POOMPUHAR COLLEGE (AUTONOMOUS) Of the Tamilnadu HR & CE Admn., Dept. (Accredited B⁺ By NAAC) MELAIYUR - 609 107



Plant Biology & Plant Biotechnology

DEPARTMENT OF BOTANY (Plant Biology & Plant Biotechnology) 2022 – 2023

DEPARTMENT OF BOTANY

POOMPUHAR COLLEGE (AUTONOMOUS) MELAIYUR

Modified Syllabus (With Applicable for 2022 – 2023 Onwards) COURSE STRUCTURE

FOR UG COURSE - 2022 – 2023

Plant Biology and Plant Biotechnology

Semester	Subject	Hours	Credit	Exam	Ma	arks	
	5				Intn	Extn	Total
	Tamil I	5	3	3	25	75	100
Semester I II II	English I	5	3	3	25	75	100
	First Allied I	5	3	3	25	75	100
	(Zoology)						
	First Allied PracII	3	-	-	I	-	-
Ι	Core course 1	5	5	3	25	75	100
	Core course- II	3	-	-	I	-	-
	Value education	2	1	3	25	75	100
I II	Gender studies	2	1	3	25	75	100
		30	16				
			-				
	Tamil- II	5	3	3	25	75	100
	English - II	5	3	3	25	75	100
	First Allied-	3	3	3	40	60	100
	Practical II						
	First Allied -III	5	4	3	25	75	100
II	Core course -II	3	3	3	40	60	100
I	Practical -1						
	SBE- I	2	2	3	25	75	100
	Environmental	2	1	3	25	75	100
	studies						
	Core course-3	5	5	3	25	75	100
		30	24				
			T				
\	Tamil – III	5	3	3	25	75	100
-	English –III	5	3	3	25	75	100
-	Core Course - IV	5	5	3	25	75	100
	Core course -V	3	*	*	*	*	*
III	practical – 2						
	Second Allied -I	4	3	3	25	75	100

	Allied Practical – II	2	*	*	*	*	*	
	Chemistry							
					~-		100	
	MBE- I	4	4	3	25	75	100	
	NME- 1	2	2	3	25	75	100	
		30	20	_				
	Tamil- IV	5	3	3	25	75	100	
	English – IV	5	3	3	25	75	100	
	Second Allied –II	3	3	3	40	60	100	
	practical							
	Second Allied - III	5	4	3	25	75	100	
	NME- II	2	2	3	25	75	100	
IV	Core course- V	3	3	3	40	60	100	
	Practical			3 25 75 10 3 25 <td< th=""><th></th></td<>				
	SBE II	2	2	3	25	75	100	
	Core course- VI	5	4	3	25	75	100	
		30	24					
			-	r	1			
	Core Course -VII	4	4	3	25	75	100	
	Core Course - VIII	4	4	3	25	75	100	
	Core Course - IX	4	4	3	25	75	100	
		2					ale.	
V	Core Course - X	4 4 3 25 75 2 2 3 25 75 30 20	*					
V	Core Course VI	2	*	*	*	*	*	
	Dractical	3	-1*	- 1-	-1-			
		Λ	Λ	3	25	75	100	
		7	7	5	23	15	100	
	MBE - III	4	4	3	25	75	100	
Chemistry MBE- I NME- 1 Tamil- IV English – IV Second Allied – II practical Second Allied - III practical Second Allied - III NME- II Core course- V Practical SBE II Core course- VI Core Course - VII Core Course - VIII Core Course - VIII Core Course - X Practical MBE - II MBE - III MBE - III SBE - IV Core Course - X Practical Core Course - XI Practical Core Course - XII Core Course - XIII	'					100		
	SBE - III	2	2	3	25	75	100	
		-	_	-	-			
	SBE - IV	2	2	3	25	75	100	
		30	24				1	
	Core Course - X	3	4	3	40	60	100	
	Practical							
	Core Course - XI	3	4	3	40	60	100	
	Practical							
	Core Course - XII	5	5	3	25	75	100	
	Core Course - XIII	5	5	3	25	75	100	

	Core Course - XIV	4	4	3	25	75	100
	Core Course - XV	4	4	3	25	75	100
VI	MBE-IV	4	4	3	25	75	100
	Soft skills	2	1	3	25	75	100
	Development						
	Ext. work	-	1				100
	Total	180	140				4400

POOMPUHAR COLLEGE (AUTONOMOUS), MELAIYUR COURSE STRUCTURE FOR ALL UG DEGREE COURSES

(Applicable to the candidates admitted from the academic year 2019 – 2020 onwards)

PART	NAME OF THE PAPERS	NUMBER OF PAPERS	CREDITS
Ι	TAMIL	04	12
II	ENGLISH	04	12
	CORE (INCLUDING OPTIONAL)	21	78
III	FIRST ALLIED	03	10
	SECOND ALLIED	03	10
	NON-MAJOR ELECTIVE	02	04
	SKILL BASED ELECTIVE	03	06
IV	VALUE EDUCATION	01	02
	ENVIRONMENTAL STUDIES	01	02
	SOFT SKILLS DEVELOPMENT	01	02
	GENDER STUDIES	01	01
V	EXTENSION ACTIVITIES		01
	TOTAL	44	140

Head of the Department

Principal

OUTCOME BASED EDUCATION

Under Graduate – Science

Programme Outcomes:

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's earning to real life situations.

PO4: Analytical & Scientific Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints. Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.

PO5: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

The specific objectives of B.Sc., Botany Programme are to

PSO – 1 : Imporance of Plants to other life forms

Enrich the knowledge on diversity, life patterns of plants and their importance to other life forms.

<u>PSO – 2 : Career Development</u>

Utilize the theoretic and practical knowledge of Botany in achieving a successful career.

<u>PSO – 3 :</u> <u>Entrepreneurship</u>

Impart the knowledge obtained from the programme to develop their entrepreneurship skills in self supported or funded business /giving consultancy

PSO – 4 : Communication

Communicate appropriately and effectively in botanical science and also interact productively with people from diverse background

PSO – 5 : Research and Higher Studies

Impart the basic laboratory experiments and hands on training perceived will pave way to advanced research and higher studies

DEGREE OF BACHELOR OF SCIENCE IN BOTANY

1. Eligibility for Admission

A candidate who has passed Higher Secondary Examination in Academic or vocational stream with Botany under higher secondary board of examination, Tamil Nadu or an examination accepted as Equivalent there to by the syndicate subject to such conditions as may be prescribed there to are permitted to appear and qualify for the B.Sc degree examination of this university after a course of study of three academic years.

2. Duration of the Course

The course for the degree of Bachelor of Science shall consist of three academic years divided into six semesters.

3. Medium of Instruction: English

4. Pass Mark Particulars

THEORY									
Particular	Maximum marks	Passing minimum (CIA) 40% Marks							
University Semester Examination (ESE)	75	30							
Continuous Internal Assessment (CIA)	25	10							

Classification of Internal Assessment Structure

Particulars	Marks
Average of Best two from III Internal	15
Examinations	
Average of 2 Assignments & 1 Seminar	5
Marks	
Attendance	5
Total	25

PRACTICAL

Particular	Maximum marks	Passing minimum (CIA) 40% Marks
University Semester Examination (ESE)	75	30
Continuous Internal Assessment (CIA)	25	10

First Year		CORE COURSE –1 Semester I			r I							
									S		Mark	S
Course Code	Т	itle of the Course	Category	L	Т	Р	0	Credits	Inst. Houn	CIA	External	Total
22AU:13M1	ALGAE,	FUNGI & LICHENS		5	-		-	5	5	25	75	100

	Learning Objectives
1	To learn about the structural organization, reproduction and significance of algae
	fungi and lichen.
2	To demonstrate knowledge in understanding the various life cycle patterns and the
	fundamental concepts in algal, fungal and Lichen growth
3	To gain knowledge of benefits of various algal technologies on the ecosystem
4	To compare and contrast the thallus organization and modes of reproduction in
	algae fungi and lichen.
5.	To acquire knowledge on determine the emerging areas of Algal Biotechnology for
	identifying commercial potentials of algal products and their uses.

UNIT-I: ALGAE

- Fritsch classification of algae, General characters of algae
- Life cycle patterns in algae Economics importance of algae.
- Thallus organization (unicellular-*Chlorella*, Diatoms, colonial-*Volvox*)

UNIT-II: Morphology, structure, reproduction and life cycle of the following Algae

 Characteristic features, thallus organization, mode of nutrition, structure, reproduction and life-history of classes, each with one suitable example: Zygomycotina (Pilobolus, Mucor, Rhizopus), Ascomycotina (Aspergillus, Saccharomyces Peziza), Basidiomycotina (Agaricus, Pleurotus, Puccinia)

UNIT-III: FUNGI

Characteristic features, thallus organization, mode of nutrition, structure, eproduction and life-history of classes, each with one suitable example: Zygomycotina (Pilobolus, Mucor, Rhizopus),

UNIT-IV: FUNGI

Structure and Reproduction of the following: Ascomycotina (Aspergillus, Saccharomyces Peziza), Basidiomycotina (Agaricus, Pleurotus, Puccinia)

UNIT-V: LICHENS

General features of lichens, Types of lichens, Structure and reproduction of Usnea

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Relate to the structural organization, reproduction and significance of algae fungi and lichen.	К3
CO 2	Demonstrate knowledge in understanding the various life cycle patterns and the fundamental concepts in algal, fungal and Lichen growth	K4
CO 3	Explain the benefits of various algal technologies on the ecosystem	K4
CO 4	Compare and contrast the thallus organization and modes of reproduction in algae fungi and lichen.	К3
CO 5	Determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.	K4

REFERENCE:

Fritsch F.E., (1935), The structure & Reproduction of Algae, Cambridge University Press, Cambridge, U.K. Vol. I and II

Smith.G.M. (1955): Cryptogamic Botany Vol. I (Algae, Fungi & Lichens) McGraw-Hill Book Co., New York

Pandey, B.B., (1993), A Text Book of Botany – Algae, S. Chand & Co. (P) Ltd, New Delhi.

Vashista, B.R. (1993): Botany for Degree students – Algae, S. Chand & Co., New Delhi. Kumar, H.D., (1999), Introductiory Phycology, Affiliated East West Press (P) Ltd., New Delhi.

Landecker, (1972), Fundamentals of the Fungi, Prentice Hall, Inc., New Jersey, U.S.A Vashista, B.R. (1982): Botany for Degree students – Fungi, S. Chand & Co., New Delhi.

Hudson, H.J., (1986), Fungal Biology, ELBS/Edward Arnold-London-Bold, H.C., Bold, H.C., Alexopoulos, C.J., Delavoryas, T., (1996), Morphology of plants & Fungi Harper & Row, Publishers, New York.

Smith.G.M. (1955): Cryptogamic Botany Vol. I (Algae, Fungi & Lichens) McGraw-Hill Book Co., New York.

Misra, A, and Agarwal, R.P., (1970). Lichens, A Preliminary text, Oxford & IBH Publishing Co.

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

First YearCORE COURSE - 3Se					Sen	neste	er - I	[
	Title of the Course							S	v Marks		
Course Code			L	Т	Р	0	Credits	Inst. Hour	CIA	External	Total
22AU:13M3	BACTERIA, VIRUSES AND PLANT PATHOLOGY		5	-		-	5	5	25	75	100

	Learning Objectives
1	Recognize the general characteristics of microbes and disease symptoms.
2	Develop an understanding of microbes and appreciate their adaptive strategies
	based on structural organization
3	Identify the common plant diseases, according to geographical locations and device
	control measures
4	Enable to learn various cell structures and functions of prokaryotes and eukaryotes
	and understand the salient features and functions of cellular organelles.
5.	Determine the economic importance of bacteria and virus

Course Units

UNIT – I BACTERIA

General characters of Bacteria - Morphological of Bacteria - Different types and flagellation in Bacteria - Ultra-structure of *Escherichea Coli* cell - structure and reproduction of bacteria, Mycoplasma,

UNIT-II

Endospore in Bacteria: structure, formation and significance - Staining methods of Bacteria (Simple & differential) - *Rhizobium* root nodule formation and nitrogen fixation by Bacteria - Harmful and beneficial roles of Bacteria

UNIT-III VIRUSES

General characters and reproduction of Viruses - Structure of Tobacco Mosic - Virus (TMV) and T4 bacteriophage - Lytic and lysogenic cycle Virology -Viruses general characters, structure and reproduction.

UNIT-III PLANT PATHOLOGY

Types of plant diseases and their causal organism and control measures Blast disease of Paddy - Red rot of Sugarcane Viral diseases – Tobacco Mosaic and Vein clearing of Papaya

UNIT-V

Causative organism, symptoms and control measures of following fungal diseases:

- Tikka disease of Ground nut, Bacterial diseases – Citrus canker and Bacterial wilt of Banana

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Recognize the general characteristics of microbes and disease symptoms.	K4
CO 2	Develop an understanding of microbes and appreciate their adaptive strategies based on structural organization	K3
CO 3	Identify the common plant diseases, according to geographical locations and device control measures	K4
CO 4	Enable to learn various diseases and control measures.	K3
CO 5	Determine the economic importance of bacteria and virus	K4

REFERENCE:

BACTERIA AND VIRUSES

- 1. Sistrom, W.R., (1962), Microbial life. Holt, Rinchart Winson
- 2. Biswas, S.B., and Biswas, A., (1976), An introduction to virus, Vikas publishing House Pvt. Ltd.
- 3. **Pelzer, J, Chan,E.S., and Kriez,R.**, (1998), Microbology, Tata McGraw and Hill New Delhi.
- 4. **Dube., H.C.,** (1978), Atext of fungi, bacteria and viruses, Vikas Publishing house (P) Ltd.,

PLANT PATHOLOGY

- 1. **Rangaswami, G. & Bhagyaraj, D. J.**, (1993), Agricultural Microbiology Prentice Hall of India (P) Ltd., New Delhi.
- 2. **Bilgrami, K.S. and H.C. Dube,** (1990). AText Book of Plant Pathology, Vikas Publishing house (P) Ltd., New Delhi.

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

CORE COURSE – 2 PRACTICAL - 1

Semester - II

		y							Marks			
Course Code	Title of the Course	Categor	T T Categor		Р	0	Credits	Inst. Hours	CIA	Extern al	Total	
22AU:13M2P	ALGAE, FUNGI, LICHENS, BACTERIA, VIRUSES AND PLANT PATHOLOGY		5	-		-	3	3	40	60	100	

	Learning Objectives
1.	To develop skills to identify algae based on habitat, thallus structure and the internal organization.
2.	To understand importance of algae, to animals and humans.
3.	To identify microalgae in a mixture.
4.	Enable to learn various cell structures and functions of prokaryotes and eukaryotes
	and understand the salient features and functions of cellular organelles.
5.	Determine the economic importance of bacteria and virus
~	

Course Objectives

- **1.** To develop skills to identify algae based on habitat, thallus structure and the internal organization.
- 2. To identify microalgae in a mixture.
- 3. To develop skills to prepare the micro slides of algae,
- 4. To study the economic importance of few species.
- 5. To understand importance of algae, to animals and humans.

EXPERIMENTS TO BE CARRIED OUT

- 1. Micro-preparation of the types prescribed in the syllabus.
- 2. Identifying the micro slides relevant to the syllabus.
- 3. Identifying types of algal mixture.
- 4. Economic importance of Algae
- 5. Field visit to study fresh water/marine water algal habitats.
- 6. Visit to nearby industry actively engaged in algal technology

Botanical excursion for collection of algae Bonafide record of practical work done should be submitted for the practical examination

CO No.	CO Statement	Knowledge level
CO 1	Identify microbes, fungi and lichens using key identifying characters	K4
CO 2	Develop practical skills for culturing and cultivation of fungi.	К3

Course Outcomes: Students will be able to:

CO 3	Identify and select suitable control measures for the common plant diseases	K4
CO 4	Analyze the characteristics of microbes, fungi and plant pathogens	К3
CO 5	Analyze the characteristics of microbes, fungi and plant pathogens.	K4

Manual Experiments

Handling of laboratory equipment's Identification of Alga from Algal mixture using microscope Internal structure of *Sargassum* leaf and stipe Microscopic preparation of *Albugo* infected leaf, *Peziza* and *Puccinia* spores Gram's staining of Bacteria Hanging drop preparation of Bacteria Preparation of sterile media Bunchy Top of Banana

Soptters

Microscopic slides and specimens related to the genera in the core course 1 and 3

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	2
CO2	2	3	2	2	3
CO3	2	2	3	2	3
CO4	2	3	3	2	2
CO5	2	2	3	2	3

Second Year	CORE COURSE – 4						Sei	nest	er -]	II	
		0r	M S M		Marks						
Course Code	Title of the Course	Catego	L	Т	Р	0	Credi	Inst. Hour	CIA	Exte rnal	Total
	BRYOPHYTES, PTERIDOPHYTES,		5	-		-	5	5	25	75	100
22AU:13M4	GYMNOSPERMS AND										
	PALAEOBOTANY										

Learning Objectives To understand the general characteristics of bryophytes, pteridophytes,

-	
	gymnosperms and palaeobotany.
2	Identify the common plants, according to geographical locations.
3	Develop knowledge about thallus structure and cell variation.
4	Enable to learn various salient features and functions of pteridophytes.
5.	Develop critical understanding on fossil evidence.

UNIT –I:

1

Classification of Bryophytes (Smith) Range of thallus structure in Bryophytes, Reproduction in Bryophytes, Ecology of Bryophytes

UNIT – II:

Detailed study of the following *Marchantia*, *Porella*, *Anthoceros* and *Funaria* **UNIT - III:**

Classification of Pteridophytes (Reimer) ,Structure, reproduction and life cycle of *Psilotum, Lycopodium, Selaginella, Equisetum, Adiantum* and *Marsilea*, Stelar types and their evolution in Pteridophytes , Heterospory and Orign of seed habit

UNIT – IV: Classification (Smith), Structure and Reproduction of *Cycas, Pinus* and *Gnetum,* Economic importance of Gymnosperms

UNIT - V:

Geological time scale, Fossils and methods of fossilization, detailed account on *Rhynia*, *Lepidodendron* and *Lepidocarpon*

CO No.	CO Statement	Knowledge level
CO 1	Recognize the general characteristics of bryophytes, pteridophytes, gymnosperms and palaeobotany.	К3
CO 2	Develop an understanding of thallophytes and appreciate their adaptive strategies based on structural organization	К3
CO 3	Identify the common plants, according to geographical locations.	K4
CO 4	Analyze the emerging trends in fungal biotechnology with special reference to agricultural and pharmaceutical applications.	K4
CO 5		К3

Course Outcomes: Students will be able to:

REFERENCE:

Cavers, Frank (1963): The inter-relationship. Bryophytes New Phytologist, Indian Reprint.

Smith.G.M. (1955): Cryptogamic Botany Vol.II (2nd Edition) (Bryophtes, Pteridophytes) Tata McGraw hill Publishing Co., New Delhi.

Vashista, B.R. (1983): Botany for Degree students a – Abryophytes S. Chand & Co., New Delhi – 392pp,

Chopra, R. N. & Kumara, P.K. (1988): Biology of bryophytes – Wiley Eastern Ltd., New Delhi.

Rashid, A (1998): An Introduction to Bryophytes – Vikas Publishing House (P) Ltd., New Delhi 298pp,

Eames, A.J. (1963): Morphology of Vascular plants (Lower Groups) Tata McGraw Hill, Bierhorst, D.WE. (1971): Morphology of Vascular plants Tata McGraw Hill,

Sundara Rajan, S. (1994): Introduction to Pteridophyta – New Age International Publishers Ltd., Wiley eastern Ltd., 318pp., Seward, A.C (1959) Plant Life Through the Ages Hafner Publishing Co., N.Y. 442 & 446pp.,

Misra, S. P., (1975): Essentials of Palaeobotany - Vikas Publishing House (P) Ltd., New Delhi 383pp,

Venkatachala, B.S., Shukla, M. & Sharma, M (1992): Plant Fossils – a Link with the past (A Birbal Sahni Birth Centenary Tribute) –Birbal Sahni Institute of poalaeobotany, Lucknow, India.

Sporne, K. R. 1962. Morphology of Gymnosperms Hutchinston University Library **Dutta, S. C. 1979**. An Introduction to Gymnosperms Bishen Singh & Mehidra Pal Singh Publishers, Dehradun.

Identify the common plant diseases, according to geographical locations and device control measures

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Second Year	CORE COURSE	CORE COURSE – 6				Semester - IV					
		1						LS		Mark	KS
Course Code	Title of the Course	Category	L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
22AU:13M6	ANATOMY AND EMBRYOLOGY		5	-		-	4	5	25	75	100

Learning Objectives

1	Learn the importance of plant anatomy in plant production systems.
2	Develop an understanding of appreciate their adaptive strategies based on structural
	organization
3	Identify the Anamalous Secondary thickenings
4	Enable to learn various salient features micro and mega sporangium
•	Endere to reality various suitent reactives intero and mega sportangiani.
5.	Develop critical understanding on embryo and endosperm

UNIT –I

Plant tissues – Classification, Simple and Complex tissues – Meristems – Classification, Distribution and theories (Apical cell theory, Histogen theory and Tunica Carpus theory) – Epidermal, Ground and Vascular tissue systems.

UNIT – II

Secretory tissues: (glands, Glandular hairs, nectaries and hyadothodes) Structure of stomatal complex and stomatal types, Primary structure of Dicot and Monocot stem, root and leaf

UNIT – III

Secondary thickening: Dicot stem and Root, Annual rings, Heart wood and Sap wood, Periderm formation. Anamalous Secondary thickenings in *Boerhaavia*, *Bignonia*, *Nyctanthes* and *Dracena*

$\mathbf{UNIT} - \mathbf{IV}$

Microsporangium: Structure, microsporogenesis and development of male gametophytes. **Megasporangium:** Structure, Types of Ovules and megasporogenesis – Detailed study of monosporic (*polygonum* type) Bisporic (*Allium* type) and Tetrasporic (*Peperomia*) Embryo sac – Triple fusion - Double Fertilization and its significance.

UNIT –V

Endosperm: Nuclear, Cellular& Helobial endosperms, Ruminate endosperms and Haustoria **Embryo:** Development of Dicot embryo (*Capsella bursapastoria*) – Monocot embryo (*Luzula forsteri*) Polyembryony, Apomixis and Apospory.

CO No.	CO Statement	Knowledge level
CO 1	Recognize the general characteristics of bryophytes, pteridophytes, gymnosperms and palaeobotany.	K4
CO 2	Develop an understanding of appreciate their adaptive strategies	К3
CO 3	Identify the Anamalous Secondary thickenings	K3
CO 4	Enable to learn various salient features micro and mega sporangium.	K4
CO 5	Relate the behavior of embryo. Analyse the different types of endosperm	К3

Course Outcomes: Students will be able to:

REFERENCE:

Ganguly & Dutta, College Botany Vol – II

Pandey B.P.1972, Plant anatomy, S Chand & Co. New Delhi

John Jothi Prakash, E. Plant anatomy, Emkay Publications New Delhi

Pandey B.P. Embryology of Angiosperms

Dwividi, J.N. 1986, Embryology of Angiosperms, Rastogi & Co., Meerut **Maheshwari P. 1974,** An Introduction to Embryology of angiosperms Mc Graw Hill Co., New York.

Sporne, K.R. 1962. Morphology of Gymnospers Hutchinson University Library **Dutta, S.C. 1979.** An Introduction to Gymnosperms Bishen Singh & Mehidra Pal Singh Publishers, Dehradun.

Esau. K. 1974. Anatomy of seed plants John Wiley & sons New Delhi **Fhan, A. 1988.** Plant Anatomy, Pergamon press, Oxford U.K.

Bhojwani S.S. & BhatanagalS.P. 2000. The embryology of Angiosperms (4th Revised Ed.,) – Vikas Pub., House, New Delhi.

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	3	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Second Year

CORE COURSE – 5 PRACTICAL – 2

Semester - IV

		y.					70			Marl	KS
Course Code	Title of the Course	Categor	L	Т	Р	0	Credits	Inst. Hours	CIA	Extern al	Total
	BRYOPHYTES,		5	-		-	5	5	25	75	100
	PTERIDOPHYTES,										
	GYMNOSPERMS										
22AU:13M5P	PALAEOBOTANY										
	ANATOMY AND										
	EMBRYOLOGY										

	Learning Objectives
1.	To develop skills to identify plant tissue
2.	To understand importance of simple and complex tissue.
3.	To identify Anomalous secondary thickenings.
4.	Enable to learn various cell structures and functions
5.	Determine the whole mounts and Isolation and Mounting of Embryo

Manual Experiments (Specimen / Sectioning)

Internal structure of Funaria stem, Internal structure of Adiantum stem,

Internal structure of Lycopodium stem, Internal structure of Selaginella stem

Internal structure of Cycas coralloid root, Internal structure of Cycas leaf

Internal structure of Monocot & Dicot stem, Internal structure of Anomalous secondary

thickenings in Boerhaavia, Nyctanthus and Dracena

Structure of pollen grains using whole mounts Hibiscus

Isolation and Mounting of Embryo (Dicot / Monocot)

Spotters:

Microscopic slides and specimens related to the genera in the core course 4 & 6 Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Identify skills to identify plant tissue	K4
CO 2	Develop practical skills for simple and complex tissue.	K3
CO 3	Identify and select Anomalous secondary thickenings	K4
CO 4	Analyze the various cell structures and functions	K3
CO 5	Analyze the whole mounts and Isolation and Mounting	K4

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	3
CO2	2	3	2	2	3
CO3	2	2	3	2	3
CO4	2	3	3	2	2
CO5	3	2	3	2	3

Second Year	SBE– I Ser				mest	ter-	II				
		7						rs		Mark	S
Course Code	Title of the Course	Category	L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
22AU:13SBE -1	HORTICULTURE AND GARDEN DESIGNING		5	-		-	5	5	25	75	100

	Learning Objectives
1	Learn the importance of Horticulture
2	Develop an understanding of propagation technique
3	Develop practical skills of Layering, Grafting, Budding technique
4	Enable to learn various types of garden making.
5.	Develop critical understanding on Common diseases in Garden Plants and its
	control

UNIT -I

Horticulture: Importance and scope of Horticulture, Classification of Horticultural crops – fruits, vegetable crops, climate, soil, water, and nutrition needs of Horticultural crops.

UNIT – II

Plant propagation methods: Cutting, Layering, Grafting, Budding, Stock-Scion relationship, use of plant regulators in Horticulture.

UNIT – III

Garden designs: Types of gardens- formal, informal and kitchen garden, units of garden, hedge, border and Topiary Arches and Lawn maintenance.

UNIT - IV

Floriculture, cultivation of commercial flowers – Rose and Jasmines. Cultivation of important fruit tress – Mangoes and Banana.

UNIT – V

Green house, Indoor gardening – Bonsai – Flower arrangements – Nursery management and maintenance. Common diseases in Garden Plants and its control measures.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Recognize the importance of Horticulture	K3
CO 2	Develop an understanding of propagation technique	K3
CO 3	learn various types of garden making	K4
CO 4	Develop critical understanding on Common diseases in Garden Plants and its control	K4
CO 5	Develop practical skills of Grafting, Budding technique	К3

References:

Bose, T.K. & Mukherjee, D. (1972). Gardening in India Oxford & IBH Publishing Co., Kolkatta, New Delhi – 385pp,

Sandhu, M.K. (1989). Plant propagation – Wiley Eastern Ltd., New Delhi, Bangalore, Pune-287pp,

Kumar, N. (1997). Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, India.

Manigush S.K. (1999). Horticulture. Wiley Eastern Ltd., New Delhi, Bangalore, 321pp,

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	3	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Second Year	SBE-II				Semester - IV						
		7						SJ		Mark	(S
Course Code	Title of the Course		L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
22AU:13SBE -2	BIOFERTILIZER and MUSHROOMCULTIVATION		5	-		-	2	2	25	75	100

	Learning Objectives
1	Learn the importance of Biofertilizer.
2	Develop an understanding of Symbiotic association – Mass cultivation
3	Enrich knowledge about culture technique
4	Enable to learn various salient features edible mushrooms
5.	Develop critical understanding on mushroom cultivation

UNIT –I

Biofertilizer – Definition, Kinds of microbes as biofertilizers, Rhizobium-legume Symbiotic association – Mass cultivation and carrier materials.

UNIT –II

Cultural methods of *Azospirillum*, *Azatobacter*, *Azolla* and *Anabaena*, carrier materials.

UNIT –III

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

UNIT – IV

Edible and Poisonous mushrooms, nutritive value of mushrooms, structure of edible mushrooms, *Pleurotus* and *Agaricus* (Fruiting body)

UNIT – V

Mushroom cultivation: Spawn, mother spawn production, spawn multiplication, Requirements of mushroom cultivation (Polythene bags, paddy straw substrates, spawn running room, cropping room) – Preparation of paddy straw ,cylindrical beds, spawn running, cropping and harvesting, Diseases and control measures.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Recall various types and categories of mushroom	K3
CO 2	Explain about various types mushroom industry.	K3
CO 3	Apply techniques studied for cultivation of various types of mushroom.	K4
CO 4	Understanding of Symbiotic association – Mass cultivation applications.	K4
CO 5	Analyze and decipher the environmental factors and economic value associated with mushroom cultivation	К3

References:

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

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

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2
CO2	2	3	2	3	3
CO3	3	2	3	2	2
CO4	2	2	2	3	2
CO5	2	3	3	2	3

OUTCOME MAPPING

Third Year	hird Year CORE COURSE – 7				- 7 Semester - V							
		7	L					S		Mark	S	
Course Code	Title of the Course	Category		Т	Р	0	Credits	Inst. Hour	CIA	External	Total	
22AU:13M7	PLANT TAXONOMY AND ECONOMIC BOTANY		4	-		-	4	4	25	75	100	

	Learning Objectives
1	Learn the importance of plant morphology systems.
2	Develop an understanding of Binomial Nomenclature
3	Identify the common plant families and their Economic importance
4	Enable to learn Herbarium Preparation and role of herbarium in plant taxonomy
5.	Develop critical understanding on Medicinal Plants

UNIT – I

Morphology of Roots, Stems and Leaves & their modification, phyllotaxy, venation. **Inflorescence:** Racemose, Cymose, Mixed and Special types. Descriptive terminology of flower and floral parts. **Fruits:** Simple, Fleshy, Dry dehiscent and Dry indehiscent, Aggregate and Multiple fruits.

UNIT –II

Binomial Nomenclature, Citation of Authors. Systems of classification - Bentham & Hooker and Engler & Prantl. Merits and Demerits of these systems. Herbarium Preparation and role of herbarium in plant taxonomy

UNIT – III

A detailed study of the families and their Economic importance of *Annonaceae*, *Capparidaceae*, *Tiliaceae*, *Rutaceae*, and *Cucurbitaceae*.

UNIT –IV

A detailed study of the families and their Economic importance of *Asteraceae*, *Apocyanaceae*, *Convolvulaceae*, *Acanthaceae*, *Euphorbiaceae* and *Poaceae*.

$\mathbf{UNIT} - \mathbf{V}$

Economic Botany: - A brief study of the following:

Cereales (*Oryza, Eleusine*), Pulses (*Phaseolus*), Edible oil (*Seasamum*), Sugar (*Saccharum*), Fibers (Jute), Medicinal Plants (*Ocimum, Phyllanthus* and *Solanum*), Forest Products–Timber (Teak) Tannins, Gums, Resins and Turpentine.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Recognize the importance of plant morphology systems.	K3
CO 2	Develop an understanding of Binomial Nomenclature	K3
CO 3	common plant families and their Economic importance	K4
CO 4	Herbarium Preparation and role of herbarium in plant taxonomy	K4
CO 5	Develop critical understanding on Medicinal Plants	K3

References

Lawrence, G.H.M. (1953). Taxonomy of vascular plants. Oxford &IBH Publishers, New Delhi, Calcutta. 823pp.

Mitra, J.N. (1964). An Introduction to plant Taxonomy J.A. Churchill, London-142pp.Naik,V.K. (1996)

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Third Year	SBE-III				Semester - V						
		7						ß		Mark	S
Course Code	Title of the Course		L	Т	Р	0	Credits	Inst. Hour	CIA	External	Total
22AU:13SBE 3	BIOINSTRUMENTATION AND BIOTECHIQUES		4	-		I	2	2	25	75	100

	Learning Objectives
1	Learn the importance of Principle and applications of Microscopy
2	Develop a skill of Preparation of laboratory solutions and reagents
3	Common idea about Sterilization procedures
4	Enable to learn various Principle and applications of Chromatography
5.	Develop critical understanding on Blotting techniques

UNIT I

Microscopy – Principle and applications – Light, Bright field, Fluorescent, and Electron (TEM & SEM). Brief account on Histochemistry and Staining procedures, preparation of whole mounts.

UNIT II

Preparation of laboratory solutions and reagents – Buffers, Molar, Molal, Normal and percentage solutions, ppm. Units used in calculations – ratios and dilutions. Photometric calculation and titrimetric analysis.

UNIT III

Principle and application of pH meter, Colorimetry and Spectrophotometry (Visible and UV). Sterilization procedures – physical and chemical methods-Working principle and use of Autoclave and Hot Air Ovens.

UNIT IV

Principle and applications of Chromatography (Paper, TLC and Column) Centrifugation – Differential and Ultra.

UNIT V

Principle and applications of Gel Electrophoresis (AGE and SDS- PAGE) Blotting techniques – Southern and Northern. PCR and use of Primers. Biosensors and biological markers – definition and applications.

CO No.	CO Statement	Knowledge level
CO 1	Principle and applications of Microscopy	K3
CO 2	Develop a skill of Preparation of laboratory solutions and reagents	К3
CO 3	Idea about Sterilization procedures	K4
CO 4	Enable to learn various Principle and applications of Chromatography	K4
CO 5	Develop critical understanding on Blotting techniques	K3

Course Outcomes: Students will be able to:

REFERENCE BOOKS

1. Keith Wilson and John Walker. 1996. Biochemical methods. Cambridg University. Press, London.

2. Plummerm,D.T. 2000. Practical Biochemisty. Tata McGraw Hill Publishing Co., Ltd.,

3. Donald Alexander Johansen. 1967. Plant Microtechnique.II Ed. Tata McGraw Hill Publishing Co., Ltd., New Delhi.

4. Krishnamoorthy,K.V. 1988. Histochemistry, S. Viswanathan (Printers and Publishers) Private Ltd.

	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	2
CO2	3	3	2	2	3
CO3	2	2	3	3	2
CO4	2	3	2	2	2
CO5	3	2	3	2	3

Thi	rd Year	CORE COURS	RSE – 8 S					Sem	Semester - V			
Course Code									S	Marks		S
		Title of the Course	Category	L	T	Р	0	Credits	Inst. Hou	CIA	External	Total
		CELL BIOLOGY AND		5	-		-	4	4	25	75	100
22AU:13M8		GENETICS										
		Learning Obje	ective	5								
1	Learn the importance of Structure of Prokaryotic and Eukaryotic cells											
2	Develop an understanding of Nucleus and cell division											
3	To under	stand about Mendelian concepts										

4 Enable to learn Mapping of genes on the chromosomes

5. Develop critical understanding on Sex determination

Unit I

Structure of Prokaryotic and Eukaryotic cells – Ultra structure of cell organelles – Plastids, Mitochondria, Golgi bodies, ER Microbodies – peroxisomes and glyoxisomes – Lysosome – Ultra structure and functions of plasma membrane.

Unit II

Nucleus – Nucleolus – Structure of Euchromatin and Heterochromatin; Special types of chromosomes – Lamp brush chromosome and polytene chromosome; Mitosis and Meiosis.

Unit III

Genetics – Monohybrid and Dihybrid Cross (Mendel's Laws). Deviation from Mendelian ratio: Incomplete dominance (Mono and Dihybrid), Lethal factor, Complementary factor and Epistasis (dominant), Multiple factor Hypothesis, Multiple alleles – Blood groups.

Unit IV

Linkage, Crossing over, Recombination, Cytological proof of Crossing over, Mapping of genes on the chromosomes, Sex Linkage – *Drosophila* (eye colour) and Humans (colour blindness), cytoplasmic inheritance.

Unit V

Sex determination in *Drosophila*, Humans and Plants – Changes in Chromosome Structure, number and behavior, their genetic effects, ploidy, types and significances.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Recognize the general characteristics and importance of	V2
	Structure of Prokaryotic and Eukaryotic cells	KJ
CO 2	Develop an understanding of Nucleus and cell division	V2
	organization	КJ
CO 3	Develop ba skill about Mendelian concepts	K4
CO 4	Analyze the emerging trends in Enable to learn Mapping	V A
	of genes on the chromosomes	N 4
CO 5	Develop critical understanding on Sex determination	K3

REFERENCE:

- 1. Sharma N.S. 2005, Molecular Cell Biology, International Book distributors, Dehradun.
- 2. Verma P.S and Agarwal V.K. 1986, Cell Biology and Molecular Biology (Cytology) S.Chand and Company, New Delhi.
- 3. Old, R.W. and Primrose S.B. 1994, Principles of Gene Manipulation, Blackwell Science, London.
- 4. Grierson, D. and Convey S.N. 1989, Plant Molecular Biology, Blackie Publishers, New York.
- 5. Lea, P.J. and Leegood R.C. 1999, Plant Biochemistry and Molecular Biology, John Wiley and sons, London.
- 6. Power C.B. 1984, Cell Biology, Himalaya Publishing Co. Mumbai.
- 7. **De Robertis and De Robertis, 1998,** Cell and Molecular Biology, K.M.Verghese and Company.

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2
CO2	2	3	2	3	3
CO3	3	2	3	2	2
CO4	2	2	2	3	2
CO5	2	3	3	2	3

Third Year	CORE COURSE – 9 Semester - Y				V						
Course Code		1						rs		Mark	KS
	Title of the Course		L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
22AU:13M9	MOLECULAR BIOLOGY		5	-		-	4	4	25	75	100

	Learning Objectives
1	Learn the types of DNA, Organization of DNA
2	To understand Bacterial genome: Transcription
3	Genetic code and its characterization
4	Enable to learn Basic principles of transcriptional regulation
5.	Develop critical understanding on Basic principles of transcriptional regulation

Unit I

Genetic material – Properties and replication of genetic material – Structure – Hershey & Chase experiment. Types of DNA, Organization of DNA sequences – Satellite DNA, repetitive DNA sequences.

Unit II

Bacterial genome: Transcription and its control in Prokaryotes, Initiation, Elongation and Termination. DNA supercoiling (positive and negative), gene regulation in Prokaryotes & Eukaryotes

Unit III

Translation – organization of mRNA, Genetic code and its characterization, Ribosomes – rRNA, aminoacyl synthetase, tRNA and amino acid activation, Mechanism of Initiation, Elongation and Termination

Unit IV

Gene Regulation – Basic principles of transcriptional regulation – Positive and Negative; Inducible and Repressible; Activators and Repressors. The lac operon model concept – RNA interference.

Unit V

Chloroplast and Mitochondrial genome – Semi autonomous organelles, Receptors, Signal transduction pathway, Phosphorylation and PCD- Programmed Cell Death

CO No.	CO Statement	Knowledge level
CO 1	Recognize the types of DNA, Organization of DNA	K3
CO 2	Skill about Genetic code and its characterization	K3
CO 3	Identify the common plant diseases, according to geographical locations and device control measures	K4
CO 4	Basic principles of transcriptional regulation applications.	K4
CO 5	To understanding on Basic principles of transcriptional regulation	К3

Course Outcomes: Students will be able to:

REFERENCES

Agarwal, V.K (2000) : Simplified course in Genetics B.Sc., Zoology), S.Chand & Co., New Delhi – 168 pp.

De Robertis, (2010): Cell and Molecular Biology, Gerald Carp, Iwasa (2019). Cell and Molecular Biology.

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	3	2	2	2	2
CO5	2	2	3	3	3

Third Year

CORE COURSE –10

Semester - VI

PRACTICAL - 3

	Title of the Course					0	Credits	rs	Marks		
Course Code			L	Т	Р			Inst. Hou	CIA	External	Total
	PLANT TAXONOMY AND		5	-		-	4	3	25	75	100
	ECONOMIC BOTANY										
22AU:13M10P	CELL BIOLOGY &										
	GENETICS AND										
	MOLECULAR BIOLOGY										

	Learning Objectives
1	Learn the importance of plant taxonomy plant production systems.
2	To understand the medicinal value
3	To develop skills to identify plant species
4	To study the economic importance of few species.
5.	Evaluate the various techniques for preserve plants

Identification of Family, Genus, Species of following and their floral diagram and formula

Annonaceae, Rutaceae, Cucurbitaceae, Apocynaceae, Asclepiadaceae, Convolvulaceae, Euphorbiaceae, Anacardiaceae, Amaranthaceae and Poaceae Mitotic cell division (Onion root tip), Monohybrid and Dihybrid cross (Problems) Incomplete dominance (Problem)

Spotters

Microscopic slides and specimens related to the genera

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Recognize the general characteristics of plants	K3
CO 2	Develop an understanding of medicinal value	K3
CO 3	Develop skills to identify plant species	K4
CO 4	Analyze the study the economic importance of few pecies.	K4
CO 5	Evaluate the various techniques for preserve plants	K3

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Third Yea	r CORE COURSE PRACTICAL	CORE COURSE – 11 PRACTICAL - 4				Semester- VI					
		1						LS		Mark	S
Course Code	Title of the Course	Category	L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
	PLANT PHYSIOLOGY,		5	-		-	4	3	25	75	100
22AU:13M11P	PLANT ECOLOGY AND										
	PHYTOGEOGRAPHY										

	Learning Objectives
1	To acquire detailed knowledge of selected water plants
2	To comprehend the quadrat method and transect method.
3	To acquire a basic knowledge of Potato osmoscope
4	Enable to learn various salient features and functions Plasmolysis of Tradescantia
5	To get knowledge about the different modes of Photosynthesis under different light

Plasmolysis of *Tradescantia* leaf peel, Potato osmoscope, Ganong's photometer *Hydrilla* experiment, Photosynthesis under different light, Quadrat method and Transect method.

Spotters: Microscopic slides and specimens related to the genera

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Identify and label the features of different light intensity	K3
CO 2	Illustrate and examine the osmosis.	К3
CO 3	Differentiate and compare the Quadrat method and Transect method.	K4
CO 4	To compare and distinguish the Plasmolysis of <i>Tradescantia</i>	K4
CO 5	To get knowledge about the different modes of Photosynthesis under different light	К3

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2
CO2	2	3	2	3	3
CO3	3	2	3	2	2
CO4	2	2	2	3	2
CO5	2	3	3	2	3

Third Year	CORE COURSE -	- 12				Se	emes	ter-	VI			
		1		Т				rs	Marks			
Course Code	Title of the Course	Category	L		Р	0	Credits	Inst. Hour	CIA	External	Total	
00 A XX 4 00 44 0	Plant physiology, Biochemistry		5	-		-	5	5	25	75	100	
22AU:13M12	and Biophysics									Marks External External Total 75		

	Learning Objectives
1	Learn the importance of Transpiration
2	Develop an understanding of Photosystems
3	The common uses and role of hormones
4	Enable to learn various Properties and classification of enzymes
5.	Develop critical understanding on Biological effect of Ionizing radiations

Unit – I

Water relation: significance – osmotic and non-osmotic uptake of water. Ascent of sap-cohesion theory: Root pressure, Transpiration, physiology of stomatal. Movement, Translocation of Solutes and Assimilates.

Mass flow – Membrane permeability Mineral uptake: Passive and Active. Role of major and minor elements, mineral deficiency symptoms.

Unit – II

Photosynthesis: Absorption Spectrum, Action Spectrum, Role of Photosynthetic pigments, Enhancement effect, Photosystems I & II, Photosynthetic Electron Transport, Photophosphorylation, carbon Assimilation: C3 & C4 cycle pathway. Respiration: Respiratory substrates – Aerobic and anaerobic – Glycolysis – Kreb's cycle, oxidative phosphorylation and Alcohol Fermentation.

Unit – III

Plant Growth Hormones: Auxins, Kinitins, Gibberellins, Abscissic acid and their function. Role of hormones in Flowering, Senescence and Abscission – Photoperiodism, phytochrome – Vernalization and Seed dormancy.

Unit – IV

Biochemistry – Enzymes: Nature, Properties and classification. Mechanism of Enzyme action – Factors affecting Enzyme action, Substrate concentration – inhibitors, cofactors. Structure and functions of carbohydrates, lipids and proteins. A brief account of Alkaloids, Flavonoids, Terpenoids and Anthocymins.

Unit – V

Biophysics – Physical forces and Chemical bonds, Basic properties of light diffraction – Biological effect of Ionizing radiations – Laws of Thermodynamics and entropy – Gibb's free energy.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Learn the importance of Transpiration	K3
CO 2	Develop an understanding of Photosystems	K3
CO 3	The common uses and role of hormones	K4
CO 4	Enable to learn various Properties and classification of enzymes	K4
CO 5	Develop critical understanding on Biological effect of Ionizing radiations	К3

REFERENCES:

- 1. Steward. F.C. (1964) : Plants at work (A summary of Plant Physiology). Addison-wesley Publishing Co., Inc., Reading, Massachusetts, Palo alto, London.
- 2. Verma, V. (2001) : A Text Book of Plant Physiology , Emkay Publications, New Delhi
- 3. Plummer, D.T (1988) : An Introduction to Practical Biochemistry (3rd Edition) Tata McGraw Hill Publishing Co., Ltd., New Delhi
- 4. Jain, J.L(1998) : Fundamentals of Biochemistry S.Chand & Co., New Delhi
- 5. Salil Bose, S. (1982) : Elementary Biophysics, Vijaya Printers, Madurai

BIOCHEMISTRY

- 1. Plummer, D.T (1988) : An Introduction to Practical Biochemistry (3rd Edition) Tata McGraw Hill Publishing Co., Ltd., New Delhi
- 2. Jain, J.L (1998) Fundamentals of Biochemistry. S.Chand & Co., New Delhi
- 3. Salil Bose, S. (1982) : Elementary Biophysics, Vijaya Printers, Madurai

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Third Year	SBE - IV				Semester- VI							
								S		Mark	S	
Course Code	Title of the Course	Category	L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total	
22AU:13SBE 4 FERMENTATION TECHNOLOGY			5	-		-	2	2	25	75	100	

	Learning Objectives
1	To learn basic concepts relating to various Microbial growth
2	To comprehend the processes involved during fermentation processes
3	To learn basic concepts of making beverages or liquors
4	To know the basic concepts of Production of antibiotics
5	To learn about aspects of Production of amino acids

Unit I

Theory and principles of industrial fermentation, Batch, fed-batch and continuous cultures, Microbial growth and product formation kinetics, media formulation and sterilization, isolation, preservation and improvement of industrially important micro-organisms, inoculums development for industrial fermentations

Unit II

Fermenter design, various types of fermenters used in industrial fermentation. Surface, submerged and solid-state fermentation processes. Basic principal of microbial fuel cells and its application. Alcohol production: Preparation of medium, Fermentation process and recovery; Production of Malt beverages: Production of Beer-malting process, mashing process and finishing; other malt products.

Unit III

Production of Wine: Microbial process, wine from grapes, Fermentation and recovery, types of winewhite and red wine. Production of distilled beverages or liquors-rum, whiskey and brandy; Microbial production of organic acids-vinegar production (substrate, Microbial processing and product recovery)

UNIT - IV

Citric Acidfermentation, recovery and uses; Lactic acid-fermentation, medium and manufacturing process, recovery and uses. Production of antibiotics-strain improvement for secondary metabolite production; PenicillinFermentation and recovery; Tetracycline and Chloramphenicol production; Streptomycin-structure, media composition, production and recovery.

UNIT - V

Production of Amino acids: L-Lysine production and strain improvement forl ysine production; L-glutamic acid production-strain improvement for glutamic acid production and recovery process; Tryptophan production and recovery. Production of enzymes: Pectolytic enzymes- Pectinases production, harvest, recovery and uses; Invertase and Lipase production; Cellulase production and recovery; Production of vitamins: VitaminB12 (Cyanocobalamine) Production; Riboflavin (vitamin B2) production.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Learn theconcepts relating to various Microbial growth	K3
CO 2	Processes involved during fermentation processes	K3
CO 3	To learn basic concepts of making beverages or liquors	K4
CO 4	To know the basic concepts of Production of antibiotics	K4
CO 5	To learn about aspects of Production of amino acids	K3

Text Books:

Unit - I: A.N. Shukla, Industrial Bioprocess Technology, ISBN: 9789350560303, 9789350560303

Unit - II: Modi H.A. Bioprocess Technology, Pointer Publishers) ISBN: 9788171325924, 9788171325924.

Unit - III: P T Kalaiselvan and I. Arul Pandi. Bioprocess Technology: Volume 1. MJP PUBLISHERS. 9788180940323.

Unit - IV: A.N. Shukla, Advanced Bioprocess Technology. ISBN Number: 978 935056 0273 69

Unit - V: Stanbury, P.E. and Whitaker A., Principles of Fermentation Technology (1984) Pergamon Press.

Reference books, Journal: 1. Pirt, S.J. Principles of Microbial and Cell Cultivation. Blackwell Scientific Publication, London

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Scond Year	MBE - I					Semester- III							
		4						rs		Mark	S		
Course Code	Title of the Course		L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total		
22AU:13MBE 1	BIOMETRICS AND COMPUTER APPLICATIONS		5	-		-	4	4	25	75	100		

	Learning Objectives
1	To learn basic concepts relating to various data
2	To comprehend the processes involved central tendency
3	To learn basic concepts of computers
4	To know the basic concepts of test of significance
5	To learn about aspects of MS office

Unit – 1

Definition: Data – Types, Collection, Classification, Tabulation and Interpretation.

Frequency distribution – Discrete and Continuous.

Presentation of Data – Diagrams and Graphs.

Unit – II

Measures of Central tendency: Mean, Median and Mode, Standard Deviation and Standard Error. Skewness and Kurtosis.

Unit – III

Test of significance – Chi-square test, t- test and 'F' test (one way ANOVA)

Unit-IV

Introduction to computers - Hardware components- Input and Output Devices,

Memory devices Mass storage devices, Hard Disk, Floppy, CD, ROM, Data storage, pen drives. Important biological software. (Discuss any Two in detail)

Unit – V

MS office – Word, Excel, and Power point – features and importance. Simple mathematical functions using Exccl. Basis of e-mail and Internet. Basics of Bioinformatics.

CO No.	CO Statement	Knowledge level
CO 1	To learn basic concepts relating to various data	K3
CO 2	To comprehend the processes involved central tendency	K3
CO 3	To learn basic concepts of computers	K4
CO 4	To know the basic concepts of test of significance	K4
CO 5	To learn about aspects of MS office	K3

Course Outcomes: Students will be able to:

REFRENCES

N.Gurumani, 2004. An Introduction to Biostatistics, MJP publishers, Chennai **Bhanu Pratap.2004**. Computer fundamentals I Ed. Cyber tech publications, New Delhi.

Leon and Leon. 2000 Fundamentals of Information Technology. Himalaya Publishing House, New Delhi.

Gupta, S.C.1928. Fundamentals of Statistics Himalaya Publishing Co., New Delhi **Bahl R. 2001.** Exploring Microsoft office XP I Ed Cyber Tech Publications, New Delhi.

Mansified R. 1994. A compact guide to Microsoft Office and Applications. Tata McGraw Hill Publishing Co., New Delhi.

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Thi	ird Year		MBE – II Seme			este	ster- V							
				7						S		Mark	S	
Co	Course Code		Title of the Course	Category	L	Т	Р	0	Credits	Inst. Hour	CIA	External	Total	
22A	U:13MBE	3MBE 2 MEDICINAL BOTANY 5							4	4	25	75	100	
	Learning Objectives													
1	Learn th	ne im	portance of cultivation - harvestin	ng of i	ned	icin	al p	lant	S					
2	Develop	o an i	understanding of chemical constitu	ents a	nd 1	ned	icin	al						
3	To get	a kn	owledge about ethno medicinal Bo	otany										
4	Enable	to lea	arn various salient features of clas	sifica	tion	of	drug	gs						
5.	Develop	o crit	ical understanding on active princi	ples ii	n pla	ants								
UN	IT:I	His	story and scope – Definition of c	ommo	n N	ſedi	ical	teri	ns –	- Sys	tems	of		
		me	dicine – Ayurveda, Siddha, Hor	neopa	thy	an	d U	Jnar	ni. C	ultiv	ation	ı —		
		har	vesting – processing – storage, m	arketi	ng a	and	util	izat	ion	of m	edici	nal		
		pla	nts (General)		-									
UN	IT : II	Sys	stematic description, cultivation,	chemi	cal	con	stit	uent	s ar	nd m	edici	nal		
		use	es of the following medicinal pla	nts –	Ос	imu	m s	sanc	tum	, Eu	calyp	tus		
		glo	globules, Azadirachta indica, Allium cepa, Allium sativum, Aloe vera and											
		Ми	Iurraya koenghii.											
UN	IT : III	Eth	thno medicinal Botany – Folklore medicine – Folk medicines – methods											
		of	of preparations – administration. (Internal and External) – Adjustments –											
		Die	et – Toxicity – Antidotes.											
UN	IT : IV	Pha	armacognosy – Classification of	f Dru	gs	- (Che	mis	try	of L	Drugs	—		
		Zin	ngiber officinale, Alstonia	schol	laris	5,	Са	ате	llia	ch	inen	sis,		
		Ch	rysanthemum cinerarifolium and M	<i>Iyristi</i>	ica f	rag	ran	s.						
UN	IT : V	Phy	ytochemistry – Active Princip	les, 1	met	hod	s (of	their	tes	sting	—		
		Ide	entification and utilization of the fo	llowir	ng n	nedi	cina	al pl	ants	•				
			• <i>Ricinus communis</i> (Laxatives)	– Euj	pho	rbia	cea	e.						
			Digitalis purpurea (Cardioton	ics) -	Scro	oph	ular	iace	eae					
			• Datura metal (Drugs acting or	n nerv	ous	sys	tem) – (Sola	nace	ae.			
			• Rauwolfia serpentina (Antihypertensives) – Apocynaceae											
			• Vitex negundo (Antirheumatic	s) - V	erbi	nac	eae							
Co	urse Outo	come	s: Students will be able to:											
	CO No. CO Statement Knowledge level							l						
	CO 1 Learn the importance of cultivation – harvesting of								К3					
		mee	dicinal plants						_		110			
	CO 2 De		velop an understanding of chemical constituents and						К3					
_		mee	dicinal						_					
-	CO 3	To	get a knowledge about ethno med	icinal	Bot	tany					K4			
	CO 4	Ena	ble to learn various salient feature	s of c	class	sific	atic	n			K4			
ļ	ac -	of d	lrugs											
	CO 5	Dev	velop critical understanding on acti	ve pri	ncip	oles	in		1		K3			
	plants													

REFERENCE:

- 1. Hand Book of medicinal plants S.K. Bhattacharjee Pointer Publication, Jaipur.
- 2. Medicinal herbs in Indian life Vivekananda Kendra Patica 16(1)1987.
- 3. An introduction to Medical Botany N.C.Kumar Emkay Publications, Delhi.

4. Medicinal and Aromatic plants in Asia, Breeding and Improvement, - ED. by Naranga Chanchalow and Han V.Henle.Oxford and IBH Publications Co. Pt Limited, New Delhi

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Third Year	CORE COURSE	2 – 13 Semester- VI							[
								ß		Mark	S
Course Code	Title of the Course		L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
22AU:13M13	PLANT ECOLOGY AND PHYTOGEOGRAPHY		5	-		1	5	5	25	75	100

	Learning Objectives
1	Learn the importance of Morphological and Anatomical adaptations
2	Develop an understanding of ecosystem concept
3	To understand the Concept of Autecology and Synecology
4	Enable to learn various pollution and its control
5.	Develop critical understanding on Approaches to Phytogeography

Unit – I

General Ecology – Plant environment – Climatic, Edaphic and Biotic factors – Ecological classification of plants – Hydrophytes, Mesophytes and Xerophytes – Morphological and Anatomical adaptations.

Unit – II

Ecosystem concept – Components Abiotic, Autotrophic producers & Heterotrophic consumers, biomass, Ecological Pyramids, Productivity – Primary, Secondary & Tertiary; Food chain – Food web & Energy flow – Pond Ecosystem.

Unit – III

Concept of Autecology and Synecology. Vegetation – Units of Vegetation – formation, association, consociation, society – Development of Vegetation: Migration – Ecesis, Colonization, Methods of study of Vegetation (Quadrate & Transect). Plant Succession – Hydrosere & Xerosere.

Unit – IV

Applied Ecology – Pollution and its control Atmospheric pollution – Air pollution – particulate matter, Chemicals, Acid rain, Radiation pollution, Noise pollution, Thermal pollution. Soil pollution: Industrial effluents, Agricultural pollution, Plant residues, Insecticides, Pesticides, Fungicides, Herbicides. Water pollution – Industrial effluents (Water soluble metals & liquid effluents oil)

Unit – V

Phytogeography: Approaches to Phytogeography – Climate of India & its Climatic zones, Botanical regions of India – Vegetational types of Tamilnadu: Evergreen, deciduous, scrub & Mangrove, Continuous and Discontinuous Distribution. Endermism, Continental Drift Theory and Age and Area theory.

Course Outcomes	Students wi	Il be able to:
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CO No.	CO Statement	Knowledge level
CO 1	Learn the importance of Morphological and Anatomical adaptations	К3
CO 2	Develop an understanding of ecosystem concept	K3
CO 3	To understand the Concept of Autecology and Synecology	K4
CO 4	Enable to learn various pollution and its control	K4
CO 5	Develop critical understanding on Approaches to Phytogeography	К3

REFERENCES:

- 1. Puri, G.S. (1960) : Indian Forest Ecology (Vol. I & II) Oxford Book Co., New Delhi & Calcutta
- Kormandy, E.J. (1978) : Concepts of Ecology (2nd Edition) Prentice Hall of India (P) Ltd., New Delhi
- 3. Verma, P.S. & Agarwal, V.K (1999) :Concept of Ecology (Environmental iology) S.Chand & Co., New Delhi 264 pp.,
- 4. Newman, E.I. (2000) : Applied Ecology. Blackwell Scientific Publisher, U.K 328 pp.,
- 5. Sharma, P.D (2000) : Ecology & Environment

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Third Year	Third YearCORE COURSE - 1			Semester- VI							
		1						rs		Mark	s
Course Code	Title of the Course	Category	L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
22AU:13M14	Biodiversity and conservation		5	-		-	4	4	25	75	100

	Learning Objectives
1	To enable students to identify genetic diversity, species diversity
2	To prepare Conservation of biodiversity
3	To know the Wild plant wealth and ecosystem
4	To identify the threats of biodiversity
5.	To know the Conservation of Biodiversity

Unit I

Biodiversity – definition, factors responsible for determination, levels of biodiversity – genetic diversity, species diversity, ecological diversity, evolutionary diversity and habitat diversity (Brief account only)

Unit II

Biodiversity hot spots at national level, Wild plant wealth and ecosystem diversity in Inida. Endangered plant species (in south India) – categories.

Unit III

Loss of Biodiversity – Threats of biodiversity – factors of threat – Need for conservation of Biodiversity

Unit IV

Conservation of Biodiversity. Insitu and exsitu conservation, National Parks, Sanctuaries in Tamil Nadu (any 2), Biosphere reserves – Agasthiar malai, Nilgiri.

Unit V

Indian forest act (1927), Forest conservation act (1980), Wild life protection Act (1972). Endangered species Act. The compensatory afforestration fundbill 2008. Compensatory Afforestation fund Management and Planning Authority (CAMPA).

CO No.	CO Statement	Knowledge level
CO 1	To enable students to identify genetic diversity, species diversity	К3
CO 2	To prepare Conservation of biodiversity	K3
CO 3	To know the Wild plant wealth and ecosystem	K4
CO 4	To identify the threats of biodiversity	K4
CO 5	To know the Conservation of Biodiversity	K3

Course Outcomes: Students will be able to:

References

1. kumar. U & Mahendra Jeet Asiya, 2005, Biodiversity, Principles and conservation, Agrobios (India) Jodhpur, India.

2. Kartikeya, K. 2005, Biodiversity – Extinction and conservation Asvishkar Publishers, Distributors, Jaipur, India.

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

J	Third Year	CORE COURSE – 15Semester- VI										
			L						S	Marks		
Co	urse Code	Title of the Course	Category	L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
		PLANT BREEDING AND		5	-		-	4	4	25	75	100
22 <i>A</i>	AU:13M15	EVOLUTION										
		Learning Obje	ectives	5								
1	To develop skills to Plant Breeding											
2	To understand importance of Hybridization											
3	3 To identify Mutation and crop improvement											
4	4 Enable to learn various Breeding for disease resistance and drought tolerance											
5.	5. Determine the Role of mutation in speciation											

Unit I

Plant Breeding: History and objectives; genetic basis and important achievements in plant breeding; modes of reproduction in crop plants (asexual, sexual, apomictic)-advantages and limitations, Floral biology in relation to selfing and crossing techniques; Plant Introduction – types and procedures; Centres of origin and domestication of crop plants.

Unit II

Selection methods: Mass selection, pure line and clonal selection- merits and demerits; Hybridization: objectives, choice of parents and causes of failure; Incompatibility and male sterility - methods to overcome; Methods of handling segregation material for isolation superior strains – bulk method and pedigree method of selection; Role of distant hybridization- in crop improvement.

Unit III

Inbreeding depression and heterosis: genetic basis and its applications; Steps in the production of single cross, double cross, three-waycross; Polyploidy: induced polyploidy, role of auto and allopolyploids; Mutation and crop improvement.

Unit IV

Back crossing: theory and procedure for transferring various types of character; Breeding for disease resistance and drought tolerance; Preservation and utilization of germplasm; Breeding techniques for rice, sugarcane, groundnut and maize; Limitations of conventional breeding; Aspects of molecular breeding.

Unit V

Evolution: origin of life, theories of evolution of life forms: Lamarckism and Darwinism. Variations – definition causes and types, mutation (principles of Hugo De'Vries). Role of mutation in speciation. Evolution through ages: human evolution. Evidences for evolution.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	To develop skills to Plant Breeding	K3
CO 2	To understand importance of Hybridization	K3
CO 3	To identify Mutation and crop improvement	K4
CO 4	Enable to learn various Breeding for disease resistance and drought tolerance	K4
CO 5	Determine the Role of mutation in speciation	K3

Reference

- 1. Fahn. A. 1987. Plant Anatomy. Pergamon Press, New York.
- 2. V.K. Jain, 1992. Text Book of Plant Physiology. S.Chand & Company Ltd., New Delhi.
- 3. Verma, S.K., 2002. Text Book of Plant Physiology. S.Chand & Company Ltd., New Delhi.
- 4. D.C. Dubey, 1993. Text book of Biotechnology. S.Chand & Company Ltd., New Delhi.
- 5. Sandya Mitra, 2001. Genetic Engineering. Mac millan Puplishers, New Delhi
- 6. Hartman and Kester. 1989. Plant propagation principles and practices 4th Edn. Prentice Hall. Of India. New Delhi.

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Semester-V

											IS	Marks		
Course Code	Title of the Course	Category	L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total			
22AU:13MBE3	PLANT BIOTECHNOLOGY		5	-		-	5	5	25	75	100			

	Learning Objectives
1	Learn the importance of Future impacts of Biotechnology.
2	Develop an understanding of Role of genetic engineering
3	Enrich knowledge about Immunoglobulins
4	Enable to learn various tissues culture technology in Agriculture
5.	Develop critical understanding on mushroom cultivation

Unit I

Scope and importance of Plant biotechnology – Application of Biotechnology in Industry, Agriculture and Medicine, Future impacts of Biotechnology.

Unit II

Genetic engineering – Basic steps involved in Genetic engineering - Restriction enzymes (Endonucleases and ligases) – Gene cloning Vectors; Plasmid, Cosmids and Bacteriophage. Role of *Agrobacterium* in genetic engineering.

Unit III

Immunoglobulins – Types and structures – Hybridoma technology (Production of Monoclonal antibodies) – Genetic engineering for vaccine production (Transgenic plants).

Unit IV – Plant Tissue Culture

Techniques: Explants, Methods of Sterilization, Media - Preparation of M.S. medium; Induction of callus. Application of tissues culture technology in Agriculture. Protoplast isolation, Micropropagation, Somatic hybridization and Synthetic seeds.

Unit V – Application of Biotechnology

Single cell protein – *Spirulina,* Mycoprotein – Yeast, Hydrogen production – Cyanobacteria, Biogas – Water hyacinth and *Salvinia,* Mushroom cultivation – *Agaricus and* Humulin – *E.coli*

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Learn the importance of Future impacts of	V2
	Biotechnology.	КJ
CO 2	Develop an understanding of Role of genetic engineering	K3
CO 3	Enrich knowledge about Immunoglobulins	K4
CO 4	Enable to learn various tissues culture technology in	K4
CO 5	Develop critical understanding on mushroom cultivation	K3

Reference:

- 1. Dubey. R.C.a (1996) Text book of Biotechnology
- 2. Gupta P.K. Biotechnology
- 3. Bilgrami. K.S. (1992) Introduction to Biotechnology
- 4. Pandey, A.K. CBA Publishers, New Delhi

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

Third Year	MBE - IV				Semester- VI						
		1						S		Mark	S
Course Code Title of the Course		Category	L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
22AU:13MBE 4	POST HARVEST TECHNOLOGY		5	-		-	4	4	25	75	100

	Learning Objectives
1	Learn the importance of postharvest operations
2	Develop an understanding of principles of drying
3	To learn Management of storage structures
4	Enable to learn various Introduction to various grain drying systems
5.	Develop critical understanding on Principle of storage of fruits and vegetables.

UNIT - I

Introduction to post harvest technology of agricultural produce; Status of Production, Losses, Need, Scope and Importance. Introduction to various postharvest operations such as Primary Processing Operation Vs. Secondary Operation, Operations like Harvesting, Handling cleaning, grading, sorting, drying, storage, milling, size reduction, expelling, extraction, blending, heat treatment, separation, material handling (transportation, conveying, elevating), washing; their functions and use in the postharvest processing.

UNIT - II

Introduction, importance of drying, principles of drying and factors affecting drying, types of drying methods i.e. sun drying & artificial drying by mechanical means – Psychometric Chart, Moisture content representation, equilibrium moisture content, determination of moisture content by direct and indirect methods.

UNIT - III

Introduction to various grain drying systems - solar drying system, batch drying system, continuous flow drying system. Precautions during drying. Principles and operation of different types of Dryers viz. Deep Bed Dryers, Flat Bed Dryers, Continuous Flow Dryers, L.S.V. Dryers, Spray Dryer, Fluidized Bed Dryers, Rotary Dryer, Spouted Beds, Freeze Dryer, Tray And Tunnel Dryers

UNIT - IV

Introduction, need and importance, general principles of storage. Temperature and moisture changes during storage i.e. influence of moisture content, relative humidity, temperature, fungi etc. on stored product. Fungi, insect and other organism / Infections associated with stored grains. Familiarization with the various types of storage structures. Deep and shallow bins. Traditional and

modem storage structures. Management of storage structures. Losses during storage and their control, space requirement of bag storage structure. Types of material conveying Systems. Belt Conveyor, Bucket Elevator, Screw Conveyor, Pneumatic Conveyor.

UNIT - V

Methods of Harvesting and Postharvest losses in fruits and vegetables, Handling of Fruits and Vegetables. Introduction to the storage of fruits and vegetables. Need and importance of storage. Principle of storage of fruits and vegetables. Recommended storage operation conditions for some important fruits and vegetables and their storage life. Postharvest treatment to increase shelf life i.e. freezing, chilling, dehydration, canning, thermal processing. Introduction to Packaging of fruits and vegetables and types of packaging. Concept of modified atmosphere packaging.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge
		level
CO 1	Learn the importance of postharvest operations	K3
CO 2	Develop an understanding of principles of drying	K3
CO 3	To learn Management of storage structures	K4
CO 4	Enable to learn various Introduction to various grain drying systems	K4
CO 5	Develop critical understanding on Principle of storage of fruits and vegetables.	К3

Text Books:

Unit - I: K. P. Sudeer and V. Indra. 2007. Postharvest technology of horticultural crops. New India Publishing Agency, New Delhi.

Unit - II: Amalendu Chakraverti, Arun S. Mujumdar, G.S. Vijayaraghavan and Hosahalli S. Ramaswamy. 2003. Handbook of PostHarvest Technology. Mercel-Dekker Inc. USA.

Unit - III: K.K. Balachandran. 2001. Post Harvest Technology of Fish and Fish Products. Daya Publishing House, New Delhi.

Unit - IV: A. Chakraverty. 2019. Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH Publishing Company

Unit - V: P. Jacob John. 2008. A Handbook on Post Harvest Management of Fruits and Vegetables. Daya Publishing House, New Delhi.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

First YearB.Sc., Zoology (Allied Botany Paper – I)Semester I

								S	Marks		
Course Code Title of the Course		Category	L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
22AU:08A1	PLANT DIVERSITY		5	-		-	3	5	25	75	100

	Learning Objectives
1	To study morphological structure of algae
2	To demonstrate Structure and Life history of fungi
3	To familiarize with the General characters of Bryophytes
4	To carryout experiments related with Pteridophytes
5.	To learn Structure and Life history of <i>Cycas</i>

Unit - I Alage

General characters of Alage – Brief account Structure and Life cycle of the following

Chlorophyceae – *Oedogonium*, Cyanophyceae - *Nostoc*, Rhodophyceae

- Gracilaria, Phaeophyceae - Sargassum, Economic Importance of Alage

Unit –II Fungi

General characters of Fungi and Lichens – Brief account

Structure and Life history of the following Ascomycetes – *Peziza*, Basidiomycetes – *Puccinia*, Oomycetes – *Albugo* Lichens – *Usnea* Economic Importance of Fungi

Unit - III Bryophytes

General characters of Bryophytes - Brief account

Structure and Life history of Anthoceros, Economic Importance of Bryophytes

Unit –**IV Pteridophytes**

General characters of Pteridophytes - Brief account

Structure and Life history of Adiantum, Economic Importance of Pteridophytes

Unit – V Gymnosperms

General characters of Gymnosperms – Brief account Structure and Life history of *Cycas*, Economic Importance of Gymnosperms

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	Increase the awareness and appreciation of human friendly algae and their economic importance	К3
CO 2	Develop an understanding of microbes and fungi and appreciate their adaptive strategies.	К3
CO 3	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes	K4
CO 4	Compare the structure and function of cell Gymnosperms s and explain the development of cells.	K4
CO 5	Develop critical understanding on morphology, anatomy and reproduction of Gymnosperms	К3

Text and Reference books :

- 1. Gangulee and Kar. 1998. College Botany Vol. II, Books and Allied (P) Ltd. Calcutta.
- 2. Pandly, B.P. 1976 College Botany Vol. I & II S.Chand & Co Company Ltd., Reprint 2004
- 3. Pandey B.P 1973, An Introduction to Gymnosperms. I Edn. Naveen press, Meerut.
- 4. Sharma, O.P.1998. Text book of algae- seventh reprint. Tata mc. Graw Hill Publishing company Ltd., New Delhi.

5. Sharma,O.P. 1989. Text book of fungi, Tata Mc Graw – Hill Publicshing company

Ltd., New Delhi.

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

First YearB.Sc., Zoology (Allied Botany Paper –II)

Semester- II

	Title of the Course							S	Marks			
Course Code			L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total	
22AU:08A3	STRUCTURAL AND FUNCTIONAL BOTANY		5	-		-	4	5	25	75	100	

	Learning Objectives
1	Understand the fundamental concepts of plant anatomy and embryology.
2	Analyze and recognize the different organs of plants and secondary growth.
3	Understand water relation of plants with respect to various physiological processes
4	To study the Classify aerobic and anaerobic respiration.
5.	To learn about the physiological processes that underlie plant metabolism.

Unit –**I** Taxonomy

Study of the following families Annonaceae ,Rubiaceae, Euphorbiaceae, Solanaceae, Poaceae

Unit – II Anatomy and Embryology

Types of Plant tissues, Meristems, Anamalous secondary growth in *Nyctanthes* Structure of Mature Ovule and Anther, Development of Dicot embryo

Unit –III Plant physiology

Absorption of Minerals, Photosynthesis (Calvin cycle) Respiration (Glycolysis) – Kreb's cycle and ETC

Unit – IV Genetics

Gene – definition, structure, Operon concept, Genetic engineering – Tools, Plasmids – Restriction enzymes, Basic Steps in Gene cloning

Unit – V Horticulture

Horticulture, Scope and Importance, Propagation Methods: Cutting, Layering, Air Layering and Grafting techniques.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	To enhance information on the identification of taxonomical plant	K3
CO 2	To be familiar with the basic concepts and principles of plant systematics.	K3

CO 3	Understanding of reproduction and development of angiosperms	K4
CO 4	To understand the internal organization of Angiopserms	K4
CO 5	To study the effect of various physical factors on photosynthesis.	К3

Text and Reference Books

Sharma, O.P., 2006. Text book of Taxonomy. Tata McGraw Hill Puplishing Company Ltd., New Delhi.

Guruchaaran Singh – 2007. Plant systamatics Oxford & IBH puplishing Co. Pvt. Ltd.,

B.P.Pandey. 2007. Plant Anatomy. S.Chand &Company Ltd., New Delhi, Reprint.

Fahn. A. 1987. Plant Anatomy. Pergamon Press, New York.

V.K. Jain, 1992. Text Book of Plant Physiology. S.Chand & Company Ltd., New Delhi.

Verma, S.K., 2002. Text Book of Plant Physiology. S.Chand & Company Ltd., New Delhi.

D.C. Dubey, 1993. Text book of Biotechnology. S.Chand & Company Ltd., New Delhi.

Sandya Mitra, 2001. Genetic Engineering. Mac millan Puplishers, New Delhi

Hartman and Kester. 1989. Plant propagation principles and practices 4th Edn. Prentice Hall. Of India. New Delhi.

N. Kumar, 1986. Introduction to Horticulture TNAU Coimbatore.Dutta A.C. College Botany, Vol I & II

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

NON-MAJOR ELECTIVE -I

	Title of the Course							LS		Mark	S
Course Code			L	Т	Р	0	Credits	Inst. Hou	CIA	External	Total
22AU:NME1	BIOFERTILIZER and MUSHROOM CULTIVATION		5	-		-	2	2	25	75	100

	Learning Objectives
1	To develop skills about bio fertilizers
2	To study about Mass cultivation and carrier materials for bio fertilizers
3	To develop skills to Mushroom cultivation
4	To study the VAM association and its types
5.	To understand importance of edible mushrooms

UNIT –I

Biofertilizer – Definition, Kinds of microbes as biofertilizers, *Rhizobium*-legume Symbiotic association – Mass cultivation and carrier materials.

Cultural methods of *Azospirillum*, *Azatobacter*, *Azolla* and *Anabaena*, carrier materials.

UNIT –II

Mycorrhizea - VAM association, types, isolation and inoculum production.

Edible and Poisonous mushrooms, nutritive value of mushrooms, structure of edible mushrooms, *Pleurotus* and *Agaricus* (Fruiting body)

UNIT – III

Mushroom cultivation: Spawn, mother spawn production, spawn multiplication, Requirements of mushroom cultivation (Polythene bags, Paddy straw substrates, spawn running room, cropping room) – Preparation of Paddy straw, cylindrical beds, spawn running, cropping and harvesting.

Course Outcomes: Students will be able to:

CO No.	CO Statement	Knowledge level
CO 1	To develop skills about bio fertilizers	K3
CO 2	To study about Mass cultivation and carrier materials for bio fertilizers	К3
CO 3	To develop skills to Mushroom cultivation	K4
CO 4	To study the VAM association and its types	K4
CO 5	To understand importance of edible mushrooms	K3

References

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

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

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	2	2	2	3	2
CO5	3	2	3	2	3

OUTCOME MAPPING

NON-MAJOR ELECTIVE -II

	Title of the Course			LT	Р	ο	Credits	Inst. Hours	Marks		
Course Code			L						CIA	External	Total
22AU:NME2	HORTICULTURE AND GARDEN DESIGNING		5	-		I	2	2	25	75	100

	Learning Objectives
1	To enable students to learn basic concepts relating to aspects of horticulture
2	To study Plant propagation methods
3	To develop skills to garden designs and types of gardens
4	To study the Lawn maintenance
5.	To understand importance of Nursery management and maintenance.

UNIT -I

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

Plant propagation methods: Cutting, Layering, Grafting, Budding, Stock-Scion relationship, use of plant growth regulators in horticulture.

UNIT – II

Garden designs: Types of gardens- formal, informal and kitchen garden, units of garden, hedge, border, Topiary Arches and Lawn maintenance.

Floriculture, cultivation of commercial flowers – Rose and Jasmines. Cultivation of important fruit tress – Mangoes and Banana.

UNIT – III

Green house, Indoor gardening – Bonsai – Flower arrangements – Nursery management and maintenance.

CO No.	CO Statement	Knowledge level
CO 1	To enable students to learn basic concepts relating to aspects of horticulture	К3
CO 2	To study Plant propagation methods	К3
CO 3	To develop skills to garden designs and types of gardens	K4
CO 4	To study the Lawn maintenance	K4
CO 5	To understand importance of Nursery management and maintenance.	K3

Course Outcomes: Students will be able to:

References:

Bose, T.K. & Mukherjee, D. (1972). Gardening in India Oxford & IBH Publishing Co., Kolkatta, New Delhi – 385pp,

Sandhu, M.K. (1989). Plant propagation – Wiley Eastern Ltd., New Delhi, Bangalore, Pune-287pp,

Kumar, N. (1997). Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, India.

Manigush S.K. (1999). Horticulture. Wiley Eastern Ltd., New Delhi, Bangalore, 321pp,

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3 3 2		2
CO4	2	2	2	3	2
CO5	3	2	3	2	3