



PSGR Krishnammal College for Women



DEPARTMENT OF BOTANY

**CHOICE BASED CREDIT SYSTEM (CBCS)
&
LEARNING OUTCOMES- BASED CURRICULAR FRAMEWORK
(LOCF)**

**BACHELOR OF BOTANY
2021 – 2024 BATCH**



PROGRAMME LEARNING OUTCOMES (PLO's)

Courses within the Botany curriculum will address goals and objectives at the appropriate level through measurable student learning outcomes developed by course instructors

PLO 1: Students will be able to remember, comprehend, apply, analyze and synthesize the core concepts in botany, like evolution, biodiversity, structure and function, information flow, exchange, and storage, pathways and transformations of energy and matter.

PLO 2: Students will develop the ability to apply and understand the defining characteristics of various processes of science and its uncertainty.

PLO 3: Students will also develop the ability to practice the skills of the scientific method. Engage in research projects and apply the quantitative skills to biological problems.

PLO 4: Students will be able to communicate and collaborate within and outside of biology and tap into the interdisciplinary nature of science.

PLO 5: Students should understand the relationship between science and society. Evaluate the impact of science as well as ethical implications of science. Explore how science is applied in a social context.

PROGRAMME SPECIFIC OBJECTIVES (PSOs)

At the end of the programme the student will

PSO1: Obtain strong foundation in classical botany, interdisciplinary subjects such as Bioinformatics, Biostatistics, and advance topics in Cell and Molecular biology, Biochemistry and Plant Biotechnology.

PSO2: Build capacity in Horticulture and production of cut flowers from the skill-based courses offered.

PSO3: Carry out individual short-term internship and project work to acquire knowledge on research using basic and advanced instruments/equipments.

PSO4: Find opportunities for higher studies in top ranking universities.

PSO5: Gain career in teaching/research in Botany



DEPARTMENT OF BOTANY
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED CURRICULAR
FRAMEWORK (LOCF)

BACHELOR OF BOTANY (2021-2024 Batch)
SYLLABUS & SCHEME OF EXAMINATION

Applicable to students admitted during the academic year 2021 – 2022 onwards (I-VISem)

SEM	Part	Subject Code	Title of the Paper		Instruction hours/week	Contact hours	Tutorial	Duration of Examination	Examination Marks			Credits	
									CA	ESE	TOTAL		
I	I	TAM2101/ HIN2101/ FRE2101	Language T/H/F Paper I	Language	6	86	4	3	50	50	100	3	
	II	ENG2101	English Paper-I	English	6	86	4	3	50	50	100	3	
	III A		PL21C01	Core Paper I- Microbiology & Plant diversity I	CC	6	86	4	3	50	50	100	5
			PL21CP1	Core Practical – I	CC	3	45	-	-	-	-	-	-
			CE21A01/ PS21A01/ TH21A01	Allied Chemistry for Biologists Paper-I/ Allied Physics Paper –I/ Allied Paper I -Mathematical Statistics - I	GE	4	56	4	3	30	45	75	4
			CE21AP1 /PS21AP1	Allied Practical Chemistry / Physics	GE	7	101	4	3	50	50	100	5
	IV	NME19B1/A1 NME21ES/ NC21NC01	Basic Tamil/Advanced Tamil** Introduction to Entrepreneurship/NCC- Organization and Integration	AEC	3	-	-	-	-	-	-	-	-
				2	-	-	3	50/ 50/ 100	50/ 50	100	2		
II	I	TAM2102/HIN 2102/FRE2102	Language T/H/F Paper - II	Language	6	86	4	3	50	50	100	3	
	II	ENG2102	English Paper-II	English	5	71	4	3	50	50	100	3	
	III A		PL21C02	Core Paper II – Plant diversity II(Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany)	CC	5	71	4	3	50	50	100	5
			PL21CP1	Core Practical I (Core Paper I & II)	CC	3	45	-	3	50°	50°	100	4
			CE21A02/ PS21A02/ TH21A02	Allied Chemistry for Biologists Paper-II / Physics Paper –II / Allied Paper II - Mathematical Statistics II	GE	5	71	4	3	30	45	75	4
				GE	8	116	4	3	50	50	100	5	
	III A	CE21AP1/ PS21AP1	Allied Chemistry Practical/Allied Physics Practical	GE	3	45	-	3	25	25	50.	2	
	IV		OPS1808	Open course-self study online courses					-	-	-	-	-
			NME19B2/A2	Basic Tamil/Advanced Tamil**	AEC				-	-	-	-	-
	IV	21PELS1/ NC21NC02	Professional English for Life Sciences	AEC	3	45	3	2	50	50	100	2	

V	III	PL21C05	Core Paper V – Plant taxonomy and Economic Botany	CC	4	56	4	3	50	50	100	4
		PL21C06	Core Paper VI- Genetics, Plant breeding and Biostatistics	CC	4	56	4	3	50	50	100	4
		PL21E01	Application Oriented Subject (AOS) I -Dietetics, Food Processing and Preservation (or)	AOS	5	71	4	3	50	50	100	5
		PL21E02	AOS II Bioinoculants- Paper I (or)									
		PL21E03	AOS III Environmental Biotechnology									
		PL21CP3	Core Practical III Paper V-Plant Taxonomy and Economic Botany	CC	3	-	-	3	50°	50°	100	4
			Paper VI- Genetics, Plant breeding and Biostatistics									
			AOS I-Dietetics, Food processing and preservation									
		PL16AC1	**Advanced Learners Course- Food Microbiology (or)	ALC	-	-	-	3	-	-	*100	*5
		PL16AC2	**Advanced Learners Course- Nutrition Science									
		PL21PROJ	Project & Viva voce	-	4	-	-	Viva	50	50	100	5
		PL21SBP1/ PL21SBCE	Skill Based Subject – Horticulture Practicals /	SEC	3	43	2	2	100	-	100	3
			Coursera Course – Climate Change and Health: From Science to Action	SEC	3	45	-	-	-	-	-	
IV	NM21CS1	Cyber Security I	--	2	-	-	-	100	-	100	-	
	PL16CE	Comprehensive Test		--	--	--	--	--	--	Grade	Gra	
VI	III	PL21C07	Core Paper VII –Bio-Chemistry and Plant Physiology	CC	5	73	2	3	50	50	100	4
		PL21C08	Core Paper VIII – Basics of Bioinformatics	CC	5	73	2	3	50	50	100	4
		PL21C09	Core Paper IX – Plant Ecology & Phytogeography	CC	4	58	2	3	50	50	100	4
		PL21E04	AOS IV Plant Biotechnology or	AOS	5	73	2	3	50	50	100	5
		PL21E05	AOS V Bioinoculants- Paper II or									
		PL21E06	AOS- VI Pharmacognosy									
		PL21CP4	Core Practical IV Core Paper VII, VIII, IX & AOS IV)	CC	3+3+2	120	-	3	50°	50°	100	6
		PL16AC3	**Advanced Learners Course Industrial Biotechnology (or)	ALC	-	-	-	3	25	75	*100	*5
PL19AC4	**Advanced Learners Course – Mushroom Culture											

VI	III	PL21SBP1	Skill Based Subject – Horticulture Practicals/ Coursera - Climate Change and Health: From Science to Action	SEC	3	41	4	-	100	-	100	3
		PL21SBCE				45	-					
	16BONL1	Online course 1	-	-	-	-	-	-	-	-	-	1 (extra cre
16BONL2	Online course 2	-	-	-	-	-	-	-	-	-	1 (extra cre	
Total										3800	140	

*Allied theory papers with practicals will be evaluated for 50/50 and converted into 30/45; **Grade - Outside regular class hours**not considered for grand total and CGPA °Core Practical CA & ESE will be evaluated for 100 converted into 50

CC – Core Courses
 GE – Generic Elective
 AEC – Ability Enhancing Course
 AOS – Application Oriented Subject

CA – Continuous Assessment
 ESE - End Semester Examination
 SEC – Skill Enhancement Course
 ALC – Advanced Learners Course

CIA PATTERN

1. Theory – 50:50 = 100 Marks

Internal Component	50 Marks
CIA I	10 (Conducted for 60 marks after 50 days)
Model Exam	20 (Conducted for after 85 days 100 marks (Each Unit 20 Marks))
Seminar/Assignment/Quiz	10
Class Participation	7
Attendance	3
TOTAL	50 Marks + ESE 50 Marks (Conducted for 100 Marks)

2. Practical - 50 : 50 = 100 Marks

Internal Component (Practical)	50 marks
Lab Performance (Practical + Interaction) (12+12)	24
Regularity in record submission	8
Model Examination	15
Attendance	3
Total	50

3. ALC 25/75 pattern:

Internal Component(Theory)	25 Marks
CIA	10
Model exam	15
Total	25 marks

4. SBS pattern:

Internal Component (Practicals)	100 Marks
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Test 1 (Theory / Practical)	50
Test 2 (Theory / Practical / Project)	50
Total	100 Marks

CIA Pattern

Question from each unit comprising of

One question with a weightage of 2 Marks : $2 \times 3 = 6$

One question with a weightage of 6 Marks (Internal Choice at the same CLO level): $6 \times 3 = 15$

One question with a weightage of 12 Marks (Internal Choice at the same CLO level) : $12 \times 3 = 36$

Total : 60 Marks

ALC

Section A (Paragraph answer) (4 out of 6) 4×4 : 16 Marks

Section B (Essay type) 1 out of 2 : 9 Marks

Total : 25 Marks

ESE Question Paper Pattern: 5 x 20 = 100 Marks

Question from each unit comprising of

One question with a weightage of 2 Marks : $2 \times 5 = 10$

One question with a weightage of 6 Marks (Internal Choice at the same CLO level): $6 \times 5 = 30$

One question with a weightage of 12 Marks (Internal Choice at the same CLO level): $12 \times 5 = 60$

Total : 100 Marks

Advance Learner Courses (ALC)

Section A : 5 questions out of 8 - open choice 5×5 : 25 marks

Section B : 5 questions out of 8-open choice 5×10 : 50 marks

Total : 75 marks

Mapping with Programme Learning Outcomes

Course 1 – PL21C01

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	M	M
CLO3	M	S	M	S	S
CLO4	S	M	S	M	M
CLO5	S	M	M	S	S

Course 2 – PL21C02

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	M	M	S
CLO4	S	S	M	M	M
CLO5	S	S	S	S	S

Course 3 – PL21CP1

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	S
CLO2	S	S	M	M	M
CLO3	S	S	M	M	S
CLO4	S	S	M	M	M

Course 4 – PL21C03

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M

Course 5 – PL21C04

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	S	M	S	M	M
CLO3	S	S	M	S	M
CLO4	S	S	M	M	M

Course 6 – PL21CP2

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	S

CLO2	M	S	S	M	S
CLO3	S	S	M	S	M
CLO4	M	S	S	M	S

Course 7 – PL21SB01

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	S	S
CLO2.	S	S	S	M	S
CLO3.	M	S	M	S	S
CLO4.	M	M	M	M	M

Course 8 – PL21A01

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	M	M	S	S
CLO2	S	S	M	M	M
CLO3	S	S	S	S	S

Course 9 – PL21A02

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	S	M	M	M
CLO2	S	S	M	S	S
CLO3	M	M	M	M	M
CLO4	S	S	S	S	M
CLO5	S	M	M	M	M

Course 10 - PL21AP1

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	M	S	M	M	M
CLO2.	S	S	M	S	S
CLO3.	M	M	M	M	M
CLO4.	S	S	S	S	M

Course 11 - PL21SB02

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	S	M
CLO2.	S	M	S	S	M
CLO3.	M	S	S	M	S
CLO4.	S	S	S	S	S

Course 12- NM21DTG

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
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CLO 1.	S	M	M	S	S
CLO 2.	M	S	S	M	M
CLO 3.	S	S	S	M	S
CLO 4.	S	S	S	S	S

Course 12 – PL21C05

CLOs	PLO	PLO2	PLO3	PLO4	PLO5
CLO1.	M	S	M	S	M
CLO2.	S	M	S	S	M
CLO3.	M	S	M	M	S
CLO4.	M	S	M	S	S

Course 13 – PL21C06

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M

Course 14 – PL21E01

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M
CLO5.	S	S	S	S	S

Course 15 - PL21E02

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M
CLO5.	S	S	S	S	S

Course 16 - PL21E03

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M
CLO5.	S	S	S	S	S

Course 17 - PL21CP3

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	S	M	S	S
CLO2	S	M	S	S	M
CLO3	S	S	M	M	S
CLO4	M	S	S	M	S

Course 18 - PL16AC1

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	M	S	S
CLO2.	S	S	M	M	S
CLO3.	S	S	M	M	S
CLO4.	S	S	M	M	S
CLO5.	S	S	M	M	M

Course 19 - PL16AC2

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	L	M	S
CLO2.	S	S	L	M	S
CLO3.	S	S	L	M	S
CLO4.	S	S	L	M	S
CLO5.	S	S	L	M	M

Course 20: PL21PROJ

Course 21: PL21SBCE

Course 22 - PL21C07

CLOs	PLO1	PLO	PLO3	PLO4	PLO5
CLO1	S	S	M	M	M
CLO2	S	M	M	S	M
CLO3	M	S	S	M	S
CLO4	M	S	M	M	S

Course 23 - PL21C08

CLOs	PLO	PLO2	PLO	PLO4	PLO5
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CLO1.	S	S	S	S	S
CLO2.	S	M	S	S	M
CLO3.	M	M	M	M	S
CLO4.	S	S	S	M	S
CLO5.	S	M	S	S	M

Course 24 - PL21C09

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	S	S
CLO2.	S	S	S	S	S
CLO3.	S	S	M	S	S
CLO4.	S	S	S	M	S
CLO5.	S	M	M	S	M

Course 25- PL21E04

COs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	S
CLO2	S	S	S	M	S
CLO3	S	S	S	M	M

Course 26 - PL21E05

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M
CLO5.	S	S	S	S	S

Course 27 - PL21E06

CLOs	PLO1	PLO	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	M	S	S	M
CLO3.	M	M	M	M	S
CLO4.	S	S	S	M	S

Course 28- PL21CP4

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	M	S	S	M	S
CLO2.	S	M	M	S	S
CLO3.	M	S	S	S	M
CLO4.	S	M	S	S	S

Course 29 – PL16AC3

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	S	S
CLO2.	S	S	S	M	S

CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M
CLO5.	S	S	S	M	M

Course 30– PL19AC4

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	S	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M
CLO5.	S	S	S	M	M

Course 31 - PL21SBP1

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	M
CLO2	S	S	M	M	M
CLO3	S	S	M	M	S
CLO4	S	S	M	M	S

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21C01	Core Paper I - Microbiology & Plant diversity I	CORE	86	4	-	5

Preamble

To study the characteristics and life cycle of Bacteria, Virus, Algae, Fungi and Lichens.
 To study various plant diseases and their control measures.
 To impart knowledge on Artificial Intelligence and its types.

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Classify the microbes and understand the characteristics of Bacteria and viruses	K1
CLO2	Acquire knowledge about the diversity of Algae based on structure and reproduction	K2
CLO3	Know about the morphology, reproduction and economic importance of fungi and lichens	K2
CLO4	Identify the causes, symptoms and control measures of plant diseases	K2
CLO5	Familiarize with Artificial intelligence and its types.	K3

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	M	M
CLO3	M	S	M	S	S
CLO4	S	M	S	M	M
CLO5	S	M	M	S	S

S- Strong; M-Medium

Syllabus

Unit-I Microbiology

17 hrs

History and scope of microbiology. Structure and reproduction of viruses. Bacteria: Morphology, ultra structure, growth and reproduction. Bacterial classification (Bergey, 1923). Gram staining. Study of bacterial growth curve. Microbial technique - methods of sterilization, culture media and pure culture techniques.

Unit-II Algae

19hrs

General characteristics of algae, Classification (Fritsch, 1935). A detailed study of the structure, reproduction and life cycle of *Anabaena*, *Chlamydomonas*, *Oedogonium*, *Ectocarpus*, and *Polysiphonia* (developmental studies on sex organs not required). Economic importance of Algae.

Unit-III Fungi and Lichens

21 hrs

General characteristics of Fungi. Classification (Alexopoulos and Mims, 1972). Detailed study of morphology and reproduction of *Albugo*, *Saccharomyces*, *Penicillium*, *Puccinia*, *Polyporus* and *Aspergillus* (developmental studies on sex organs not required). Economic importance of Fungi.

Lichens: General characteristics, classification (Alexopoulos and Mims, 1979), reproduction and economic importance of Lichens. Detailed study of *Usnea*.

Unit- IV Plant Pathology

19 hrs

Classification of diseases– general symptoms. Penetration and disease development. Morphological and biochemical defense mechanisms in plants. A detailed study of the following plant diseases – Mosaic disease of tobacco, Citrus canker, Late blight of Potato, Red rot of sugarcane, Tikka disease of groundnut (causal organisms, symptoms, disease cycle and bio-control measures).

Unit-V

10 hrs

Artificial Intelligence-Definition; Types- Weak AI or Narrow AI, General AI and Super AI. Brief introduction to solutions to real-world problems by implementing the following AI processes/ techniques: 1-Machine Learning, 2- Deep Learning, 3- Natural Language Processing and 4- Robotics. AI to reintegrate biology: Biological knowledge discovery and assembly, Behavioural ecology, Genes to phenotypes, Prediction, evolution, and control of infectious diseases.

Text Books

S. No.	Authors	Year of publication	Title of the book	Publishers
1.	Vashishta, B.R., Sinha, A.E and Singh, V.P	2013	Algae	S Chand and Company Ltd., New Delhi
2.	Sharma O.P	2011	Algae	Tata Mc Graw-Hill Education
3.	Sharma O.P	2011	Fungi and allied microorganisms	Tata Mc Graw-Hill Education
4.	Purohit, S.S	2017	Microbiology- Fundamentals & Applications (7 th edition)	Rastogi Publications, Meerut
5.	Pandey, B.P	2005	College Botany Vol I	S Chand & Company, New Delhi.
6.	Vashishta B.R./ Sinha A.K. & Kumar Adarsh	2016	Botany for degree students Fungi	S. Chand and Company Ltd., New Delhi

Reference Books

S. No.	Authors	Year of publication	Title of the book	Publishers
1.	Alexopoulos, CJ, Mims CW & Blackwell M	2007	Introductory Mycology	John Wiley & Sons, New York
2.	Gangulee, HC. & Kar AK	2011	College Botany, Vol-II	New Central Book Agency Pvt.Ltd.Calcutta.

3.	Mehrotra, RS & Aneja, KR	2015	An introduction to Mycology, 2nd Ed.,	New Age International Private Limited, New Delhi
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Online course materials

1. <https://www.researchgate.net/publication/354185787>
2. <https://www.edureka.co/blog/types-of-artificial-intelligence/>
3. <https://www.mygreatlearning.com/blog/what-is-artificial-intelligence/#WhatisArtificialIntelligence>

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designers

1. Dr. C. Krishnaveni
2. Dr.M. Kanchana
3. Dr.H. Rehana banu

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21C02	Core Paper II - Plant Diversity II (Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany)	CORE	71	4	-	5

Preamble

To study the classification, characteristics and life cycle of Bryophytes, Pteridophytes and Gymnosperms

To study the process of fossilization, geo-chronology and radio-carbon dating

Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Classify Bryophytes, understand its lifecycle	K2
CLO2	Understand the characteristics of Pteridophytes and their classification	K2
CLO3	Assess the evolutionary features in Pteridophytes	K3
CLO4	Understand the characteristics of Gymnosperms and their classification	K2
CLO5	Interpret the evolutionary sequence with the knowledge of the geological time scale	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	M	M	S
CLO4	S	S	M	M	M
CLO5	S	S	S	S	S

S- Strong; M-Medium

Syllabus

Unit I - Bryophytes

14hrs

General characteristics, Classification of Bryophytes (Reimers-1954), occurrence, distribution, common species, structure and reproduction of *Marchantia*, *Anthoceros* and *Funaria* (developmental studies on sex organs not required). Economic and ecological importance of Bryophytes.

Unit II - Pteridophytes**14hrs**

General characteristics and Classification of Pteridophytes (Sporne, 1975). Stellar Evolution Homospory, heterospory and seed habit. Economic importance of Pteridophytes.

Unit III – Pteridophytes(Contd..)**14hrs**

A detailed study of morphology, anatomy and reproduction of *Psilotum*, *Lycopodium*, *Equisetum Marsilea* (developmental studies on sex organs not required).

Unit IV- Gymnosperms**14hrs**

General characteristics, distribution and classification (Sporne, 1965). Detailed study of morphology, anatomy, reproduction of *Cycas*, *Pinus* and *Gnetum* (developmental studies on sex organs not required). Economic importance of Gymnosperms.

Unit V- Palaeobotany**15hrs**

Fossils, fossilization process, Types of fossils: compression, impression, petrification, coal balls. Geological time scale. A detailed study of external and internal morphology and reproduction in *Rhynia*, *Lepidodendron*, *Lepidocarpan*, and *Calamites*.

Text Books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Vasishta.B.R , Sinha & Adarsh Kumar	2012	Botany for Degree students –Bryophyta	S Chand And Company Ltd., New Delhi
2.	Sharma O.P	2011	Bryophyta	Tata Mc Graw-Hill Education
3.	Sharma O.P	2011	Pteridophyta	Tata Mc Graw-Hill Education
4.	Vasishta PC, Sinha AK & Anilkumar	2005	Botany for degree students,	S Chand And Company Ltd., New Delhi.
5.	Pandey, B.P	2003	College Botany Vol II	S Chand & Company, New Delhi

Reference Books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Arnold. C. A.	2013	An Introduction to Palaeobotany	McGraw Hill Book Company, London
2.	Sporne, KR	1974	The Morphology of Gymnosperms	Hutchinson & Co., London.
3.	Sporne, KR	2015	The Morphology of Pteridophytes	Hutchinson & Co., London
4.	Steward.N.Wilson & Rothwell, W. Gar	2005	Palaeobotany and evolution of Plants	Cambridge University Press

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designers:

1. Dr. C. Krishnaveni
2. Dr. K.S. Tamilselvi
3. Dr. B. S. Chithra Devi
4. Dr. R. Sumathi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21CP1	Core Practical – I (Theory Paper - I and II – Microbiology, Plant diversity I and Plant Diversity II)	CORE	-	-	90	4

Preamble

- To observe, characterize and identify the different types of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and fossilized plants.
- To identify and differentiate the various plant diseases and the causative organisms.
- To isolate microorganisms from soil and establish pure cultures
- To distinguish between Gram positive and Gram negative bacteria

Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Remember and differentiate the different forms of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and fossilized plants.	K1
CLO2	Know the host – pathogen interactions	K2
CLO3	Prepare sterile microbial culture media and demonstrate pure culture techniques	K3
CLO4	Interpret the industrial impact of fermentation process	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	S
CLO2	S	S	M	M	M
CLO3	S	S	M	M	S
CLO4	S	S	M	M	M

S- Strong; M-Medium

Syllabus

45 Hrs

Algae - *Anabaena, Chlamydomonas, Oedogonium, Ectocarpus* and *Polysiphonia*

Fungi - *Albugo, Saccharomyces, Penicillium, Puccinia, Polyporus* and *Aspergillus*

Lichens - *Usnea*

Plant pathology- Mosaic disease of tobacco, Citrus canker, Late blight of potato, Red rot of sugarcane, Tikka disease of groundnut.

Microbial Techniques

Sterilization techniques.

Preparation of culture media: Nutrient broth and Nutrient Agar medium

Potato Dextrose Agar Medium

Preparation of slants

Soil dilution, Plating techniques, Enumeration of bacteria and fungi.

Microscopic observation of fungi- Lactoglycerol trypan blue staining,

Microscopic observation of bacteria- Gram staining

Fermentation using yeast

45Hrs

Study of the following types

Bryophyta- *Marchantia, Anthoceros* and *Funaria*.

Pteridophyta- *Psilotum, Lycopodium, Equisetum* and *Marsilea*

Gymnosperms - *Cycas, Pinus* and *Gnetum*

Palaeobotany - *Rhynia, Lepidodendron, Lepidocarpan* and *Calamites*

Course Designers:

1. Dr. C. Krishnaveni
2. Dr. M. Kanchana
3. Dr.K.S. Tamil Selvi
4. Dr. H. Rehana banu
5. Dr.E. Uma

COURSE NUMBER	COURSENAME	Category	L	T	P	Credit
21PELS1	PROFESSIONAL ENGLISH FOR LIFE SCIENCES		40	5	--	2

Objectives

1. To develop the language skills of students by offering adequate practice in professional contexts.
2. To enhance the lexical, grammatical and socio-linguistic and communicative competence of first year physical sciences students
3. To focus on developing students' knowledge of domain specific registers and the required language skills.
4. To develop strategic competence that will help in efficient communication
5. To sharpen students' critical thinking skills and make students culturally aware of the target situation.

CourseOutcomes

On the successful completion of the course, students will be able to

CLO Number	CO Statement	Knowledge Level
CLO1	Recognise their own ability to improve their own competence in using the language	K1
CLO2	Use language for speaking with confidence in an intelligible and acceptable manner	K2
CLO3	Read independently unfamiliar texts with comprehension and understand the importance of reading for life	K3
CLO4	Understand the importance of writing in academic life	K3
CLO5	Write simple sentences without committing error of spelling or grammar	K3

(Outcomes based on guidelines in UGC LOCF – Generic Elective)

Mapping with ProgrammeOutcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	M	M	S
CLO4	S	S	M	M	M
CLO5	S	S	S	S	S

S- Strong; M-Medium

Syllabus

UNIT 1: COMMUNICATION**8 hours****Listening:** Listening to audio text and answering questions**Speaking:** Pair work and small group work.**Reading:** Comprehension passages –Differentiate between facts and opinion**Writing:** Developing a story with pictures.**Vocabulary:** Register specific - Incorporated into the LSRW tasks**UNIT 2: DESCRIPTION****8 hours****Listening:** Listening to process description.-Drawing a flow chart.**Speaking:** Role play (formal context)**Reading:** Skimming/Scanning- Reading passages on products, equipment and gadgets.**Writing:** Process Description –Compare and Contrast Paragraph-Sentence Definition and Extended definition- Free Writing.**Vocabulary:** Register specific -Incorporated into the LSRW tasks.**UNIT 3: NEGOTIATION STRATEGIES****8 hours****Listening:** Listening to interviews of specialists / Inventors in fields (Subject specific)**Speaking:** Brainstorming. (Mind mapping).Small group discussions (Subject- Specific)**Reading:** Longer Reading text.**Writing:** Essay Writing (250 words)**Vocabulary:** Register specific - Incorporated into the LSRW tasks**UNIT 4: PRESENTATION SKILLS****8 hours****Listening:** Listening to lectures.**Speaking:** Short talks.**Reading:** Reading Comprehension passages**Writing:** Writing Recommendations Interpreting Visuals inputs**Vocabulary:** Register specific - Incorporated into the LSRW tasks**UNIT 5: CRITICAL THINKING SKILLS****8 hours****Listening:** Listening comprehension- Listening for information.**Speaking:** Making presentations (with PPT- practice).**Reading :** Comprehension passages –Note making.Comprehension: Motivational article on Professional Competence, Professional Ethics and Life Skills)**Writing:** Problem and Solution essay– Creative writing –Summary writing**Vocabulary:** Register specific - Incorporated into the LSRW tasks**Textbook**

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	TamilNadu State Council for Higher Education (TANSICHE)	English for Life Sciences Semester 1	--	--

Reference Books

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	Sreedharan, Josh	The Four Skills for Communication	Foundation books	2016
2	Pillai, G Radhakrishna, K Rajeevan, P Bhaskaran Nair	Spoken English for you	Emerald	1998
3	Pillai, G radhakrishna, K Rajeevan, P Bhaskaran Nair	Written English for you	Emerald	1998

Evaluation pattern : Internal 50 marks
ESE 50 marks

NOTE :

Internals 5 tests x 10 marks each =50 marks

Test 1 : Listening

Test 2 : Speaking

Test 3 : Reading

Test 4 : Listening

Test 5 : Speaking

ESE :Only Reading, Writing and Vocabulary components from all 5 units

Question Paper pattern for ESE

Section A : 5 x 2 = 10 marks

Section B : 4/6 x 5 = 20 marks

Section C : 2/3 x 10 = 20 marks

Total = 50 Marks

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21C03	Paper - III Cell and Molecular Biology	Core	71	4	-	5

Preamble

- To study the structure and function of basic components of prokaryotic and eukaryotic cells, cell membranes and cell wall
- To study the structure and function of cell organelles
- To appreciate the cellular components underlying mitotic cell division.
- To understand the structure and function of DNA, RNA.
- To appreciate the central dogma of life, protein synthesis

Course outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1.	Recall the structure and function of prokaryotic and eukaryotic cells, cell membranes, cell wall and cell organelles	K1
CLO2.	Know the cell cycle and cell division	K1
CLO3.	Understand the structure and function of DNA, RNA	K2
CLO4.	Appreciate the concept of transcription and translation	K2

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M

S- Strong; M-Medium

Syllabus

Unit-1

14 hrs

*Prokaryotic and eukaryotic cell – structure: *cell wall, *plasma membrane and *cytoplasm – *structure and function. Cell organelles- Mitochondria, chloroplast, Endoplasmic reticulum, Golgi body, Lysosomes, *Vacuoles and Ribosomes, Nucleus; *Cell cycle, *Cell division- mitosis and meiosis.

Unit-II

14 hrs

*Chromosomes-Structure and function *Classification based on position of centromere. *Types - Lampbrush and Polytene chromosomes. Euchromatin and heterochromatin (outline only). Karyotype and Idiogram: Definition, Process, Significance.

Unit-III

14 hrs

*Nucleic acids: Structure and function of DNA (Watson and Crick Model), *DNA replication- conservative and semi-conservative. RNA– structure, function& Types (tRNA, mRNA and rRNA).

Unit-IV

14 hrs

Transcription in prokaryotes and eukaryotes – initiation, elongation and termination.

*Difference between prokaryotic and eukaryotic transcription. Gene regulation- prokaryotes-operon concept (lac operon).

Unit- V

15 hrs

*Genetic code- concept and properties, *wobble hypothesis, *Central dogma of life, Translation in prokaryotes and eukaryotes – initiation, elongation and termination. Difference between prokaryotic and eukaryotic translation.

Note: *Online Learning

Text Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1.	Gupta P.K.	1988	Cell and Molecular Biology	Rastogi publications. Tata Mc Graw Hill, New Delhi
2.	P.S. Verma and Agarwal V.K.	2004	Cell biology, Genetics, Molecular Biology, Evolution and Ecology.	S. Chand and Company, New Delhi.
3.	Shukla, R.S. and Chandel, P.S.	2009	Cytogenetics, evolution, Biostatistics and Plant Breeding	S. Chand & Co, New Delhi
4.	Verma, P.S. and Agarwal, V.K	2010	Cytology, Genetics and plant breeding.	S.Chand& Co, New Delhi

Reference Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1.	De Robertis and De Robertis.	2005	Cell and Molecular biology	Lippincott Williams and Wilkins. UK
2.	David Freifelder	2008	Molecular Biology	Narosa Publishing House.
3.	Ajoy Paul.	2011	Cell and Molecular Biology	3 rd edition, Books and Allied Pvt Ltd., Kolkatta
4.	Geoffrey M. Cooper and Robert E. Hausman,	2013	The Cell – A Molecular Approach.	6 th Edition, Sinauer Associates, Inc. Publishers - Sunderland, Massachusetts U.S.A.

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designers

Dr.K.Gajalakshmi

Dr.S. Subhashini

Dr. K. SunithaKumari

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21SB01	Skill Based Subject I- Horticulture	SBS	43	2	-	3

Preamble

- To impart skill-oriented knowledge on the fundamental aspects of horticulture.
- To learn the soil types and their impact on growth of plants
- To know the methods of plant propagation
- To understand the different plant growing structures

Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1.	Acquire knowledge about the fundamental aspects of horticulture	K1
CLO2.	Understand the different techniques in gardening	K2
CLO3.	Know the cultivation of horticultural plants through various propagation techniques and structures	K2
CLO4.	Apply the knowledge in flower arrangement technique, hydroponics and microgreens	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	S	S
CLO2.	S	S	S	M	S
CLO3.	M	S	M	S	S
CLO4.	M	M	M	M	M

S-Strong; M- Medium

Syllabus

Unit I

9 hrs

History and importance of horticulture, Branches in horticulture ;Soil types, Inorganic fertilizers–Nitrogen, phosphorous, potassium, mixed fertilizers, organic fertilizers, bio-fertilizers, biopesticides

UnitII

9 hrs

Techniques in horticulture -Selection of site, Preparation of soils for garden; Mulching, top-dressing, blanching; Sowing, transplantation; Irrigation - Overhead, Surface, Underground; Weeding and pruning- Principles, Objectives and general technique.

Unit III

9 hrs

Plant Propagation techniques- Cutting-root, stem, leaf cutting; Layering- Simple, Tip, Serpentine, Trench, Mound and Airlayering; Grafting- Approach, Cleft, Splice, Bark, Side Veneer, Whip and Tongue, Saddle, Bridge Inarch grafting; Budding-T-patch and H-chip budding

Plant propagating structures- Shade Houses, Greenhouse, Hot beds; Lath houses, Mist chambers, Nursery bed, Plastic Mulch, Light Chamber, High-Humidity Chambers.

Unit IV

8 hrs

Commercial Horticulture- Study of cut flower, production technology of Carnation, Gerbera, Anthurium, Gladiolus, Post harvest management of cut flowers – Floral decorations, bouquets and dry flowers – Grading, packing and marketing of flowers; Introduction to Hydroponics and Microgreens

Unit V

8 hrs

Landscape gardening-Importance; Principles; Garden adornments; Garden Types-Formal, Informal, Free style; Garden features -Walls, Fencing, Hedges, Edges, Arches, Pergola, Lawn, Shrubbery, Rockery, Topiary; Famous Gardens in India.

Text books

S.No.	Authors	Year of publication	Title of the book	Publishers
1.	Kumaresan, V	2014	Horticulture	Saras Publications, Nagercoil.
2.	Kumar.N	2010	Introduction to Horticulture	Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
3.	Bansil,P.C.	2008.	Horticulture in India.	CBS Publishers and Distributors, NewDelhi.
4.	Manibhushan Rao.K.	1991.	Text Book of Horticulture	Macmillan India Ltd, New Delhi

Reference Books

S. No.	Authors	Year of publication	Title of the book	Publishers
1.	Rajan,S. and B.L.Markose,	2007	Propagation of horticultural crops.	Pitam Pura, New Delhi
2.	Bhattacharjee,S.K.	2006	Horticulture, Biotechnology and post harvest technology,	Pointer publishers, Jaipur.
3.	Christopher, E.P,	2001	Introductory Horticulture	Biotech Books, New Delhi.

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designer

Dr. K.S.TamilSelvi

Dr.Sarah Jaison

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21SBCE	SBS / Coursera - Climate Change and Health: From Science to Action	SBS	45	-	-	3

S.No.	Topic of the Course	Link of the Course	Duration in hrs
1.	What is Climate Change?	https://www.coursera.org/learn/what-is-climate-change?specialization=our-responses-climate-change	6
2.	Tropical Forest Landscapes 101: Conservation & Restoration	https://www.coursera.org/learn/tropicalforests101	20
3.	Climate change and Indigenous People and local communities	https://www.coursera.org/learn/climate-change-indigenous-communities	14
4.	Our Earth's future	https://www.coursera.org/learn/earth-climate-change	8

1. What is Climate change?

Week 1 - The Climate System and Climate Change – 2 hours

Week 2 - Impacts of Climate Change – 2 hours

Week 3 - Attitudes About Climate Change – 3 hours

2. Tropical Forest Landscapes 101: Conservation & Restoration

Week 1 - Why conserve and restore tropical forest landscapes? – 3 hours

Week 2 - Ecology of tropical forest landscapes – 3 hours

Week 3 - Social considerations for restoration and conservation – 3 hours

Week 4 - Conservation strategies – 3 hours

Week 5 - Restoration fundamentals – 3 hours

Week 6 - Agroforestry and agroecology – 3 hours

Week 7 - Funding conservation and restoration – 4 hours

3. Climate change and Indigenous People and local communities

Week 1 - Climate change and Indigenous Peoples and local communities – 1 hour

- Introduction – 2 hours

Week 2 - Climate change impacts on indigenous peoples and local communities – 3 hours

Week 3 - Coping and adapting to climate change impacts – 3 hours

Week 4 - Local Indicators of climate change impacts – 2 hours

Week 5 - The role of IPLC in global climate governance – 3 hours

4. Our Earth's future

Week 1 - Climate Change Is Happening: See It – 2 hours

Week 2 - It All Comes Down to the Ocean – 1 hour

Week 3 - Climate Change is Happening: Model It – 1 hour

Week 4 - Living with Climate Change – 1 hour

Week 5 - Mitigate, Adapt, or Suffer? – 2 hours

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21A01	Allied Paper – I: Fundamentals of Botany - I	Allied	71	4	-	4

Preamble

- To study the characteristics and life cycle of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms
- To gain knowledge of adaptations of plants to different environments
- To learn the horticulture techniques.

Course outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Know about characteristics and life cycle of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms	K1
CLO2	Understand the concept of plant adaptations to different environments	K2
CLO3	Appraise the horticulture techniques.	K2

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	M	M	S	S
CLO2	S	S	M	M	M
CLO3	S	S	S	S	S

S- Strong; M-Medium

Syllabus

Unit I

14 hrs

General characteristics and classification of Algae (Fritsch-1935,1948) - A study of distribution, structure, reproduction and life cycle of *Volvox*. *Economic importance of algae, General characteristics and classification of Fungi (Alexopoulos and Mims, 1979) –A study of distribution, structure, reproduction and life cycle of *Saccharomyces*. *Economic importance of Fungi. General characteristics, classification (Zahlbruckner,1907), reproduction and *Economic importance of Lichens.

Unit II

14hrs

*General characteristics and Classification of Bryophyte (Engler,1892)- Structure, Reproduction and Life cycle of *Riccia*, *General characteristics and Classification of Pteridophytes (Reimer,1954) - Structure, Reproduction and Life cycle of *Lycopodium*,

*General characteristics and Classification of Gymnosperms (Sporne-1965) - Structure, Reproduction and Life cycle of *Cycas*.

Unit III

14 hrs

General Characteristics and Classification of Angiosperms (Bentham and Hooker, 1883). *Morphology of stem, *root, *leaf, *inflorescence, *flower and *fruit. Study of the following families with their Economic importance – Annonaceae, Rutaceae, Rubiaceae, Lamiaceae, Amarantaceae and Poaceae.

Unit- IV

14 hrs

Ecology –*Plant adaptations. Xerophytes - *Nerium*, *Opuntia*. Mesophytes -*Helianthus*, *Hibiscus*. Hydrophytes-*Hydrilla*, *Nelumbium*. *Phytogeography –*Vegetations of Tamil Nadu: *Evergreen, *scrub jungle, *Mangrove

Unit V

15 hrs

Horticulture: scope and importance, *propagation methods –*cutting, *layering and *grafting techniques), gardening and landscaping, *irrigation methods, manures, lawns, indoor plants, bonsai techniques.

Note: *Online Learning

Text Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1.	Srivastava, H.N	2004	Algae	Pradeep Publications, Delhi
2.	Srivastava, H.N.	2004	Fungi.	Pradeep Publications, Delhi
3.	Srivastava, H.N.	2004	Pteridophytes	Pradeep Publications, Delhi
4.	Pandey, P.B	2001	Plant Anatomy	S. Chand & Co, New Delhi
5.	Singh, V. and Jain	1981	Taxonomy of Angiosperms	Rastogi Publications, New Delhi
6.	Purohit S.S & Ranjan .R	2003	Ecology, Environment and Pollution (First Edition)	Agrobios, India, Jodhpur

Reference Books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Sharma O.P.	2009.	Plant Taxonomy	Tata McGraw Hill Comp, New Delhi
2.	Pandey, B. P.	1992	Taxonomy of Angiosperms	S. Chand & Co, New Delhi

Pedagogy: Powerpoint, lecture, seminar, quiz and discussion.

Course Designers

Dr. R. Sumathi
Mrs. P. Kemila

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
NM21EVS	Foundation Course-II Environmental Studies	AEC	Self-study	-	-	Grade

Unit I - Multidisciplinary Nature of Environmental studies **3 hrs**

Prologue, Definition, Scope and Significance, Need for public awareness.

Unit II - Natural resources **3 hrs**

Renewable and non-renewable resources, Natural resources and associated problems. Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources, Role of an individual in conservation of natural resources and Equitable use of resources for sustainable lifestyles.

Unit III – Ecosystems **3 hrs**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Food chains and food webs, Ecological pyramids, Ecological succession, Types of ecosystems

Unit IV - Biodiversity and its conservation **4 hrs**

Introduction, Levels of biodiversity - genetic, species and ecosystem, Biogeographical classification of India, Value of biodiversity, Biodiversity at global, National and local levels, India as a megadiversity nation, Hotspots of biodiversity, Threats to biodiversity, Endangered and Endemic species of India, Conservation of biodiversity.

Unit V - Environmental Pollution **4 hrs**

Definition – Air, Water, Soil, Marine, Noise and Thermal pollution, Nuclear hazards, Solid waste management, Disaster management, Role of an individual in pollution management, Case studies

Unit VI - Social issues and the environment **4 hrs**

From unsustainable to sustainable development, Urban problems related to energy, Water conservation, Climatic changes, Wasteland reclamation, Consumerism and waste products, Environment protection Acts, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act, Enforcement of environment legislation, Public awareness

Unit VII - Human population and the environment **4 hrs**

Population growth and explosion, Family Welfare programme, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and child welfare, Role of information technology in Environment and human health

Unit VIII - Field work

5

hrs Topics for field work and project, Guidelines for field work and project, Project report.

References

1. Agarwal.K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email: maping@icenet.net(R)
3. Brunner.R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
4. Clark.R.S, Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham.V.P, Cooper, T.II.Gorhani.E&Hepworth.M.T, 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick.H.P, 1993, Water in crisis, Pacific Institute for Studies in Dev. Environment & Security, Stockholm Env. Institute Oxford Univ. Pres 173 p
9. Hawkins.R.E, Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay ®
10. Heywood.V.II& Watson.R.T.1995, Global Biodiversity Assessment. Cambridge Univ.Press 11.10p
11. Jadhav.II& Bhosale.V.M.1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mekinney.M.I&Schoeh.R.M 1996, Environmental Science systems & Solutions, Web enhanced edition 639p.
13. Mhaskar.A.K, Matter Hazardous, Techno-Science Publications (TB)
14. Miller.T.G. Jr., Environmental Science, Wadsworth Publishing Co,(TB)
15. Odum.E.P 1971, Fundamentals of Ecology, W.B.Saunders Co. USA. 574p
16. Rao.M.N&Datta.A.K. 1987, Waste Water treatment, Oxford & IBM Publ. Co. Pvt. Ltd. 345 p.
17. Sharma.B.K. 2001, Environmental Chemistry, Goel Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend.C, Harper.J and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
20. Trivedi.R.K, Handbook of Environmental Laws, Rules, Guidelines, compliances and Standards, Vol I and II Enviro Media (R).
21. Trivedi.R.K and P.K.Goel, Introduction to air pollution, Techno-Sciences Publications (TB)
22. Wagner.K.D., 1998, Environmental Management. W.B.Saunders Co., Philadelphia, USA 499p (M) Magazine; (R) Reference; (TB) Textbook

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21C04	Paper - IV – Plant Anatomy, Wood Technology and Embryology	Core	71	4	-	5

Preamble

- To know the anatomical structure of the Angiosperm plants
- To identify woods of commercial importance
- Methods of preserving and seasoning woods.
- To study the structure and development of embryo

Course outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Know the fundamental structure of different plant tissue system	K1
CLO2	Understand the development of different types of cells in plant system	K2
CLO3	Identify the quality of wood	K3
CLO4	Analyse the Anatomical variation between the plant species	K4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	S	M	S	M	M
CLO3	S	S	M	S	M
CLO4	S	S	M	M	M

S- Strong; M-Medium

Syllabus

Unit I

(14 hrs)

Plant Anatomy: General account on Meristems. *Shoot Apical Meristems, theories - apical cell theory, histogen, tunica and corpus*. Root Apical Meristems- Korper and Kappe theory and Quiscent centre theory. Simple tissues- parenchyma, collenchyma and sclerenchyma.

Unit II

(14 hrs)

Evolution of plant vascular system. Complex tissues – primary xylem and phloem, secondary xylem and phloem. Primary structure of dicot and monocot stem; dicot and monocot root. Anatomical structure of dicot and monocot leaf. Epidermal Tissues -Types of stomata and *Secretory tissues*.

Unit III:

(14 hrs)

Formation of Secondary thickening in Dicot stem and Dicot root. Anomalous secondary thickening in Dicot stems - *Nyctanthus* and *Boerhaavia*; Dicot root of *Beta vulgaris*. *Anomalous secondary thickening in monocot stem – *Dracaena**.

Unit IV:

(14 hrs)

Wood Technology: Brief account on the formation and types of woods. Annual rings and Dendrochronology. Physical, Chemical, and Mechanical properties of wood. *Defects in woods*. *Seasoning of woods*, Methods of preservation of wood, and uses of wood.

Unit V: (15 hrs)

Embryology: Microsporogenesis and development of male gametophyte; Megasporogenesis and development of female gametophyte. Structure of 8 nucleate monosporic embryosac (*Polygonum*), Bisporic (*Allium*), tetrasporic (*Peperomia*). *Fertilization and Double Fertilization*. *Types of endosperm*. Development of monocot (*Luzulla*) and dicot (*Capsella*) embryo.

Note: *Blended Learning

Text Books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Pandey.BP.	2001	Plant Anatomy	Sixth Revised edition. S.Chand and company.
2.	Tayal, MS	2004	Plant Anatomy	Rastogi Publications
3.	Katherine Esau	2011	Anatomy of seed plants	John Wiley and Sons. U.S.A.
4.	Singh, V., Pande, PC. and Jain, DK	2018	Anatomy and Embryology of Angiosperms	Rastogi Publications
5.	Christian Brischke	2020	Wood Protection and Preservation	Mdpi AG

Reference Books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	D.F.Cutter, C.E.J Bottla, D.W.Stevenson,	2011	Plant Anatomy, An applied Approach	Blackwell Publishing. Australia.
2.	Franz F. P. Kollmann, Wilfred A. Côté	2020	Principles of Wood Science and Technology	Springer Berlin, Heidelberg
3.	Bhojwani, SS., Bhatnagar, SP and Dantu, PK	2020	The Embryology of Angiosperms	S Chand publishers

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Links for blended learning

S.No.	Unit	Topic	Link for the topic
1.	Unit I	Shoot Apical Meristems, theories - apical cell theory, histogen, tunica	https://www.youtube.com/watch?v=03K82iPyWS0

		and corpus	
2.	Unit II	Secretory tissues	https://www.youtube.com/watch?v=03K82iPyWS0
3.	Unit III	Anomalous secondary thickening in monocot stem – <i>Dracaena</i>	https://m.youtube.com/watch?v=lp4rIgsRdLc https://byjus.com/biology/ts-of-dracaena-stem/
4.	Unit IV	Defects in woods	https://www.youtube.com/watch?v=9zT3qaZJxIw
		Seasoning of woods	https://www.youtube.com/watch?v=qHzIWI7CS8E
5.	Unit V	Fertilization and Double Fertilization	https://www.youtube.com/watch?v=dgFY7WUTASQ
		Types of endosperm	https://www.youtube.com/watch?v=bUjVHUf4d1I

Course Designer

Dr.M.Kamalam

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDI T
PL21CP2	Core Practical II (Core Papers III and IV)	Core	-	-	60	4

Preamble

- To study the structural and functional aspects of various tissue systems and organs of dicots and monocots.
- To discuss the structure and functions of the meristematic, primary & complex tissues.
- To understand the structure of cells in relation to the functional aspects.
- Understand the cellular components underlying cell division.

Course outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the structure of the cell organelles through electron micrographs.	K1
CLO2	Understand the structure and functions of the meristematic, primary and complex tissues.	K2
CLO3	Distinguish between normal and anomalous secondary growth.	K2
CLO4	Discuss the development of the endosperm and embryo.	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	S
CLO2	M	S	S	M	S
CLO3	S	S	M	S	M
CLO4	M	S	S	M	S

S- Strong; M-Medium

Syllabus

Paper III - Cell and Molecular Biology

(30hrs)

- Study of plant cell organelles through photomicrographs/permanent slides-

- Cell wall
- Plasma membrane (Fluid Mosaic model)
- Nucleus
- Mitochondria
- Chloroplast
- Endoplasmic reticulum
- Golgi body

- Lysosomes
 - Vacuoles
 - Ribosomes
 - Lampbrush and Polytene chromosomes.
- Study of cytological techniques (virtual mode). G-banding and Karyotype techniques
 - Study of Nucleic acids by micrographs
 - DNA (Watson & Crick model), t-RNA (clover leaf model).
 - Study of various stages of mitosis using cytological preparation of Onion root tips.
 - Study of various stages of meiosis using cytological preparation of Flower bud-anther.

Paper IV – Plant Anatomy, Embryology and Wood technology: (30hrs)

Sectioning and Identification:

Plant Anatomy:

- Primary structure of Leaf, stem and root of dicot and monocot.
- Secondary thickening in dicot stem -*Polyalthia* and root – *Vigna*.
- Anomalous secondary thickening in the stems - *Nyctanthus* and *Boerhaavia*;
- Root – *Beta vulgaris*.
- Anomalous secondary thickening in the monocot stem-*Dracaena*.

Spotters: Book diagram/Permanent slides/Photographs

- Meristems – shoot and root apex
- Xylem – tracheids and vessels
- Phloem
- Annual rings
- Wood preservatives
- Defects in wood.

Embryology:

- T.S of anther
- Types of ovules
- Types of embryosac- uninucleate, bi-nucleate and mature embryosac
- Types of endosperms – nuclear, cellular and helobial
- Embryo mounting (*Tridax*)

Course Designers

Dr. M. Kamalam

Dr.K.Gajalakshmi

Dr.E.Uma

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21SB02	Skill Based Subject II - Horticulture	SBS	43	2	-	3

Preamble

- To impart the knowledge on the horticultural wealth of India
- To get acquainted to commercial floriculture
- To develop skill in post-harvest technology
- To understand the concept of packing and marketing of horticultural products
- To understand agripreneurship and its concepts

Course outcomes

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1.	Understand the techniques involved in cultivation and maintenance of commercial flowers	K1
CLO2.	Apply the techniques in commercial horticulture	K2
CLO3.	Skilled in the post-harvest technology	K3
CLO4.	Understand the strategies to become women entrepreneurs.	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	S	M
CLO2.	S	M	S	S	M
CLO3.	M	S	S	M	S
CLO4.	S	S	S	S	S

S- Strong; M-Medium

Syllabus

Unit I

9 hrs

Scope and importance of commercial floriculture in India. Production techniques of commercial flower crops - Rose, Chrysanthemum, Tuberose, Gladiolus, Dahlia, Marigold, Jasmine, Crossandra, Bird of Paradise, Lilies and Heliconia. Postharvest management of flower crops

Unit II

7 hrs

Flower arrangement concepts and Ikebana- techniques, types, suitable flowers and cut foliage. Dry flowers- dehydration techniques and preservation. Floral arts and adornments, Bonsai culture and maintenance

Unit III

9 hrs

Importance of post-harvest technology in horticulture crops, pre-harvest factors affecting quality, post-harvest losses and factors responsible for deterioration of horticulture produce; Maturity indices, physiological and biochemical changes during ripening process, hastening and delaying of ripening process

Unit IV

9 hrs

Harvesting, handling, curing, grading and pre-cooling of horticulture produce; Packaging, types of packages, recent advances in packaging, use of grape guard in packaging, cushioning materials; Transportation and modes of transport; Marketing of fresh produce; Pre and post-harvest treatments for extending storage life; Principles and methods of storage.

Unit V

9 hrs

Agripreneurship: definition, nature, scope, importance, types, functions and dimensions, characteristics of successful entrepreneur, approaches to entrepreneurship, Factors affecting entrepreneurial growth - psychological factors, cultural factors, social factors, economic factors, personality factors, Women entrepreneurship concept, importance, problems and remedies

Text Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1.	Kumaresan, V	2014	Horticulture	Saras Publications, Nagercoil.
2.	Bansil, P.C.	2008	Horticulture in India.	CBS Publishers and Distributors, New Delhi
3.	K.L.Chadda,	2009	Advances in Horticulture.	Malhotra Publishing House, New Delhi.
4.	Dhillon, W.S.	2013	Fruit Production In India	Narendra Publishing House. New Delhi

Reference Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1.	Rajan, S and Markose, B.L.	2007	Propagation of horticultural crops.	New India Publishing Agency, New Delhi
2.	Bhattacharjee, S.K.	2006	Horticulture, Biotechnology and post harvest Biotechnology	Pointer publishers, Jaipur.
3.	Kumar, N.J.B. M. Md. Abdul Khaddar, Ranga Swamy, P. and Irrulappan, I.	1997	Introduction to spices, Plantation crops and Aromatic plants.	Oxford & IBH, New Delhi.

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designer

Dr.Sarah Jaison

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21A02	Allied Paper II – Fundamentals of Botany- II	Allied	71	4	-	4

Preamble

- To Gain Knowledge of the anatomy of plants
- To Gain Knowledge of the embryology of plants
- To study the metabolism of plants
- To know about the plant tissue culture techniques
- To Gain Knowledge of the microbial techniques

Course outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Appreciate the anatomy of plants	K1
CLO2	Appreciate the embryology of plants	K2
CLO3	Appreciate the metabolism of plants	K3
CLO4	Understand the plant tissue culture techniques	K3
CLO5	Understand the microbial techniques	K2

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	S	M	M	M
CLO2	S	S	M	S	S
CLO3	M	M	M	M	M
CLO4	S	S	S	S	M
CLO5	S	M	M	M	M

S- Strong; M-Medium

Syllabus

Unit I

14 hrs

A brief account of meristems. Simple and complex permanent tissues Primary structure of dicot and monocot stem, root and leaf; *Secondary structure of dicot stem and root*.

Unit II

14 hrs

Microsporogenesis and development of male gametophyte, megasporogenesis and development of female gametophyte, structure of monosporic 8 – nucleate embryo sac (*Polygonum*). *Types of endosperm*, *development of dicot and monocot embryos*.

Unit III

15hrs

Plant Physiology- *osmosis and *diffusion*. Passive and Active absorption of water, Photosynthesis - Photosynthetic apparatus, light and dark reaction. *Transpiration*.Plant movements, *plant growth regulators –Auxin and Cytokinin*.

Unit IV

14hrs

Tissue culture: Concept and Techniques– Sterilization, *Medium preparation (MS medium)*, Callus culture, organogenesis and regeneration. *Hardening and field transfer*.

Unit-V Microbial techniques

14hrs

Methods of sterilization, *Culture media- PDA*, *Serial dilution techniques*. Pure culture techniques, Microbial growth and Growth curve. Typical Fermentation process.

Note: *Blended Learning

Text books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Jain.V.K	2017	Fundamentals of plant physiology	Chand & Company, New Delhi
2.	Kalyan Kumar, De.	2004	An Introduction to Plant Tissue Culture.	New Central Book Agency Pvt.Ltd. Howrah.
3.	Kumaresan, V	2001	Biotechnology	Saras Publication, Nagercoil, TamilNadu
4.	Verma.	1985	Text book Plant Physiology	Emkay publication, New Delhi.

Reference books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Sharma, P.D	2010.	Microbiology	Rastogi Publications, Meerut.
2.	Michael J. Pelczar, E.C.S. Chan and Noel R Krieg.	1988	Microbiology	Mc Graw Hill, New Delhi.
3.	Mukherji.S. and A.K. Ghosh.	1996.	Plant Physiology	New Central Book Agency,(P) Ltd. Kolkatta.

Pedagogy: Powerpoint, lecture, seminar, quiz and discussion.

Links for blended learning

S.No.	Unit	Topic	Link for the topic
1.	Unit I	Secondary structure of dicot stem	https://www.youtube.com/watch?v=SiZiTeQ-nHk https://www.youtube.com/watch?v=LzFDghMoMRQ
		Secondary structure of dicot root	https://www.youtube.com/watch?v=bbgwE-h84iE

2.	Unit II	Types of endosperm	https://www.youtube.com/watch?v=EgiET_piGpA
		Development of dicot and monocot embryos	https://www.youtube.com/watch?v=DPcSTA3EUE4 https://www.youtube.com/watch?v=x26Fg8ltCGw
3.	Unit III	Osmosis and diffusion	https://www.youtube.com/watch?v=eeOcGX5qPp8 https://www.youtube.com/watch?v=iP6PtdhgZSk
		Transpiration	https://www.youtube.com/watch?v=zt9ja6p8q6U
		Plant growth regulators - Auxin, Cytokinin	https://www.youtube.com/watch?v=Py2O9rXENIg https://www.youtube.com/watch?v=DMWB9b58Rt4
4.	Unit IV	Medium preparation (MS medium)	https://www.youtube.com/watch?v=eMv_PMNPYMc
		Hardening and field transfer	https://www.youtube.com/watch?v=YodPROvjroU
5.	Unit V	Methods of sterilization	https://www.youtube.com/watch?v=Bh-ytzY5uVY
		Culture media- serial dilution techniques	https://www.youtube.com/watch?v=OLz9JOrJepU https://www.youtube.com/watch?v=Ppe_bgnPFHU

Course Designer

Dr. R. Sumathi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21AP1	Allied Botany - Practical	Allied	-	-	60	2

Preamble

- To observe and identify the different types of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
- To obtain knowledge on anatomy of plants.

Course outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Differentiate the different forms of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.	K1
CLO2	Preparation of culture media.	K2
CLO3	Illustrate the internal structure of plant tissues.	K3
CLO4	Analyse the various pigments in plants	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	M	S	M	M	M
CLO2.	S	S	M	S	S
CLO3.	M	M	M	M	M
CLO4.	S	S	S	S	M

S- Strong; M-Medium

Syllabus

Semester- III

30 hrs

Specimens

- Bryophytes - Habit of *Riccia*
- Pteridophytes - Habit of *Lycopodium cernuum*, *L. clavatum*, *L. phlegmaria*
- Gymnosperms - Habit of *Cycas*, Male cone, Female cone
- Taxonomy - Study of plants belonging to the families:
 - ✓ Annonaceae
 - ✓ Rutaceae
 - ✓ Rubiaceae
 - ✓ Lamiaceae
 - ✓ Amaranthaceae
 - ✓ and Poaceae and their economic importance
- Ecology- Habit of:
 - ✓ *Nerium*
 - ✓ *Opuntia*

- ✓ *Helianthus*
- ✓ *Hibiscus*
- ✓ *Hydrilla*
- ✓ *Nelumbium*

Slides

- Algae - *Volvox*- Daughter colonies, Oogonia and Antheridia.
- Fungi - *Saccharomyces*-Single cell structure
- Bryophytes - *Riccia*- Reproductive Structures-Antheridium, Archegonium and Sporangium
- Pteridophytes - *Lycopodium*- L.S. of Cone
- Gymnosperms - *Cycas*- T.S. of Corolloid root

Sectioning

- Bryophytes - *Riccia*- T.S. of Thallus
- Pteridophytes - *Lycopodium*- T.S. of Stem
- Gymnosperms - *Cycas* - T.S. of Leaflet, T.S. of Rachis

Demonstration – cutting, layering, Grafting and bonsai

Semester- IV

30 hrs

Slides

- Anatomy
 - ✓ Simple Tissues (Parenchyma, Sclerenchyma and Collenchyma)
 - ✓ Complex Tissues (Xylem and Phloem)
- Embryology
 - ✓ T.S. of Mature anthee
 - ✓ 8- nucleated Embryosac
 - ✓ Mature Embryo

Sectioning

- Anatomy- Primary structure of Dicot stem, root and leaf
- Primary structures of Monocot stem and root
- Secondary structure of stem and root

Experiments

- Physiology
 - ✓ Determination of osmotic potential by Plasmolytic method
 - ✓ Separation of leaf pigment by Paper chromatography.
- Microbiology
 - ✓ Preparation of Potato Dextrose Agar Medium
 - ✓ Serial dilution techniques

Demonstration Experiments

- Physiology
 - ✓ Hill reaction
- Tissue culture
 - ✓ Sterilization
 - ✓ Preparation of MS medium
 - ✓ Inoculation
 - ✓ Callus induction and
 - ✓ Organogenesis.

Spotters

- Microbiology – fermentor, culture methods

Course Designers

Dr. R. Sumathi

Dr.E.Uma

COURSENUMBER-	COURSENAME	Category	L	T	P	Credit
NM21DTG	DESIGN THINKING	Theory	26	2	-	2

Preamble

1. To expose the students to the concept of design thinking as a tool for innovation
2. To facilitate the analysis of the design process in individual and business decisions
3. To impart the design thinking skills

Course Outcome

On the successful completion of the course, students will be able to:

CLO Number	CLO Statement	Knowledge Level
CLO 1	Understand the concepts of Design thinking and its application in varied business settings	K1
CLO 2	Describe the principles, basis of design thinking and its stages	K2
CLO 3	Apply design thinking process in problem solving	K3
CLO 4	Analyze the best practices of design thinking and impart them in business and individual day today operations.	K4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	S	M	M	S	S
CLO 2	M	S	S	M	M
CLO 3	S	S	S	M	S
CLO 4	S	S	S	S	S

S-Strong; M-Medium

Syllabus

UNIT- 1 (5Hours)

Design Thinking Overview: ***Introduction to Design Thinking*** and Design Research Strategies - ***Design Thinking Skills***

UNIT-II (5Hours)

Design Thinking Mindset- ***Principles of Design Thinking-Basis for design thinking*** - ***Design Thinking Hats***- Design thinking team

UNIT-III (5Hours)

Empathize-definition-Listen&Empathize with the Customers and/or Users-Tools and Techniques

UNIT-IV**(5Hours)**

Define-Definition –Defining the Problem-Tools and Techniques-Journey mapping and ***Ideate***-definition-Ideation techniques

UNIT- V**(6 Hours)**

Prototype-Definition-Prototype Alternate Solutions-***TesttheSolutions***Visualization - Story Telling - Cautions and Pitfalls - Best Practices

(*Seminar-Internal evaluation only)

TextBooks:

Sl.No.	Author(s)	TitleoftheBook	Publisher	Year ofPublication
1.	Christian Mueller-Roterberg	Handbook of Design Thinking Tips&Toolsfor how todesign thinking	Amazon KindleVersion	2018
2	Gavin AmbrosePaulHarris	DesignThinking	VA PublishingSwitzerland	2010

ReferenceBooks:

Sl.No.	Author(s)	TitleoftheBook	Publisher	Year ofPublication
1	Maurício ViannaYsmar ViannaIsabelK.A dler Brenda LucenaBeatrizRusso	Design Thinking - BusinessInnovation	MJVPress	2011
2	MoritzGekeler	Apractical guidetodesignthinking	Friedrich-Ebert-Stiftung	2019
3	J.Berengueres	TheBrownBookofDesign Thinking	UAEUniversity College,Al Ain	2014

DesignThinking –FinishingSchool Assessmentpattern**CA–100marks****CIA I(UnitI&II)Duration1hr**

SectionA	(3/5) x5marks	15 marks
SectionB	(1/2) x10marks	10 marks
	Total	25Marks

CIAII(UNITIII,IV&V)Duration1hr

SectionA	(3/5) x5marks	15 marks
SectionB	(1/2) x10marks	10 marks
	Total	25Marks

***Project–50marks**

Stage	Marks
Stage1–Empathize	10
Stage2–Define	10
Stage3–Ideate	10
Stage4–Prototype	10
Stage5 - Test	10
Total	50marks

*Group project – Maximum 6 students per team, concept note of the project has to be approved by the HoD before the start of the project

INTERNAL COMPONENT MARKS

CAI	25
CAII	25
Project	50
TOTAL	100

Blended Learning Links

UNIT	TOPICS	LINK
UNIT I	Introduction to Design Thinking	https://www.digimat.in/nptel/courses/video/109104109/L01.html
	Design Thinking skills	https://www.youtube.com/watch?v=b-9Id-Jt_PI
UNIT II	Principles & Basis of Design Thinking	https://youtu.be/6-NRiom8K9Y
	Design Thinking hats	https://www.youtube.com/watch?v=bc-BvFQDmmk
UNIT III	Empathize	http://acl.digimat.in/nptel/courses/video/109104109/L02.html http://acl.digimat.in/nptel/courses/video/109104109/L03.html https://youtu.be/ls2mqHs02B0
UNIT IV	Define	http://acl.digimat.in/nptel/courses/video/109104109/L04.html https://youtu.be/veixQsRnZZU https://youtu.be/6-bDSKZJEAM
	Ideate	http://acl.digimat.in/nptel/courses/video/109104109/L11.html http://acl.digimat.in/nptel/courses/video/109104109/L12.html http://acl.digimat.in/nptel/courses/video/109104109/L13.html
UNIT V	Prototype	http://acl.digimat.in/nptel/courses/video/109104109/L15.html
	Testing	http://acl.digimat.in/nptel/courses/video/109104109/L16.html http://acl.digimat.in/nptel/courses/video/109104109/L17.html http://acl.digimat.in/nptel/courses/video/109104109/L18.html http://acl.digimat.in/nptel/courses/video/109104109/L19.html

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21C05	Core Paper V – Plant taxonomy and Economic Botany	Core	58	2	-	4

Preamble

- To acquire the fundamental knowledge, basic concepts and principles of plant systematic.
- To study the economically importance of the plants.

Course outcomes

On the successful completion of the course, students will be able to:

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the general features of Angiosperms and the terminologies used.	K1, K2, K3, K4
CLO2	Understand the history and concepts underlying various approaches to plant taxonomy and classification of angiosperms; scientific names and the rules governing their application.	K1, K2, K3, K4
CLO3	Comprehend major taxa and their identifying characteristics, and develop knowledge of the current taxonomy of major plant families.	K1, K2, K3, K4
CLO4	Develop a deep knowledge on economic importance of plants and herbarium preparation	K1, K2, K3, K4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	M	S	M	S	M
CLO2.	S	M	S	S	M
CLO3.	M	S	M	M	S
CLO4.	M	S	M	S	S

S- Strong; M-Medium

Syllabus

Unit I

12 hrs

Plant Taxonomy: History of plant taxonomy, Herbarium techniques and specimen preparation, technical terms of plant description- plant types (Habit and Habitat) vegetative (root, stem and leaf) and reproductive (inflorescence flower and fruit) parts, preparation of floral diagram and floral formula.

Unit II**12 hrs**

Systems of classification: Artificial – Linnaeus; Natural – Bentham and Hooker; Phylogenetic– Engler and Prantl, Outline of APG system of classification. Botanical Nomenclature – ICN – priority, typification, effective and valid publication and author citation.

Unit III**11 hrs**

A detailed study of the following families including economic importance-Annonaceae, Nymphaeaceae, Capparidaceae, Tiliaceae, Rutaceae, Anacardiaceae, Myrtaceae, Cucurbitaceae, Rubiaceae, Asteraceae.

Unit IV**11 hrs**

A detailed study of the following families including economic importance-Sapotaceae, Apocynaceae, Asclepiadaceae, Verbenaceae, LamiaceaeAmarantaceae, Euphorbiaceae, Orchidaceae, Liliaceae and Poaceae.

Unit V**12hrs**

Economic Botany – The importance and uses of plant products – fibres: Cotton (*Gossypium hirsutum* L.) and Jute (*Corchorus olitorius* L.); food plants – rice (*Oryza sativa* L.) and potato (*Solanum tuberosum* L.); tannins and dyes –*Terminalia chebula* Retz. and *Indigofera tinctoria* L.; resins and gums- *Ferula asafoetida* L. and gum Arabic (*Acacia arabica* (L.f.) Willd); spices and condiments – Cardamom (*Elettaria cardamomum* Maton.) and Clove (*Eugenia caryophyllata* L. Merr. & Perry).

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Henry, A. N. and M. Chandrabose.	1980	An aid to the International Code of Botanical nomenclature	Today and Tomorrow's Printers and Publisher, New Delhi
2.	Sambamurthy, A.V.V.S. and N.S.Subramanyam.	1989	A Text book of Economic Botany	Wiley Eastern Limited, New Delhi
3.	Sharma O.P.	1993	Plant Taxonomy	Mc Graw Hill, New Delhi.
4.	Pandey, B.P.	1999	Text book of Economic Botany	S. Chand & Company, New Delhi
5.	Simpson, M.G.	2011	Plant Systematics, 2 nd ed,	Academic Press, Newyork.

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Michael G Simpson	2010	Plant systematics	Academic Press
2.	Davis, P.H. and Heywood, V.M	2011	Principles of Angiosperm Taxonomy	Oliver Boyd London
3.	Gurucharan Singh	2018	Plant Systematics: An Integrated Approach, Third Edition	CRC Press

Pedagogy: Power point presentation, Lecture, seminar, quiz, discussion, jigsaw and flipped classroom

Course Designers

Dr. K.S. Tamil Selvi

Dr. K. Kiruthika

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21C06	Core Paper - VI Genetics, Plant breeding and Biostatistics	Core	58	2	-	4

Preamble

- To study the Mendelian principles of genetics
- To study the inheritance pattern of characters
- To understand the breeding methods with specific objective
- To understand the quality trait of each crop
- To study the application of statistics in biology

Course outcomes

On the successful completion of the course, students will be able to:

CLO Number	CO Statement	Knowledge Level
CLO1	Understand the Mendelian principles, different types of inheritance pattern and basic statistics	K1
CLO2	Develop critical understanding of basis of genes and their interactions at population levels	K2
CLO3	Impart knowledge of objectives, quality traits and breeding methods for crop improvement	K2
CLO4	Develop analytical, quantitative and problem-solving skills from genetics and statistics	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M

S- Strong; M-Medium

Syllabus

Unit I-Genetics

12hrs

*Mendelism- Mendel's Laws of heredity - Monohybrid and Dihybrid Cross; Test Cross and Back Cross. Deviation from Mendelian principle - Incomplete Dominance; Gene Interaction - Complementary, Supplementary, Duplicate and Inhibitory factors, Epistasis. Linkage- Complete and incomplete linkage and its importance.

Unit II- Genetics

11hrs

Extra nuclear inheritance - Cytoplasmic Inheritance (plastid inheritance in *Mirabilis jalapa*); Polygenic Inheritance (skin colour in man). Multiple Alleles (ABO Blood Groups in Man); Sex

Determination XX-XO, XX-XY methods. Sex determination in plants. Sex linked inheritance in Human – colour blindness and Haemophilia.

Unit III- Plant Breeding

12 hrs

Objectives, Plant Introduction-types, procedure, purpose, merits and demerits, Hybridization Techniques-objectives, types, procedure-choice of parents, evaluation of parents, emasculation, bagging, tagging, pollination, harvesting and F₁ generation. Heterosis and inbreeding depression (outline only).

Unit IV- Plant Breeding

11 hrs

Methods of breeding for Self-pollinated, cross-pollinated and asexually propagated crops; pure line selection, mass selection and pedigree selection.

Breeding for crop Quality - Rice, Cotton and Tomato. Breeding for nutritional quality. Sources for quality traits. Vitamin A in tomato.

Unit V- Biostatistics

12 hrs

Sample and sampling, Collection and representation of data-Tabulation of data, Graphical representation-Histogram, Line Diagram, Bar Diagram, and Pie chart. Measures of Central Tendency- Mean, Median and Mode; Measures of Dispersion – Range, Standard Deviation and Standard error. Students‘t’ test, Chi-square test.

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Chaudhari, H.K.	1984	Elementary Principles of Plant Breeding, 2 nd edn,	Oxford – IBH, New Delhi
2.	Singh, B.D	2005	Plant Breeding:Principles and Methods, 7 th edn,	Kalyani Publishers, New Delhi
3.	Shukla, R.S. and Chandel, P.S.	2009	Cytogenetics, evolution, Biostatistics and Plant Breeding	S. Chand & Co, New Delhi
4.	Verma, P.S. and Agarwal, V.K.	2010	Cytology, Genetics and plant breeding	S.Chand& Co, New Delhi
5.	Gupta, P.K.	2014	Genetics, 4 th edn.	Rastogi Publications, Meerut. New Delhi

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Strickberger, N.W.	1985	Genetics, 3 rd Ed.	Macmillan Co. New York.
2.	Gardner, E.J, Simmons, M.J, Snustad, D.P	2008	Principles of Genetics, 8 th edn.	Wiley-India.
3.	Zar, J.H.	2012	Biostatistical Analysis, 4th edition,	Pearson Publication. U.S.A.

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designer

Dr. M. Kamalam

Dr. K. Gajalakshmi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21E01	AOS I - Dietetics, Food Processing and Preservation	Elective	73	2	-	5

Preamble

- To study the nutritive importance of food stuffs.
- To understand food security and RDA.
- To recognize the value of food processing methods.
- To gain knowledge in food preservation and packaging.
- To appreciate the methods of quality control.

Course outcomes

On the successful completion of the course, students will be able to:

CLO Number	CO Statement	Knowledge Level
CLO1.	Impart the knowledge on nutritive value of food stuffs and the various sources of food.	K1
CLO2.	Recognize diet based foods on the needs of people.	K2
CLO3.	Illustrate food processing methods.	K3
CLO4.	Apply the knowledge in preventing food spoilage.	K4
CLO5.	Employ good manufacturing practice.	K

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M
CLO5.	S	S	S	S	S

S- Strong; M-Medium

Syllabus

Unit I

14 hrs

Introduction – Nutritive importance of proteins, carbohydrates, fats, vitamins and minerals. Food sources – Plant and animal food. Fermented vegetables. Milk Products. Nutritional requirements and food security.

Unit II

15 hrs

Balanced diet, Recommended Dietary Allowances (RDA). Diet counseling. Menu planning. Nutritional and food requirements of infants, expectant mothers, lactating women and old ages. Diet therapy and therapeutic diets. Diet for obesity, cardiovascular disease and diabetes.

Unit III

14 hrs

Food processing: processing of legumes, milk, vegetables, fruits, fish, meat, poultry and eggs. Food additives- mono-sodium glutamate, aspartame for flavor, enzymes for texture modification; synthetic/natural food coloring agents.

Unit IV

15 hrs

Food preservation: Physical, chemical and biological methods - drying, cooling, freeze-drying, heating, curing, jellying, salting, pickling, smoking, canning, and irradiation, Ultra High Temperature (UHT). Food spoilage and food adulterants. Food sanitation- safe methods of handling food.

Unit V

15 hrs

Packing of preserved foods: concepts, definition, significance, classification, Primary packaging materials, methods of packaging - vacuum packaging, Modified Atmosphere Packaging (MAP), Controlled Atmosphere Packaging (CAP) & bio-degradable packages. Quality control; food standards: Agricultural Marketing (AGMARK), Food Safety and Standards Authority of India (FSSAI), Prevention of Food Adulteration (PFA). Good laboratory practice (GLP) Good Manufacturing Practice. Nutrition information on labels.

The topics in bold shall be taught through Flipped mode of learning. The topics shall be studied by visiting a Food Processing Institute / Industry.

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Srilakshmi, B.	2011	Dietetics	New Age International Limited, Publishers, New Delhi
2.	Jay, J.M.	2012	Modern Food Microbiology	CBS Publishers & Distributors, New Delhi
3.	Gordon L. Robertson	2012	Food Packaging: Principles and Practice, Third Edition	New age International Ltd. Publishers, New Delhi
4.	Michael Saltmarsh, Mike Saltmarsh	2013	Essential Guide to Food Additives	RSC Publishing, UK

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	William C Frazier, Dennis C Westoff	2000	Food Microbiology	McGraw-Hill Publishing Company, New Delhi
2.	Winton, A. and Winton, K.B.	2006	Milk and milk products	Agrobios, Jodhpur
3.	Jung H. Han	2014	Innovations in Food Packaging	Academic Press, Inc
4.	Fellows, P.J.	2017	Food processing technology: Principle and Practice	Woodhead Publishing, United Kingdom

Activities: Seminar, Assignment, Quiz and Institute/Industry visit
Flipped mode: online links

- <https://www.youtube.com/watch?v=UWhkFYDB8J4>
- <https://www.youtube.com/watch?v=CkoOm4Lxmjk>
- <https://www.fssai.gov.in/home>
- <https://www.youtube.com/watch?v=JLDFMkpENzk>

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designers

Dr. K.S. Tamil Selvi

Dr. B.S Chitra Devi

Dr. H. Rehana Banu

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21E02	AOS – II Bioinoculants Paper I	Elective	73	2	-	5

Preamble

- To study the classification of bioinoculants.
- To study the growth of microbes and their distribution like bacterial, fungal and algal bioinoculants.
- To understand the Microbial solubilization, ecto and endo mycorrhiza.

Course outcome

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1	Identify the type of bioinoculants	K1
CLO2	Recognize and appreciate soil as the medium for the growth of microbes and their diversity	K1
CLO3	Working of the different groups of bacterial, fungal and algal bioinoculants.	K2
CLO4	Use phosphorus mobilization, ecto and endomycorrhizal activities for improving plant growth	K1
CLO5	Analyse the microbial solubilization in silicates and zinc.	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M
CLO5.	S	S	S	S	S

S- Strong; M-Medium

Syllabus

Unit -1

15 hrs

Definition, Classification of fertilizers (synthetic fertilizers & organic manures), Bioinoculants, Microbial inoculants in Agriculture - contributions of microorganisms to soil fertility. Advantages and limitations of bioinoculants over chemical fertilizers.

Unit-II

15 hrs

Soil as a medium for growth of plants- Soil microorganisms- Distribution of microorganisms in soil. Factors influencing the microbial populations in soil. Rhizosphere and mycorrhizosphere concept.

Unit-III

15 hrs

Different groups of bioinoculants- bacterial, fungal and algal bioinoculants. Phosphate solubilizers- Aluminium/iron solubilisation – *Bacillus megaterium*, *Bacillus circulans* and *Pseudomonas* sp.

Unit-IV

14hrs

Phosphorus mobilization in the soil– Mycorrhizal types – Endomycorrhiza, Ectomycorrhiza and Orchid mycorrhiza.

Unit- V

14 hrs

Microbial solubilisation of silicates and zinc- Plant growth promoting rhizobacteria- application of silica nanoparticles as manures.

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1	Kumaraesan, V.	2001	Biotechnology, 1 st edn	Saras Publication, Nagercoil
2	Dubey, R.C.	2004	A Text book of Biotechnology, 4 th edn	S. Chand & Co, New Delhi
3	Satyanarayana, U	2005	Biotechnology. 1 st edn,.	Books and Allied Publishers. Ltd. Kolkatta

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1	Nutman, P.S.	1976	Symbiotic nitrogen fixation in plants	Cambridge Univ. Press, London, P.584.
2	Subba Rao, N.S	1982	Advances in Agricultural	Oxford and IBH Publ. Co.,

			Microbiology	New Delhi.
3	Subba Rao. N.S	1993	Biofertilizers in Agriculture and Forestry	Oxford and IBH Publ. Co., New Delhi P.242

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designer

Dr. R.Sumathi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21E03	AOS III- Environmental Biotechnology	Elective	73	2	-	5

Preamble

- To study the biodiversity, conservation of endangered plants and Global biodiversity information system.
- To study the concepts, types, data structure of GIS.
- To understand the strategies for effluent treatment in different industries using microbes.
- To appreciate the types of IPR, biohazards and biosafety guidelines.

Course outcomes

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1	Study the biodiversity types, conservation methods, endangered plants and Global biodiversity information system.	K1
CLO2	Concepts, types, data structure of GIS and output of geographical data.	K1
CLO3	Familiarize the sewage and waste water treatments at primary, secondary and tertiary levels.	K2
CLO4	Study the strategies for effluent treatment in different industries using microbes.	K2
CLO5	Analyze the types of IP, biohazards and biosafety guidelines.	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	M	S
CLO2.	S	S	S	M	S
CLO3.	S	S	M	M	M
CLO4.	S	S	M	M	M
CLO5.	S	S	S	S	S

S- Strong; M-Medium

Syllabus

Unit -1-Biodiversity

15 hrs

Definition; Geographical causes for diversity; Types of diversity: Genetic diversity, Species diversity and Ecosystem diversity; Quantifying biodiversity; importance of biodiversity; *in-situ&ex-situ* conservation; Gene banks; Cryopreservation; Assessing, analyzing and

documenting biodiversity; Introduction to biodiversity database: Endangered plants, Endemism and Red data books; Global biodiversity information system.

Unit II-GIS and Environmental Monitoring **14 hrs**

Concept of Remote sensing; Concept of GIS; Types of Geographical Data; Data Structure; Vector and Raster data: their Advantages and Disadvantages; Input, verification, storage and output of geographical data; Importance of Geographical Information System in environmental studies.

Unit III - Effluent treatment systems **15 hrs**

Sewage and waste water treatments systems; Primary, secondary and tertiary treatments. Biological treatments- aerobic versus anaerobic treatments; Environmental pollution control- Bioremediation, Bioaugmentation and Biostimulation; Biofilms in treatment of waste water; Aerobic Biofilms; Bioreactors for Sewage and waste water treatments systems; Primary, secondary and tertiary treatments.

Unit IV- Removal of specific pollutants **14 hrs**

Physicochemical characteristics and treatment strategies for effluent generated by Distillary and Fermentation industry, Fertilizers and Pesticide manufacturing industries, Dyes and textile industries, Paper and pulp industries, Food and dairy industries. Bioremediation.

Unit V-IPR & Biosafety **15 hrs**

Types of Intellectual Property Rights (IPR): Patents, Trademarks, Copyright and Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.

Biosafety

Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines - Government of India; Definition of Genetically Modified Organisms (GMOs) & Living Modified Organisms (LMOs).

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1	Kumar.S.	2005	Basics of Remote Sensing and GIS	Laxmi Publications, Chennai.
2	Verma, P.S. and Agarwal,V.K.	2006	Environmental Biotechnology	Discovery Publishing House,New Delhi
3	Sateesh.M.K	2008	Bioethics and Biosafety	IK International Publishing House Pvt Ltd, New Delhi.
4	Acharya,N.K.	2012	Text book on Intellectual Property Rights.	Jain Book Depot, New Delhi

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1	Purohit S.S and	2003	Ecology, Environment	Agrobios, India,Jodhpur

	Ranjan. R		and Pollution (First Edition)	
2	Marcos Von Sperling	2007	Basic principles of Waste Water Treatment	IWA Publishing, Newyork
3	John R and Jenson	2009	Remote Sensing of the Environment an Earth Resource Perspective: 2 nd edn	Dorling Kindersly Pvt Ltd, New Delhi

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designer

Dr. R.Sumathi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21CP3	Core Practical III (Core Paper V, VI & AOS I/II/III)	Core	-	-	120	4

Preamble

Collection, identification and preparation of herbarium

- ✓ To understand the factor interaction in plants and solve the problems involved in it.
- ✓ To apply common statistical tools to derive inference.
- ✓ To get acquainted with the techniques of food preservation

Course outcomes

On the successful completion of the course, students will be able to:

CLO Number	CLO Statement	Knowledge Level
CLO1.	Identify the plants using taxonomically and to observe the economic importance	K3
CLO2.	Interpret the genetic problems and the hybridization techniques involved in plants	K3
CLO3.	Apply common statistical tools to derive inference.	K3
CLO4.	Analyze the nutritional quality and adulterants of various food stuffs	K4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	S	M	S	S
CLO2	S	M	S	S	M
CLO3	S	S	M	M	S
CLO4	M	S	S	M	S

S- Strong; M-Medium

Syllabus

Paper V -Taxonomy (45 hrs)

Study of forms belonging to the families mentioned in the syllabus and submission of herbarium of 10 plants representing biological spectrum.

A field visit to study the vegetation and flora of the plants.

Economic Botany -Spotters:

Terminalia chebula Retz., *Indigofera tinctoria* L., *Gossypium hirsutum* L., *Chorchorus solitorius* L., *Elettaria cardamomum* Maton., *Ferula asafetida* L., *Eugenia caryophyllata* L. Merr. & Perry, *Solanum tuberosum* L., *Oryza sativa* L., *Acacia arabica* (L.f.) Willd (gum Arabic).

Paper VI - Genetics, Plant breeding and Biostatistics (45hrs)

Genetics and Plant breeding: Simple problems in genetics. Hybridization techniques – different types of Emasculation, bagging, tagging.

Field visit to any one Plant breeding research Institutes- Sugarcane breeding institute/ central institute for cotton research, Coimbatore. IARI –Wellington/ Tamilnadu Agricultural University, Coimbatore.

Biostatistics -1. Mean, Median, Mode, Standard Deviation & Standard errors, 2. Students ‘t’ test
3. Chi-square test

AOS I- Dietetics, Food Processing and Preservation(30 hrs)

Individual experiments:

1. Qualitative detection of nutrients in food:
 - i. Carbohydrates
 - ii. Proteins
 - iii. Fats
 - iv. Vitamins
 - v. Minerals
2. Detection of Food additives
 - i. Mono-sodium glutamate
 - ii. Aspartame
3. Milk spoilage test.
4. Detection of Adulterants in oils and Fats.
5. Detection of Adulterants in spices and spices powder.

Demonstrations:

1. Fermented vegetables - Sauerkraut
2. Milk Products – Yoghurt, Cheese
3. Preparation of sample menu based on Recommended Dietary Allowance for:
 - i. Infants
 - ii. Expectant mother
 - iii. Lactating women
 - iv. Old age people
 - v. Therapeutic Diets:
 - a. Obesity
 - b. Cardiovascular disease
 - c. Diabetes
4. Preparation of low calorie diet.
5. Food preservation:
 - i. Preparation of pickles
 - ii. Preparation of jams
 - iii. Preparation of jellies
 - iv. Canning & bottling of vegetable and fruit.

6. Isolation and identification of storage mycoflora from food stuffs/vegetables/fruits.

Or

AOS-II – Bioinoculants Paper I

1. Isolation of Rhizobium from legume root nodules; purification and characterization of Rhizobium.
2. Testing the efficiency- leonard jar technique and plant infection test.
3. Rhizobium strain identification by immunological methods.
4. Isolation of *Azospirillum* from rhizosphere.
5. Identification and characterization of *Azospirillum*.
6. Isolation of Phosphobacterium from soils.
7. Quantitative determination of Phosphate solubilization by phosphobacteria

Or

AOS-III- Environmental Biotechnology

a. Environmental Parameters

1. Estimation of halides in water samples by potentiometer.
2. Estimation of CO^{2+} and Ni^{2+} by colorimeter/spectrophotometer.
3. Estimation of sulphates by turbidometer.
4. Detection of heavy metals- Zinc, Cobalt, Cadmium, Lead, Ferrous in anyone of the polluted sample.
5. Sampling techniques: wastewater analysis for physico-chemical characteristics such as pH, conductivity, Total dissolved solids (TDS), Dissolved oxygen (DO), Biological oxygen demand (BOD), Chemical oxygen demand (COD), CO_2 , alkalinity, nutrients, chlorides, hardness, set ability of solids.

b. Bioremediation

1. Microbial degradation of textile dyes/pesticides/hydrocarbons and oils
2. Assay of enzymes involved in biotransformation.
3. Phytoremediation of metal contaminated soil samples using Tomato/Brassica plants and estimation of metal removal in soil and metal accumulation in plants using Atomic Absorption Spectrum (AAS).
4. Pollutant removal using microorganisms from industrial effluent.
5. Effect of Heavy metals on microbial growth and microbial leaching of metals.
6. Effect of Pesticides on soil microorganism

Course Designers

Dr. K.Gajalakshmi

Dr. K.S. Tamil Selvi

Dr. B. S.Chithra Devi

Dr. R. Sumathi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16AC1	Food Microbiology	Advanced Learners Course	-	-	-	5

Preamble

- To understand the interaction between micro-organisms and food
- To understand the factors affecting the growth of microbes.
- To understand the contamination, preservation and spoilage of different foods
- To realize the microbes underlying food spoilage and food borne illnesses.
- To appreciate the role of government agencies involved in food sanitation and control

Course outcomes

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the interaction between micro-organisms and food	K1
CLO2	Know the factors affecting the growth of microbes	K2
CLO3	Analyze the Contamination, preservation and spoilage of different foods	K3
CLO4	Realize the microbes underlying food spoilage and food borne illnesses.	K3
CLO5	Appreciate the role of government agencies involved in food sanitation and control	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	M	S	S
CLO2.	S	S	M	M	S
CLO3.	S	S	M	M	S
CLO4.	S	S	M	M	S
CLO5.	S	S	M	M	M

S- Strong; M-Medium

Syllabus

Unit I

Food and microorganisms- Food as a substrate, important microbes, contamination of food, principles underlying spoilage.

Unit II

Contamination, preservation and spoilage of foods: cereals and cereal products; spoilage of sugar and sugar products, fruits and vegetables, milk and milk products.

Unit III

Contamination, preservation and spoilage of foods: meat– meat products; fish and other sea foods, eggs and poultry; canned foods and miscellaneous foods.

Unit IV

Food related diseases: food borne illness, food poisoning, toxins and intoxicants. Primary sources of food poisoning - bacteria and moulds. Prevention of food borne diseases.

Unit V

Microbiology in relation to food sanitation; enforcement and control agencies. Microbiological criteria for foods.

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1	Frazier C., D.C. Westhoff.	2000	Food Microbiology, 4 th edition	Tata McGraw Hill, New Delhi
2	Steinkraur K.H.	1988	Indigenous Food Fermentation, 1 st edition	Academic Press, New York
3	William C Frazier, Dennis C Westoff, Vanitha, K.N.	1971	Food Microbiology 5 th Edition	McGraw-Hill Education, New York.

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1	Adams, M.R and Moss, M.O.	1996	Food Microbiology, 2 nd edition	New age International (P) Ltd. Publ., New Delhi
2	Benwart, G.J.	1987	Basic Food Microbiology, 1 st edition	CBS Publishers & Distributors, New Delhi

Course Designer

Dr. K.S. Tamil Selvi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16AC2	Nutrition Science	Advanced Learners` Course	-	-	-	5

Preamble

- To understand the vital link between nutrition and health
- To gain knowledge on functions of nutrients
- To understand the metabolism of nutrients
- To realize the importance of deficiency of nutrients
- To appreciate the role of government agencies involved in combating malnutrition

Course outcomes

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the Vital link between nutrition and health	K1
CLO2	Acquire knowledge on functions of nutrients	K2
CLO3	Appreciate the Metabolism of nutrients	K2
CLO4	Relate the Importance of deficiency of nutrients	K3
CLO5	Comprehend the Role of government agencies involved in combating malnutrition	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	L	M	S
CLO2.	S	S	L	M	S
CLO3.	S	S	L	M	S
CLO4.	S	S	L	M	S
CLO5.	S	S	L	M	M

S- Strong; M-Medium

Syllabus

Unit I

Introduction to nutrition science– definitions and history. Nutritional importance of carbohydrates, proteins and fats.

Unit II

Energy metabolism– determination of energy value of food, determination of energy requirements, under nutrition and protein energy malnutrition

Unit III

Macro minerals– Calcium and Phosphorus; micro minerals– Iron, Iodine, Copper, Fluorine, Zinc and Chromium.

Unit IV

Vitamins – Fat soluble- A, D, E and K; water soluble– Thiamin, Riboflavin, Niacin, Folic acid, Vitamin B complex and Vitamin-C

Unit V

Antioxidants, Water and electrolyte balance. Assessment of nutritional status, National nutrition policy. Role of International and National agencies in combating malnutrition.

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1	Mudambi, R. Sumathy and Rajagopal, M.V	2005	Fundamentals of food and nutrition, IVedn	New age International Ltd. Publishers, New Delhi
2	Sheel Sharma	2000	Human nutrition and Meal planning, 1 st edn	Jnananda Prakashan, P&D, New Delhi
3	Srilakshmi, B.	2012.	Nutrition Science. Revised 4 th edn.	New age International Ltd. Publishers, New Delhi.

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1	Artibhatia	2000	Nutrition and Dietetics	Anmol Publications, PVT. LTD., NewDelhi
2	Sizer, Francis Sienkiewicz and Whitney Eleanor Whitney	2000	Nutrition – concepts and controversies, VIII edn	Wadsworth, Australia
3	Srilakshmi, B	1997	Food science. 1 st edn	New age international ltd. Publishers, New Delhi.
4	Swaminathan, M.	2002	Advanced textbook on food and nutrition	Bangalore printing and publishing company, Bangalore

Course Designer

Dr. K.S. Tamil Selvi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21PROJ	Project and Viva-voce	Core	-	-	60	5

Preamble

To make the students to understand the importance of experimental analysis, scientific approach in solving problems related to the environment and society and to educate and train the students to write scientific papers

Group Project & Viva Voce

Each group comprising of 5 members will be allotted to a staff Co-ordinator. A specific problem will be assigned to the students or they will be asked to choose a problem /area of their interest. The topic / area of work will be finalized at the end of the IV Semester, allowing scope for the students to gather relevant literature during the vacation. The research work can be carried at the college or any other organization approved by the staff Co-ordinator and the HoD.

Area of work

Cytology, Plant Biology, Plant Biotechnology, Microbiology, Tissue culture and Medicinal Botany & Environmental Sciences, Food and nutrition.

Methodology

Each project should contain the following details:

Brief introduction on the topic

Review of literature

Materials and Methods

Experimental Results and Discussion – evidences in the form of figures, tables and photographs can be enclosed

Summary

Bibliography

The above content should not exceed 50 pages.

Evaluation Internal evaluation of the project work will be carried out in stages as described below.

I Review	Selection of the field of study, topic & literature collection	- 15 marks
II Review	Research design & data collection	-15 marks
III Review	Analysis & conclusion Preparation of rough draft	- 20 marks

Total - 50 marks

End Semester Examination

Evaluation of the project

Relevance of the topic to the academic / society	- 5 marks
Objectives	- 5 marks
Experimental design	- 10 marks
Expression of results and discussion	- 10 marks
Total	- 30 marks

Viva voce

Presentation	-10 marks
Discussion	-10 marks
Total	-20 marks

Grand Total - 100 marks

Viva Voce / presentation will be conducted by a panel of internal examiners including the HoD and the staff Co-ordinator guiding the project. A PowerPoint presentation by the group before the audience will be evaluated on the basis of student's response to questions.

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21SBCE	Coursera Course - Climate Change and Health: From Science to Action	SBS	45	-	-	3

S.No.	Topic of the Course	Link of the Course	Duration in hrs
1.	What is Climate Change?	https://www.coursera.org/learn/what-is-climate-change?specialization=our-responses-climate-change	6
2.	Tropical Forest Landscapes 101: Conservation & Restoration	https://www.coursera.org/learn/tropicalforests101	20
3.	Climate change and Indigenous People and local communities	https://www.coursera.org/learn/climate-change-indigenous-communities	14
4.	Our Earth's future	https://www.coursera.org/learn/earth-climate-change	8

1. What is Climate change?

Week 1 - The Climate System and Climate Change – 2 hours

Week 2 - Impacts of Climate Change – 2 hours

Week 3 - Attitudes About Climate Change – 3 hours

2. Tropical Forest Landscapes 101: Conservation & Restoration

Week 1 - Why conserve and restore tropical forest landscapes? – 3 hours

Week 2 - Ecology of tropical forest landscapes – 3 hours

Week 3 - Social considerations for restoration and conservation – 3 hours

Week 4 - Conservation strategies – 3 hours

Week 5 - Restoration fundamentals – 3 hours

Week 6 - Agroforestry and agroecology – 3 hours

Week 7 - Funding conservation and restoration – 4 hours

3. Climate change and Indigenous People and local communities

Week 1 - Climate change and Indigenous Peoples and local communities – 1 hour

- Introduction – 2 hours

Week 2 - Climate change impacts on indigenous peoples and local communities – 3 hours

Week 3 - Coping and adapting to climate change impacts – 3 hours

Week 4 - Local Indicators of climate change impacts – 2 hours

Week 5 - The role of IPLC in global climate governance – 3 hours

4. Our Earth's future

Week 1 - Climate Change Is Happening: See It – 2 hours

Week 2 - It All Comes Down to the Ocean – 1 hour

Week 3 - Climate Change is Happening: Model It – 1 hour

Week 4 - Living with Climate Change – 1 hour

Week 5 - Mitigate, Adapt, or Suffer? – 2 hours

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21C07	Core Paper VII– Biochemistry and Plant Physiology	Core	73	2	-	4

Preamble

- To study the interactions in aqueous systems
- To understand the structure and functions of biomolecules.
- To obtain knowledge on plant-water relationships
- To understand the various aspects of plant metabolism

Course outcomes

On the successful completion of the course, students will be able to:

CLO Number	CLO Number	Knowledge Level
CLO1	Understand the interactions in aqueous systems	K1, K2
CLO2	Analyze the structure and functions of biomolecules	K2, K3
CLO3	Gain knowledge on the importance of mineral nutrition for plants	K2, K3
CLO4	Appreciate the role of various physiological functions in plant growth and movements	K3, K4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	M
CLO2	S	M	M	S	M
CLO3	M	S	S	M	S
CLO4	M	S	M	M	S

S- Strong; M-Medium

Syllabus

Biochemistry

Unit I

14 hrs

Weak Interactions in Aqueous Systems - Ionization of Water, Weak Acids, and Weak Bases - Buffering against pH Changes in Biological Systems -Water as a Reactant -The Fitness of the aqueous environment for living organisms. Biomolecules: Amino acids – introduction, essential amino acids- peptides - protein structure and properties.

Unit II

14 hrs

Enzymes: Nomenclature and Classification, Characteristics and 3-‘D’ Structure – Mechanism of Enzyme action. Carbohydrates: General Structure and properties of Monosaccharides, Oligosaccharides and Polysaccharides. Lipids: General Structure, Classification, Properties of Fats and Oils.

Plant Physiology

Unit III

15 hrs

Water relations – Diffusion and Osmosis, significance of Osmosis in plants. Determination of osmotic potential and DPD by plasmolytic method. Absorption of water- Active and Passive absorption; Factors affecting absorption of water. Transpiration –kinds of transpiration, Mechanism of stomatal movement, Factors affecting transpiration. Ascent of sap-path os ascent of sap. Transpiration pull and cohesion of water theory. Mineral Nutrition - role of Macronutrients and trace elements on plants.

Unit IV

15 hrs

Photosynthesis: Pigment systems, Light and biochemical reactions, and C₃, C₄ and CAM pathways. Respiration-Aerobic and Anaerobic, Glycolysis, Krebs cycle-electron transport system. Nitrogen metabolism– Biological nitrogen fixation, Transamination and reductive amination.

Unit V

15 hrs

Plant growth and movements: Growth Regulators– Chemical nature, Physiological effect of Auxins, Gibberellins, Kinetins, Ethylene and ABA. Plant movements– Types of movements. Physiology of flowering: Photoperiodism.

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Jain. J.L.	2005	Biochemistry	S. Chand & Company. New Delhi
2.	Rastogi, S.C.	2011	Biochemistry, Third edition	Tata McGraw Hill Education Private Limited, New Delhi.
3.	Albert L. Lehninger, David L. Nelson, and Michael M. Cox	2018	Leninger Principles of Biochemistry	8 th edition, W.H Freeman and Company, United States

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Salisbury, F.B and Ross, C.W.	1992	Plant Physiology	Prentice Hall of India. New Delhi
2.	Day, P.M., and Harborne, J.B.	2000	Plant Biochemistry	Harcourt Asia (P) Ltd., India & Academic Press, Singapore
3.	Jain. V.K.	2017	Fundamentals of Plant Physiology, 19 th ed	Chand & Company. New Delhi

Pedagogy: Power point presentation, Lecture, seminar, quiz and discussion

Course Designers

Dr. C. Krishnaveni

Dr. E. Uma

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21C08	Core Paper VIII – Basics of Bioinformatics	Core	73	2	-	4

Preamble

- To study the requisite background in areas of Genetics, Pharmacoinformatics.

Course outcomes

On the successful completion of the course, students will be able to:

CLO Number	CLO Statement	Knowledge Level
CLO1.	Understand the basic knowledge of DNA, proteins and biological databases	K1
CLO2.	Apply the different types of databases and sequence alignment methods in various fields	K2
CLO3.	Analyze the pattern of sequence analysis	K3
CLO4.	Evaluate the different methods of gene identification and genome annotation	K3
CLO5.	Create the evolutionary relationship between species	K4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO6.	S	S	S	S	S
CLO7.	S	M	S	S	M
CLO8.	M	M	M	M	S
CLO9.	S	S	S	M	S
CLO10.	S	M	S	S	M

S- Strong; M-Medium

Syllabus

Unit I

14 hrs

Bioinformatics:- **History, Scope, importance, Challenges and opportunities. Gene structure-prokaryotes and Eukaryotes.** DNA sequencing: - N-terminal sequencing- Sanger's Method and Edman's degradation method; C-terminal sequencing:- Mass spectrometry, X-ray diffraction method. Protein structure-Primary, Secondary and Tertiary structure

Unit II

14 hrs

Biological Databases:- Sequence database – nucleic acids database (NCBI, DDBJ & EMBL), protein database (PDB, SwissProt). Structure database (CATH, SCOP), literature database (Pubmed); file formats of GenBank, Swiss-Prot, PDB; data retrieval- *Entrez*.

Unit III

15 hrs

Heuristic method of sequence alignment-FASTA and BLAST algorithm, Amino acid substitution matrices – Gaps and gap penalties; Scoring schemes- PAM and BLOSUM, Comparison of PAM and BLOSUM and its limitations.

Sequence analysis types and methods: Pair wise alignment - Global, local, Multiple sequence alignment (MSA) and its applications.

Unit IV

15 hrs

Genomics- Gene identification methods- *Ab initio* method, consensus method, Web-based method-microarray. Gene prediction tools- GRAIL, Glimmer, Genscan, GeneMark. Protein prediction- methods and tools- Secondary structure (GOR, Chou-Fasman), Tertiary structure prediction - Homology Modeling, Threading and fold recognition.

Unit V

15 hrs

Phylogeny- Introduction, Characteristics, types of trees, terminologies, Steps involved in the construction of cladogram, approaches used in phylogenetic analysis, methods (outline only), Applications.

The topics in bold shall be studied by the students through online links (Flipped mode of learning) mentioned in the reference.

Text Books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Arthur.M.Lesk	2003	Introduction to Bioinformatics, 1 st edn.	Oxford University Press, USA
2.	Mani. K and Vijayaraj. N	2004	Bioinformatics A Practical Approach. 1 st edn.	Aparnaa Publication. Tamil Nadu, India
3.	Alam Khan. I	2005	Elementary Bioinformatics. 1 st edn	Pharma Book Syndicate, Adithya Art Printers,
4.	Vinay Sharma. Ashok Munjal, Asheesh Shankar	2008	A text book of Bioinformatics. 1 st edn..	Rastogi Publications, Meerut,
5.	Ignacimuthu SJ	2008	Basic Bioinformatics	Narosa Publishing House, New Delhi.

Reference Books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Pennington.S. R., M. J. Dunn	2002	Proteomics from Protein sequence to function 3 rd edn	Viva Books Pvt.Ltd. New Delhi
2.	Mehrotra,P, Kumund Sarin, Swapna.K.Srivastava.	2005	The New hand Book of Bioinformatics, 1 st edn.	Vikas Publishing House Pvt. Ltd. Noida, Uttar Pradesh. India
3.	Rastogi,R.C. Mendiratta,N. Rastogi,P	2010	Bioinformatics-Methods and applications Genomics, proteomics and Drug discovery, 3 rd edn.	PHI learning private ltd, New Delhi.
4.	List of e-sources - http://www.freebookcentre.net/Biology/BioInformatics-Books.html Bioinformatics - Shomu's Biology (shomusbiology.com)			

Pedagogy: Power point presentation, Lecture, Seminar, Quiz, Flipped Classroom and Group Discussion

Course Designers

Dr.H. Rehana banu

Dr. K. Kiruthika

Dr. Sarah Jaison

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21C09	Core Paper IX– Plant Ecology andPhytogeography	Core	58	2	-	4

Preamble

- To understand the basic principle of ecology.
- To study about the interrelationships among the organisms.
- To gain knowledge on the aspects of ecology like population, community and ecosystem.
- To know about the environmental pollution and its effects.
- To acquire knowledge on the conceptual foundations of biodiversityconservation.

Course outcomes

On the successful completion of the course, students will be able to:

CLO Number	CLOstatement	Knowledge level
CLO1	Identify specific factors that influence an ecosystem	K1
CLO2	Understanding interrelationships among the organisms	K2
CLO3	Apply the dynamics of ecosystem	K3
CLO4	Compare and explain the causes and effects of environmental pollution	K3
CLO5	Examine theimportanceof regional biodiversity anditsconservation measures	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1.	S	S	S	S	S
CLO2.	S	S	S	S	S
CLO3.	S	S	M	S	S
CLO4.	S	S	S	M	S
CLO5.	S	M	M	S	M

S-Strong; M– Medium

Syllabus

Unit I

11 hrs

IntroductiontoEcology:

Definition; scope and importance of autecology and synecology. Environment factors climatic, edaphic,topographicand biotic factors.

UnitIII11 hrs

Population and Community Ecology: Basic concept, characteristics, ecotone, ecotypes and ecads. Plant adaptations - hydrophytes, mesophytes, xerophytes and halophytes-morphological, anatomical and physiological adaptations.

Unit III**12hrs**

Ecosystem concept: Structure - Abiotic and biotic components- Producers, Consumers and Decomposers. Functions- Trophic levels, food chains, food webs, ecological pyramids and energy flow; Biogeochemical cycles- Gaseous cycles (carbon and nitrogen); Sedimentary cycles (phosphorus and sulphur).

Unit IV 12hrs

Environmental Pollution: Definition and Types. Sources, Effects and Control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution and Radiation pollution.

Solid waste management: Causes, effects and control measures of E-waste, urban and industrial wastes.

Unit V 12 hrs

Biodiversity and its Conservation: Definition. Levels of biodiversity. Major terrestrial biomes- tundra, temperate and tropical. Threats to Biodiversity- Endangered species; Vulnerable species, Red Data Book and Monotypic endemic genera of India. *Ex-situ* and *In-situ* conservation.

Phytogeography: Definition and concept of phytogeography. Phytogeographical regions of India, Vegetational Types of India, GIS-remote sensing.

Text Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1	Sharma, P.D.	2017	Ecology and Environment,	Rastogi Publications, Meerut
2	Manju Yadav.	2003	Ecology	Discovery Publishing House, New Delhi.
3	Rana, S.V.S	2013	Essentials of Ecology and Environmental Science	Prentice Hall India Learning Private Limited, India
4	Verma, V	2011	Plant Ecology	Ane Books Pvt. Ltd, New Delhi

Reference Books

S.No	Authors	Year of publication	Title of the book	Publishers
1	Singh, J.S., S.P. Singh and S. R. Gupta	2014	Ecology, Environmental Science and Conservation	S. Chand Publications, New Delhi
2	Odum, E.	2005	Fundamentals of Ecology	Cengage Publications, Saunders publication, Philadelphia
3	Purohit, S.S.	2004	Ecology and Environmental Biology	Agrobios (India).

Pedagogy: Power point presentation, Lecture, seminar, quiz and discussion

Course Designers

Dr. H. Rehana banu

Dr. B.S. Chithra Devi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21E04	AOS IV-Plant Biotechnology	Elective	73	2	-	5

Preamble

- To appreciate the basics of tissue culture techniques.
- To study the biological tools of recombinant DNA technology.
- To appreciate the construction of recombinant DNA and genetic engineering of plants.

Course outcomes

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basic principles and components of Plant Biotechnology	K2
CLO2	Interpret the various techniques of recombinant DNA technology and Plant tissue culture	K3
CLO3	Appraise the applications of genetic engineering in crop improvement.	K4

Mapping with Programme Outcomes

COs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	S
CLO2	S	S	S	M	S
CLO3	S	S	S	M	M

S- Strong; M-Medium

Syllabus

Unit I Tissue culture

14hrs

Introduction, Totipotency, preparation of tissue culture medium (Murashige and Skoog), Macronutrients, Micronutrients, Growth Hormones. Culture techniques – Selection of explants; sterilization and inoculation of explants, callus initiation and maintenance. Cell culture techniques - single cell culture, organogenesis.

Unit II

14hrs

Anther and pollen culture, embryogenesis and micropropagation methods. Protoplast culture - Isolation, fusion and somatic hybridization. Somaclonal variation and its application. Synthetic seed technology.

Unit III

15hrs

Recombinant DNA technology: Introduction to gene cloning and its applications. Tools of recombinant DNA technology – Restriction endonucleases; - Classification and general characteristics of endonucleases. Other enzymes used in the rDNA technique – DNA ligase, alkaline phosphatase – Use of linkers and adapters.

Unit IV

15hrs

Cloning vectors- pBR322 (plasmid), M13 (Bacteriophage vector), lambda gt10 (lambda phage), cosmidLFR (cosmid). Construction of rDNA: Isolation and purification of plasmid DNA, host

cells, and competent cell preparation, screening, and selection of transformed cells-blue, white colonies.

Unit V

15 hrs

Genetic engineering of plants: methods of gene transfer in plants- physical method- particle Bombardment gun method; Biological Method-Agrobacterium tumefaciens- crown gall disease and agroinfection. Application of transgenics in crop improvement-Golden rice and Bt cotton.

Text Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1	Satyanarayana, U.	2005	Biotechnology	Books and Allied Pvt. Ltd., Kolkata.
2	Rastogi, S.C.	2009	Biotechnology Principals & Applications	Narosa Publishing House, New Delhi.
3	Kalyan Kumar, De.	2010	An Introduction to Plant Tissue Culture	New Central Book Agency. Pvt.Ltd. Howrah.
4	Kumaresan, V.	2014	Biotechnology	Saras Publication, Nagercoil, TamilNadu.

Reference Books

S.No	Authors	Year of publication	Title of the book	Publishers
1	Buchanan, Gruissem and Jones.	2004	Biochemistry and Molecular Biology of Plants, 3 rd edn.	I. K. International Pvt. Ltd. New Delhi.
2	Glick and Pasternak	2005	Molecular Biotechnology	ASM Press. Washington
3	Ashwani Kumar and Sudhir K. Sopory.	2008	Recent Advances in plant biotech & its Applications	I.K. International Publishing house, New Delhi.
4	Thieman J. William and Palladino. A Michael	2009	Introduction to Biotechnology.	Dorling Kindersly, PVT. Ltd. Delhi.

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designers

Dr. M. Kamalam
 Dr. M. Kanchana
 Dr.K.Sunitha kumari

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21E05	AOS V- Bioinoculants Paper II	Elective	73	2	-	5

Preamble

- To study the symbiotic association of nitrogen fixing bacteria and the plants.
- To study the distribution, occurrence, morphological variation and characteristics features of algal and bacterial biofertilizers.
- To appreciate the applications of Azolla as bioinoculants.
- To understand the problems associated with the mass production of bioinoculants and its economical condition in the society.

Course outcomes

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1	Symbiotic association of nitrogen fixing bacteria and the plants	K1
CLO2	Appreciate the distribution, occurrence, morphological variation and characteristics features of algal and bacterial bioinoculants	K1
CLO3	Use Azolla as bioinoculants for crop improvement	K2
CLO4	Practice the methods involved in the production of bioinoculants	K1
CLO5	Problems associated with the mass production of biofertilizers and its economical condition in the society	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO6.	S	S	S	M	S
CLO7.	S	S	S	M	S
CLO8.	S	S	M	M	M
CLO9.	S	S	M	M	M
CLO10.	S	S	S	S	S

S- Strong; M-Medium

Syllabus

Unit -1

14 hrs

The organisms that fix atmospheric nitrogen- free - living, aerobic, symbiotic bacteria and Frankia. *Rhizobium* classification- cross inoculation groups- characteristics- Infection - root

nodule formation- leghaemoglobin- factors affecting nodulation. Nitrogen fixation- Nitrogen assimilation. Associative symbiosis-Biochemistry of Nitrogen fixation- nitrogenase- mechanism of nitrogenase- hydrogenase - Assay of nitrogen fixation.

Unit-II

14 hrs

Distribution - occurrence - Morphological variation – characteristics of bacterial biofertilizers: *Azotobacter*, *Azospirillum*, *Acetobacter*. Algal bioinoculants: distribution- occurrence- Morphological variation – characteristics of *Anabaena* and *Nostoc*.

Unit-III

15hrs

Azolla – Importance, *Azolla* - *Anabaena* symbiosis- growth behaviour– sporulation. Principles of Mass production- growth characteristics- Fermentation- Principles and techniques - inoculum preparation.

Unit-IV

15hrs

Carrier materials- Types and quality characteristics of an ideal carrier- preparation of inoculant packets Field performance of bioinoculants - method of application.

Unit- V

15 hrs

Large-scale production of bacterial bioinoculants, *Azolla* and Cyanobacteria, Arbuscular Mycorrhizal (AM) fungi and Ectomycorrhiza. Problems and prospects of bioinoculants. Storage Shelf life - Quality control of bioinoculants - BSI standards of bioinoculants - Economics of bioinoculants.

Text Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1	Kumaraesan, V.	2001	Biotechnology (1 st ed).	Saras Publication, Nagercoil.
2	Dubey, R.C.	2004	A Text book of Biotechnology (4 th edn).	S. Chand & Co, New Delhi
3	Satyanarayana, U.	2005	Biotechnology. (1 st ed)	Books and Allied Publishers. Ltd. Kolkatta.

Reference Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1	Subba Rao, N.S.	1982	Advances in Agricultural Microbiology	Oxford and IBH Publ.Co., New Delhi.
2	Subba Rao, N.S.	1993	Biofertilizers in Agriculture and Forestry	Oxford and IBH Publ. Co., New Delhi

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designer

Dr. K. Sunitha Kumari

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21E06	AOS VI – Pharmacognosy	Core	73	2	-	5

Preamble

- To study the importance of traditional system of medicine
- To understand the characters of crude drugs

Course outcomes

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the Traditional systems of Indian medicine	K1
CLO2	Identify the crude drugs	K2
CLO3	Appreciate the Processing of crude drugs	K2
CLO4	Detect the adulteration of the crude drug	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO5.	S	S	S	M	S
CLO6.	S	M	S	S	M
CLO7.	M	M	M	M	S
CLO8.	S	S	S	M	S

S- Strong; M-Medium

Syllabus

Unit I

14 hrs

General account of Indian Systems of medicine- Ayurveda, Siddha, Unani and Homeopathy (AYUSH). Various systems of classification of natural drugs- Alphabetical, Morphological and taxonomical classification.

Unit II

14 hrs

Crude drugs. Identification based on morphological and anatomical characters. Collection of medicinal plants – Aerial and underground drug collection. Drying of drugs. Packing and marketing of plant drugs. Factors affecting the yield of plant drugs.

Unit III

15hrs

Pharmacological grouping of plant drugs. Secondary metabolites in plants. Therapeutical and pharmaceutical applications of secondary metabolites like – alkaloids, steroids, tannins and terpenoids.

Unit IV

15 hrs

Origin, distribution and uses of herbal drugs- bark (*Cinchona officinalis* L.), leaves (*Adhatodavastica* Nees), rhizome (*Alpinia galanga* (L.) Willd.), and flower (*Eugenia caryophyllata* L.). Effect of herbal drugs on Central Nervous system- *Datura metal* L., *Withaniasomnifera*(L.) Dunaland *Papaver somniferum*L. Cardiovascular system – *Digitalis purpurea* L.

Unit V

15 hrs

Drug adulteration– types of adulteration. A brief account of biological testing of crude drugs. phytochemical investigation- qualitative testing of crude drugs – Alkaloids, tannins and terpenoids, glycosides and saponins.

Text Books

S.No	Authors	Year of publication	Title of the book	Publishers
1	Saharan, Moond, Chouhan and Gupta.	2008.	Principles of Pharmacognosy	Agrobios, Jodhpur India.
2	Kokate C.K., Purohit, A.P and Gokhale, S.B	2014.	Pharmacognosy (49 th ed.).	Nirali Publications, Mumbai.

Reference Books

S.No.	Authors	Year of publication	Title of the book	Publishers
1	Warrier, P.K, Nambiar, V.P.K and Ramakutty,(eds).	1993	Indian Medicinal Plants	Orient Longman Ltd, Chennai.
2	Evans, W.C.	2008.	Trease and Evans- Pharmacognosy (15 th ed.).	Saunders- An imprint of Elsevier, Philadelphia.

Pedagogy: Power point presentation, Lecture, seminar, quiz and discussion

Course Designer

Dr. M. Kamalam

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21CP4	Core Practical IV (Core Paper VII, VIII, IX and AOS IV/V/VI)	Core	-	-	120	6

Preamble

- To study the physiological movements and biochemical estimation of plants.
- To acquire the knowledge of pharmacological aspects of medicinal plants
- To understand the biotic interactions of organisms and their applications.
- To acquire knowledge in basic tissue culture techniques and plant genetic engineering.

Course outcomes

On the successful completion of the course, students will be able to:

CLO Number	CLO Statement	Knowledge Level
CLO1.	Determine the movement of plants	K3
CLO2.	Examine the morphological, anatomical and chemical constituents of medicinal plants	K3
CLO3.	Demonstrate the interactions, adaptations and the distribution of organisms	K3
CLO4.	Utilize the knowledge of plant tissue culture for crop improvement	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO5.	M	S	S	M	S
CLO6.	S	M	M	S	S
CLO7.	M	S	S	S	M
CLO8.	S	M	S	S	S

S- Strong; M-Medium

Syllabus

Core Paper VII -Physiology and Biochemistry (45 hrs)

Individual Experiments:

Estimation of proteins

Estimation of carbohydrates.

Determination of Osmotic potential by plasmolytic method.

Separation of leaf pigments by Paper chromatography.

Measurement of rate of photosynthesis under various CO₂ concentration.

Effect of light intensity on O₂ evolution during photosynthesis.

Demonstration experiments:

Simple respiroscope.

Ganong's photometer.

Transpiration pull apparatus.

Determination of water absorption and transpiration ratio.

Core Paper IX-Plant Ecology and Phytogeography (30 hrs)

1. To determine the soil texture, temperature, moisture and pH of different soil.

2. Study of local vegetation in the college campus by quadrat method.
3. Determination of dissolved O₂ of water samples from polluted and unpolluted sources.
4. Determination of dissolved CO₂ of water samples from polluted and unpolluted sources.
5. Estimation of Biological Oxygen Demand of water samples from polluted and unpolluted sources.
6. To locate the hotspots and phytogeographical regions in the map of India.

Spotters:

Biotic interactions: Mutualism-Lichens, Parasitism-Stem parasite *Cuscuta*, Root parasite-*Orobancha*, Epiphytes – *Vanda*, Predation- *Nepenthes*

Plant adaptations: Hydrophytes (*Eichhornia*), Xerophytes (*Nerium*) and Mesophytes (*Hibiscus*).

Core Paper VIII– Basics of Bioinformatics& AOS IV-Plant Biotechnology (45hrs)

Demonstration:

Preparation of MS medium, Sterilization of explants (such as nodes, inter nodes, shoot apex and anthers), inoculation and culture maintenance, synthetic seed preparation.

Isolation and purification of plasmid DNA, host cells and competent cell preparation, screening and selection of transformed cells - blue, white colonies., Agarose gel electrophoresis and gel documentation.

Spotters:

Biological database- Gen Bank, Multiple Sequence Alignment- Clustal W and Phylogenetic Analysis. Callus initiation, Crown gall disease in plants, Gene gun/ biolistic (particle bombardment) gun, Golden rice and Bt cotton.

Or

AOS V Bioinoculants- Paper II

Mass multiplication of bacterial bioinoculants - Fermentor

Carrier material - preparation of inoculant packets

Quality control - assessment of shelf life and storage methods

Methods of application of bacterial bioinoculants- seed coating, soil application.

Isolation, enumeration and identification of cyanobacteria

Cyanobacteria - large scale production and method of application.

Azolla - large scale production and inoculation methods.

Different genera of AM and Mass multiplication - application methods

Or

AOS VI- Pharmacognosy and Medicinal Botany

Morphology and uses of leaf drug *Adathodavasica* Nees; bark- *Cinchona officinalis* L., rhizome -*Alpinia galanga* Nees; root- *Withaniasomnifera* (L.) Dunal; Latex-*Papaver somniferum* L.; Flower bud- *Eugenia caryophyllata* L.

Course Designers

Dr. M. Kanchana

Dr. H. Rehanabanu

Dr. E. Uma

Dr. K. Sunithakumari

Dr. Sarah Jaison

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16AC3	Industrial Biotechnology	Advanced Learners Course	-	-	-	5

Preamble

- To know about the characteristics of bioprocessing.
- To study the Microbial production of human growth hormone.
- To learn the processes involved in industrial microbial production.
- To understand the concept of the waste water treatment and bioremediation.
- To get an idea about patenting biotechnology inventions.

Course outcomes

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1	Characteristics of bioprocessing	K1
CLO2	Processes involved in industrial microbial production	K1
CLO3	Microbial production of human growth hormone	K2
CLO4	Concept of the waste water treatment and bioremediation	K2
CLO5	Get an idea about patenting biotechnology inventions	K1

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO6.	S	S	S	S	S
CLO7.	S	S	S	M	S
CLO8.	S	S	M	M	M
CLO9.	S	S	M	M	M
CLO10.	S	S	S	M	M

S- Strong; M-Medium

Syllabus

Unit –I

Introduction to Industrial Biotechnology - Objectives and Scope: Characteristics and comparison of bioprocessing with chemical processing.

Unit-II

Biotechnology in health care: Gene therapy. Microbial production of human growth hormone. An outline of recombinant vaccines.

Unit III

Industrial microbial production: Production of industrial enzymes: amylase, aminoacid: L-lysine, antibiotics: streptomycin, Organic acid: Vinegar and lactic acid.

Unit-IV

Waste water treatment for dairies, dye industries, distilleries, tanneries and sugar industries. Water recycling. Bioremediation

Unit- V

Biotechnology and society: Patenting biotechnology inventions. Environmental risks of genetically engineered organisms.

Text Books

S.No	Authors	Year of publication	Title of the book	Publishers
1	Satyanarayana, U.	2005.	Biotechnology, 1 st Edition	Books and Allied Publishers, Ltd. Kolkatta.
2	Dubey, R.C.	2006.	A Textbook of Biotechnology	S.Chand& Co. Ltd, New Delhi.

Reference Books

S.No	Authors	Year of publication	Title of the book	Publishers
1	Michael L.Shuler and Fikret Kargi.	1992	Bioprocess Engineering Basic concepts,	Prentice Hall, United States.
2	Presscott and Dunn.	1983	Industrial Microbiology, 4 th edition,	AVI publishing Co. USA.

Course Designer

Dr. H. Rehana banu

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL19AC4	Mushroom Culture Techniques	Advanced Learners Course	-	-	-	5

Preamble

- To know about the morphology and classification of common edible mushrooms.
- To gain knowledge on the life cycle of mushrooms.
- To learn the cultivation processes of mushrooms.
- To understand the medicinal properties of mushrooms.
- To obtain knowledge on the diseases of mushrooms.

Course outcomes

On the successful completion of the course, students will be able to understand the following:

CLO Number	CLO Statement	Knowledge Level
CLO1	Know about the morphology and classification of common edible mushrooms	K1
CLO2	Gain knowledge on the life cycle of mushrooms	K1
CLO3	Cultivation processes of mushrooms	K2
CLO4	Medicinal properties of mushrooms	K2
CLO5	Obtain knowledge on the diseases of mushrooms	K1

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO6.	S	S	S	S	S
CLO7.	S	S	S	M	S
CLO8.	S	S	M	M	M
CLO9.	S	S	M	M	M
CLO10.	S	S	S	M	M

S- Strong; M-Medium

Syllabus

Unit –I

Introduction, history of mushroom cultivation; Morphology and classification of mushrooms. Poisonous mushrooms. Distinctive features and symptoms of mushroom poisoning. Key to differentiate Edible from non-edible mushroom.

Unit-II

Distinguishing characteristics, germination and life cycle of commonly cultivated mushrooms – Indian Oyster mushroom (*Pleurotus* sp.), button mushroom (*Agaricus* sp.), and paddy straw mushroom (*Volvariella* sp.) and medicinal mushrooms (*Ganoderma* sp.).

Unit III

Mushroom Cultivation– Conditions for tropical and temperate countries, Infrastructure, equipments and substrates used in mushroom cultivation. Isolation, spawn production, growth media, maintenance and harvesting of mushrooms.

Unit-IV

Medicinal properties and nutritional value of mushrooms, storage and composting of waste using mushrooms. Recipes of mushrooms: Mushroom pulav, mushroom gravy and Mushroom cutlet. Mushroom research centers/farms: National level and regional level. Marketing of mushrooms in India and world.

Unit- V

Diseases of mushrooms- Insect pest, nematodes, mites, viruses, fungal competitors and other important diseases. Post harvest technology – Freezing, drying and canning.

Text Books

S.No	Authors	Year of publication	Title of the book	Publishers
1	Satyanarayana, U.	2005.	Biotechnology, 1 st Edition,	Books and Allied Publishers, Ltd. Kolkatta.
2	Dubey, R.C.	2006.	A Textbook of Biotechnology	S.Chand& Co. Ltd, New Delhi.
3	Reeti Singh and U.C. Singh.	2011.	Modern Mushroom Cultivation,	Agrobios (India).

Reference Books

S.No	Authors	Year of publication	Title of the book	Publishers
1	Tripathi, D.P	2005	Mushroom Cultivation,	Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
2	Pathak Yadav Gour.	2010.	Mushroom Production and Processing Technology	Published by Agrobios (India).

Course Designer

Dr. H. Rehana banu

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL21SBP1	Skill Based Subject - Horticulture Practicals	SBS	-	-	45	3

Preamble

- ✓ To understand the preparation of vermicompost to grow various horticultural crops
- ✓ To get skilled in various horticultural techniques

Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	To gain knowledge on the various tools used in horticulture	K1
CLO2	To learn to prepare vermicompost and to construct vegetable garden	K2
CLO3	To learn cut flower techniques	K2
CLO4	Develop skills to propagate various horticultural crops	K3

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	M
CLO2	S	S	M	M	M
CLO3	S	S	M	M	S
CLO4	S	S	M	M	S

S- Strong; M-Medium

Syllabus

Practicals

1. Study of tools used in horticulture
2. Preparation of vermicompost
3. Build a vegetable garden
4. Cutting-leaf, root and stem cutting
5. Layering-simple and air layering
6. Grafting-splice and cleft grafting
7. Budding-T-patch and H-chip budding
8. Flower arrangement-Fresh and Dry Flowers
9. Microgreen cultivation
10. Hydroponics
11. Bonsai technique
12. Visit to nursery and gardens to get a detailed understanding on nursery management

Course Designer

Dr. K.S.TamilSelvi

Dr. Sarah Jaison