT 4 CO4:</b> Understands and compares the lifecycle patterns of different fungal groups.					4	20
<b>UNIT 5 CO5:</b> Enable the students to know the organization of lichen thallus, the ecological benefits and uses of it, recognizes the causal organism and symptoms of some common plant diseases.					5	15
<b>SYLLABUS</b>						
<b>Unit I:</b> <p>Introduction to Algae, General characters of algae. An overview of F.E.Fritsch Classification (1965).General characteristics, a detailed study on the structure and reproduction of Cyanophyceae-<i>Oscillatoria</i>, Chlorophyceae-<i>Chlamydomonas</i>, <i>Volvox</i> and <i>Oedogonium</i> (Development of reproductive organs need not be studied).</p>						

**Unit II:**

General characteristics, a detailed study on the structure and reproduction of Bacillariophyceae - *Diatoms*, Phaeophyceae- *Sargassum* and Rhodophyceae –*Gracilaria* (Development of reproductive organs need not be studied).Economic importance of algae.

**Unit III:**

General Characteristics of fungi. Outline Classification of Fungi proposed by Alexopoulos and Mims, 1979. Economic importance of fungi. A study on the occurrence, structure and reproduction and life cycle of the following Oomycetes - *Albugo*, Ascomycetes -*Peziza* (Development of Reproductive organs need not be studied).

**Unit IV:**

A study on the occurrence, structure, reproduction and Life cycle of the following Basidiomycetes -*Puccinia*, Deuteromycetes - *Fusarium*, (Development of Reproductive organs need not be studied). Economic importance of Fungi.

**Unit V:**

General Characteristics of Lichens, Types of lichens, Vegetative reproduction-Fragmentation, *Isidia*, *Soredia*. Sexual reproduction- Apothecium. Structure and reproduction of *Usnea*. Economic importance of Lichens with reference to medicine and food- Lichen as pollution indicators.

**TEXT BOOKS:**

1. Pandey B.P., 2005, *College Botany Vol I*, S.Chand Company

**REFERENCES:**

1. Kumar H.D and Singh H.N., 1988, *Text Book of Algae*, East West press.
2. Sharma O.P., 1986, *Text Book of Algae*, Tata Mc Graw Hill Publications.
3. Gupta, J.S. 1986 – Text book of Fungi – Oxford and IBH Publishing Co. Pvt. Ltd.,
4. Hale, M.E. 1983 – The Biology of Lichens 3rd Ed Edward Arnold (Publishers) Ltd., London.
5. Singh, R.S. 2001 – Plant Disease Management – Oxford IBH.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 20 hours per semester			
	Introduction to Algae, General characters of algae	2 hours	Chalk–talk techniques to familiarize terms, definitions and key words used
	An overview of F.E. Fritsch Classification (1965, algal pigments)	2 hours	Use of OHP and power point presentation to introduce the selected scheme of classification for holistic coverage
	Habit and Habitats of fresh water and marine algae	2 hours	Slide shows and guided personalized observations of museum mounts
	Life cycle patterns of algae	2 hours	Animated Power Point Presentation
	Economic importance of algae	2 hours	Through survey of algal produce and products of agricultural and industrial significance made with algal input
	General characteristics, a detailed study on the structure and reproduction of Cyanophyceae- Oscillatoria	3 hours	Backed by microscopic investigations of live specimen intricacies explained through Slide show & ICT tools
	General characteristics, a detailed study on the structure and reproduction of Chlorophyceae- Chlamydomonas	3 hours	Charts, AV aids and animated projections Explanation using PPT
	A detailed study on the structure and reproduction of Volvox	2 hours	Charts, AV aids and animated projections Explanation using PPT
	A detailed study on the structure and reproduction of Oedogonium	2 hours	Charts, AV aids and animated projections Explanation using PPT

UNIT II: 15 hours per semester			
	General characteristics, a detailed study on the structure and reproduction of Bacillariophyceae - Diatoms	7 hours	Charts, AV aids and animated projections Explanation using PPT
	General characteristics, a detailed study on the structure and reproduction of Phaeophyceae- Sargassum	7 hours	Charts, AV aids and animated projections Explanation using PPT
	General characteristics, a detailed study on the structure and reproduction of Rhodophyceae –Polysiphonia	6 hours	Charts, AV aids and short films on ocean life and life cycle changes in red algae Animated projections Explanation using PPT
UNIT III: 20 hours per semester			
	General characters of fungi Classification of fungi (Mims,1979)	5 hours 5 hours	Black Board Use to familiarize and internalize terms and keywords Use of OHP to present schemes of classification
	Structure and life cycle of Oomycetes- Albugo	5 hours	Use of OHP and power point presentation to introduce the selected scheme of Lifecyclefor holistic coverage
	Structure and life cycle of Ascomycetes- Peziza	5hours	Animated presentation of life cycle, Slide show
UNIT IV: 15 hours per semester			
	Structure and life cycle of Basidiomycetes- Puccinia	5 hours	Explanation using museum mounts, Study through free hand sections
	A detailed study on the structure, reproduction and life cycle of Deuteromycetes, Economic importance of fungi	5 hours	Display and description through charts

UNIT V: 20 hours per semester			
	General characters of lichens- types of lichens Thallus organization, vegetative reproduction	4 hours	Chalk- talk AV aids
	Sexual reproduction- Apothecium, structure and reproduction of Usnea	5 hours	Lecture AV aids
	Economic importance of lichens, as pollution indicators	4 hours	Lecture
	Classification of plant diseases,  Study of plant diseases- Tikka disease, Citrus canker	4 hours	PPT Chalk talk Specimen (infected leaf)
	Little leaf of Brinjal, TMV	3 hours	Chalk talk, AV aids.

Course Outcomes (Cos)	Programme Outcomes (PO s)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	3	4	4	4	3	4	3	2	3.4
CO2	4	4	3	4	4	4	3	4	3	2	3.5
CO3	4	3	3	4	4	4	3	4	3	2	3.4
CO4	4	4	3	4	4	4	3	4	3	2	3.5
CO5	4	4	3	4	4	4	3	4	3	3	3.6
											3.48

Result: The Score for this Course is 3.48 (High Relationship)

**Programme : B.Sc.**

**Semester : I**

**Sub. Code : U22CB2P**

**Part III: Core Practical I**

**Hours: 3hrs/week 45hrs/sem**

**Credits: 3**

**TITLE OF THE PAPER: MAJOR PRACTICAL I**

Pedagogy	Hours	Lab experimentation	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	8	8	-	-	-
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To make the students know about the concepts on Plant diversity and to develop the skills in identifying the various plant group.</li><li><input type="checkbox"/> To understand the principles and concepts in Thallophytes</li><li><input type="checkbox"/> To acquire the skills in sectioning and identifying them with characteristic features.</li><li><input type="checkbox"/> To understand the practical aspects of different plant groups</li><li><input type="checkbox"/> To acquire knowledge about the pollution indicators.</li></ul>					
<b>COURSE OUTCOME</b> <p>At the end of the Semester, the students will be able to</p>					
<b>UNIT 1 CO1:</b> Able to write technical description of plants to their systemic position.					
<b>UNIT 2 CO2:</b> Apply the knowledge of plant observation and identify them with characteristic features.					
<b>UNIT 3 CO3:</b> Learn the structure of Lichen and its importance as pollution indicators.					
<b>UNIT 4 CO4:</b> Identify the types of plants and classify them					
<b>UNIT 5 CO5:</b> Learn the concepts and facts about various plant groups					
<b>SYLLABUS</b> <p><b>Study of Morphology and Anatomy of the following:</b></p> <p><b>I. Algae</b></p> <ol style="list-style-type: none"><li>1. <i>Oscillatoria</i></li><li>2. <i>Volvox</i></li><li>3. <i>Diatoms</i></li><li>4. <i>Sargassum</i></li></ol>					

5. *Gracilaria*

## II. Fungi

1. *Albugo*

2. *Peziza*

3. *Puccinia*

4. *Fusarium*

## III. Lichen

1. *Usnea*

## IV. Spotters related to theory

Course Outcomes (Cos)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	3	4	3	3	3	4	3	2	3.2
CO2	4	3	3	4	3	3	3	4	3	2	3.2
CO3	4	3	3	4	4	3	3	4	3	2	3.3
CO4	4	3	3	4	3	3	3	4	3	2	3.2
CO5	4	3	3	3	3	3	3	3	3	2	3.0
											3.18

Result: The Score for this Course is 3.18 (High Relationship)

**Programme : B.Sc.**

**Part III: Ancillary Paper I**

**Semester : I**

**Hours : 4hrs/week 60 hrs /sem**

**Sub. Code : U22ABB1**

**Credits :3**

**TITLE OF THE PAPER: INTRODUCTION TO ECOBIOLOGY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT	
	4	2		1	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To compare morphological and anatomical adaptations of plants with respect to their habitat.</li><li><input type="checkbox"/> To acquire knowledge about Organisms and their interactions with reference to habitat and Evolution.</li><li><input type="checkbox"/> To acquire knowledge about Ecosystem</li><li><input type="checkbox"/> To analyze the causes of succession and to differentiate Hydrosere from Xerosere.</li><li><input type="checkbox"/> To assess the vegetation using transect and quadrat methods</li></ul>						
<b>COURSE OUTCOME</b> At the end of the Semester, the Students will be able to					Unit	Hrs P/S
<b>UNIT 1 CO1:</b> Understand various zones of environment and adaptations of Hydrophytes, Xerophytes and Halophytes to their respective habitat.					1	12
<b>UNIT 2 CO2:</b> Differentiate positive and negative interrelations					2	12
<b>UNIT 3 CO3:</b> Understand the structure and function of ecosystem					3	12
<b>UNIT 4 CO4:</b> Develop concept on hydrosere and Xerosere. Causes and basic types of succession.					4	12
<b>UNIT 5 CO5:</b> Enable students to carry out vegetation studies					5	12
<b>SYLLABUS</b>						
<b>Unit I:</b>  Concept of biosphere, Hydrosphere: physical and chemical properties of water, Lithosphere: soil profile, Atmosphere: various zones. Adaptations - Hydrophytes: <i>Hydrilla</i> , Xerophytes: <i>Opuntia</i> , Halophytes: <i>Rhizophora</i> .						
<b>Unit II:</b>  Biotic interactions: Mutualism- <i>Rhizobium</i> ; Commensalism- <i>Vanda</i> ; Parasitism- <i>Cuscuta</i> ; Insectivorous plants- <i>Nepenthes</i> .						
<b>Unit III:</b>						

Structure of Ecosystem: Abiotic and Biotic components; Functions of Ecosystem; Food Chain, Food web, Ecological pyramid, Energy flow and productivity.

#### Unit IV:

Ecological succession – causes and basic types of succession, General process – Nudation, Invasion, Competition and Stabilization- Hydrosere and Xerosere.

#### Unit V:

Methods of study of vegetation: Quadrat and Transect methods- Parameters-Frequency-Density-Abundance.

#### TEXT BOOKS:

1. Sharma. P.D., 1995, *Ecology and Environment*, Rakesh Kumar Publications, New Delhi.
2. Shukla, R.S. and Chandel, P.S. 2006, *A text book of plant Ecology*, S. Chand & Company Ltd., New Delhi.

#### REFERENCES:

1. Krishnamurthy. T 1993, *Minor Forest products of India*, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
2. Eugene P. Odum, 1971, *Fundamentals of Ecology*, W.B. Saunders Company, Philadelphia, London.
3. Sharma. P.D., 1995, *Ecology and Environment*, Rakesh Kumar Publications, New Delhi.
4. Shukla, R.S. and Chandel, P.S. 2006, *A text book of plant Ecology*, S. Chand & Company Ltd., New Delhi.
5. Verma, P.S. and Agarwal, V.K. 1998, *Concept of Ecology*, S. Chand & Company Ltd., New Delhi.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1 12 hrs per semester			
	Concept of biosphere physical chemical properties of water lithosphere Atmosphere: various zones. Adaptations - Hydrophytes: <i>Hydrilla</i> , Xerophytes: <i>Opuntia</i> , Halophytes: <i>Rhizophora</i> .	6 hours    6 hours	Lecture    ICT
UNIT 11 12hrs per semester			

	Biotic interaction Mutualism- <i>Rhizobium</i> ; Commensalism- <i>Vanda</i> ; Parasitism- <i>Cuscuta</i> ; Insectivorous plants- <i>Nepenthes</i> .	6 hours  6 hours	ICT  ICT
UNIT III 12 hrs per semester			
	Structure of Ecosystem -Abiotic and Biotic components Functions of Ecosystem Food Chain, Food web, Ecological pyramid, Energy flow and productivity.	6 hours  6 hours	Lecture  Lecture
UNIT IV 12 hrs per semester			
	Ecological succession, causes and basic types of succession	4 hours	Lecture PPT & Video
	General process-nudation, invasion, competition, stabilisation	4 hours	Lecture
	Hydrosere & Xerosere	4 hours	Lecture Video
UNIT V 12 hrs per semester			
	Methods of Study of vegetation Quadrat	6 hours	Lecture Video and PPT
	Transect	6 hours	Lecture Video

Course Outcomes (Cos)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	4	4	3	3	4	3	3.3
CO2	3	3	3	3	4	4	3	3	4	3	3.3
CO3	3	4	3	3	4	4	3	3	4	3	3.4
CO4	3	4	3	3	4	4	3	3	4	4	3.5
CO5	3	3	3	3	4	4	3	4	4	3	3.4
											3.38

Result: The Score for this Course is 3.38 (High Relationship)

**Programme : B.Sc.**

**Semester : II**

**Sub. Code : U22CB3**

**Part III: Core Paper III**

**Hours : 6hrs per/week90 hrs per/sem**

**Credits : 5**

**TITLE OF THE PAPER: BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT	
	5	2	1	-	2	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li>❑ To gain .Knowledge about cryptogams and phanerogams and primary information about fossil records</li><li>❑ .It provides a thorough knowledge about the diversity, structural organization and reproduction of Pteridophytes and Gymnosperms.</li><li>❑ It also makes the students aware of the preserved vestiges of plant life of the geological past</li></ul>						
<b>COURSE OUTCOME</b> At the end of the Semester, the Students will be able to					Unit	Hrs P/S
<b>UNIT 1 CO1:</b> Understand the characteristics of Bryophytes and their classification. Assess the evolutionary features in Bryophytes					1	20
<b>UNIT 2 CO2:</b> Understand the classification of the Pteridophytes and general character of primitive groups					2	20
<b>UNIT 3 CO3:</b> Understand the morphological diversity of Pteridophytes and economic importance					3	15
<b>UNIT 4 CO4:</b> Understand the characteristics of Gymnosperms and their classification					4	20
<b>UNIT 5 CO5:</b> students are aware of the preserved vestiges of plant life of the geological past					5	15

## **SYLLABUS**

### **Unit I:**

General characteristics of Bryophytes, Classification of Bryophytes by Rothmaler (1951), A short account on Economic importance of Bryophytes. A detailed study on the structure, reproduction and life cycle of the following genera-*Riccia*, *Anthoceros* and *Funaria*. (Development of reproductive organs need not be studied).

### **Unit II:**

Classification of Pteridophytes by G.M.Smith (1955), General characteristics of Pteridophytes with reference to Psilophyta, Lepidophyta, Calamophyta, Pterophyta. Different types of steles in Pteridophytes.

### **Unit III:**

Heterospory and Seed habit. Economic importance of Pteridophytes. Structure and reproduction of following genera- *Psilotum*, *Lycopodium*, *Equisetum*, and *Marsilea*. (Development of reproductive organs need not be studied).

### **Unit IV:**

Classification of Gymnosperms by K.R.Sporne (1965). General characteristics of Gymnosperms with reference to Cycadopsida, Coniferopsida and Gnetopsida. Structure and reproduction of *Pinus* and *Gnetum*. (Development of reproductive organs need not be studied).

### **Unit V:**

Process of Fossilization, Types of fossils- Basic level- Compressions, Impressions, Encrustations, Petrifications, Compactions. Geological time scale. Study of the following fossils: *Lepidodendron*, *Lygenopteris*.

### **TEXT BOOKS:**

- 1.Biswas, C. & Johri, B.M. 1997, *The Gymnosperms*, Narosa Pub.
- 2.Rashid, A. 1976, *An Introduction to Pteridophytes*, Vikas Publishing House, New Delhi.
- 3.Sharma, O.P. 2006, *Pteridophyta* Mac Millan India Ltd.
- 4.Shripad, N. Agashe – 1996, *Paleobotany*, Oxford & IBH.
- 5.Sporne, K.R.-1965, *Morphology of Gymnosperms*, B.J.Pub

### **REFERENCES:**

- 1.Sporne, K.R.-1975, *Morphology of Pteridophytes*, Hutehinson, University Library, London.
- 2.Sundararajan, S.-2007, *Introduction to Pteridophyta*, New Age International (p) Ltd., Publishers, New Delhi.
- 3.Pandey. B.P., 1982, *A Text Book of Botany Bryophyta*, S.Chand and Company.
- 4.Rashid. A., 1998, *An Introduction of Bryophytes*, Vikas Publishing house, New Delhi.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I 20 hrs per semester			
	General characteristics of Bryophytes	6hours	Black Board Use to familiarize and internalize terms and key words Use of OHP to present schemes of classification
	Classification of Bryophytes by Rothmaler (1951)	7hours	Use of OHP and power point presentation to introduce the selected scheme of classification for holistic coverage
	A short account on Economic importance of Bryophytes	7hours	Collection of appropriate material and produce to sensitize students on their use
UNIT II 20 hrs per semester			
	Classification of Pteridophytes by G.M.Smith (1955), General characteristics of Pteridophytes with reference to Psilophyta ,	4 hours 5 hours	Chalk and talk Chalk and talk
	Lepidophyta , Calamophyta , Pterophyta.	5 hours	Chalk and talk
	Different types of steles in Pteridophytes	6hours	ICT
UNIT III 15hrs per semester			
	Sporangial organization,	4 hours	ICT
	Homospory, and Seed habit,	3 hours	Chalk and talk
	Economic importance of Pteridophytes	3 hours	Chalk and talk
	Structure and reproduction of following genera- Psilotum, Lycopodium, Equisetum, Marsilea	5 hours	Peer teaching
UNIT IV 20 hrs per semester			

	Classification of Gymnosperms by K.R.Sporne (1965)	2 hours	Chalk and talk
	General characteristics of Gymnosperms with reference to Cycadopsida,	4 hours	ICT
	Coniferopsida Gnetopsida. Structure and reproduction of Pinus Gnetum	4 hours 4 hours 3 hours 3 hours	Chalk and talk Chalk and talk ICT ICT
UNIT V 15hrs per semester			
	Process of Fossilization, Types of fossils: compressions, impressions, encrustations, petrifications, compactions.	6 hours	Chalk and talk
	Geological time scale.	3 hours	Chalk and talk
	Study of the following fossils: Lepidodendron Lygenopteris	3 hours 3 hours	Chalk and talk Chalk and talk

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	4	3	4	3	3	3	4	3.3
CO2	3	3	3	4	3	4	3	2	3	3	3.1
CO3	3	3	3	4	4	4	4	3	3	3	3.4
CO4	3	3	3	4	3	4	3	2	3	3	3.1
CO5	3	3	4	4	3	4	3	3	3	3	3.3
Mean Overall Score											3.24

Result: The Score for this Course is 3.24(High Relationship)

**Programme : B.Sc.**

**Semester : II**

**Sub. Code : U22CB4P**

**Part III: Core Practical IV**

**Hours: 3hrs/week 45hrs/sem**

**Credits :3**

**TITLE OF THE PAPER: MAJOR PRACTICAL II**

Pedagogy	Hours	Lab experimentation	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	8	8	-	-	-
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To make the students know about the concepts on Plant diversity and to develop the skills in identifying the various plant group.</li><li><input type="checkbox"/> To understand the principles and concepts in identification.</li><li><input type="checkbox"/> To acquire the skills in sectioning and identifying them with characteristic features..</li><li><input type="checkbox"/> To acquire knowledge about Fossils.</li></ul>					
<b>COURSE OUTCOME</b> <p>At the end of the Semester, the students will be able to</p>					
<b>UNIT 1 CO1:</b> Able to write technical description of plants to their systemic position.					
<b>UNIT 2 CO2:</b> Apply the knowledge of plant observation and identify them with characteristic features.					
<b>UNIT 3 CO3:</b> Learns the concept of stelar evolution in Pteridophytes					
<b>UNIT 4 CO4:</b> Identify the morphological characteristics of Gymnosperms					
<b>UNIT 5 CO5:</b> Acquires knowledge about the preservation of fossil slides					

## SYLLABUS

### Study of Morphology and Anatomy of the following :

#### I. Bryophytes

1. *Riccia*
2. *Anthoceros*
3. *Funaria*

#### II. Pteridophytes

1. *Psilotum*
2. *Lycopodium*
3. *Equisetum*
4. *Marsilea*

#### III. Gymnosperm

1. *Pinus*

#### IV. Palaeobotany

1. *Lepidodendron*
2. *Lyginopteris*

#### V. Spotters related to theory

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	3	4	3	4	4	4	3	2	3.4
CO2	4	3	3	4	3	4	4	4	3	2	3.4
CO3	4	3	3	4	3	4	4	4	3	2	3.4
CO4	4	3	3	4	3	4	4	4	3	2	3.4
CO5	4	2	3	3	3	4	3	3	3	2	3.0
Mean Overall Score											3.32

Result: The Score for this Course is 3.32 (High Relationship)

**Programme: B.Sc.**

**Semester : II**

**Sub. Code : U22ABB3**

**Part III: Ancillary Paper II**

**Hours: 4 hrs/week 60 hrs/sem**

**Credits : 4**

**TITLE OF THE PAPER: ENERGY RESOURCES**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	4	2	-		2	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li>❑ To enable the students to understand the various energy resources on earth.</li><li>❑ To acquire the basic knowledge on the availability of world energy resources</li><li>❑ To make conscious of conserving the energy available on globe.</li><li>❑ To think about the utilisation of natural resources in proper way</li><li>❑ To enable the students to understand and appreciate the applications of solar energy.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the students will be able to						
<b>UNIT 1 CO1:</b> Understands the world energy resources and its availability					1	12
<b>UNIT 2 CO2:</b> Learns about conventional and nonconventional energy and distinguishes them.					2	12
<b>UNIT 3 CO3:</b> Understands the principles and mechanism behind solar equipments .					3	12
<b>UNIT 4 CO4:</b> Enable the students to apply the principles of solar energy in routine life					4	12
<b>UNIT 5 CO5:</b> Recognizes the source of biogas production and appreciates its applications.					5	12

## **SYLLABUS**

### **Unit I:**

Introduction to Energy resources, Energy consumption as a measure of prosperity, World energy features. Energy resources and their availability, conventional and non conventional energy Resources.

### **Unit II:**

Conventional Energy Resources –Uses and Importance of Coal, Oil, Gas.

### **Unit III:**

Non- conventional Energy Resources: Solar energy – Principle, mechanism and application of solar energy in daily life. Solar powered equipments – solar cooker, solar light, solar water heater.

### **Unit IV:**

Wind energy – Principles of wind energy conversion, Applications of Wind energy.

### **Unit V:**

Biomass energy – Energy plantation –Ethanol production, Biogas generation, Community biogas plant (KVIC and Janata), Hydrogen as a source of energy, Biodiesel, Biofuel.

## **TEXT BOOKS**

1. Sharma. P.D., 2009, *Environmental Biology*, Rastogi Publications, Meerut

## **REFERENCES :**

1. Rai. G.D., 1998, *Non-conventional sources of energy (A text book for engineering students)* KhannaPublishers, New Delhi.
2. Sharma. P.D., 2009, *Environmental Biology*, Rastogi Publications, Meerut
3. Garg. H.P, 2000, *Solar Energy - Fundamental and Applications*, Tata Mc Graw-Hill Publishing Co.
4. James Mitchesll, General Editor- *The illustrated Reference Book in Natural Resources*.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 12hrs per semester			

	Energy resources, energy consumption, world energy features	4 hours	Chalk–talk
	Availability of energy resources	4 hours	Lecture , AV aids
	Conventional and non-conventional resources	4 hours	Lecture
UNIT II: 12hrs per semester			
	Conventional energy- coal	6 hours	chalk - talk AV aids
	<b>Oil and gas</b>	6 hours	Lecture
UNIT III: 12hrs per semester			
	Non-conventional energy resources-solar energy	4 hours	Chalk- talk
	Principle, mechanism and application of solar energy	4 hours	Lecture AV aids.
	Solar powered equipments- solar cooker, solar water heater	4 hours	Lecture AV aids.
UNIT IV: 12hrs per semester			
	Wind energy	4 hours	Chalk- talk
	Principles of wind energy	4 hours	Chalk- talk
	Applications of wind energy	4 hours	Lecture AV aids
UNIT V: 12hrs per semester			
	Biomass energy, Energy plantation- ethanol production, biogas generation	4 hours	Lecture PPT
	Community biogas plant( KVIC and Janata)	4 hours	Chalk talk, PPT
	Hydrogen as source of energy, biofuel, biodiesel	4 hours	Chalk talk

Result: The Score for this Course is 3.16 (High Relationship)

**Programme : B.Sc.**

**Part III: Ancillary Practical I**

**Semester : II**

**Hours: 3 hrs/week 45 hrs/sem**

**Sub. Code : U22ABB2P**

**Credits : 3**

**TITLE OF THE PAPER: ANCILLARY PRACTICAL I**

Pedagogy	Hours	Lab experimentation	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	3	3	-	-	-

**PREAMBLE:**

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	3	4	2	2	3	4	3	3.1
CO2	3	4	3	3	4	2	2	3	4	3	3.1
CO3	3	4	3	3	4	2	3	3	4	3	3.2
CO4	3	4	3	3	4	2	3	3	4	3	3.2
CO5	3	4	3	3	4	2	3	3	4	3	3.2
Mean Overall score											3.16

- ☐ To help the students know about the habitats of plants
- ☐ To understand the positive and negative interaction.
- ☐ To acquire the skills on sectioning and identifying them with characteristic features.
- ☐ To understand the principles of solar equipments.
- ☐ To acquire knowledge about the study of vegetation.

**COURSE OUTCOME**

At the end of the Semester, the students will be able to

Course Outcomes (Cos)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO 1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	3	4	4	3	4	3	4	4	3.7
CO2	4	4	3	4	4	3	4	3	4	4	3.7
CO3	4	4	3	4	4	3	4	3	4	4	3.7
CO4	4	4	3	4	4	3	4	3	4	4	3.7
CO5	4	4	3	4	4	3	4	3	4	4	3.7
Mean Overall score											3.7
<b>UNIT 1 CO1:</b> Able to compare the distinguishing features of plants of various habitats.											
<b>UNIT 2 CO2:</b> Apply the knowledge of plant interaction and identify them with special features.											
<b>UNIT 3 CO3:</b> Develops the skill of sectioning and handling lab wares.											
<b>UNIT 4 CO4:</b> Identify and apply the principles of solar powered equipments.											
<b>UNIT 5 CO5:</b> Enable the students to study vegetation using quadrat method.											
<b>SYLLABUS</b> <ol style="list-style-type: none"> <li>1. External study of Hydrophytes: <i>Hydrilla</i>; Xerophytes: <i>Opuntia</i> ; Halophytes: <i>Rhizophora</i></li> <li>2. Anatomical study of <i>Hydrilla</i> stem.</li> <li>3. Positive and Negative Interactions.</li> <li>4. Study of vegetation using Quadrat method.</li> <li>5. Ecosystem – Food chain, Food web, Ecological Pyramid.</li> <li>6. Model showing: Solar light, Solar cooker and Solar water heater.</li> <li>7. Photographs showing Conventional and Non-conventional energy sources.</li> </ol>											

Result: The Score for this Course is 3.7 (High Relationship)

**Programme : B.Sc.**

**Semester : III**

**Sub. Code : U22CB5**

**Part III: Core Paper V**

**Hours : 6 hrs/week 90hrs/sem**

**Credits : 5**

**TITLE OF THE PAPER: PLANT ANATOMY AND EMBRYOLOGY OF  
ANGIOSPERMS**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	5	2	1	1	1

**PREAMBLE:**

- ☐ To impart an insight into the internal structure and reproduction of the most evolved group of plants, the Angiosperm.
- ☐ To know the detailed structure of and functions of tissue systems of plants
- ☐ To get an insight into secondary growth
- ☐ To Understand the post fertilization changes in Angiosperms.
- ☐ To Understand the morphology and development of reproductive parts.
- ☐ To Get an insight in to the fruit and seed development.

<b>COURSE OUTCOME</b>	Unit	Hrs P/S
At the end of the Semester, the Students will be able to		
<b>UNIT 1 CO1:</b> List down the different kinds of tissues, able to differentiate simple tissue from complex tissue.	1	15/S
<b>UNIT 2 CO2:</b> Compare and contrast the anatomy of root & stem and also between dicot and monocot appreciate the vascular supply.	2	15/S
<b>UNIT 3 CO3:</b> Describe the normal secondary growth and differentiate it from anomalous thickening.	3	15/S
<b>UNIT 4 CO4:</b> Analyse the sequences of reproductive process and appreciate the way the life perpetuates.	4	15/S
<b>UNIT 5 CO5:</b> Differentiate the various kinds of endosperm and summarize the embryogeny and polyembryony, apomixis.	5	15/S
<b>SYLLABUS</b>		
<b>Unit 1:</b> Meristems – Types. Root apex: Histogen theory, KorperKappe theory, Shoot apex: Apical cell theory, Tunica corpus theory. Tissues: Simple parenchyma, Collenchyma and Sclerenchyma. Complex tissues: Xylem and Phloem.		
<b>Unit II:</b> Primary structure of the following: Dicot and Monocot root, Dicot and Monocot stem, Leaf anatomy- Dorsiventral and Isobilateral leaf, Stomatal types and distribution, Nodal anatomy, Unilacunar, Trilacunar and Multilacunar.		
<b>Unit III:</b> Secondary growth of Dicot stem and Dicot root. Anomalous secondary growth in Dicot stem- <i>Boerhaavia</i> . Anomalous secondary growth in Monocot stem- <i>Dracena</i> . General account of vessel elements, Annual rings Dendrochronology - Heart wood, Sap wood, Porous and Non-porous wood- Tyloses.		
<b>Unit IV:</b> Microsporangium: Microsporogenesis, Male gametophyte. Megasporangium: Megaspores, Female gametophyte. Ovule types, Types of female gametophyte: Monosporic - <i>Polygonum</i> , Bisporic - <i>Allium</i> , Tetrasporic - <i>Adoxa</i> . Fertilization: Porogamy, Chalazogamy and Mesogamy Development and significance of double fertilization. Post fertilization changes		
<b>Unit V:</b> Endosperm: Types – Nuclear, Cellular and Helobial. Embryo structure and development, Dicot embryo- <i>Capsella</i> , Monocot embryo <i>Luzula</i> . Polyembryony Apomixis.		
<b>TEXT BOOKS:</b>		

1. Richard Crang;2018, *Plant Anatomy*, Springer Cham.
2. Pandey, B.P., 2001, *Plant Anatomy*, S.Chand & Company.

#### REFERENCES:

1. Charles B.Beck;2005,An Introduction to Plant Structure and Development, Cambridge University Press
2. Pandey, B.P., 2001, *Plant Anatomy*, S.Chand & Company
3. William.C.Dickison; 2000,Integrative Plant Anatomy, Academic Press.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I 15 hrs per semester			
	Meristems – Types. Root apex: Histogen theory , Korpe Kappe theory, Shoot apex: Apical cell theory, Tunica corpus theory.	5hrs	ICT
	Tissues:Simple parenchyma, collenchyma and sclerenchyma	5hrs	GD
	Complex tissues: xylem and phloem.	5hrs	LECTURE METHOD
UNIT II 15 hrs per semester			
	Primary structure of the following: Dicot and Monocot root, Dicot and Monocot stem,	5hrs	ICT
	Leaf anatomy dorsiventral and isobilateral leaf , Stomatal types and distribution,	5hrs	ICT
	Nodal anatomy, unilacunar, Trilacunar and Multilacunar	5hrs	ICT
UNIT III 15 hrs per semester			
	Secondary growth of Dicot stem and Dicot root. Monocot stem – Dracena.	5hrs	GROUP DISCUSSION
	Anomalous secondary growth in dicot stem – Boerhaavia. Anomalous secondary growth in Dracena	5hrs	ICT

	General account of vessel elements, Annual rings (Dendrochronology) heart wood, sap wood, porous and nonporous wood– Tyloses.	5hrs	ICT
UNIT IV 15 hrs per semester			
	Microsporangium: Microsporogenesis, Male gametophyte. Megasporangium: Megasporeogenesis, female gametophyte.	5hrs	LECTURE METHOD
	Ovule types, Types of female gametophyte: Monosporic – Polygonum, Bisporic – Allium, Tetrasporic – Adoxa.	5hrs	LECTURE METHOD
	Fertilization: Porogamy, Chalazogamy and Mesogamy Development and significance of double fertilization. post fertilization changes	5hrs	
UNIT V 5 hrs per semester			
	Endosperm: Types – Nuclear, Cellular and Helobial	5hrs	LECTURE METHOD

Result: The Score for this Course is 3.44 (High relationship)

Cours Outcom (Cos)
CO1
CO2
CO3
CO4
CO5

**Programme : B.Sc.**

**Semester : III**

**Sub. Code : U22CB6P**

**Part III: Core Practical III**

**Hours : 3hrs/week45hrs/sem**

**Credits : 3**

**TITLE OF THE PAPER: MAJOR PRACTICAL III**

Pedagogy	Hours	Lab experimentation	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	8	8	-	-	-
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To make the students know about the concepts on Plant diversity and to develop the skills in identifying the various plant group.</li><li><input type="checkbox"/> To understand the principles and concepts in Anatomy.</li><li><input type="checkbox"/> To acquire the skills in sectioning and identifying them with characteristic features.</li><li><input type="checkbox"/> To understand the practical aspects of Biostatistics and solve problems related to probability.</li><li><input type="checkbox"/> To acquire knowledge about the Mendelian laws.</li></ul>					
<b>COURSE OUTCOME</b> <p>At the end of the Semester, the students will be able to</p>					
<b>UNIT 1 CO1:</b> Able to write technical description of plants to their systemic position.					
<b>UNIT 2 CO2:</b> Apply the knowledge of plant observation and identify them with characteristic features.					
<b>UNIT 3 CO3:</b> Identify the types of stomata and its distribution in plants					
<b>UNIT 4 CO4:</b> Learns the germination patterns of pollen in Angiosperms					
<b>UNIT 5 CO5:</b> Learn how to dissect the plant embryo and identify the stage					

## SYLLABUS

### Plant Anatomy and Embryology of Angiosperms:

1. Anatomy of monocot and dicot root.
2. Anatomy of monocot and dicot stem.
3. Investigation of secondary growth and Anomalous secondary growth(*Boerhaavia*).
4. Study of leaf anatomy –dorsiventral and isobilateral
- 5.. Nodal anatomy (*Justicea, Neem, Dracaena*)
6. Study of pollen morphology and germination.
7. Isolation of plant embryos and identification of stages – Globular and Heart shaped.
8. Spotters related to theory

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	4	4	4	3	4	4	3	3	3.6
CO2	3	4	4	4	4	3	4	4	3	3	3.6
CO3	3	4	4	4	4	3	4	4	3	3	3.6
CO4	3	4	4	4	4	3	4	4	4	3	3.7
CO5	3	4	4	4	4	3	4	4	4	3	3.7
Mean Overall score											3.64

Result: The Score for this Course is 3.64 (High relationship)

**Programme : B.Sc.**

**Semester : III**

**Sub. Code : U22NMB1**

**Part IV: Non Major Elective Course 1**

**Hours: 2 hrs/week 30hrs/sem**

**Credits : 2**

**TITLE OF THE PAPER: HORTICULTURE**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	2	1	-		1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To enable the students to know the importance of Horticulture.</li><li><input type="checkbox"/> To develop interest in propagation techniques.</li><li><input type="checkbox"/> To acquire the knowledge of preservation methods of vegetables and fruits.</li><li><input type="checkbox"/> To enable the students understand the art of gardening.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the students will be able to						
<b>UNIT 1 CO1:</b> Understands the basic knowledge of horticulture					1	6
<b>UNIT 2 CO2:</b> Learns the techniques of artificial propagation.					2	6
<b>UNIT 3 CO3:</b> Enable the students to know the preservation methods for storing vegetables.					3	6
<b>UNIT 4 CO4:</b> Understands and recognizes the vegetable growing methods.					4	6
<b>UNIT 5 CO5:</b> Appreciates the art of gardening and develops interest in decoration.					5	6

## SYLLABUS

### Unit I:

Introduction, Importance of horticulture. Divisions of horticulture – Pomology, Olericulture, Floriculture.

### Unit II:

Vegetative propagation: Advantages. Cuttage: root cutting, stem cutting, leaf cutting. Layerage: Simple, Compound, Trench and Air layering. Graftage: Side grafting, Whip grafting, Cleft grafting.

### Unit III:

Establishment of Orchard, lay out of orchards, planting, harvesting, marketing and storage of fruits. Preservation of fruits.

### Unit IV:

Type of vegetable growing: Kitchen garden, Market gardening, Truck garden, Vegetable forcing, vegetable seed industry. Preservation of vegetables.

### Unit V:

Indoor gardening: Indoor plants, Types of indoor gardening -Hanging baskets, Bonsai, Bottle garden, Vertical garden. Flower arrangement and Dry decoration.

### TEXT BOOKS :

1. Kumar N., 1994. *Introduction to Horticulture*, Rajalakshmi Pub. Nagarcoil

### REFERENCE:

1. Adams C.R., Early M.P. 2004. *Principles of Horticulture*, Elsevier, New Delhi.
2. Edmond J.B., Senn T.L., Andrews F.S., Halfacre P.G. 1975. *Fundamentals of Horticulture*. 4<sup>th</sup> Edn. TMH New Delhi.
3. John Weathers. 1993, *Encyclopaedia of Horticulture*, Discovery Pub. House, New Delhi.
4. Manibhushan Rao K. 2005. *Text Book of Horticulture*, Macmillan India Ltd.
5. Randhawa G.S., Mukhopadhyay A. 1986. *Floriculture in India*, Allied Publishers Pvt. Ltd. Ahmedabad.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 6 hrs per semester			
	Importance of horticulture.	3 hours	Chalk-talk AV aids

	Divisions of horticulture – Pomology , Olericulture ,Floriculture.	3 hours	Lecture , AV aids
UNIT II: 6 hrs per semester			
	Vegetative propagation: Advantages. cuttage: root cutting, stem cutting ,leaf cutting.	1 hour	chalk - talk AV aids
	Layerage: Simple, Compound, Trench and Air layering.	2 hours	Lecture AV aids
	Graftage: Side grafting, Whip grafting, Cleft grafting.	3 hours	PPT
UNIT III: 6 hrs per semester			
	Establishment and lay out of orchards	2 hours	Chalk- talk , AV aids.
	Harvesting, marketing and storage of fruits	2 hours	Lecture AV aids.
	Preservation of fruits	2 hours	Lecture AV aids
UNIT IV: 6 hrs per semester			
	Types of vegetable growing- kitchen garden, truck garden, market garden	3 hours	Chalk- talk AV aids
	Vegetable forcing, vegetable seed industry	1 hour	Chalk- talk
	Preservation of vegetables	2 hours	Lecture AV aids
UNIT V: 6 hrs per semester			
	Indoor gardening, indoor plants	2 hours	Lecture
	Types of indoor gardening- hanging basket, bonsai, bottle garden	2 hours	Chalk talk AV aids.
	Flower arrangement and Dry decoration	2 hours	

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	3	4	3	4	3	4	4	3	3.7

CO2	4	4	4	4	4	4	4	4	4	3	3.9
CO3	4	4	4	4	4	4	4	4	4	4	4.0
CO4	4	4	4	4	4	4	4	4	4	4	4.0
CO5	4	4	4	4	4	4	4	4	4	3	3.9
Mean Overall score											3.9

Result: The Score for this Course is 3.9(High Relationship)

**Programme : B.Sc.**

**Semester : IV**

**Sub. Code : U22CB7**

**Part III: Core Paper VII**

**Hours: 4 hrs/week 60 hrs/sem**

**Credits : 4**

**TITLE OF THE PAPER: TAXONOMY OF ANGIOSPERMS**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	5		-			
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To get an insight into scientific knowledge of worlds plant resources.</li><li><input type="checkbox"/> To understand the different systems of classification.</li><li><input type="checkbox"/> To categorize organism which aids easy communication.</li><li><input type="checkbox"/> To analyze the evolutionary relationship among plants.</li><li><input type="checkbox"/> To relate Taxonomy with other branches of botany.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the students will be able to						
<b>UNIT 1 CO1:</b> Understand the different parts of the plant and their modifications.					1	10
<b>UNIT 2 CO2:</b> Understand the various systems of classification and appreciates the use of Taxonomy in other branches.					2	10

<b>UNIT 3 CO3:</b> Analyse the important characteristics and relate the evolutionary relationship among Polypetalae.	3	15
<b>UNIT 4 CO4:</b> Analyse the important characteristics and relate the evolutionary relationship among Gamopetalae.	4	15
<b>UNIT 5 CO5:</b> Analyse the important characteristics and relates the evolutionary relationship among Monochlamydeae and monocots.	5	10
<b>SYLLABUS</b> <b>Unit I:</b> Morphology: Root; Types and modifications of tap root and fibrous root system. Stem; Types Aerial and underground stem modifications. Leaf; Phyllotaxy, Simple and Compound leaves, Leaf modifications. Inflorescence; Racemose, Cymose, Mixed and special types. Fruits: Simple, Aggregate and Multiple fruits. <b>Unit II:</b> Systems of classification- Artificial : (Linnaeus) Natural : (Bentham and Hooker), Phylogenetic (Engler and Prantl). Merits and Demerits of Bentham & Hooker's system. Chemotaxonomy, Numerical Taxonomy. Objectives and functions of Herbarium; collection, pressing, poisoning, drying and mounting. <b>Unit III:</b> A detailed study and economic importance of the following Angiospermic families. Polypetalae: Annonaceae, Capparidaceae, Meliaceae, Fabaceae, Myrtaceae, Cucurbitaceae. <b>Unit IV:</b> A detailed study and economic importance of the following Angiospermic families. Gamopetalae: Rubiaceae, Asteraceae, Apocynaceae, Convolvulaceae, Lamiaceae. <b>Unit V:</b> Study of the following families and their Economic Importance of Monochlamydeae: Amaranthaceae, Euphorbiaceae, and Monocots: Liliaceae, Poaceae. <b>TEXT BOOKS :</b> 1. Pandey, B.P., 1999, <i>Taxonomy of Angiosperms</i> S.Chand & Company 2. Sharma, O.P., 2009, <i>Plant Taxonomy</i> , Tata Mc Graw Hill Education Private Limited. 3. Subramanyan, N.S., 1996, <i>Laboratory Manual of Plant Taxonomy</i> , Vikas Publishing House Pvt Ltd., 4. Vasishta, P.C., 2000, <i>Taxonomy of Angiosperms</i> , S.Chand and Co. Ltd., <b>REFERENCES:</b> 1. Gamble, J.S., 1953, <i>Flora of the Presidency of Madras Vol I, II, III</i> , Botanical Survey of India Govt. of India Press. 2. Lawrence, H.M.G. , 1964, <i>Taxonomy of Vascular Plants</i> , Oxford & I BH Pub. Calcutta. 3. Mathew , K.M., 1991, <i>The Excursion Flora of Central Tamilnadu</i> , India Oxford IBH Pub. New Delhi. 4. Saxena, N.B., Shamindra Saxena 2006, <i>Plant Taxonomy</i> , Pragati Prakashan.		

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 10 hours per semester			
	Morphology: Root; Types and modifications of tap root and fibrous root system. Stem; Types Aerial and underground stem modifications	4 hours	Lecture, Alive specimens
	Leaf; Phyllotaxy, Simple and Compound leaves, Leaf modifications.	3 hours	Lecture, Alive specimens, ICT
	Inflorescence; Racemose, Cymose, Mixed and special types. Fruits: Simple, Aggregate and Multiple fruits	3hours	Lecture, Alive specimens
UNIT II: 10 hours per semester			
	Systems of classification-Artificial :(Linnaeus) Natural : (Bentham and Hooker), Phylogenetic (Engler and Prantl).	3 hours	Lecture cum ICT
	Merits and Demerits of Bentham & Hooker's system.	2 hours	Lecture cum ICT
	Chemotaxonomy, Numerical Taxonomy. Objectives and functions of Herbarium; collection, pressing, poisoning, drying and mounting	5 hours	Chalk and talk
UNIT III: 15 hours per semester			
	A detailed study and economic importance of the following Angiospermic families. Polypetalae: Annonaceae.	5 hours	Chalk and talk, Alive specimens
	Capparidaceae, Meliaceae, Fabaceae	5 hours	Chalk and talk, Alive specimens
	Myrtaceae, Cucurbitaceae	5 hours	Chalk and talk, Alive specimens
UNIT IV: 15 hours per semester			
	A detailed study and economic importance of the following Angiospermic families. Gamopetalae: Rubiaceae,	5 hours	Chalk and talk, Alive specimens
	Apocynaceae, Asteraceae	5 hours	Chalk and talk, Alive specimens

	Convolvulaceae, Lamiaceae	5 hours	Chalk and talk, Alive specimens
UNIT V: 10 hours per semester			
	Study of the following families and their Economic Importance of Monochlamydeae: Amaranthaceae, Euphorbiaceae	5 hours	Chalk and talk, Alive specimens
	Monocots- Liliaceae, Poaceae.	5 hours	Chalk and talk, Alive specimens

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	3	4	4	4	4	4	4	3	3.7
CO2	4	3	3	4	4	4	4	4	4	3	3.7
CO3	4	3	4	4	4	4	4	4	4	3	3.8
CO4	4	3	4	4	4	4	4	4	4	3	3.8
CO5	4	3	4	4	4	4	4	4	4	3	3.8
Mean Overall score											3.76

Result: The Score for this Course is 3.76 (High Relationship)

**Programme : B.Sc.**

**Semester : IV**

**Sub. Code : U22CB8P**

**Part III: Core Practical IV**

**Hours: 3 hrs/week 45 hrs/sem**

**Credits: 3**

**TITLE OF THE PAPER: MAJOR PRACTICAL IV**

Pedagogy	Hours	Lab experimentation	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	8	8	-	-	-

**PREAMBLE:**

- ☐ To make the students to know about the concepts of Plant systematics and to develop the skills in identifying the flora.

**COURSE OUTCOME**

At the end of the Semester, the students will be able to

**UNIT I CO1:** Able to write technical description of plants and construct Floral diagrams and formulas.

**UNIT 2 CO2:** Apply the knowledge of plant observation to their systemic position.

**UNIT 3 CO3:** Learn to compare and differentiate the family characters at generic level

**UNIT 4 CO4:** Identify plants belonging to same genera and families, compares monocots and dicots

**UNIT 5 CO5:** Acquire knowledge in preparing key for plant identification.

## SYLLABUS

1. Morphology of flowering plants: General description and traits of taxonomic interest.
2. Field survey of families
3. Herbarium preparation.
4. Analysis of plant characters- Polypetalae-Annonaceae, Capparidaceae, Meliaceae, Fabaceae, Myrtaceae, Cucurbitaceae.
5. Analysis of plant characters- Gamopetalae- Rubiaceae, Asteraceae, Apocynaceae, Convolvulaceae, Lamiaceae
6. Analysis of plant characters- Monochlamydeae-Amaranthaceae, Euphorbiaceae
7. Analysis of plant characters- Monocot-Liliaceae, Poaceae.
8. Spotters related to theory.

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	4	4	3	4	3	4	4	4	3.6
CO2	4	3	4	4	3	4	3	4	4	4	3.7
CO3	4	3	4	4	3	4	3	4	4	4	3.7
CO4	4	3	4	4	3	4	3	4	4	4	3.7
CO5	4	3	3	4	3	3	3	3	4	3	3.3
Mean Overall score											3.6

Result: The Score for this Course is 3.6 (High Relationship)

**Programme : B.Sc**

**Semester : IV**

**Sub. Code : U22NMB2**

**Part IV: Non Major Elective Course II**

**Hours : 2 hrs/week 30 hrs/sem**

**Credits : 2**

**TITLE OF THE PAPER: MEDICINAL BOTANY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT	
	2	1	-	-	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li>□ To gain information about Medicinal Plants, History of medicinal plants in India and its conservation.</li><li>□ To understand the medicinal practices based on indigenous plant knowledge, and plant .as source of food and medicine.</li><li>□ To appreciate the medicinal value of non-flowering plants.</li><li>□ To appreciate the medicinal value of flowering plants</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the Students will be able to						
<b>UNIT 1 CO1:</b> Describe the applications of plants in a historical, cultural, medicinal, legislative, and global context.					1	6
<b>UNIT 2 CO2:</b> Critically evaluate the ideas and discussed plant as source of food and medicine.					2	6
<b>UNIT 3CO3:</b> Identify and learnt medicines obtained from Non-flowering plants.					3	6
<b>UNIT 4 CO4:</b> Identify and learnt medicines obtained from flowering plants.					4	6
<b>UNIT 5 CO5:</b> Acquired knowledge on cultivation and uses of medicinal plants.					5	6
<b>SYLLABUS</b>						
<b>Unit I:</b>						

Medicinal plants – an overview. History of medicinal plants in India. Indian system of medicine- Siddha, Ayurveda, Unani. Indigenous system of medicine - Conservation of medicinal plants. Classification of medicinal plants based on useful parts.

#### Unit II:

Plants as source of food and medicine, Kitchen herbs (Coriander, Mint and Spring onion) as source of medicine, Folk medicines- Traditional methods.

#### Unit III:

Drugs from Non-flowering plant: Algae-*Spirulina*, Fungi-*Penicillium*, Lichens-*Cetraeria*, Bryophyte-*Sphagnum*, Fern-*Dryopteris*, Gymnosperm-*Ephedra*.

#### Unit IV:

Drugs from flowering plants: Roots -*Withaniasomnifera*, Rhizome - *Curcuma longa*, Leaves -*Ocimumbasilicum*, *Aloe barbadensis*, Bark -*Cinchona*.

#### Unit V:

Brief study about cultivation, collection, constituents and uses of the following plants.

Flower	- <i>Hibiscusrosa-sinensis</i> .
Fruits	- <i>Emblicaofficinalis</i>
Seeds	- <i>Trigonellafoenum- graceum</i>
Entire plant	- <i>Phyllanthusniruri</i>

#### TEXT BOOKS:

- 1.Joshi.S.G; – 2018, *Medicinal Plants*,Oxford and IBH Publishing
- 2.Anamika Singh and Mani Singh; 2022, *Concepts ofMedicinal Botany*, IK International Publishing House Pvt Ltd.

#### REFERENCES:

- 1.Kumar.N.C; *An Introduction to Medicinal Botany*, Pharmacognosy Emkay Publications, New Delhi.
- 2.Kokate.C.K.Purohit,A.P.Gokhale; 2003, *Pharmacognosy* Nivali Prakashan, Pune.
3. Pal.D.C.,1998, *Tribal Medicine*, Naya Prakash, Calcutta.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
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UNIT 16 hrs per semester			
	Medicinal plants – an overview. History of medicinal plants in India. Indian system of medicine- Siddha, Ayurveda, Unani. Indigenous medical system –. Classification of medicinal plants based on useful parts.	5 hours	Lecture
	Conservation of medicinal plants	1 hour	ICT
UNIT 11 6 hrs per semester			
	Plants as source of food and medicine, , folk medicines-traditional methods.	5 hours	Lecture
	kitchen herbs as source of medicine	1 hour	ICT
UNIT III 6 hrs per semester			
	Drugs from Non-flowering plant: Algae – <i>Spirulina</i> , Fungi – <i>Penicillium</i> , Lichens: <i>Cetraeria</i> , Bryophyte : <i>Sphagnum</i> , Fern – <i>Dryopteris</i> ,	5 hours	Lecture
	Gymnosperm – <i>Ephedra</i> .	1 hour	ICT
UNIT IV 6 hrs per semester			
	Drugs from flowering plants: Roots – <i>Withania somnifera</i> , Rhizome - <i>Curcuma longa</i> , Leaves - <i>Ocimum basilicum</i> , <i>Aloe barbadensis</i> ,	5 hours	Lecture
	Bark – <i>Cinchona</i> .	1 hour	ICT
UNIT V 6 hrs per semester			
	Brief study about cultivation, collection, constituents and uses of the following plants. Flower – <i>Hibiscus rosa-sinensis</i> . Fruits - <i>Emblica officinalis</i> Seeds – <i>Trigonella foenum-graceum</i>	5 hours	Lecture
	Entire plant – <i>Phyllanthus niruri</i>	1 hour	ICT

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	

CO1	3	3	3	4	4	3	3	3	4	3	3.3
CO2	3	4	3	4	4	4	4	3	4	3	3.6
CO3	4	4	3	4	4	4	4	3	4	3	3.7
CO4	4	4	3	4	4	4	4	3	4	3	3.7
CO5	4	4	3	4	4	4	4	3	4	3	3.7
Mean Overall Score											3.6

Result: The Score for this Course is 3.6 (High Relationship)

**Programme : B.Sc.**

**Part IV: Skill Enhancement course I**

**Semester : IV**

**Hours: 2 hrs/week 30hrs/sem**

**Sub. Code : U22SEB1**

**Credits : 2**

**TITLE OF THE PAPER: HORTICULTURE**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	2	1	-		1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To enable the students to know the importance of Horticulture.</li><li><input type="checkbox"/> To develop interest in propagation techniques.</li><li><input type="checkbox"/> To acquire the knowledge of preservation methods of vegetables and fruits.</li><li><input type="checkbox"/> To enable the students understand the art of gardening.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the students will be able to						
<b>UNIT 1 CO1:</b> Understands the basic knowledge of horticulture					1	6
<b>UNIT 2 CO2:</b> Learns the techniques of artificial propagation.					2	6
<b>UNIT 3 CO3:</b> Enable the students to know the preservation methods for storing vegetables.					3	6
<b>UNIT 4 CO4:</b> Understands and recognizes the vegetable growing methods.					4	6

<b>UNIT 5 CO5:</b> Appreciates the art of gardening and develops interest in decoration.	5	6
<b>SYLLABUS</b> <b>Unit I:</b> Introduction, importance of horticulture. Divisions of horticulture - Pomology, Olericulture, Floriculture. <b>Unit II:</b> Vegetative propagation: Advantages. Cuttage: root cutting, stem cutting, leaf cutting. Layerage: Simple, Compound, Trench and Air layering. Graftage: Side grafting, Whip grafting, Cleft grafting. <b>Unit III:</b> Establishment of Orchard, lay out of orchards, planting, harvesting, marketing and storage of fruits. Preservation of fruits. <b>Unit IV:</b> Type of vegetable growing: Kitchen garden, market gardening, truck garden, vegetable forcing, vegetable seed industry. Preservation of vegetables. <b>Unit V:</b> Indoor gardening: Indoor plants, Types of indoor gardening -Hanging baskets, Bonsai, Bottle garden, Vertical garden. Flower arrangement and Dry decoration. <b>TEXT BOOKS :</b> 1. Kumar N., 1994. <i>Introduction to Horticulture</i> , Rajalakshmi Pub. Nagarcoil <b>REFERENCE:</b> 1. Adams C.R., Early M.P. 2004. <i>Principles of Horticulture</i> , Elsevier, New Delhi. 2. Edmond J.B., Senn T.L., Andrews F.S., Halfacre P.G. 1975. <i>Fundamentals of Horticulture</i> . 4 <sup>th</sup> Edn. TMH New Delhi. 3. John Weathers. 1993, <i>Encyclopaedia of Horticulture</i> , Discovery Pub. House, New Delhi. 4. Manibhushan Rao K. 2005. <i>Text Book of Horticulture</i> , Macmillan India Ltd. 5. Randhawa G.S., Mukhopadhyay A. 1986. <i>Floriculture in India</i> , Allied Publishers Pvt. Ltd. Ahamedabad.		

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 6 hrs per semester			
	Importance of horticulture.	3 hours	Chalk-talk AV aids
	Divisions of horticulture – Pomology , Olericulture ,Floriculture.	3 hours	Lecture , AV aids
UNIT II: 6 hrs per semester			

	Vegetative propagation: Advantages. cuttage: root cutting, stem cutting ,leaf cutting.	1 hour	chalk - talk AV aids
	Layerage: Simple, Compound, Trench and Air layering.	2 hours	Lecture AV aids
	Graftage: Side grafting, Whip grafting, Cleft grafting.	3 hours	PPT
UNIT III: 6 hrs per semester			
	Establishment and lay out of orchards	2 hours	Chalk- talk , AV aids.
	Harvesting, marketing and storage of fruits	2 hours	Lecture AV aids.
	Preservation of fruits	2 hours	Lecture AV aids
UNIT IV: 6 hrs per semester			
	Types of vegetable growing- kitchen garden, truck garden, market garden	3 hours	Chalk- talk AV aids
	Vegetable forcing, vegetable seed industry	1 hour	Chalk- talk
	Preservation of vegetables	2 hours	Lecture AV aids
UNIT V: 6 hrs per semester			
	Indoor gardening, indoor plants	2 hours	Lecture
	Types of indoor gardening- hanging basket, bonsai, bottle garden	2 hours	Chalk talk AV aids.
	Flower arrangement and Dry decoration	2 hours	

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	3	4	4	3	4	4	4	3	3.6
CO2	4	4	4	4	4	4	4	4	4	3	3.9

CO3	4	4	4	4	4	4	4	4	4	4	4.0
CO4	4	4	4	4	4	4	4	4	4	4	4.0
CO5	4	4	4	4	4	4	4	4	3	3	3.8
Mean Overall score											3.86

Result: The Score for this Course is 3.86 (High Relationship)

**Programme : B.Sc.**

**Semester : V**

**Sub. Code : U22CB9**

**Part III: Core Paper IX**

**Hours: 5 hrs/week 75 hrs/sem**

**Credits : 4**

**TITLE OF THE PAPER: CELL BIOLOGY, GENETICS AND EVOLUTION**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	4	2	-	1	1

**PREAMBLE:**

- ☐ To enable the students to study the structure of plant cells and its organelles.
- ☐ To acquire the basic knowledge on the cell structure and its features and relate to its function.
- ☐ To develop critical thinking in concepts related to Genetics.
- ☐ To enable the students to understand the basic concepts involved in inheritance of characters in biological system.
- ☐ To enable the students to understand and appreciate the various concepts of evolution.

<b>COURSE OUTCOME</b>	Unit	Hrs P/S
At the end of the Semester, the students will be able to		
<b>UNIT 1 CO1</b> understand tissue morphogenesis and ultimately facilitates to know what happens at the cellular and molecular levels.	1	12

<b>UNIT 2 CO2:</b> Learn the principles in microscopy and the structure, chemistry and functions of cellular organelles	2	12
<b>UNIT 3 CO3:</b> Learn about Mendelian principles	3	12
<b>UNIT 4 CO4:</b> understand the different types of genetic interaction, incomplete dominance, codominance, inter allelic genetic interactions, multiple alleles and quantitative inheritance	4	12
<b>UNIT 5 CO5:</b> Familiarize about Evolution and the emergence of evolutionary thoughts	5	12
<b>SYLLABUS</b>  <b>Unit I:</b> Microscopy; Principles of Light microscopy, Electron microscopy , TEM , SEM, Phase contrast. Features of prokaryotic cell and eukaryotic cell: Ultra structure of a plant cell, Structure and chemistry of Cell wall and Cell membrane – Fluid Mosaic model. Cell cycle. Cell division – Mitosis and Meiosis.  <b>Unit II:</b> Structure and Function of cell organelles: Chloroplast, Mitochondria, Ribosomes, Endoplasmic Reticulum, Golgi bodies and Nucleus. Chromosome: Morphology, Structure of eukaryotic chromosome, Special Types: Polytene and Lamp brush chromosomes. Nucleic acids: DNA structure (Watson and Crick Model), RNA structure and types, Protein synthesis.  <b>Unit III:</b> Mendelism - Monohybrid and Dihybrid cross, Incomplete dominance, Gene interactions: Dominant epistasis – Complementary factor – Multiple alleles with reference to blood groups  <b>Unit IV:</b> Linkage and Crossing over: Types, mechanism and significance. Sex determination types: XX – XO, XX-XY, and ZZ-ZW. Sex linked inheritance: Eye color in <i>Drosophila</i> . Mutation types, Molecular basis of mutation.  <b>Unit V:</b> Evidences of Evolution. Theories of Evolution – Lamarck’s theory, Darwin’s theory of Natural Selection, Mutation theory of De Vries.		

**TEXT BOOKS :**

- 1.Sundararajan 1988, *Introduction to Cell Biology* Vikas Pub.
2. Pandey B.P., 2005, *College Botany Vol I*, S.Chand Company

**REFERENCES:**

- 1.P.K.Gupta 1995, *Cell and Molecular Biology* Rastogi Pub.
- 2.G.Karp 1984, *Cell Biology* Mac Graw Hill Comp. New Delhi.
- 3.Roberties and Roberties 1968, *Cell and Molecular Biology*, K.M.Varchese Pub.
- 4..Arora M.P. and Sandhu G.S. 2000, *Genetics*, Himalayan Pub.
5. Savage J.M. 1976, *Evolution*, Amerind Pub. Co.Ltd.
6. Sinnot E.W. Dunn L.C. and Dbzhansky T.1996, *Principles of Genetics*,  
Tata Mc Graw Hill Pub.
- 7.William S. Klug and Michael R. Cummings, 2000 *Concepts of Genetics*, Prentice Hall.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 12 hours per semester			
	Microscopy: Principles of light microscopy, Electron microscopy, TEM, SEM, Phase contrast.	4 hours	Chalk–talk method, use of AV aids
	Features of prokaryotic cell and eukaryotic cell: Ultra structure of a plant cell,	4 hours	Lecture method, AV aids
	Structure and chemistry of cell wall and cell membrane – Fluid Mosaic model. Cell cycle. Cell division – Mitosis and Meiosis.	4 hours	Lecture method, Group discussion using POP,
UNIT II: 12 hours per semester			
	Structure and Function of cell organelles: Chloroplast, Mitochondria, Ribosomes, Endoplasmic Reticulum, Golgi bodies and Nucleus.	3 hours	chalk and talk method and AV aids

	Chromosome: Morphology, Structure of an eukaryotic chromosome, Special Types: Polytene and Lamp brush chromosomes.	4 hours	Explanation using PPT, Lecture method.
	Nucleic acids: DNA structure (Watson and Crick Model), RNA structure and types, Protein synthesis.	4 hours	chalk and talk method and group discussion
UNIT III: 12 hours per semester			
	Mendelism - Monohybrid and Dihybrid cross,	4 hours	Chalk and talk method , Use of AV aids.
	Incomplete dominance, Gene interactions: dominant epistasis –	4 hours	Lecture method and GD
	complementary factor – Multiple alleles with reference to blood groups	4 hours	PPT and Chalk and talk method
UNIT IV: 12 hours per semester			
	Linkage and Crossing over: Types, mechanism and significance.	4 hours	Black Board teaching techniques and Use of OHP
	Sex determination types: XX – XO, XX-XY, and ZZ-ZW. Sex linked inheritance: Eye colour in Drosophila.	4 hours	Use of OHP and Chalk and talk method
	Mutation types, Molecular basis of mutation, Regulation of gene expression: Lac operon.	4 hours	Lecture method and group discussions
UNIT V: 12 hours per semester			
	Evidences of Evolution.	4 hours	Lecture method and group discussions
	Theories of evolution – Lamarck's theory,	4 hours	Use of OHP and Chalk and talk method
	Darwin's theory of Natural selection, Mutation theory of De Vries.	4 hours	Chalk and talk method ,Use of AV aids.

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	

CO1	3	3	4	3	4	3	3	4	3	3	3.4
CO2	4	3	3	3	2	4	3	4	4	3	3.3
CO3	3	3	3	4	3	3	3	3	3	3	3.2
CO4	4	3	3	4	3	4	3	4	4	3	3.5
CO5	4	3	4	3	3	4	3	3	4	3	3.3
Mean Overall score											3.34

Result: The Score for this Course is 3.34 (High Relationship)

**Programme : B.Sc Botany**

**Part III: Core Paper X**

**Semester : V**

**Hours : 5 hrs/week 75 hrs/semester**

**Sub. Code : U22CB10**

**Credits : 5**

#### **TITLE OF THE PAPER: PLANT PHYSIOLOGY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	5	4	-	-	1
<b>PREAMBLE:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> To understand the water relationship in plants and gain knowledge in physiological activities like transpiration types, and theories of stomata opening.</li> <li><input type="checkbox"/> To understand plant mineral nutrition and role of minerals in plants.</li> <li><input type="checkbox"/> To gain a knowledge on photosynthetic processes unique to plants and learn metabolic CO<sub>2</sub> fixation in Plants.</li> <li><input type="checkbox"/> To understand their physiology of respiration in Plants and diverse sources of nitrogen for Plants.</li> <li><input type="checkbox"/> To describe the importance of plant growth regulators.</li> </ul>					
<b>COURSE OUTCOME</b> At the end of the Semester, the Students will be able to					Unit Hrs P/S

<b>UNIT 1 CO1:</b> To understand water relations in plants	1	15
<b>UNIT 2 CO2:</b> To give knowledge about Mineral nutrition and the role of minerals in plants	2	15
<b>UNIT 3 CO3:</b> Develop the students, understanding of photosynthesis and pathways of CO <sub>2</sub> fixation in plants.	3	15
<b>UNIT 4 CO4:</b> To provide knowledge about respiration and different sources of nitrogen to plants.	4	15
<b>UNIT 5 CO5:</b> Develop the students' appreciation for the complexity of plant growth and development and physiology of flowering in plants.	5	15

## **SYLLABUS**

### **UNIT I:**

Water relations in plants – Properties of water, Diffusion, Osmosis, Imbibition, Absorption of water, Mechanism of water absorption: Cohesion- tension theory. Transpiration: Types, Theories of stomatal opening and closing: Starch glucose theory, Potassium ion theory. Guttation .

### **UNIT II:**

Mineral nutrition – Macronutrients, Micronutrients. Role of minerals in plants. Translocation of mineral nutrients. Active and passive absorption of minerals. Donnan's equilibrium.

### **UNIT III:**

Photosynthesis: Photosynthetic apparatus, Energy sources, Photosystem I and II, Electron flow through Cyclic and Non cyclic Photo Phosphorylation, Pathways of CO<sub>2</sub> fixation in C<sub>3</sub> and C<sub>4</sub> plants, CAM pathway. Factors affecting photosynthesis.

### **UNIT IV:**

Respiration: Aerobic and Anaerobic, Fermentation, Respiratory quotient, Mechanism of respiration Glycolysis, Krebs's cycle, Oxidative phosphorylation. Factors affecting respiration. Sources of Nitrogen to plants –Mechanism of Nitrogen fixation, Ammonia assimilation, Nitrate reduction, Denitrification.

### **UNIT V:**

Growth and Development: Sigmoidal growth curve, Plant growth regulators: Auxins, Gibberellins, Cytokinins, Abscissic acid and Ethylene. Physiology of flowering: Photoperiodism, Vernalization, Seed dormancy, causes and methods of breaking seed dormancy, Stress physiology and Biological clock.

### **TEXT BOOKS:**

1. Fundamentals of Plant Physiology by Dr. V.K Jain.

### **REFERENCES:**

1. Bidwell. R.G.S. 1974 – *Plant Physiology*, Mac Millan Pub.

2. Devlin. R.M. Witham, F.H. 1999 – *Plant Physiology*, 4<sup>th</sup> Ed CBS. Pub. New Delhi.
3. Noggle, G.R. Fritz, G.J.-2010, *Introductory Plant Physiology*, 2<sup>nd</sup> Ed PHI Learning Pvt. Ltd., New Delhi.
4. Sinha, R.K. – 2007, *Modern Plant Physiology*, Narosa Publishing House, New Delhi.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I 15hrs per semester			
	Water relations in plants – Properties of water, Diffusion, Osmosis, imbibitions, Absorption of water.	7 hours	Lecture
	Mechanism of water absorption: cohesion-tension theory. starch glucose theory, potassium ion theory. Guttation.	7 hours	Lecture
	Transpiration: Types, Theories of stomatal opening and closing.	1 hour	ICT
UNIT II 15hrs per semester			
	Mineral nutrition – Macronutrients, Micronutrients.	6 hours	Lecture
	Role of minerals in plants.	1 hour	ICT
	Translocation of mineral nutrients. Active and passive absorption of minerals. Donnan's equilibrium	8 hours	Lecture
UNIT III 15hrs per semester			
	Photosynthesis: Photosynthetic apparatus, energy sources.	6 hours	Lecture
	Photosystem I and II, electron flow through Cyclic and Non cyclic Photo Phosphorylation.	1 hour	ICT
	Pathways of CO <sub>2</sub> fixation in C3 and C4 plants, CAM pathway.	8 hours	Lecture

	Factors affecting photosynthesis.		
UNIT IV 15hrs per semester			
	Respiration: Aerobic and Anaerobic, fermentation, Respiratory quotient, Mechanism of respiration Glycolysis, Kreb's cycle, Oxidative phosphorylation. Factors affecting Respiration.	9 hours	Lecture
	Sources of Nitrogen to plants – Ammonia assimilation, Nitrate reduction, denitrification.	5 hours	Lecture
	Mechanism of Nitrogen fixation,	1 hour	ICT
UNIT V 15hrs per semester			
	Growth and Development: Sigmoidal growth curve, Plant growth regulators: Auxins, Gibberellins, Cytokinins, Abscissic acid and Ethylene. Physiology of flowering: Photoperiodism, Vernalization.	10 hours	Lecture
	Seed dormancy: Causes and methods of breaking seed dormancy,	1 hour	ICT
	Stress physiology. Biological clock.	4 hours	Lecture

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	4	4	3	4	4	4	3	3	3.7
CO2	4	4	4	4	3	4	4	4	3	3	3.7
CO3	4	4	4	4	3	4	4	4	3	4	3.8

CO4	4	4	4	4	3	4	4	4	3	3	3.7
CO5	4	4	4	4	3	4	4	4	3	3	3.7
Mean Overall Score											3.72

Result: The Score for this Course is 3.72 (High Relationship)

**Programme : B.Sc.**

**Part III: Core Paper XI**

**Semester : V**

**Hours: 5 hrs/week 75 hrs/semester**

**Sub. Code : U22CB11**

**Credits: 5**

**TITLE OF THE PAPER: BIOCHEMISTRY AND BIOPHYSICS**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	4	2	-	1	1
<b>PREAMBLE:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> To familiarize the students about the fundamental concepts of various biomolecules like carbohydrates, lipids, proteins and amino acids.</li> <li><input type="checkbox"/> To help the students to acquire knowledge on the structure, properties and biological significance of various biological molecules.</li> <li><input type="checkbox"/> To facilitate the students to learn the concepts involved in the mechanism of enzyme action using enzyme kinetics.</li> <li><input type="checkbox"/> To emphasize the significance and role of vitamins and coenzymes.</li> <li><input type="checkbox"/> To appreciate the laws of thermodynamics and their biological significance.</li> </ul>					
<b>COURSE OUTCOME</b>					Unit
					Hrs P/S

At the end of the Semester, the students will be able to		
<b>UNIT 1 CO1:</b> Understand the structure and properties of Macromolecules	1	15
<b>UNIT 2 CO2:</b> Learn about the Significance of Carbohydrates, Protein and Lipids.	2	15
<b>UNIT 3 CO3:</b> Learn the properties of enzymes, enzyme catalysis and Mechanism of enzyme action	3	15
<b>UNIT 4 CO4:</b> Understand the role and function of water soluble and fat soluble vitamins.	4	15
<b>UNIT 5 CO5:</b> Understand the concepts in biophysics	5	15

## **SYLLABUS**

### **Unit I:**

Introduction. Types of Biomolecules – Brief Introduction, Carbohydrates: Classification, structure and properties of Monosaccharides – Glucose. Disaccharides – Sucrose and Lactose. Polysaccharides – Starch and Cellulose. Amino acids - general structure – properties and classification of Amino acids: Essential and Non-essential amino acids. Nucleic acids-Structure of DNA and RNA.

### **Unit II:**

General structure of Protein, classification, chemical bonds involved in protein structure – primary, secondary, tertiary, quaternary structure. Lipid: Structure of Lipids – general structure, fatty acid – Saturated fatty acids – Palmitic acid. Unsaturated fatty acids – Linoleic acid. Triglycerides. Phospholipids: Lecithin – Glycolipids- Cerebrocides - Derived lipid: Cholesterol.

### **Unit III:**

Nomenclature and classification of Enzymes, chemical nature of enzymes, mechanism of enzymes action – Energy Kinetics – Michaelis Menton Equation. Models: Lock and Key model, Induced fit model, Enzyme Inhibition – Competitive, Non-competitive and Feedback inhibition.

### **Unit IV:**

Vitamins – occurrence, classification, function and deficiency symptoms of water soluble and fat soluble vitamins. Coenzymes: NAD and FAD.

### **Unit V:**

Bioenergetics – Concept of Free energy – Energy rich compounds – Structure of ATP – Laws of Thermodynamics – Entropy – Enthalpy – Standard free energy.

**TEXT BOOKS:**

1. Verma. S.K., 2002, *A Text book of Plant Physiology and Biochemistry*, S.Chand & Co., New Delhi
2. Jain. J.L ,2000, *Fundamentals of Biochemistry*, Chand & Co., New Delhi.

**REFERENCES:**

1. Conn E.E & Stumpf P.K., 1997, *Outlines of Biochemistry*, Wiley Eastern.
2. Banerjee , P.K. 2008. *Introduction to Biophysics*, S.Chand & Co., NewDelhi.
3. Tuszynski, J.A. and Kurzynski, M. 2003. *Introduction to Molecular Biophysics*, CRC Press , Chennai.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 15 hours per semester			
	Introduction. Types of Biomolecules – Brief Introduction, carbohydrates: classification, structure and properties of Monosaccharides – Glucose.	5 hours	Chalk–talk method, use of AV aids
	Disaccharides – Sucrose and Lactose. Polysaccharides – Starch and Cellulose. Nucleic acids-Structure of DNA and RNA.	5 hours	Lecture method, AV aids
	Amino acids - general structure – properties and classification of Amino acids: Essential and Non-essential amino acids.	5 hours	Lecture method, Group discussion using POP,
UNIT II: 15 hours per semester			
	General structure of protein, classification , chemical bonds involved in protein structure – primary, secondary, tertiary, quaternary structure.	5 hours	chalk and talk method and AV aids
	Lipid: Structure of Lipids – general structure , fatty acid – saturated fatty acids – palmitic acid. unsaturated fatty acids – linoleic acid.	5 hours	Explanation using PPT,Lecture method.

	Triglycerides. phospholipids: lecithin – glycolipids- cerebrosides–derived lipid: Cholesterol.	5 hours	chalk and talk method and group discussion
UNIT III: 15 hours per semester			
	Nomenclature and classification of enzymes , chemical nature of enzymes ,	5 hours	Chalk and talk method , Use of AV aids.
	Mechanism of enzymes action – Energy Kinetics – Michaelis Menton Equation.	5 hours	Lecture method and GD
	Models: lock and key model , induced fit model, Enzyme Inhibition – competitive ,non competitive and feedback inhibition.	5 hours	AV aids and Chalk and talk method.
UNIT IV: 15 hours per semester			
	Vitamins – occurrence, classification, function and deficiency symptoms of water soluble vitamins.	5 hours	Black Board teaching techniques and Use of OHP
	Vitamins – occurrence, classification, function and deficiency symptoms of fat soluble vitamins	5 hours	Use of PPT and Chalk and talk method
	Coenzymes: NAD and FAD.	5 hours	Lecture method and group discussions using AV aids
UNIT V: 15 hours per semester			
	Bioenergetics – concept of free energy	5 hours	Lecture method and group discussions
	Energy rich compounds – Structure of ATP	5 hours	Use of OHP ,Chalk and talk method
	Laws of thermodynamics – Entropy – Enthalpy – Standard free energy	5 hours	Chalk and talk method ,Use of AV aids .

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	3	4	3	2	3	4	3	2	3.1

CO2	4	3	3	4	3	2	3	4	3	2	3.1
CO3	4	3	3	4	3	2	3	4	3	2	3.1
CO4	4	4	3	4	3	2	3	4	3	2	3.2
CO5	4	4	3	4	3	2	3	4	3	2	3.2
Mean Overall score											3.14

Result: The Score for this Course is 3.14 (High Relationship)

**Programme : B.Sc.**

**Semester : V**

**Sub. Code : U22CB12P**

**Part III: Core Practical V**

**Hours: 6 hrs/week 90 hrs/sem**

**Credits :5**

**TITLE OF THE PAPER: MAJOR PRACTICAL V**

Pedagogy	Hours	Lab experimentation	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	8	8	-	-	-

**PREAMBLE:**

- ☐ To make the students to know about the principles of genetics and to develop the skills in identifying various gene interactions
- ☐ To understand the principles and concepts involved in Plant physiological systems through simple experiments.
- ☐ To identify the biomolecules using biochemical experiments.
- ☐ To acquire knowledge about the techniques and basic concepts in Biochemistry.

**COURSE OUTCOME**

At the end of the Semester, the students will be able to
<b>UNIT 1 CO1:</b> able to write technical description in genetics and solve genetic problems.
<b>UNIT 2 CO2:</b> apply the knowledge of plant observation to their underline physiological causes.
<b>UNIT 3 CO3:</b> learn the qualitative and quantitative analysis of biomolecules through various lab techniques.
<b>UNIT 4 CO4:</b> learn the theories related to evolution and about the different cell organelles and their functions
<b>UNIT 5 CO5:</b> acquire knowledge in experiments pertaining to biochemistry.
<p><b>SYLLABUS</b></p> <ol style="list-style-type: none"> <li>1. Verification of Mendelian laws-Monohybrid, Dihybrid.</li> <li>2. Drosophila eye colour – demonstration.</li> <li>3. Human traits-Earlobes, clasping the hand.</li> <li>4. Potato Osmoscope.</li> <li>5. Measurement of Water potential by plasmolytic method.</li> <li>6. Stomatal index.</li> <li>7. Rate of transpiration – Ganong’s potometer.</li> <li>8. Rate of photosynthesis using Wilmot’s bubbler – Effect of carbonate source, Monochromatic light.</li> <li>9. Respiration – Ganong’s respiroscope</li> <li>10. Preparation of Standard graph for glucose and protein from plant tissue.</li> <li>11. Paper chromatography – Separation of Pigments.</li> <li>12. Preparation of buffer.</li> <li>13. Estimation of chlorophyll and carotenoids.</li> <li>14. Qualitative test for carbohydrates, protein, lipid.</li> <li>15. Spotters related to theory</li> </ol>

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	4	3	3	4	4	4	3	2	3.5
CO2	4	4	4	3	3	4	4	4	3	2	3.5
CO3	4	4	4	3	3	4	4	4	3	2	3.5
CO4	4	4	4	3	3	4	4	4	3	2	3.5
CO5	4	4	4	3	3	4	4	4	3	2	3.5
Mean Overall score											3.5

Result: The Score for this Course is 3.5 (High Relationship)

**Programme : B.Sc.**

**Part III: Discipline Specific Elective Course I**

**Semester : V**

**Hours : 5 hrs/week 75 hrs/sem**

**Sub. Code : U22DSB1A**

**Credits: 4**

**TITLE OF THE PAPER: FORESTRY AND ECONOMIC BOTANY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT	
	5	3	1	-	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To effectively demonstrate knowledge of the value of plants in our everyday lives.</li><li><input type="checkbox"/> .To make the students aware about conservation and sustainable use of plants for the people and future generation</li><li><input type="checkbox"/> . To disseminate the value of plants ,the types of forest, its degradation, agroforestry</li><li><input type="checkbox"/> . To inculcate the habit of economic utilization of plants .</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the Students will be able to						
<b>UNIT 1 CO1:</b> Make decisions and exercise informed judgement in relation to native forest, plantation ,develop and implement well-justified forest					1	15

management strategies Get awareness on the conservation practices of medicinal plants		
<b>UNIT 2 CO2:</b> Incorporate the foundational natural and social sciences into decision making, Study the interactions of people and plants	2	15
<b>UNIT 3 CO3:</b> Understand the economic products with special reference to the Botanical name, family, morphology of useful part and the uses, Describe healing and medicinal uses of plants	3	15
<b>UNIT 4 CO4:</b> Gain knowledge about economic products with special reference to the Botanical name, family, morphology of useful part and the uses, Describe healing and medicinal uses of plants	4	15
<b>UNIT 5 CO5:</b> Know about the major and minor ethnic groups or Tribals of India, and their life styles. Gain knowledge on the role of ethnobotany in modern Medicine	5	15

**SYLLABUS****UNIT I:**

Introduction, Types of forest in India, Indian institutes involving Forest management and Conservation.

**UNIT II:**

Deforestation – natural and man made, Afforestation and Reforestation. Shifting cultivation.-Social forestry, Agro forestry and its components and their significance .

**UNIT III:**

Major forest products: Wood, (Sandal, Rosewood) Timber (Teak and Neem) Fuel Wood (Acacia and Prosopis). Minor forest products: Essential oils (Lemon grass) spices and condiments: Cinnamon, Clove and Pepper. Gums and resins: Gum Arabic and Ferula.

**UNIT IV:**

Economic Botany: Name, Family, Cultivation (in brief) and Uses of Cereals (Rice, Wheat), Pulses (Red gram, Black gram), Oil (Gingelly oil, Cocount oil), Spices (Chilly, Crocus), Condiments (Garlic, Ginger) and Beverages (Tea, Coffee).

**UNIT V:**

Ethnobotany: History of Ethnobotany, Tribals in Tamil Nadu, Types of Ethnic groups, Ethno medicines, Traditional Medicines used by Ethnic groups for diseases management.

**TEXT BOOKS:**

1. Krishnamoorthy.T., 1993, *Minor forest products of India*, Oxford and IBN Publishing Co.Pvt., Ltd., New Delhi.
2. Pandey.B.P., 1995, *Economic Botany*, Chand & Company Ltd., New Delhi.
3. Ganesan. S., 2011, *Vol.I, South India Ethnomedicinal Plants*, Thiagarajar College, Madurai

**REFERENCES:**

1. Agarwal.V.P., 1990, *Forests in India*, Oxford & IBH Publsihing Co,Pvt., Ltd., New Delhi.
2. Bandyopadhyay, A.K., 1997, *A Text Book of Agroforestry with Applications*, Vikas Publishing House Pvt., Ltd., New Delhi

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 15hrs	per semester		
	Introduction, Types of forest in India,	8 hours	Chalk and talk
	Indian institutes involving forest management and conservation	7 hours	ICT
UNIT 11	15hrs per semester		
	Deforestation – natural and man made	3 hours	Chalk and talk

	Afforestation and Reforestation. Shifting cultivation.	5 hours	Chalk and talk
	Social forestry, Agro forestry and its components and their significance	7 hours	Peer teaching
UNIT III 15hrs per semester			
	Major forest products: Wood, (Sandal, Rosewood )	4 hours	ICT
	Timber (Teak and Eucalyptus) Fuel Wood (Acacia and Prosopis).	5 hours	ICT
	Minor forest products: Essential oils (Lemon grass)	2 hours	Chalk and talk
	spices and condiments: Cinnamon, Clove and Pepper.	2 hours	Chalk and talk
	Gums and resins: Gum Arabic & Ferula	2 hours	Chalk and talk
UNIT IV 15hrs per semester			
	Economic Botany: Name, Family, Cultivation (in brief) and Uses of Cereals (Rice, Wheat),	5 hours	Chalk and talk
	Pulses (Red gram, Black gram), Oil (Gingelly oil, Coconut oil),).	4 hours	Chalk and talk
	Spices (Chilly, Crocus), Condiments (Garlic, Ginger)	3 hours	Chalk and talk

	Beverages (Tea, Coffee)	3 hours	Chalk and talk
UNIT V 15hrs per semester			
	Ethnobotany: History of Ethnobotany	4 hours	ICT
	Tribals in Tamil Nadu, Types of Ethnic groups	5 hours	ICT
	Traditional Medicines used by Ethnic groups for diseases management,  Ethno medicines	3 hours	Chalk and talk
		3 hours	Chalk and talk

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	2	2	4	4	4	3	4	4	4	3.7
CO2	4	2	2	4	4	4	4	4	4	3	3.5
CO3	4	2	2	4	4	4	3	4	4	3	3.4
CO4	4	2	2	4	4	4	4	4	4	3	3.5
CO5	4	2	3	4	4	4	4	4	4	4	3.7
Mean Overall Score											3.56

Result: The Score for this Course is 3.56 (High Relationship)

**Programme : B.Sc.**

**Part III: Discipline Specific Elective Course I**

**Semester : V**

**Hours: 5 hrs/week 75 hrs/sem**

**Sub. Code : U22DSB1B**

**Credits: 4**

**TITLE OF THE PAPER: ENVIRONMENTAL BIOTECHNOLOGY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT	
	2	1	-	-	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li>□ To know the principles and practices of organic farming for sustainable crop production.</li><li>□ To reduce the usage of chemical fertilizers gradually and usage of Integrated pest management..</li><li>□ To make the students aware of sustainable use of biofertilizers.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the Students will be able to						
<b>UNIT 1 CO1:</b> To appraise the four R's of waste management.					1	15
<b>UNIT 2 CO2:</b> Awareness about biofertilisers and hazards of synthetic fertilizers and pesticides.					2	15
<b>UNIT 3 CO3:</b> Learns the process of Biogas production and its advantages.					3	15
<b>UNIT 4 CO4:</b> Understands and appreciates the use of plant derived fuels.					4	15
<b>UNIT 5 CO5:</b> learns the sewage treatment process and treatment of effluents of textile industry.					5	15
<b>SYLLABUS</b>						
<b>Unit: I</b> <p>Solid waste management- Types of waste- biodegradable and non biodegradable-Four R's- Refuse- Reuse-Recycle-Reduce in waste management. Biodegradation of xenobiotic of compounds - Halogenated benzoic acids.</p>						
<b>Unit: II</b> <p>Biofertilizers and Biopesticides - Hazards of synthetic fertilizers and pesticides, Phytoremediation- Bioremediation.</p>						
<b>Unit: III</b> <p>Biomethanation- Production of biogas – Factors affecting biogas production- Advantages of biogas – Biomass gasification.</p>						
<b>Unit: IV</b> <p>Biofuel and bio diesel- Production and advantages of bio diesel – Plant derived fuels- Ethanol from lingo cellulose waste.</p>						
<b>Unit: V</b>						

Treatment of sewage – primary, secondary and tertiary treatment- Treatment of effluents of textile industry.

**REFERENCES :**

1. Kumar. H.D., 1994, General Ecology, Vikas Publishing House, New Delhi.
2. Sharma P.D. 1993, Ecology and Environment, Rastogi Pub. Meerut.
3. Kudesia Pragade, V.P, 1990, Industrial pollution, Pragathi Pub. Meerut.
4. Kumar. H.D., 2000, A Text Book Biotechnology, Affiliated East West Press.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I 15hrs per semester			
	Solid waste management- Types of waste- biodegradable and non biodegradable-.	4 hours	Chalk and talk
	Four R's- Refuse- Reuse-Recycle-Reduce in waste management	6 hours	ICT
	Biodegradation of xenobiotic of compounds - Halogenated benzoic acids.	5 hours	
UNIT II 15hrs per semester			
	Biofertilizers and Biopesticides	3 hours	Chalk and talk
	Hazards of synthetic fertilizers and pesticides	5 hours	Chalk and talk
	Phytoremediation- Bioremediation	7 hours	Peer teaching
UNIT III 15hrs per semester			
	Biomethanation- Production of biogas	5 hours	ICT
	Factors affecting biogas production-	5 hours	ICT
	Advantages of biogas, Biomass gasification.	2 hours	Chalk and talk
		3 hours	Chalk and talk
UNIT IV 15hrs per semester			
	Biofuel and bio diesel	6 hours	Chalk and talk

	Production and advantages of bio diesel, Plant derived fuels	4 hours 2 hours	Chalk and talk
	Ethanol from lingo cellulose waste	3 hours	ICT
UNIT V 15hrs per semester			
	Treatment of sewage – primary, secondary and tertiary treatment	9 hours	ICT
	Treatment of effluents of textile industry	6 hours	ICT Chalk and talk

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	4	4	3	4	3	4	3	4	3.6
CO2	4	3	3	4	4	4	4	4	4	4	3.8
CO3	4	4	3	3	4	3	4	4	3	4	3.6
CO4	4	4	4	4	3	4	3	4	4	3	3.7
CO5	4	3	3	4	4	4	4	4	4	4	3.8
Mean Overall Score											3.7

Result: The Score for this Course is 3.7 (High Relationship)

**Programme : B.Sc**

**Semester : V**

**Sub. Code : U22GEB1A**

**Part III: Generic Elective Course I**

**Hours : 2 hrs/week 30hrs/semester**

**Credits: 2**

**TITLE OF THE PAPER: ORGANIC FARMING**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT	
	2	1	-	-	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li>□ To know the principles and practices of organic farming for sustainable crop production.</li><li>□ To reduce the usage of chemical fertilizers gradually and usuage of Integrated pest management..</li><li>□ To make the students aware of sustainable use of biofertilizers.</li></ul>						
<b>COURSE OUTCOME</b> At the end of the Semester, the Students will be able to					Unit	Hrs P/S
<b>UNIT 1 CO1</b> To appraise the concepts and objectives of organic farming					1	6
<b>UNIT 2 CO2:</b> The importance of organic manures, farm yard manure, compost, advantages of green manure, concentrated manures, vermicompost, most widely used.					2	6
<b>UNIT 3 CO3:</b> ..Learns the characteristics, identification, cultural methods and maintenance of Azospirillum, Azotobacter, Azolla and Anabaena					3	5
<b>UNIT 4 CO4:</b> Understands and appreciates the use of organic and biological methods to control pests and diseases					4	7
<b>UNIT 5 CO5:</b> learns the benefit reducing the usage of fertilizers gradually and usage of integrated of pest management					5	6
<b>SYLLABUS</b>						
<b>UNIT I:</b>  Organic farming- Introduction, Concepts and Objectives of Organic farming-Types of Organic manures-Organic Farming in TamilNadu and India.						
<b>UNIT II:</b>  Organic Manure: Farm yard manure, Green manure, Vermicompost, Vermiwash. Panchakavya, Fish Gunabajalam.						
<b>UNIT III:</b>						

Integrated Nutrient Management (INM): Production and applications of *Rhizobium*, *Azotobacter*, *Anabaena* - *Azolla*, *Phosphobacteria*, AM fungi.

**UNIT IV:**

Integrated Disease Management (IDM): Production and application of *Trichoderma*, *Pseudomonas fluorescens*.

**UNIT V:**

Integrated Pest Management (IPM): - Production and application of Bacteria -*Bacillus thuringiensis*, Fungi -*Beauveria bassiana* (*Metarhizium*), Virus - NPV.

**TEXT BOOKS:**

1. Arun, K. Sharma – 2008, *A Hand book of Organic Farming* Agrobios (India), Jodhpur.
2. Dahama, A.K.-2009, *Organic Farming for Sustainable Agriculture* Agrobios (India), Jodhpur.
3. Gupta, M.K.-2007, *Hand book of Organic Farming and Biofertilizers*, ABD Publishers, New Delhi.

**REFERENCES:**

1. Talashilkar, S.C. and Dosani, A.A.K.-2008, *Earth Worms in Agriculture*, Agrobios (India) Jodhpur.
2. Swaminathan, C. Swaminathan, V. & Vijayalakshmi, K.-2007 *Panchagarya boon to Organic Farming*, International Book Distributors, New Delhi.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1 6 hrs per semester			
	Organic farming-introduction	1 hour	Chalk and talk
	Organic farming - objectives	1 hour	Chalk and talk
	Organic farming and its types	2 hours	Chalk and talk
	Organic farming in Tamilnadu and India	2 hours	Chalk and talk
UNIT 11 6 hrs per semester			
	Organic Manure: Farmyard manure , Green manure ,	2 hours	Chalk and talk
	Vermi compost, Vermi wash.	2 hours	ICT
	Panchakavya, Fish Gunabajalam	2 hours	Chalk and talk

UNIT III 5 hrs per semester			
	Integrated Nutrient Management (INM): production and applications of <i>Rhizobium</i> , ,	3 hours	Chalk and talk
	<i>Azotobacter</i> , <i>Anabaena</i> – <i>Azolla</i>	2 hours	Chalk and talk
UNIT IV 7 hrs per semester			
	Integrated Disease Management (IDM): production and application of <i>Trichoderma</i>	5 hours	ICT
	<i>Pseudomonas fluorescence</i>	2 hours	Chalk and talk
UNIT V 6 hrs per semester			
	Integrated Pest Management (IPM): - production and application of Bacteria – <i>Bacillus thuringiensis</i>	3 hours	ICT
	Fungi – <i>Beauveria bassiana</i> ( <i>Metarhizium</i> ),	1 hour	Chalk and talk
	Virus – NPV	2 hours	Chalk and talk

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	4	3	3	3	3	3	3	3.1
CO2	3	4	4	4	4	3	4	3	4	4	3.7
CO3	3	4	4	4	4	3	4	3	4	4	3.7
CO4	3	4	4	4	4	3	4	3	4	4	3.7
CO5	3	4	4	4	4	3	4	3	4	4	3.7
Mean Overall Score											3.58

Result: The Score for this Course is 3.58 (High Relationship)

**Programme : B.Sc**

**Semester : V**

**Part III: Generic Elective Course I**

**Hours : 2 hrs/week 30 hrs/semester**

Sub. Code : U22GEB1B

Credits : 2

**TITLE OF THE PAPER: MEDICINAL BOTANY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	2	1	-	-	1
<b>PREAMBLE:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> To gain information about Medicinal Plants, History of medicinal plants in India and its conservation.</li> <li><input type="checkbox"/> To understand the medicinal practices based on indigenous plant knowledge, and plant as source of food and medicine.</li> <li><input type="checkbox"/> To appreciate the medicinal value of non-flowering plants.</li> <li><input type="checkbox"/> To appreciate the medicinal value of flowering plants</li> </ul>					
<b>COURSE OUTCOME</b> At the end of the Semester, the Students will be able to					Unit
					Hrs P/S
<b>UNIT 1 CO1:</b> Describe the applications of plants in a historical, cultural, medicinal, legislative, and global context.					1
<b>UNIT 2 CO2:</b> Critically evaluate the ideas and discussed plant as source of food and medicine.					2
<b>UNIT 3 CO3:</b> Identify and learnt medicines obtained from Non-flowering plants.					3
<b>UNIT 4 CO4:</b> Identify and learnt medicines obtained from flowering plants.					4
<b>UNIT 5 CO5:</b> Acquired knowledge on cultivation and uses of medicinal plants.					5
<b>Unit I:</b> Medicinal plants – an overview. History of medicinal plants in India. Indian system of medicine- Siddha, Ayurveda, Unani. Indigenous medical system – Conservation of medicinal plants. Classification of medicinal plants based on useful parts.					
<b>Unit II:</b> Plants as source of food and medicine, kitchen herbs (Coriander, Mint and Spring onion) as source of medicine, Folk medicines- Traditional methods.					
<b>Unit III:</b> Drugs from Non-flowering plant: Algae - <i>Spirulina</i> , Fungi - <i>Penicillium</i> , Lichens: <i>Cetraeria</i> , Bryophyte : <i>Sphagnum</i> , Fern - <i>Dryopteris</i> , Gymnosperm - <i>Ephedra</i> .					
<b>Unit IV:</b> Drugs from flowering plants: Roots – <i>Withaniasomnifera</i> , Rhizome - <i>Curcuma longa</i> , Leaves - <i>Ocimumbasilicum</i> , <i>Aloe barbadensis</i> , Bark - <i>Cinchona</i> .					
<b>Unit V:</b> Brief study about cultivation, collection, constituents and uses of the following plants.					

Flower	– <i>Hibiscusrosa-sinensis</i> .
Fruits	– <i>Emblicaofficinalis</i>
Seeds	– <i>Trigonellafoenum- graceum</i>
Entire plant	– <i>Phyllanthusniruri</i>

**TEXT BOOKS:**

1. Joshi.S.G; – 2018, *Medicinal Plants*, Oxford and IBH Publishin
2. Anamika Singh and Mani Singh; 2022, *Concepts of Medicinal Botany*, IK International Publishing House Pvt Ltd.

**REFERENCES:**

1. Kumar.N.C; *An Introduction to Medicinal Botany*, Pharmacognosy Emkay Publications, New Delhi.
2. Kokate.C.K.Purohit,A.P.Gokhale;2003, *Pharmacognosy* Nivali Prakashan, Pune
3. Pal.D.C.,1998,*Tribal Medicine*,Naya Prakash,Calcutta

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I 6 hrs per semester			
	Medicinal plants – an overview. History of medicinal plants in India. Indian system of medicine- Siddha, Ayurveda, Unani. Indigenous medical system –. Classification of medicinal plants based on useful parts.	5 hours	Lecture
	Conservation of medicinal plants	1 hour	ICT
UNIT II 6 hrs per semester			
	Plants as source of food and medicine, , folk medicines- traditional methods.	5 hours	Lecture
	kitchen herbs as source of medicine	1 hour	ICT
UNIT III 6 hrs per semester			
	Drugs from Non-flowering plant: Algae – <i>Spirulina</i> , Fungi – <i>Penicillium</i> , Lichens: <i>Cetraeria</i> , Bryophyte: <i>Sphagnum</i> , Fern – <i>Dryopteris</i> ,	5 hours	Lecture
	Gymnosperm – <i>Ephedra</i> .	1 hour	ICT
UNIT IV 6 hrs per semester			
	Drugs from flowering plants: Roots – <i>Withania somnifera</i> , Rhizome - <i>Curcuma longa</i> , Leaves - <i>Ocimum basilicum</i> , <i>Aloe barbadensis</i> ,	5 hours	Lecture
	Bark – <i>Cinchona</i> .	1 hour	ICT
UNIT V 6 hrs per semester			

	Brief study about cultivation, collection, constituents and uses of the following plants. Flower – <i>Hibiscus rosa-sinensis</i> . Fruits - <i>Emblica officinalis</i> Seeds – <i>Trigonella foenum- graceum</i>	5 hours	Lecture
	Entire plant – <i>Phyllanthus niruri</i>	1 hour	ICT

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	4	4	3	3	3	4	3	3.3
CO2	3	4	3	4	4	4	4	3	4	3	3.6
CO3	4	4	3	4	4	4	4	3	4	3	3.7
CO4	4	4	3	4	4	4	4	3	4	3	3.7
CO5	4	4	3	4	4	4	4	3	4	3	3.7
Mean Overall Score											3.6

Result: The Score for this Course is 3.6 (High Relationship)

Semester : V

Hours: 2 hrs/week 30hrs/sem

Sub. Code : U22SEB2

Credits : 2

**TITLE OF THE PAPER: MUSHROOM CULTIVATION**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	2	1	-		1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> Able to identify edible mushroom from the poisonous one</li><li><input type="checkbox"/> To develop interest in cultivating mushrooms</li><li><input type="checkbox"/> To acquire the knowledge of raw materials used for growing mushrooms</li><li><input type="checkbox"/> To understand the nutritive values of mushroom</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the students will be able to						
<b>UNIT 1 CO1:</b> Understands the basic knowledge of identifying edible mushroom from the poisonous one					1	6
<b>UNIT 2 CO2:</b> Learns the techniques of mushroom cultivation					2	6
<b>UNIT 3 CO3:</b> Understands and recognizes the raw materials used for growing mushrooms					3	6
<b>UNIT 4 CO4:</b> Enable the students to know the preservation methods and marketing of mushrooms					4	6
<b>UNIT 5 CO5:</b> Appreciates the nutritive values of mushroom and prepares recipes from it.					5	6
<b>SYLLABUS</b>						
<b>Unit I:</b> <p>Introduction to Mushroom cultivation. External and Internal structure of mushroom. Types of Edible mushroom available in India- <i>Agaricusbisporous</i>, <i>Pleurotuscitrinopileatus</i>, <i>Volvoriellavolvacea</i>. Identification of poisonous mushrooms.</p>						
<b>Unit II:</b> <p>Techniques of mushroom cultivation – Spawn production-Composting and maintenance of Mushroom sheds.</p>						

**Unit III:**

Working procedure for cultivation of Button Mushroom (*Agaricus bisporous*) and Paddy straw mushroom (*Volvariella volvacea*).

**Unit IV:**

Harvesting–Storage, Preservation,(Refrigeration,Canning,Drying,Salting), Marketing, Commercial significance of mushrooms. Risks involved in mushroom cultivation. Common pathogens affecting mushroom.-bacteria, fungi, insects and nematodes.

**Unit V:**

Nutritive value and uses of mushroom, Value added products of mushroom. Food recipes prepared from mushroom: Omelet, Soup, Pakoda, Pickle, Mushroom biriyani.

**TEXT BOOK:**

1. Bahl.N., 2009, *Hand book on Mushrooms*, 4<sup>th</sup> Edition, Oxford and IBH Publishing Co.Pvt., Ltd.,New Delhi.

**REFERENCE:**

1. Bahl.N., 2009, *Hand book on Mushrooms*, 4<sup>th</sup> Edition, Oxford and IBH Publishing Co.Pvt., Ltd., New Delhi.
2. Fletcher. J.T., White P.F., &Gaze.R.H.,*Pest and Disease Control*, Intercept Limited Ponteland, Newcastle, England.
3. Kapoor. J.N., 1989, *Mushroom Cultivation*, ICAR Publication, Krishi Anusandhan, Pusa, New Delhi.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 6 hrs per semester			
	External and internal structure of mushroom	4 hours	Chalk–talk AV aids
	Types of edible mushroom in India	1 hour	Lecture , AV aids
	Identification of poisonous mushrooms	1 hour	Lecture
UNIT II: 6 hrs per semester			
	Techniques of mushroom cultivation- spawn production	3 hours	chalk - talk AV aids
	Compost and maintenance of mushroom sheds	3 hours	PPT, Lecture
UNIT III: 6 hrs per semester			
	Cultivation of Button Mushroom ( <i>Agaricus bisporous</i> )	3 hours	Chalk- talk , AV aids.
	Cultivation of Paddy straw mushroom ( <i>Volvariella volvacea</i> )	3 hours	Lecture AV aids.

UNIT IV: 6 hrs per semester			
	Harvesting –storage, preservation, marketing of mushrooms	2 hours	Chalk- talk
	Significance of mushrooms Risks involved in mushroom cultivation	3 hours	Lecture AV aids
	Common pathogens affecting mushroom	1 hour	Lecture
UNIT V: 6 hrs per semester			
	Nutritive value and uses of mushroom	3 hours	Lecture
	Recipes prepared from mushroom- omlet, soup, mushroom biriyani, pakoda, pickle	3 hours	Chalk talk AV aids.

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	4	3	4	3	3	3	2	3.1
CO2	3	3	4	4	4	4	3	4	4	2	3.5
CO3	3	4	4	4	4	4	3	4	4	2	3.6
CO4	3	4	4	4	4	4	4	4	4	2	3.7
CO5	3	4	4	4	4	3	4	3	4	2	3.5
Mean Overall score											3.48

Result: The Score for this Course is 3.48 (High Relationship)

**Programme : B.Sc.**

**Part III: Core Paper XIII**

**Semester : VI**

**Hours : 5 hrs/week 75 hrs/sem**

**Sub. Code : U22CB13**

**Credits :5**

**TITLE OF THE PAPER: MICROBIOLOGY AND PLANT PATHOLOGY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	5	4	-	-	1

**PREAMBLE:**

- ☐ To recognize and describe the history and characteristics of bacteria.
- ☐ To describe the beneficial role of microorganisms in fermented foods.
- ☐ To Identify the bacteria, techniques to study Preparation of various culture media
- ☐ To acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.
- ☐ To understand plant diseases and organisms causing it.

<b>COURSE OUTCOME</b>	Unit	Hrs P/S
At the end of the Semester, the Students will be able to		
<b>UNIT 1 CO1:</b> Students will be able to acquire, articulate, retain and apply knowledge relevant to microbiology.	1	15
<b>UNIT 2 CO2:</b> Students will acquire and demonstrate competency growth and reproduction of bacteria.	2	15
<b>UNIT 3 CO3:</b> Students will learn culture medium types and bacterial straining.	3	15
<b>UNIT 4 CO4:</b> Students will make the students to Understand the general characteristics of water and food microbiology.	4	15
<b>UNIT 5 CO5:</b> Students will acquire knowledge on diseases affecting plants and its control measures.	5	15

**SYLLABUS**

**UNIT I:**

History-Contributions of Anton von Leewenhoek, Louis Pasteur, Robert Koch, Classification of Bacteria (Bergey's Manual), Ultrastructure of Bacteria, General characters of Virus, Bacteriophage – structure and multiplication

**Unit II:**

Growth of Bacteria: growth and multiplication of bacteria, Sigmoidal growth curve-Generation time. Nutritional types of Bacteria-Photosynthetic, Chemosynthetic Bacterial Recombination – Transformation, Transduction, Conjugation (F<sup>+</sup> and HFr).

**Unit III:**

Techniques to study bacteria: Staining methods – Simple, Gram staining and Negative staining. Culture of bacteria: Culture media: Types, preparation and sterilization of medium. Pure culture techniques – Streak plate, Pour plate, Spread plate.

**Unit IV:**

Water microbiology-analysis of water for Coli forms, Waste water treatment processes- Primary, secondary and tertiary methods. Food microbiology::microbial spoilage of fruits, vegetables, meat. Flora of Milk and Pasteurization of milk.

**Unit V:**

Classification of plant diseases based on host and pathogen. Study of the following diseases with reference to causal organism, symptoms, epidemiology and control measures. Fungal disease: Early leaf spot of groundnut (Tikka), Bacterial disease: Citrus canker, Phytoplasmal disease: Little leaf of Brinjal, Viral disease: TMV.

**TEXT BOOKS:**

1. Dubey and D.K. Maheswari – 2001, *A Text Book of Microbiology*, S. Chand and Co., New Delhi.

**REFERENCE:**

1. Frazier, C.W. Westhoff, C.D. – 2011, *Food Microbiology*, Tata Mc Graw Hill Education Pvt. Ltd., New Delhi.
2. Micheal, J. Pelczar Jr. C.S. Chan, Noel R.Krieg – 1993, *Microbiology*, Tata Mc Graw, New Delhi, 5<sup>th</sup>ed.
3. Nicklin, J.Grasme Cook, K. Paget & Killington, R. 1998, *Instant Notes in Microbiology*, Viva Books.
4. Purohit, S.S.-1998, *Microbiology and Application Botanica*, 6<sup>th</sup> Ed.
5. Talora, K.P. & Talora, A.-1998, *Fundamentals in Microbiology*, WCB Mc Graw Hill.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1 15hrs per semester			
	History-Contributions of Anton von Leewenhoek, Louis Pasteur , Robert Koch, Classification of Bacteria (Bergey's Manual),	7 hours	Lecture
	ultrastructure of Bacteria, General characters of virus	7hours	Lecture
	Bacteriophage – structure and multiplication	1 hour	ICT

UNIT II 15hrs per semester			
	Growth of Bacteria : growth and multiplication of bacteria ,	6 hours	Lecture
	sigmoidal growth curve-Generation time.	1 hour	ICT
	Nutritional types of Bacteria-Photosynthetic, Chemosynthetic Bacterial Recombination – Transformation, Transduction, Conjugation ( F <sup>+</sup> & HFr).	8 hours	Lecture
UNIT III 15hrs per semester			
	Techniques to study bacteria: Staining methods – Simple, Gram staining and Negative Staining.	8 hours	Lecture
	Culture of bacteria : Culture media :Types , preparation and sterilization of medium.	6 hours	ICT
	Pure culture techniques – streak plate, pour plate, spread plate	1 hour	Lecture
UNIT IV 15hrs per semester			
	Water microbiology-analysis of water for coli forms, waste water treatment processes-Primary, secondary and tertiary methods.	9 hours	Lecture
	Food microbiology: microbial spoilage of fruits vegetables, meat.	1 hour	ICT
	Flora of Milk and pasteurization of milk .	5 hours	Lecture
UNIT V 15hrs per semester			
	Classification of plant diseases based on host and pathogen. Study of the following diseases with reference to causal organism, symptoms, epidemiology and control measures.	6 hours	Lecture

	Fungal disease: Early leaf spot of groundnut (Tikka), Bacterial disease: Citrus canker	6 hours	ICT
	Phytoplasmal disease: Little leaf of Brinjal, Viral disease: TMV.	3 hours	ICT

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	3	4	4	4	2	2	3	3	3.2
CO2	4	4	3	4	3	4	2	3	3	3	3.3
CO3	4	4	4	4	4	3	4	4	4	3	3.8
CO4	4	4	4	4	4	4	4	4	4	5	4.1
CO5	4	4	4	4	4	4	4	4	4	5	4.1
Mean Overall Score											3.7

Result: The Score for this Course is 3.7(High Relationship)

**Programme :B.Sc**

**Semester : VI**

**Sub. Code : U22CB14**

**Part III: Core Paper XIV**

**Hours : 5 hrs/week75 hrs/sem**

**Credits :5**

**TITLE OF THE PAPER: PLANT BIOTECHNOLOGY AND BIOINFORMATICS**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	5	4	-	-	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To provide brief introduction and tools of biotechnology</li><li><input type="checkbox"/> To know fermentation technology and fermentor types and design.</li><li><input type="checkbox"/> To introduce the students about plant biotechnology and gain knowledge on gene transfer through microbes</li><li><input type="checkbox"/> To analyze about patent and learn its applications.</li><li><input type="checkbox"/> This course will provide students to know about bioinformatics and types of databases.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the Students will be able to						
<b>UNIT 1 CO1:</b> Know and describe the scope and tools of biotechnology.					1	15
<b>UNIT 2 CO2:</b> Understand the gene cloning and it applications.					2	15
<b>UNIT 3 CO3:</b> Gain knowledge on plant biotechnology and gene transfer in plants through microbes.					3	15
<b>UNIT 4 CO4:</b> Acquires knowledge about Intellectual Property Rights and its uses to society.					4	15
<b>UNIT 5 CO5:</b> Understand bioinformatics and data bases.					5	15
<b>SYLLABUS</b>						
<b>Unit I:</b> <p>Brief introduction on Biotechnology, Scope of Biotechnology, Recombinant DNA Technology: Tools- Restriction enzymes: Endonuclease and Exonuclease. Basic properties of Plasmids:Vector-Types of vectors –Plasmid- PBR 322.</p>						
<b>Unit II:</b> <p>Gene cloning: Steps in gene cloning. Methods of gene transfer-Microinjection, Electroporation-Particle bombardment. Analysis of cloned genes – Southern and Northern Blotting – PCR Technique.</p>						
<b>Unit III:</b>						

Plant biotechnology – Introduction to tissue culture – Genetic transformation of plants by *Agrobacterium tumefaciens*. Genetic Organization of Ti plasmid, structure and functions encoded by T-DNA.

#### Unit IV:

Bioethics and Biosafety- guidelines and regulation, Intellectual Property Rights- Patenting of biological materials- Product patents – Conditions for Patenting - Plant variety protection and Farmer's Rights (PVPFR).

#### Unit V:

Bioinformatics, Data base, Types of data base – Retrieval of information from Data Base – Protein and Nucleic acids. Details of websites – Pairwise Alignment – FASTA, BLAST. Sequence analogy - Protein sequences -Nucleic acid sequences, Phylogenetic analysis.

#### TEXT BOOKS :

1. Dubey. R.C., 2006, *A Text Book of Biotechnology* S.Chand and Company, New Delhi.

#### REFERENCE:

1. Balasubramanian. D. – Bryce CFA , Dharmalingam K. Green J, Kunthala Jayaraman, 2007, *Concepts in Biotechnology* – University Press India Pvt. Ltd.
2. Singh. B.D., 2007, *Biotechnology, Expanding Horizon*, Kalyani Publications, Ludhiana.
3. Veer Bala Rastogi 2008, *Fundamentals of Molecular Biology*, Ane Books Pvt. Ltd.
4. Remawat. K.G., 2006, *Plant Biotechnology* S. Chand & Company Ltd., New Delhi.
5. Purohit. S. S., 2004, *A Laboratory Manual of Plant Biotechnology*. Agro bios India.
6. Balaji, S. 2010. *Nanobiotechnology*. MJP Publishers, Chennai.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1 15hrs per semester			
	Brief introduction on Biotechnology, Scope of Biotechnology, Recombinant DNA Technology: Tools- Restriction enzymes: Endonuclease and Exonuclease. Basic properties of Plasmids: Vector- Types of vectors –Plasmid- PBR 322. Phage Lambda vector. Analysis of cloned genes – Southern and Northern Blotting .	12 hours	Lecture
	PCR Technique	3 hours	ICT

UNIT II 15hrs per semester			
	Gene cloning-steps and methods	10 hours	ICT
	Analysis of cloned genes	5 hours	Lecture
UNIT III 15hrs per semester			
	Plant biotechnology – Introduction to tissue culture – Genetic transformation of plants by Agrobacterium tumefaciens. Genetic organisation of	12 hours	Lecture
	Ti plasmid, structure and, functions encoded by T-DNA.	3 hours	ICT
UNIT IV 15hrs per semester			
	Bioethics and Biosafety, Intellectual Property rights- patents	10 hours	Lecture
	Plant variety protection and Farmer's Rights (PVPFR).	5 hours	ICT
UNIT V 15hrs per semester			
	Bioinformatics, Data base, Types of data base – Retrieval of information from Data Base – Protein and Nucleic acids. Details of websites – Pairwise Alignment – FASTA, BLAST. Multiple Sequence Alignment- Clustal W, Sequence analogy – Protein sequences –	12 hours	Lecture
	Nucleic acid sequences, Phylogenetic analysis.	3 hours	ICT

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	4	4	4	3	4	4	4	3	3.8
CO2	4	4	4	4	4	3	4	4	4	4	3.9
CO3	4	4	4	4	4	4	4	4	4	4	4.0
CO4	4	4	4	4	4	3	4	4	4	4	3.9
CO5	4	4	4	4	4	4	4	4	4	4	4.0
Mean Overall Score											3.92

Result: The Score for this Course is 3.92(High Relationship)

**Programme : B.Sc.**

**Semester : VI**

**Sub. Code : U22CB15P**

**Part III: Core Practical VI**

**Hours: 6 hrs/week 90 hrs/sem**

**Credits: 5**

**TITLE OF THE PAPER: MAJOR PRACTICAL VI**

Pedagogy	Hours	Lab experimentation	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	8	8	-	-	-
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To identify the microbes and its isolation.</li><li><input type="checkbox"/> To understand the practical aspects of Microbiology such as characterization of microbes, staining procedures and preparation of pure cultures.</li><li><input type="checkbox"/> To acquire knowledge about the techniques and basic concepts in Biotechnology.</li></ul>					
<b>COURSE OUTCOME</b>					
At the end of the Semester, the students will be able to					
<b>CO1:</b> Learn the methods of media preparation					
<b>CO2:</b> Apply the knowledge of isolation of bacteria.					
<b>CO3:</b> Learn the different culture techniques in microbiology.					
<b>CO4:</b> Identify common microbes from diverse natural habitats and isolate microbial culture					
<b>CO5:</b> Acquire knowledge in experiments pertaining to biotechnology and identifying various plant diseases					
<b>SYLLABUS</b>					
<b>Microbiology</b> <ol style="list-style-type: none"><li>1. Simple staining</li><li>2. Gram staining.</li></ol>					

3. Preparation of media.
4. Isolation of bacteria from soil.
5. Pure culture Techniques –Streak plate/Spread plate/Pour plate.
6. Hanging drop method.

#### **Biotechnology**

7. Preparation of MS media.
8. Initiation of Callus Culture.
9. Initiation of Suspension Culture.
10. Isolation of Plant DNA.

#### **Plant Pathology**

11. Citrus canker
12. Tikka disease
13. Little leaf of Brinjal
14. TMV

#### **Spotters related to theory.**

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	4	4	4	4	2	3.3
CO2	3	3	4	4	4	4	4	4	4	3	3.7
CO3	2	2	4	4	4	3	3	3	4	4	3.3
CO4	4	4	4	4	4	2	3	3	3	3	3.4
CO5	5	4	4	3	3	4	3	3	3	3	3.5
Mean Overall Score											3.44

Result: The Score for this Course is 3.44(High Relationship)

**Programme : B.Sc.**

**Semester : VI**

**Sub. Code : U22DSB2A**

**Part III: Discipline Specific Elective Course II**

**Hours: 5 hrs/week 75 hrs/sem**

**Credits: 4**

**TITLE OF THE PAPER: INDUSTRIAL MICROBIOLOGY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	6	3	1	1	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li>□ The drive to device and develop bio-base technologies make structurally simple and easy to manoeuvre microbes as agents of change in food, pharmaceutical and health industries where marketable products are made.</li><li>□ Thus with opportunities booming, this course is all set out to entrain learners looking for career opportunities in the various avenues.</li></ul>						
<b>COURSE OUTCOME</b> At the end of the Semester, students will be able to					Unit	Hrs P/S
<b>UNIT 1 CO1:</b> understand the role and functions of microbes in nature and confidently handle microbes for gainful employment as technician and expert					1	12 hrs
<b>UNIT 2 CO2:</b> apply their knowledge and training for manipulation of microbes and microbial processes in production and service industries					2	20 hrs
<b>UNIT 3 CO3:</b> produce marketable products that they will be job-ready to join large scale and small or can start their own entrepreneurial projects					3	13 hrs
<b>UNIT 4 CO4:</b> find their spaces of engagement in the extended domains of food industries and energy production and gain confidence in taking job roles as technicians and managers					4	15 hrs
<b>UNIT 5 CO5:</b> to intelligently manipulate microbes in producing vaccines and antibiotics thereby gaining confidence in seeking placements in sales and service sector of the pharmaceutical companies					5	15 hrs

## **SYLLABUS**

### **Unit I:**

Introduction, Microbes as ideal organisms for Industries, Microbes as suppliers of Natural Resources. Role of microorganisms in the production of Industrial Products.

### **Unit II:**

Fermentation Technology- Stages of Fermentation, Designing of Bioreactors, Stirred tank Fermentor, Formulation of Medium, Sterilization, Isolation, Selection of microorganisms. Inoculum development: Culture of Microorganisms. Downstream processing- Purification of Products.

### **Unit III:**

Fermentation Products- Amino Acids, Alcohols, Vinegar. Industrial Production of Ethanol.

### **Unit IV:**

Enzymes: Amylase, Protease. Organic Acids: Citric Acid, Lactic Acid. Biomass into bioenergy- Production of Biogas.

### **Unit V:**

Production of Antibiotics: Penicillin, Streptomycin. Preparation of Vaccines and Marketing.

### **Text Book:**

1. A Text Book of industrial Microbiology by A.H Patel, Macmillan , 1984.

### **References:**

1. Pelzar. M.J., Chan. E.C.S., Kreig. N.R., 1993, *Microbiology Concepts and Applications*, Mc Graw Hills, Inc. New York.
2. Dubey and D.K.Maheswari, *Text Book of Microbiology*, S.Chand and Company, New Delhi.
3. Sullia.S. and S.Shantha Ram, *General Microbiology*, Oxford and IBH Publishing, New Delhi.
4. Atlas. R.M., 1997, *Principles of Microbiology*, Mc Graw Hills.

<b>UNITS</b>	<b>TOPIC</b>	<b>LECTURE HOURS</b>	<b>MODE OF TEACHING</b>
<b>UNIT 1 : 12 hours per semester</b>			
	Introduction, microbes as ideal organisms for Industries	4 hours	Using collection of data of microbes used as catalysts and raw materials for industrial processes
	Microbes as suppliers of Natural Resources	4 hours	Industrial visit Market Sensitization
	Role of microorganisms in the production of Industrial Products	4 hours	Using collection of appropriate material, products and produce for making display as exhibits, GD
<b>UNIT II : 20 hours per semester</b>			
	Fermentation Technology- Stages of Fermentation	3 hours	Explaining pathways using charts and AV aids
	Designing of Bioreactors, Stirred tank fermentor	4 hours	AV aids, charts and Power point presentation

	Formulation of Medium, Sterilization	4 hours	Demonstrations and group work , Power point presentation
	Isolation, Selection of microorganisms. Inoculum development: Culture of Microorganisms	5 hours	Hands- on training and study in asepsis in small volume cultures and large installations
	Downstream processing- Purification of Products	4 hours	Industrial Visits to study equipment design on small and large installations
UNIT III : 13 hours per semester			
	Fermentation Products- Amino Acids	3 hours	Survey of market potential Peer teaching
	Fermentation Products- Alcohols	3 hours	Using collection of marketable products for Display, AV aids, charts and slides
	Fermentation Products- Vinegar	4 hours	Assessment of diversified use in Food Industry, Peer teaching
	Industrial Production of Ethanol	3 hours	Power point presentation, GD and Peer Teaching Technique
UNIT IV : 15 hours per semester			
	Enzymes: Amylase, Protease	5 hours	AV aids and Power point presentation
	Organic Acids: Citric Acid, Lactic Acid	5 hours	AV aids and Power point presentation, Site Study at Commercial Plant
	Biomass into bioenergy- Production of Biogas	5 hours	Power point presentation, Site Study, Creation of Table Top POP Model
UNIT V : 15 hours per semester			
	Production of Antibiotics: Penicillin	5 hours	Visit to Production Units Study of equipment design at installations in a site study AV aids, charts and slides
	Production of Streptomycin	5 hours	Industrial Visit and Market Survey for Impact Assessment
	Preparation of Vaccines & Marketing	5 hours	Industrial visit and site study at King /Pasteur institute Study of production-sales network

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO 1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	3	3	3	3	4	3	3	3.0
CO2	4	4	4	4	4	3	4	4	4	3	3.8
CO3	4	4	4	4	4	3	4	4	4	3	3.8
CO4	4	4	4	4	4	3	4	4	4	5	4.0
CO5	4	4	4	4	4	3	4	4	4	3	3.8

Mean Overall Score	3.68
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Result: The Score for this Course is 3.68 (High Relationship)

**Programme : B.Sc.**

**Part III: Discipline Specific Elective Course II**

**Semester : VI**

**Hours: 5 hrs/week 75 hrs/semester**

**Sub. Code : U22DSB2B**

**Credits : 4**

**TITLE OF THE PAPER: MOLECULAR BIOLOGY AND RECOMBINANT  
TECHNOLOGY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	6	3	1	1	1
<b>PREAMBLE:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> The drive to device and develop bio-base technologies make structurally simple and easy to make recombinants and their applications in industry.</li> <li><input type="checkbox"/> Thus with opportunities booming, this course is all set out to entrain learners looking for career opportunities in the various avenues.</li> </ul>					
<b>COURSE OUTCOME</b> At the end of the Semester, students will be able to					Unit Hrs P/S
<b>UNIT 1 CO1:</b> Understand the role and functions of DNA and its replication methods					1 10 hrs
<b>UNIT 2 CO2:</b> Knows about RNA, its role in transcription process.					2 12 hrs
<b>UNIT 3 CO3:</b> Aware about translation and post translational modifications					3 15 hrs
<b>UNIT 4 CO4:</b> Admires recombinant technology and develops keen interest in gene cloning.					4 20 hrs
<b>UNIT 5 CO5:</b> To intelligently manipulate cloning methods and apply it in agriculture.					5 18 hrs
<b>SYLLABUS</b> <b>Unit: I</b> Identification of DNA as Genetic Material, structure of DNA- Replication of DNA- (Semi conservative methods)- genetic code and its characteristics. <b>Unit: II</b>					

Structure of RNA- Types – Transcription in Prokaryotes (Initiation, Elongation and Termination). Regulation of Gene expression – Lac operon.

**Unit: III**

Translation (Initiation, Elongation and Termination), Post-translational modifications.

**Unit: IV**

Recombinant DNA technology- Definition of gene cloning – Cloning vectors- plasmids (PBR 322)- phage vector. Restriction endonucleases- types I, II, III Ligases.

**Unit: V**

Steps in Gene cloning – Isolation of gene, Insertion of gene into the plasmid, Introduction of r DNA into host cells, Identification of cloned genes- Insertional inactivation.

**REFERENCES :**

1. Verma, P.S. and V.K. Agarwal 1998, Concept of Molecular Biology, & Chand and Company.
2. Kumar, H.D., 2000, Molecular Biology, Vikas Publishing House, Pvt., Ltd., New Delhi.
3. Twyman, R., 1998, Advanced Molecular Biology, Viva Books, Pvt., Ltd., New Delhi.
4. Turner, P.C., AgMclennal, A.D. Bates and M.H., White 2001, Instant New Molecular Biology, Viva Books Pvt., Ltd.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1 : 10 hours per semester			
	Identification of DNA as Genetic Material	3 hours	Lecture
	Structure of DNA- Replication of DNA- (Semi conservative methods)	3 hours	ICT
	Genetic code and its characteristics.	4 hours	Lecture, GD
UNIT II : 12 hours per semester			
	Structure of RNA- Types	3 hours	Explain using charts and AV aids
	Transcription in Prokaryotes (Initiation, Elongation and Termination).	5 hours	AV aids, charts and Power point presentation
	Regulation of Gene expression – Lac operon.	4 hours	Power point presentation
UNIT III : 15 hours per semester			
	Translation (Initiation, Elongation and Termination)	8 hours	ICT
	Post-translational modifications.	7 hours	AV aids, charts ICT
UNIT IV : 20 hours per semester			

	Recombinant DNA technology	5 hours	AV aids and Power point presentation
	Definition of gene cloning Cloning vectors- plasmids (PBR 322)- phage vector. .	9 hours	AV aids and Power point presentation
	Restriction endonucleases- types I, II, III Ligases	6 hours	Power point presentation
UNIT V : 18 hours per semester			
	Steps in Gene cloning – Isolation of gene, Insertion of gene into the plasmid	8 hours	ICT AV aids, charts
	Introduction of r DNA into host cells	5 hours	ICT
	Identification of cloned genes- Insertional inactivation.	5 hours	ICT

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	3	3	3	3	4	3	3	3.0
CO2	4	4	4	4	4	3	4	4	4	3	3.8
CO3	4	4	4	4	4	3	4	4	4	3	3.8
CO4	4	4	4	4	4	3	4	4	4	5	4.0
CO5	4	4	4	4	4	3	4	4	4	3	3.8
Mean Overall Score											3.68

Result: The Score for this Course is 3.68 (High Relationship)

**Programme : B.Sc.**

**Semester : VI**

**Sub. Code : U22DSB3A**

**Part III: Discipline Specific Elective Course III**

**Hours: 5 hrs/week 75 hrs/semester**

**Credits: 4**

**TITLE OF THE PAPER: BIODIVERSITY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	5	2	1	1	1
<b>PREAMBLE:</b>  <input type="checkbox"/> This paper is structured to cap the learning of plant sciences at its threshold. Content selection is done in such way to impress upon the student to realize her obligation in protecting, conserving and judiciously managing nature and its resources.					
<b>COURSE OUTCOME</b>					Unit
At the end of the Semester, the students will be able to					Hrs P/S
<b>UNIT 1 CO1:</b> scientifically and systematically study and investigate botanical elements that have material, cultural and aesthetic values and take upon themselves the obligation to upkeep and replenish the dwindling resources					1
<b>UNIT 2 CO2:</b> handle issues that are considered serious threats to biodiversity as they would be sensitized to prevent the ongoing onslaughts on nature					15 hours
<b>UNIT 3 CO3:</b> creatively participate and contribute to the implementation of national and global initiatives and involve in focussed efforts directed on saving nature and biodiversity					2
<b>UNIT 4 CO4:</b> to preserve depleting bioresources and evince interest in proactive and confident engagement in preparing action plans and advocacies aimed to conserve the bioresources					15 hours
<b>UNIT 5 CO5:</b> wilfully give their time and effort in fulfilling the tasks and goals they set before themselves to befit their training for a meaningful participation and wholesome involvement directed at protecting and managing biodiversity					3
<b>SYLLABUS</b>					4
					15 hours

**Unit I:**

Biodiversity and its importance. Genetic, Species and Ecosystem diversity. Uses of biodiversity- source of food, medicine, raw material, aesthetic and cultural values. Keystone species, Umbrella species, Flagship species, Charismatic species and Feral species.

**Unit II:**

Biodiversity centres- Global and Indian level. Hotspots and Mega diversity zones of India. Threats to biodiversity (natural and anthropogenic), IUCN threat categories, Red data book.

**Unit III :**

Conventions on Biodiversity (CBD)-Rio Summit, Kyoto Conference. Man and Biosphere- UNEP- IUCN. Characteristic features of Biosphere reserves: Gulf of Mannar, Nilgris Biosphere Reserve.

**Unit IV:**

Principles and strategies of Biodiversity conservation: *Ex situ*-Botanical garden, Zoos, Aquaria, Herbarium. *In situ*-Sanctuaries, Biosphere reserve, National park. In vitro Germplasm, Gene bank, Tissue culture, Pollen bank, DNA bank, Traditional knowledge in relation to IPR.

**Unit V:**

Remote sensing: definition, applications of GIS, GPS, Remote sensing in Environmental studies, Vegetation, Classification (techniques need not be discussed in detail). TRIP, Patent Act.

**TEXT BOOKS**

1. Krishnamurthy, K.V. 2003, *An Advanced Text book on Biodiversity*, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. A Text Book of Biodiversity by Anupam Rajak, Independently Published ,2020

**REFERENCES :**

- 1.Jaganmohan Reddy, K. & Veeraiah, S. 2010, *Aavishkar*, Publishers, Distributors, Jaipur.
- 2.Narasaiah, M.L. 2005, *Biodiversity and Sustainable Development*, Discovery Publishing House, New Delhi.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 15 hours per semester			

	Biodiversity and its importance. Genetic, species and ecosystem diversity	5 hours	Blackboard use to familiarize and internalize terms, definitions and key words
	Uses of biodiversity- source of food, medicine, raw material, aesthetic and cultural values.	5 hours	Sensitising students to do surveys and to collect appropriate materials, products and produce that would form an input for food, health and pharmaceutical industries and exhibit the collections
	Keystone species, umbrella species, flagship species, charismatic species and feral species.	5 hours	Comparative studies with charts and Power point presentations
UNIT II : 15 hours per semester			
	Biodiversity centres- Global and Indian level	4 hours	ICT enabled presentations and video conferencing with experts
	Hotspots and Mega diversity zones of India	4 hours	Appraisal through field trips and site study, use of museum mounts and AV aids, Peer teaching
	Threats to biodiversity (natural and anthropogenic)	4 hours	Preparation of chart, models and other exhibits for knowledge dissemination and public viewing
	IUCN threat categories, Red data book	3 hours	Power Point Presentation with animations and video clips, Peer teaching
UNIT III : 15 hours per semester			
	Conventions on Biodiversity (CBD)-Rio summit, Kyoto conference	3 hours	Power point presentations, videos
	Man and Biosphere- UNEP-IUCN	3 hours	GD, Videos, Tutorial
	Characteristic features of biosphere reserves	3 hours	Use of AV aids, Peer teaching techniques

	Gulf of Mannar Biosphere Reserve	3 hours	Appraisal through field trips and site study, Documentaries and slide shows
	Nilgris Biosphere Reserve	3 hours	Appraisal through field trips and site study, Documentaries and slide shows
UNIT IV : 15 hours per semester			
	Principles and strategies of biodiversity conservation	2 hours	Blackboard use towards familiarising and internalising key words, terms, definitions used GD and Peer teaching to present schemes of nature conservation and management
	Ex situ-Botanical garden, Zoos, Aquaria, Herbarium	4 hours	Study of designs and constructions making use of ICT tools Field trips and institutional visits for site study
	In situ-Sanctuaries, Biosphere reserve, National park	4 hours	Appraisal through field trips and site study, Documentaries and slide shows
	In vitro germplasm, gene bank, tissue culture, pollen bank, DNA bank	5 hours	AV aids, Peer teaching, Power point presentations
UNIT V : 15 hours per semester			
	Remote sensing: definition, applications of GIS, GPS	4 hours	Visits and site study of installations, Power point presentations
	Remote sensing in environmental studies, vegetation classification	4 hours	Short films and Documentaries

	Intellectual property rights : TRIP, Patent Act	4 hours	GD and Peer Teaching, Power point presentations
	Traditional knowledge in relation to IPR	3 hours	Community Interactions Survey and Interview techniques using formatted questionnaires

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	4	4	4	4	3	4	4	3	3.8
CO2	4	3	4	4	4	3	3	3	4	4	3.6
CO3	4	4	4	4	3	4	3	4	3	4	3.7
CO4	4	4	4	4	3	4	3	3	4	4	3.7
CO5	4	3	4	4	3	4	3	4	4	3	3.6
Mean Overall Score											3.68

Result: The Score for this Course is 3.68 (High Relationship)

**Programme : B.Sc.**

**Part III: Discipline Specific Elective Course III**

**Semester : VI**

**Hours: 5 hrs/week 75 hrs/semester**

**Sub. Code : U22DSB3B**

**Credits: 4**

**TITLE OF THE PAPER: ENVIRONMENT RELATED OCCUPATIONAL HAZARDS**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	4	2	-	1	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To help the students understand the factors affecting health.</li><li><input type="checkbox"/> To facilitate the students to learn various occupational health hazards.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the students will be able to						
<b>UNIT 1 CO1:</b> Understand the factors affecting health.					1	15
<b>UNIT 2 CO2:</b> Gains knowledge about water borne diseases and chemicals in water that affect health.					2	15
<b>UNIT 3 CO3:</b> Learn the types of airborne diseases and control measures.					3	15
<b>UNIT 4 CO4:</b> applies the knowledge about food additives and food preservatives.					4	15
<b>UNIT 5 CO5:</b> Understands about the occupational health hazards.					5	15
<b>SYLLABUS</b>						
<b>Unit: I</b> Introduction Occupational hazards – Environment and health- Factors affecting health- physical, chemical and Biological factors- sanitation						
<b>Unit: II</b> Chemical substances in water that affect health- fluoride and heavy metals. Water borne diseases- typhoid, cholera and Jaundice- causes and control measures.						

**Unit: III**

Air and health- Air borne diseases-modes of transmission of air borne diseases- influenza and tuberculosis- causes and control measures.

**Unit: IV**

Chemicals in day to day life- food additives- artificial food colors emulsifiers – food preservatives- Sorbates, benzoates- food adulterants (any five).

**Unit: V**

Occupation health hazards, diseases prevailing in different occupational environment – Industries, hospitals. Indian standard- air quality- water quality- noise quality.

**REFERENCES :**

1. Harish Kumar, 2001, Environmental Health Hazards, Ivy Publishing House, New Delhi.
2. Park, K. 2002, Text Book of Preventive and Social Medicine, Banarsidas Bhanot Publishers, Jabalpur.
3. Srilakshmi, B., 1998, Food Sciences, New Age International Ltd, New Delhi.
4. Subbulakshmi, G. & Udipi, A.S., Food processing & Preservation, New Age International Publishers, New Delhi.
5. Sharma, B.K, & Kour, H., Environmental Pollution.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 15hours per semester			
	. Introduction Occupational hazards – Environment and health	8 hours	Chalk–talk method, use of AV aids
	Factors affecting health- physical, chemical and Biological factors- sanitation	7hours	Lecture method, AV aids
UNIT II: 15 hours per semester			
	. Chemical substances in water that affect health- fluoride and heavy metals.	7 hours	chalk and talk method and AV aids
	. Water borne diseases- typhoid, cholera and Jaundice- causes and control measures.	8 hours	Lecture method.
UNIT III: 15 hours per semester			
	Air and health- Air borne diseases-modes of transmission of air borne diseases-.	8 hours	Chalk and talk method ,AV aids

	influenza and tuberculosis- causes and control measures	7 hours	Chalk and talk method
UNIT IV: 15 hours per semester			
	Chemicals in day to day life- food additives- artificial food colors emulsifiers	7 hours	Chalk and talk Use of AV aids.
	food preservatives- Sorbates, benzoates- food adulterants (any five).	8 hours	Chalk and talk method
UNIT V: 15 hours per semester			
	Occupation health hazards, diseases prevailing in different occupational environment	7 hours	Lecture method,
	Industries, hospitals. Indian standard- air quality- water quality- noise quality.	8 hours	Use of AV Aids,Chalk and talk method

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	4	3	2	3	3	3	3	3.0
CO2	4	4	4	4	4	3	4	4	3	4	3.8
CO3	4	4	4	4	4	3	3	3	3	4	3.6
CO4	4	4	4	4	4	3	3	3	3	4	3.6
CO5	4	4	3	4	4	3	3	3	3	4	3.5
Mean Overall score											3.5

Result: The Score for this Course is 3.5 (High Relationship)

**Programme : B.Sc.**

**Part IV: Skill Enhancement Course III**

**Semester : VI**

**Hours: 2 hrs/week 30 hrs/sem**

**Sub. Code : U22SEB3**

**Credits:2**

**TITLE OF THE PAPER: BIOLOGICAL TECHNIQUES**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	4	2	-	1	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li>□ To enable the students to comprehend the principles and methods of studying plant cell using microtechniques.</li><li>□ To help the students understand the principles and handling of various instruments used in biological research.</li><li>□ To facilitate the students to learn the applications of various modern biological techniques such as chromatography and spectroscopy and other biological instruments.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the students will be able to						
<b>UNIT 1 CO1:</b> Understand the methods used in micrometry, microtomy and staining procedures.					1	6
<b>UNIT 2 CO2:</b> Gain skills on working principles of pH meter and colorimeter					2	5
<b>UNIT 3 CO3:</b> Learn the technique of centrifugation & its applications					3	5
<b>UNIT 4 CO4:</b> Gain knowledge about various chromatographic techniques					4	7
<b>UNIT 5 CO5:</b> Understand about radiometry, its application in biological studies.					5	7
<b>SYLLABUS</b>						

**Unit I:**

Micrometry. Principles and methods of measuring plant cell. Microtechniques -Fixatives - stains - Dehydration -Embedding - Sectioning - (rotary microtome) - Staining- double staining.

**Unit II:**

Analytical methods -pH meter - principles -measurement of pH . Preparation of buffers -acetate buffer. Colorimetry. Spectrophotometry - basic principles.

**Unit III:**

Separation methods: Centrifugation techniques – Density gradient- basic principles - types (Clinical & Ultra) and their applications.

**Unit IV:**

Chromatographic techniques -principles and techniques - Thin layer chromatography - Electrophoretic techniques - Principle, Agarose Gel Electrophoresis.

**Unit: V**

Radiometry-Isotopes, Measurement of radioactivity-Scintillation counter-Autoradiography.

**TEXT BOOKS:**

1. Johansen, M. 1940, *Plant Microtechniques* Mc Graw Hill, New Delhi.

**REFERENCES:**

1. Anbalagan, K. 1985, *Electrophoresis Life Science Book House*, New Delhi.
2. David Plumer, 1987, *An Introduction to Practical Biochemistry* Tata Mc Graw Hill, New Delhi.
3. Jeyaraman, 1978, *Laboratory Manual in Biochemistry* Wiley Eastern Ltd New Delhi

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 6 hours per semester			
	Micrometry. Principles and methods of measuring plant cell.	2 hours	Chalk–talk method, use of AV aids
	Microtechniques – fixatives – stains – dehydration – embedding	2 hours	Lecture method, AV aids
	Sectioning – (rotary microtome) – staining- double staining.	2 hours	Lecture method, Group discussion using POP,
UNIT II: 6 hours per semester			
	Analytical methods –pH meter – principles – measurement of pH.	2 hours	chalk and talk method and AV aids
	Preparation of buffers –acetate buffer. .	1 hour	Lecture method.

	Colorimetry. Spectrophotometry – basic principles	2 hours	chalk and talk method and group discussion
UNIT III: 5 hours per semester			
	Separation methods: Centrifugation techniques – density gradient- basic principles – types (clinical & ultra) and their applications	5 hours	Chalk and talk method ,AV aids
UNIT IV: 7 hours per semester			
	Chromatographic techniques – principles and techniques - paper and thin layer chromatography	4 hours	Chalk and talk Use of AV aids.
	Electrophoretic techniques – Principle- Agarose Gel Electrophoresis	3 hours	Use of PPT and Chalk and talk method
UNIT V: 7 hours per semester			
	Radiometry-Isotopes,measurement of radioactivity	3hours	Lecture method,
	Scintillation counter-Autoradiography.	4 hours	Use of AV Aids,Chalk and talk method

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	4	3	4	2	2	3	3	3	2	2.9
CO2	4	4	4	4	2	2	4	3	4	2	3.3
CO3	4	4	4	4	2	2	3	3	4	2	3.2
CO4	4	4	4	4	2	2	4	4	3	2	3.3
CO5	4	3	4	4	2	2	4	3	4	2	3.3
Mean Overall score											3.2

Result: The Score for this Course is 3.2(High Relationship)

## VALUE ADDED COURSES

### Scheme of Examination

Semester	Subject Code	Credit	Title of the Course	Class	Duration of Exam (Hours)	Passing Minimum 40%		
						Int	Ext	Total
III	VAB1	2	Home Gardening	B.Sc/B.A/B.Com/B.B.A	2	20	30	50
IV	VAB2	2	Nutraceuticals	For Botany Major Students	2	20	30	50

**Programme : B.Sc./B.A/B.B.A/B.Com, B.C.A**

**Value Added Course**

**Semester : III**

**Hours: 2 hrs/week30hrs/sem**

**Sub. Code : VAB1**

**Credits :2**

**TITLE OF THE PAPER: HOME GARDENING**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	2	2	-	1	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To enable the students to know the techniques of gardening</li><li><input type="checkbox"/> To help the students understand the aesthetic value of nature</li><li><input type="checkbox"/> To facilitate the students to learn the principles involved in preservation techniques of vegetables and fruits</li></ul>						
<b>COURSE OUTCOME</b> At the end of the Semester, the students will be able to					Unit	Hrs P/S
<b>UNIT 1 CO I:</b> acquires knowledge about importance of gardening and garden implements					I	5
<b>UNIT 2 CO 2:</b> knows the different types of gardens which can be practiced by themselves					II	7
<b>UNIT 3 CO3:</b> enable the studentsabout the aesthetic value of nature					III	6
<b>UNIT 4 CO4:</b> understand the plants and containers that can be used in indoor gardening					IV	6

<b>UNIT 5 CO5:</b> facilitate the students to learn the principles involved in preservation techniques of vegetables and fruits	V	6
<p><b>SYLLABUS</b></p> <p><b>Unit I:</b> Gardening- features, scope and importance. Types of containers- Garden implement-techniques in propagation: Cuttage, Grafting (Tongue and Side) and Budding (T and I)</p> <p><b>Unit II:</b> Types of gardens- Terrace garden, Kitchen garden, Ornamental garden, Vertical garden and Hydroponics garden- advantages and limitations- plants suitable for different types of gardening.</p> <p><b>Unit III:</b> Components of garden- Arboretum-Shrubbery-Topiary-Edges-Rock garden-Arches-Pergolas-Landscaping-Lawn, Types of lawn grasses- Preparation and establishment of lawn.</p> <p><b>Unit IV:</b> Indoor gardening: choosing suitable shade loving plants- DIY containers in gardening -Succulents and cacti- Terrarium and Bonsai.</p> <p><b>Unit: V:</b> Value addition in Horticulture technology- Need and benefits-Post harvest management practices -Processing of vegetables and fruits: Drying, Dehydration and Pickling.</p> <p><b>TEXT BOOKS :</b></p> <p>1. Kumar N., 1994. <i>Introduction to Horticulture</i>, Rajalakshmi Pub. Nagarcoil</p> <p><b>REFERENCE:</b></p> <ol style="list-style-type: none"> <li>1. Adams C.R., Early M.P. 2004. <i>Principles of Horticulture</i>, Elsevier, New Delhi.</li> <li>2. Edmond J.B., Senn T.L., Andrews F.S., Halfacre P.G. 1975. <i>Fundamentals of Horticulture</i>. 4<sup>th</sup>Edn.TMH New Delhi.</li> <li>3. John Weathers. 1993, <i>Encyclopaedia of Horticulture</i>, Discovery Pub. House, New Delhi.</li> <li>4. Manibhushan Rao K. 2005. <i>Text Book of Horticulture</i>, Macmillan India Ltd.</li> <li>5. Randhawa G.S., Mukhopadhyay A. 1986. <i>Floriculture in India</i>, Allied Publishers Pvt. Ltd. Ahamedabad.</li> </ol>		

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I : 5 hours per semester			
	Gardening- features, scope and importance.	1 hour	Chalk–talk method, use of AV aids
	Types of containers. Garden implement-techniques in propagation: Cuttage	2 hours	Lecture method, AV aids
	Grafting (Tongue and Side) and Budding (T and I)	2 hours	Lecture method, Group discussion using POP
UNIT II: 7 hours per semester			
	Types of gardens- Terrace garden, Kitchen garden	2 hours	chalk and talk method and AV aids
	Ornamental garden, Vertical garden	2 hours	Explanation using PPT, Lecture method.
	Hydroponics garden- advantages and limitations- plants suitable for different types of gardening.	3 hours	chalk and talk method and group discussion
UNIT III: 6 hours per semester			
	Components of garden- Arboretum-Shrubbery-Topiary-Edges-Rock garden-Arches-Pergolas-	3 hours	Chalk and talk method ,Use of AV aids.
	Landscaping-Lawn, Types of lawn grasses- Preparation and establishment of lawn.	3 hours	Lecture method and GD
UNIT IV: 6 hours per semester			
	Indoor gardening: choosing suitable shade loving plants	2 hours	Black Board teaching techniques PPT
	DIY containers in gardening	2 hours	Use of PPT and Chalk and talk method
	Succulents and cacti- Terrarium and Bonsai.	2 hours	Lecture method and group discussions using AV aids

UNIT V: 6 hours per semester			
	Value addition in Horticulture technology	1 hour	Lecture method and group discussions
	Need and benefits-Post harvest management practices	2 hours	Chalk and talk method
	Processing of vegetables and fruits: Drying, Dehydration and Pickling.	3hours	Chalk and talk method ,Use of AV aids

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	4	4	3	4	4	3	4	4	3.8
CO2	4	4	4	4	4	4	4	3	4	4	3.9
CO3	4	4	4	5	4	4	4	4	4	4	4.1
CO4	4	4	4	4	4	4	4	4	4	5	4.1
CO5	4	4	4	5	4	4	4	4	4	5	4.2
Mean Overall score											4.02

Result: The Score for this Course is 4.02(High Relationship)

**Programme : B.Sc.**

**Class : II B.Sc. Botany**

**Sub. Code : VAB2**

**Value Added Course**

**Hours: 2 hrs/week 30hrs/sem**

**Credits: 2**

**TITLE OF THE PAPER: NUTRACEUTICALS**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT	
	2	2	-	1	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To familiarize the students with the field of functional foods and nutraceuticals.</li><li><input type="checkbox"/> Students will have the knowledge about the functional components of the food and regulatory framework required for regulatory approval of functional foods and Nutraceuticals.</li><li><input type="checkbox"/> To understand the importance of functional foods or nutraceutical supplementation for chronic disease prevention.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the students will be able to						
<b>UNIT 1 CO 1:</b> The student will be able to: differentiate between different classes of Nutraceuticals.					I	5
<b>UNIT 2CO2:</b> To Explain regulatory aspects of nutraceuticals and functional foods.					II	7

<b>UNIT 3CO3:</b> To apply the knowledge of nutraceuticals and functional foods in food industries.	III	6
<b>UNIT 4CO4:</b> Identify the food sources used as functional foods.	IV	6
<b>UNIT 5CO5:</b> Aware about the quality of foods and the safety measures to be taken.	V	6
<p><b>SYLLABUS</b></p> <p><b>UNIT: I</b></p> <p>Introduction to Nutraceuticals and Functional foods: Nutraceuticals- bridging gap between food and drug. Important definitions associated with nutraceuticals –Potential nutraceuticals.</p> <p><b>UNIT: II</b></p> <p>Role of functional foods in Health: Role of nutraceuticals in management of health and disease, Nutraceuticals for hypertension, cancer, diabetes, cholesterol management, obesity and age-related muscular degeneration.</p> <p><b>UNIT: III</b></p> <p>Functional properties of Nutraceuticals: Properties and functions of various nutraceuticals such as Lycopene, Prebiotics and Probiotics, Glucosamine, Phytosterols, and Antioxidants.</p> <p><b>UNIT: IV</b></p> <p>Food sources Different foods as functional food: Cereal products (rice bran), Fruits (banana) and Vegetables(Drumstick), Nuts (cashews), Seeds (pumpkin seeds).</p> <p><b>UNIT: V</b></p> <p>Regulatory aspects- International and national regulatory aspects of functional foods in India, ICMR guidelines for regulatory aspects of nutraceuticals. Quality Assurance of probiotics and its safety.</p> <p><b>TEXT BOOKS :</b></p> <ol style="list-style-type: none"> <li>1. Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.</li> <li>2. Gibson GR &amp; William CM. 2000. Functional Foods - Concept to Product.</li> </ol> <p><b>REFERENCE:</b></p> <ol style="list-style-type: none"> <li>1. Brigelius-Flohé, J &amp; Joost HG. 2006. Nutritional Genomics: Impact on Health and Disease. Wiley VCH.</li> <li>2. Goldberg I. 1994. Functional Foods: Designer Foods, Pharma Foods.</li> <li>3. Shi J. (Ed.). 2006. Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.</li> <li>4. Webb GP. 2006. Dietary Supplements and Functional Foods. Blackwell Publ</li> </ol>		

UNITS	TOP IC	LECTURE HOURS	MO DE OF TEA CHI NG
UNIT I : 6 hours per semester			
	Intro ducti on to Nutra ceuti calsa nd Funct ional foods	1 hour	Chal k-tal k meth od, use of AV aids
	Nutra ceuti cals- bridg ing gap betw een food and drug.	3 hours	Lect ure meth od, Grou p discu ssion usin g POP
	Impo rtant defini tions assoc iated with nutra ceuti cals	2 hours	Lect ure meth od

	–Potential nutra ceuti cals.		
UNIT II: 6 hours per semester			
	Role of functi onal foods in Healt h: Role of nutra ceuti cals in mana geme nt of healt h and disea se	2 hours	chal k and talk meth od
	Nutra ceuti cals for hyper tensi on, cance r, diabe tes	2 hours	Expl anati on usin g PPT, Lect ure meth od.
	chole sterol	2 hours	chal k

	management, obesity and age-related muscular degeneration		and talk method and group discussion
UNIT III: 6 hours per semester			
	Functional properties of Nutraceuticals: Properties and functions of various nutraceuticals such as Lycopene	3 hours	Chalk and talk method ,Use of AV aids.
	.	3 hours	Lecture

	Prebiotics and Probiotics, Glucosamine, Phytoosterols, and Antioxidants.		method and GD
UNIT IV: 6 hours per semester			
	Food sources Differential food sources	3 hours	Black Board teaching techniques PPT

	ct io n al f o o d : C er e al p r o d u ct s (r ic e b ra n )		
	F r ui ts ( b a n a n a) a n	2 hours	Use of PPT and Chalk and talk method

	d V e g e t a b l e s( D r u m s t i c k )		
	N ut s (c a s h e w s) , S e e d s ( p u m p ki n	1 hour	Lecture method and group discussions using AV aids

	s e e d s) .		
UNIT V: 6 hours per semester			
	Regu latory aspec ts- Inter natio nal and natio nal regul atory aspec ts of functi onal foods in India,	2 hours	Lecture method and group discussions
	ICM R guide lines for regul atory aspec ts of nutra ceuti cals.	3 hours	Chalk and talk method

	Quality Assurance of probiotics and its safety.	1hour	Chalk and talk method								
Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	4	4	4	3	3	4	3	3	3.4
CO2	4	3	3	3	4	4	3	4	3	3	3.4
CO3	3	3	4	4	3	3	3	3	3	3	3.2
CO4	4	4	3	4	3	4	3	4	3	3	3.5
CO5	4	3	4	3	4	4	4	3	3	3	3.5
Mean Overall score											3.4

Result: The Score for this Course is 3.4 (High Relationship)

### Ancillary Environmental Biology for Geography Major

#### Scheme of Examination

Semester	Subject Code	Credit	Title of the Course	Duration of Exam (Hours)	Passing Minimum 40%		
					Int	Ext	Total
I	U22ABGT1	3	Introduction to Ecobiology	3	25	75	100
II	U22ABGT2	4	Basic Forest Botany	3	25	75	100
III	U22ABGP	3	Ancillary Practical	3	40	60	100

**Programme : B.Sc. Geography**

**Part III: Allied for Geography Major**

**Semester : I**

**Hours : 4hrs/week 60 hrs/sem**

**Sub. Code : U22ABGT1**

**Credits: 3**

**TITLE OF THE PAPER: INTRODUCTION TO ECOBIOLOGY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL	ICT	
	4	2			2	
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> Relate the anatomical and Morphological modifications with reference to their eco system and environment.</li><li><input type="checkbox"/> Appreciate dual nature of lichens and their importance and mode of nutrition and interactions in plants.</li><li><input type="checkbox"/> Understand the concept of eco system.</li><li><input type="checkbox"/> Trace the evolutionary origins and inter relatedness of different forms with reference to habitat.</li><li><input checked="" type="checkbox"/> Build knowledge to study vegetation, using quadrat and transect.</li></ul>						
<b>COURSE OUTCOME</b>					Unit	Hrs P/S
At the end of the Semester, the Students will be able to						
<b>UNIT 1 CO1:</b> Understand and analyze different zones of environment and relates adaptations of plants to respective environment.					1	12

<b>UNIT 2 CO2:</b> Differentiate positive and negative interrogations	2	12
<b>UNIT 3 CO3:</b> Understand relationship between biotic and abiotic components.	3	12
<b>UNIT 4 CO4:</b> Develop concept on hydrosere and Xerosere. Causes and basic types of succession.	4	12
<b>UNIT 5 CO5:</b> Enable students to carry out vegetation studies.	5	12

## **SYLLABUS**

### **Unit I:**

Environment: Definition and various zones of environment, Hydrosphere: physical and chemical properties of water, Lithosphere: soil profile, Atmosphere: various zones of Atmosphere. Concept of biosphere, Adaptations - Hydrophytes: *Hydrilla*, Xerophytes: *Opuntia* and Halophytes: *Rhizophora*.

### **Unit II:**

Biotic interactions: Mutualism- *Rhizobium*; Commensalism- *Vanda*; Parasitism- *Cuscuta*; Insectivorous plants-*Nepenthes*.

### **Unit III:**

Structure of Ecosystem: Abiotic and Biotic components; Functions of Ecosystem; Food Chain, Food web, Ecological pyramid, Energy flow and productivity.

### **Unit IV:**

Ecological succession – causes and basic types of succession, General process – Nudation, Invasion, Competition and Stabilization- Hydrosere and Xerosere.

### **Unit V:**

Methods of study of vegetation: Quadrat and Transect methods- Parameters-Frequency-Density-Abundance.

## **TEXT BOOKS:**

1. Sharma. P.D., 1995, Ecology and *Environment*, Rakesh Kumar Publications, New Delhi.
2. Shukla, R.S. and Chandel, P.S. 2006, *A text book of plant Ecology*, S. Chand & Company Ltd., New Delhi.

## **REFERENCES:**

1. Krishnamurthy. T 1993, *Minor Forest products of India*, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
2. Eugene P. Odum, 1971, *Fundamentals of Ecology*, W.B. Saunders Company, Philadelphia, London.
3. Sharma. P.D., 1995, Ecology and *Environment*, Rakesh Kumar Publications, New Delhi.
4. Shukla, R.S. and Chandel, P.S. 2006, *A text book of plant Ecology*, S. Chand & Company Ltd., New Delhi.
5. Verma, P.S. and Agarwal, V.K. 1998, *Concept of Ecology*, S. Chand & Company Ltd., New Delhi.

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UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
	Concept of biosphere physical chemical properties of water lithosphereAtmosphere: various zones. Adaptations - Hydrophytes: <i>Hydrilla</i> , Xerophytes: <i>Opuntia</i> , Halophytes: <i>Rhizophora</i> .	6 hours     6 hours	Lecture     ICT
UNIT II			
	Biotic interaction Mutualism- <i>Rhizobium</i> ; Commensalism- Vanda; Parasitism- <i>Cuscuta</i> ; Insectivorous plants- <i>Nepenthes</i> .	6 hours     6 hours	ICT  ICT  ICT  ICT
UNIT III			
	Structure of Ecosystem -Abiotic and Biotic components Functions of Ecosystem Food Chain, Food web, Ecological pyramid, Energy flow and productivity.	6 hours     6 hours	Lecture  Lecture
UNIT IV			
	Ecological succession, causes and basic types of succession	4 hours	Lecture PPT & Video
	General process-nudation,invasion,competition,sta bilisation	4 hours	
	Hydrosere & Xerosere	4 hours	
UNIT V			
	Methods of Study of vegetation Quadrat	6 hours	Lecture Video and PPT
	Transect	6 hours	Lecture ,Video

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	

CO1	5	5	5	5	2	4	5	5	3	4	4.3
CO2	5	5	5	2	2	3	2	4	3	3	3.4
CO3	4	3	2	2	2	5	2	5	4	4	3.3
CO4	5	4	4	3	2	5	2	5	3	2	3.5
CO5	5	2	3	2	2	2	5	2	2	5	3.0
Mean Overall Score											3.4

Result: The Score for this Course is 3.4 (High Relationship)

**Programme : B.Sc. Geography**

**Part III: Allied for Geography Major**

**Semester : II**

**Hours : 4hrs/week 60 hrs/sem**

**Sub. Code : U22ABGT2**

**Credits: 4**

**TITLE OF THE PAPER: BASIC FOREST BOTANY**

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	4	3	-	1	
<b>PREAMBLE:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> To enable the students to know about natural forests, social forests and Agroforests</li> <li><input type="checkbox"/> To acquire the knowledge of threats to forests</li> <li><input type="checkbox"/> To make aware the students the causes and effects of deforestation</li> <li><input type="checkbox"/> To develop in them the need for conservation of forests</li> </ul>					
<b>COURSE OUTCOME</b>					Unit
At the end of the Semester, the students will be able to					Hrs P/S
<b>UNIT 1 CO1:</b> Understands the different types of forests in India					1
					12

<b>UNIT 2 CO2:</b> Learns the components of social forest and Agroforests	2	12
<b>UNIT 3 CO3:</b> Understands and compares the major and minor forest products	3	12
<b>UNIT 4 CO4:</b> Enable the students to develop nursery and recognizes the forest conservation strategies	4	12
<b>UNIT 5 CO5:</b> Develops keen interest in forest legislation and management	5	12

## **SYLLABUS**

### **Unit :I**

Introduction, types of forest in India , Threats to forest-causes and effects of deforestation.

### **Unit : II**

Social forestry:- components and significance. Agroforestry- various models of Agroforestry, plants suitable for Agroforestry, Agronomic importance of Agroforestry.

### **Unit : III**

Major forest products: wood (Sandal wood and Rose wood), timber (Neem and Teak), fuel wood (Prosopis). Essential oil: Lemon grass, Spices and condiments: cinnamon, pepper, clove.

### **Unit : IV**

Forest management –Nursery development, transplantation ,weeding, manuring ,mulching ,plant protection, rotation, fixation and harvesting. Forest conservation-insitu exsitu conservation .

### **Unit :V**

Forest Legislation with reference to national parks and sanctuaries –Wild life protection act, forest conservation act, vanamahotsava, joint forest management .

### **References:**

1. P.S. Verma V.K. Agarwal., 2001 *Environmental Biology: Principles of Ecology*, S.Chand & Company Ltd., New Delhi.
2. Odum H.T., E.P.Odum., 1957, *Fundamentals of Ecology*, W.B.Saunders Company, Philadelphia, London.
3. P.D. Sharma, 2009, *Environmental Biology*, Rastogi Publications, Meerut.
4. R. Rajagopalan, 2005, *Environmental Studies*, Oxford Univers.
5. Juneja, Kavita, **2002**, *Ecology*, Anmol Publications Pvt. Ltd., New Delhi

<b>UNITS</b>	<b>TOPIC</b>	<b>LECTURE HOURS</b>	<b>MODE OF TEACHING</b>
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UNIT I :			
	Types of forests in India, threats to forest Causes of deforestation	6 hours	Lecture Lecture Peer discussion
	Effects of deforestation	6 hours	Lecture
UNIT II:			
	Components of social forestry, significance	6 hours	chalk - talk AV aids
	Models of Agroforestry, Agronomic importance of Agroforestry	6 hours	Lecture AV aids
UNIT III:			
	Major forestproducts- wood,timber,fuel wood	6 hours	Chalk- talk , AV aids.
	Essential oil - lemongrass, spices and condiments- cinnamon,pepper,clove	6 hours	Lecture AV aids.
UNIT IV:			
	Forestmanagement- nursery development, transplantation, weeding, mulching, plant protection, rotation fixation and harvesting	6 hours	Chalk- talk AV aids
	Forest conservation- insitu and exsitu	6 hours	Chalk- talk AV aids
UNIT V:			
	Forest legislation –national parks and sancturies	4hours	Lecture
	Wild life protection Act Forest conservation Act	4 hours	Chalk talk
	Vanamahotsava, Joint forest management	4 hours	Chalk talk,

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO <sub>3</sub>	PSO4	PSO5	
CO1	3	4	3	3	4	3	3	3	4	3	3.3
CO2	3	3	4	3	2	3	4	4	3	4	3.3
CO3	3	3	3	4	3	3	3	3	3	3	3.1
CO4	4	3	3	3	4	4	3	4	4	3	3.5
CO5	4	3	3	4	3	4	3	3	3	4	3.4
Mean Overall Score											3.32

Result: The Score for this Course is 3.32 (High Relationship)

**Programme : B.Sc. Geography**

**Part III: Ancillary practical Paper**

**Semester : II**

**Hours: 3 hrs/week 75 hrs/semester**

**Sub. Code : U22ABGP**

**Credits : 3**

**TITLE OF THE PAPER: Ancillary Practical For Geography Major**

Pedagogy	Hours	Lab experimentation	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	3	3	-	-	-
<b>PREAMBLE:</b> <ul style="list-style-type: none"><li><input type="checkbox"/> To help the students know about the habitats of plants</li><li><input type="checkbox"/> To understand the positive and negative interaction.</li><li><input type="checkbox"/> To acquire knowledge in Ecosystem</li><li><input type="checkbox"/> To understand the major and minor forest products.</li><li><input type="checkbox"/> To acquire knowledge about the study of vegetation.</li></ul>					
<b>COURSE OUTCOME</b>					

At the end of the Semester, the students will be able to		
<b>UNIT 1 CO1:</b> able to compare the distinguishing features of plants of various habitats.		
<b>UNIT 2 CO2:</b> apply the knowledge of plant interaction and identify them with special features.		
<b>UNIT 3 CO3:</b> develops the knowledge of locating parks and sanctuaries in the country.		
<b>UNIT 4 CO4:</b> identify the types of forests and the products obtained from it.		
<b>UNIT 5 CO5:</b> enable the students to study vegetation using quadrat method.		
<b>SYLLABUS</b> <ol style="list-style-type: none"> <li>1. Positive Interactions-Mutualism -<i>Rhizobium</i>, Commensalism –<i>Vanda</i>.</li> <li>2. Negative Interactions – Parasitism - <i>Cuscuta</i>.</li> <li>3. Insectivorous plants- <i>Nepenthes</i>.</li> <li>4. Ecosystem, food chain, food web, Ecological pyramid.</li> <li>5. Study of vegetation using Quadrat method.</li> <li>6. Photographs showing social and agro forestry.</li> <li>7. Major and Minor Forest Products.</li> <li>8. Map showing National parks and Sanctuaries.</li> </ol>		

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)					Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	4	4	3	3	3	3	3	3.2
CO2	3	3	3	3	4	3	4	4	3	3	3.3
CO3	3	3	4	3	4	3	3	3	3	4	3.3
CO4	3	4	4	3	3	3	4	4	3	3	3.4
CO5	4	3	4	3	3	4	4	3	3	3	3.4
Mean Overall Score											3.32

Result: The Score for this Course is 3.32 (High Relationship)

