



# PSGR KRISHNAMMAL COLLEGE FOR WOMEN

## College of Excellence

(An Autonomous Institution, Affiliated to Bharathiar University)  
(Reaccredited with 'A' Grade by NAAC, An ISO 9001:2008 Certified Institution)  
Peelamedu, Coimbatore-641004



## DEPARTMENT OF BOTANY

### CHOICE BASED CREDIT SYSTEM & OUTCOME BASED EDUCATION SYLLABUS

### BACHELOR OF BOTANY (B.Sc Botany)

2017 - 2020



# PSGR KRISHNAMMAL COLLEGE FOR WOMEN

## College of Excellence

(An Autonomous Institution, Affiliated to Bharathiar University)  
(Reaccredited with 'A' Grade by NAAC, An ISO 9001:2008 Certified Institution)  
Peelamedu, Coimbatore-641004



### PROGRAMME OUTCOME (POs):

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

**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.

**Students will develop the ability to apply the process of science-** Understand defining characteristics of the process of science; practice the skills of the scientific method. Engage in research projects. Apply quantitative skills to biological problems. Understand the role of uncertainty in science.

**Students will be able to communicate and collaborate within and outside of biology.** Tap into the interdisciplinary nature of science.

**Students should understand the relationship between science and society.** Evaluate the impact of science on society. Evaluate the ethical implications of science. Explore how science is applied in a social context.

### PROGRAMME SPECIFIC OBJECTIVES (PSOs)

The students at the time of graduation will

**PSO 1:** Obtain strong foundation in classical botany, interdisciplinary subjects such as Bioinformatics, Biostatistics, and advance topics in Cell and Molecular biology, Biochemistry and Plant Biotechnology.

**PSO 2:** Build capacity in Horticulture and production of cut flowers from the skill based courses offered.

**PSO 3:** Carry out individual short term internship and project work to acquire knowledge on research using basic and advanced instruments/equipments.

**PSO 4:** Find opportunities for higher studies in top ranking universities.

**PSO 5:** Gain career in teaching/research in Botany.



# PSGR KRISHNAMMAL COLLEGE FOR WOMEN

## College of Excellence

(An Autonomous Institution, Affiliated to Bharathiar University)  
 (Reaccredited with 'A' Grade by NAAC, An ISO 9001:2008 Certified Institution)  
 Peelamedu, Coimbatore-641004



## DEPARTMENT OF BOTANY

### CHOICE BASED CREDIT SYSTEM & OUTCOME BASED EDUCATION SYLLABUS & SCHEME OF EXAMINATION

2017 - 2020

Sem	Part	Subject Code	Title of the Paper	Instru tion Hrs/w eek	Total Hrs		Duration of exam hrs	Maximum Marks			Cred it
					Conta ct Hrs	Tutoria l Hrs		CA	ESE	Total	
I	I	TAM1701/HIN 1701/FRE1701	Language T/H/F Paper I	6	86	4	3	40	60	100	3
	II	ENG1701/ ENG17F1	English Paper-I/Functional English Paper -I	6	86	4	3	40	60	100	3
	III	PL17C01	Core Paper –I Microbiology & Plant diversity I	6	86	4	3	40	60	100	6
		PL17CP1	Core Practical – I	3	-	-	-	-	-	-	-
		CE17A01/PS16 A01/	Allied Chemistry Paper-I/ Allied Physics Paper-I/	4	56	4	3	40	60	100#	4
			7	101	4	3	40	60	100	5	
		TH17A01	Allied Paper I - Mathematical Statistics - I								
	CE17AP1 /PS16AP1	Allied Practical Chemistry / Physics	3	-	-	-	-	-	-	-	
	IV	NME16B1/ NME16A1/ NME12 WS / NME12AS/ NME12GS	Basic Tamil/Advanced Tamil/Women Studies, Ambedhkar Studies, Gandhian Studies	2	-	-	3	50/2 5/ 100	50/7 5/-	100	2

II	I	TAM1702/HIN1702/FRE1702	Language T/H/F Paper - II	6	86	4	3	40	60	100	3	
	II	ENG1702/ENG17F2	English Paper-II /Functional English Paper - II	6	86	4	3	40	60	100	3	
	III	PL17C02	Core Paper II – Plant diversity II		5	71	4	3	40	60	100	5
		PL17CP1	Core Practical I (Core Paper I & II)		3	90	-	3	40	60	100	3
		CE17A02/ PS16A02/ TH17A02	Allied Chemistry Paper-II / Physics Paper –II / Allied Paper II - Mathematical Statistics II		5	71	4	3	20	55	75	4
					8	116	4	3	40	60	100	5
	CE17AP1/ PS16AP1	Allied Chemistry Practical/Allied Physics Practical		3	-	-	3	20	30	50	2	
IV	OPS1608	Open course-self study online courses		-	-	-	-	2	-	-		
II	IV	NME16B2/A2	Basic Tamil/Advanced Tamil**		-	-	-	-	-	-	-	
			PDP	2	-	-	-	-	-	100	2	
		NM12GAW	Foundation Course –1 (General awareness)	Self study (Online)					100	-	-	Grade
III	I	TAM1603/ HIN1603/FRE1603	Language T/H/F – Paper III	6	86	4	3	40	60	100	3	
	II	ENG1603/ENG16F3	English Paper III / Functional English Paper III	5	71	4	3	40	60	100	3	
	III	PL16C03	Core Paper III Cell & Molecular Biology	5	71	4	3	40	60	100	5	

		PL16CP2	Core Practical – II (Core Paper III)	2	30	--	--	--	--	--	--
		AS16A01/PS12 A03	Allied- II-Paper I-Zoology/ Physics	4	56	4	3	40	60	100#	4
		TH16A09	Allied-II-Paper-I-Maths	7	101	4	3	40	60	100#	5
		AS16AP1/PS08 AP1	Allied II- Practical I Zoology/Physics	3	45	-	-	-	-	-	-
		NM10EVS	FC-II-Environmental Studies	Self-study	-	-	-	-	-	-	-
		NM14VHR	FC III-Value Education and Human Rights	2	26	4	-	100	-	100	2
	IV	SB16HC01	Skill Based Subject Horticulture Level- I Theory	3	14	1	-	-	-	-	-
		SB16HCP1	Skill Based Subject Horticulture Practical Level- I		30	-	-	-	-	-	-
IV	I	TAM1604/HIN 1604/ FRE1604	Language T/H/F Paper IV	5	71	4	3	40	60	100	3
	II	ENG1604/ENG 16F4	English Paper IV / Functional English Paper IV	6	86	4	3	40	60	100	3
	III	PL16C04	Core Paper-IV- Plant Anatomy Wood Technology and Embryology	5	71	4	3	40	60	100	5
		PL16CP2	Core Practical II (Core Paper III & IV)	2	30	-	3	40	60	100	4
	IV	AS16A02/PS12 A04	Allied-II-Paper-II- Zoology/ Physics	4	56	4	3	40	60	100	4
		TH16A14	Allied II-Paper II-Maths	7	101	4	3	40	60	100	5

V		AS16AP1/PS08 AP1	Allied II – Practical – Zoology/ Physics	2	-	-	3	20	30	50	2	
		SB16HC01	Skill Based Subject Horticulture Level-I Theory	3	29	1	2	25	75	100	4	
		SB16HCP1	Skill Based Subject Horticulture Practical Level-I		15	-	3	40	60	100	2	
		NM10EVS	FC-II Environmental Studies	2	26	4	3	-	100	100	2	
		INST I	Internship/Field training	Two weeks	-	-	-	-	-	100**	2	
		-----	NSS / NCC / YRC/Sports/ Games	-	-	-				100**	1	
	III		PL17C05	Core Paper V – Plant taxonomy and Economic Botany	4	56	4	3	40	60	100	4
			PL17C06	Core Paper VI- Genetics, Plant breeding and Biostatistics	4	56	4	3	40	60	100	4
			PL17E01	AOS I Dietetics, Food Processing and Preservation  (or)	5	71	4	3	40	60	100	5
		PL16E02	AOS II Bioinoculants- Paper I (or)									
	PL16E03	AOS III Environmental Biotechnology										

		PL17CP3	Core Practical III [Core Paper V, VI, AOS I/II/III]	8(3+3+2)	-	-	-	-	-	-	-
		PL16AC1	**Advanced Learners Course- Food Microbiology or	-	-	-	3	-	-	*100	*5
		PL16AC2	**Advanced Learners Course- Nutrition Science								
		PL16PROJ	Project & Viva voce	4	-	-	Viva	20	80	100	5
IV		SB16HC02	Skill Based Subject- Horticulture Level II	1	14	1	-	-	-	-	-
		SB16HCP2	Skill Based Subject- Horticulture Practical Level II	2	30	-	-	-	-	-	-
		NM13IS1	Level-1 Information Security	2	26	4	-	100	-	100	-
		PL16CE	Comprehensive Test	--	--	--	--	--	--	Grade	Grade
VI	III	PL17C07	Core Paper VII –Bio-chemistry and Plant physiology	5	71	4	3	40	60	100	5
		PL17C08	Core Paper VIII – Basics of Bioinformatics	5	71	4	3	40	60	100	5
		PL16C09	Core Paper IX – Plant Ecology & Phytogeography	4	56	4	3	40	60	100	4
		PL16E04	AOS IV Plant Biotechnology or	5	71	4	3	40	60	100	5

	PL16E05	AOS V Bioinoculants- Paper II or									
	PL17E06	AOS- VI Pharmacognosy and Medicinal Botany									
	PL17CP3	Core Practical III [Core Paper V, VI, AOS I/II/III],	--	--	-	3	40	60	100	4	
	PL17CP4	Core Practical IV (Core Paper VII, VIII, IX, AOS IV/V/VI)	8 (3+2+ 3 (VIII & AOS)	--	--	3	40	60	100	4	
	PL16AC3	**Advanced Learners Course Industrial Biotechnology									
	PL16AC4	or **Advanced Learners Course – Mushroom Technology	-	-	-	3	-	-	*100	*5	
IV	SB16HC02	Skill Based Subject- Horticulture Level II	2	29	1	3	40	60	100	4	
	SB16HCP2	Skill Based Subject- Horticulture Practical Level II	1	15	-	3	40	60	100	2	
									3800	140	

#Allied theory papers with practicals will be evaluated for 40/60 and converted into 20/55

\*- not considered for grand total and CGPA \*\* Outside class hours.



## QUESTION PAPER PATTERN

### CORE & ALLIED PAPERS

#### **Continuous Internal Assessment : 20 Marks**

SECTION	MARKS	TOTAL
A – 5 X 2 Marks	10	50
B – 4 X 5 Marks	20	
C - 2/3 X 10 Marks	20	

#### **End Semester Examination : 20 Marks**

SECTION	WORD LIMIT	MARKS	TOTAL
A-12/15 X 2 Marks	One or two sentences	24	100
B - 6/8 X 6 Marks	250	36	
C - 4/6 X 10 Marks	500	40	

### SKILL BASED SUBJECT

#### **Continuous Internal Assessment : 20 Marks**

SECTION	MARKS	TOTAL
A – 4 / 6 X 4 Marks	16	25
B – 1 / 2 X 9 Marks	9	

#### **End Semester Examination : 20 Marks**

SECTION	MARKS	TOTAL
A- 4 / 6 X 5 Marks	20	50
B – 2 / 3 X 15 Marks	30	

### ADVANCED LEARNERS COURSE (ALC)

#### **Continuous Internal Assessment : 20 Marks**

SECTION	MARKS	TOTAL
A – 4 / 6 X 4 Marks	16	25
B – 1 / 2 X 9 Marks	9	

**End Semester Examination : 20 Marks**

SECTION	MARKS	TOTAL
A-5/8X5=25 Marks	25	75
B – 5/8X10=50 Marks	50	

**VALUE EDUCATION AND HUMAN RIGHTS / WOMEN STUDIES / AMBEDKAR STUDIES / GANDHIAN STUDIES / ENTREPRENEURSHIP / ENVIRONMENTAL STUDIES**

**Continuous Internal Assessment : 50 Marks**

SECTION	MARKS	TOTAL
A – 4 / 6 X 5 Marks	20	50
B – 2 / 3 X 15 Marks	30	

Value Education and Human Rights & Environmental Studies two internal tests will be conducted for 50 marks each and the total marks secured will be equated to a maximum of 75 marks and 25 marks is allotted for project / group discussion / presentation of a report.

**INFORMATION SECURITY**

**Continuous Internal Assessment : 50 Marks**

SECTION	MARKS	TOTAL
A – 5 / 8 X 2 Marks	10	40
B – 6 / 8 X 5 Marks	30	

**FIELD TRAINING**

The students have the option to select any organization – Government / private like industry, R & D organizations, scientific companies, etc., in consultation with the staff co-ordinator & HoD. The students are to undergo training for a period of two weeks at the end of semester IV during vacation. The students must maintain a work diary and prepare report of the training undergone and submit the same to the HoD. On a stipulated date, there will be a viva-voce with internal examiners at the beginning of the semester V

<b>MODE OF EVALUATION</b>	<b>MARKS</b>	<b>TOTAL</b>
Attendance	10	100
Work Diary	15	
Report	50	
Viva-voce	25	

## PROJECT

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 will be comprising of 5 members and will be allotted to a staff coordinator. A specific problem will be assigned to the students or they will be asked to choose a problem/ area of interest. The topic/ area of work will be finalized at the end of 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 coordinator and the HOD. Viva-voce/ presentation will be conducted by a panel of internal examiners including the HOD and the staff coordinator guiding the project. A PowerPoint / OHP presentation by the group before the audience will be evaluated on the basis of student's response to questions.

### 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	- 5 marks
II Review	Research design & data collection	-10 marks
III Review	Analysis & conclusion Preparation of rough draft	- 5 marks
	Total	-20 marks

### End Semester Examination

#### Evaluation of the project

Relevance of the topic to the academic / society	- 10 marks
Objectives	- 10 marks
Experimental design	- 20 marks
Expression of results and discussion	- 20 marks
Total	- 60 marks

### Viva voce

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

**Grand Total - 100 marks**

**WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF  
CONTINUOUS INTERNAL ASSESSMENT**

**Theory**

	CI A I	CI A II	Mod el Exa m	Assignme nt/ Class Notes	Semin ar	Qui z	Class Participati on	Librar y Usage	Attendan ce	Max. Mark s
Core / Allied	5	5	6	4	5	4	5	3	3	40
SBS	5	5	15	-	-	-	-	-	-	25
ALC		10	15	-	-	-	-	-	-	25
Informati on Security	40	40		10		10				100

**Practical**

	<b>Model Exam</b>	<b>Lab Performance</b>	<b>Regularity in Record Submission</b>	<b>Attendance</b>	<b>Maximum Marks</b>
Core / Allied / SBS	12	20	5	3	40

## RUBRICS

### Assignment/ Seminar

**Maximum - 20 Marks (converted to 4 marks)**

<b>Criteria</b>	<b>4 Marks</b>	<b>3 Marks</b>	<b>2 Marks</b>	<b>1 Mark</b>
<b>Focus Purpose</b>	Clear	Shows awareness	Shows little awareness	No awareness
<b>Main idea</b>	Clearly presents a main idea.	Main idea supported throughout	Vague sense	No main idea
<b>Organisation: Overall</b>	Well planned	Good overall organization	There is a sense of organization	No sense of organization
<b>Content</b>	Exceptionally well presented	Well presented	Content is sound	Not good
<b>Style: Details and Examples</b>	Large amounts of specific examples and detailed description	Some use of examples and detailed descriptions	Little use of specific examples and details	No use of examples

## CLASS PARTICIPATION

Maximum - 20 Marks (converted to 5 marks)

Criteria	5 Marks	4 Marks	3 Marks	2 Marks	1 Mark	Points scored
<b>Level of Engagement in Class</b>	Student proactively contributes to class by offering ideas and asks questions more than once per class.	Student proactively contributes to class by offering ideas and asks questions once per class.	Student contributes to class and asks questions occasionally	Student rarely contributes to class by offering ideas and asking no questions	Student never contributes to class by offering ideas	
<b>Listening Skills</b>	Student listens when others talk, both in groups and in class. Student incorporates or builds off of the ideas of others.	Student listens when others talk, both in groups and in class.	Student listens when others talk in groups and in class occasionally	Student does not listen when others talk, both in groups and in class.	Student does not listen when others talk, both in groups and in class. Student often interrupts when others speak.	
<b>Behavior</b>	Student almost never displays disruptive behavior during class	Student rarely displays disruptive behavior during class	Student occasionally displays disruptive behavior during class	Student often displays disruptive behavior during class	Student almost always displays disruptive behavior during class	
<b>Preparation</b>	Student is almost always prepared for class with required class materials	Student is usually prepared for class with required class materials	Student is occasionally prepared for class with required class materials	Student is rarely prepared for class with required class materials	Student is almost never prepared for class.	
					<b>Total</b>	

**MAPPING OF POs WITH COs**

COURSE	PROGRAMME OUTCOMES				
	PO1	PO2	PO3	PO4	PO5
<b>COURSE - PL17C01</b>					
CO1	S	S	S	S	-
CO2	S	S	S	M	-
CO3	M	S	M	S	-
CO4	S	M	S	M	-
CO5	S	M	M	S	-
<b>COURSE - PL17C02</b>					
CO1	S	S	S	M	-
CO2	S	S	S	M	-
CO3	S	S	M	M	-
CO4	S	S	M	M	-
CO5	S	S	S	S	-
<b>COURSE - PL17CP1</b>					
CO1	S	S	M	M	-
CO2	S	S	M	M	-
CO3	S	S	M	M	-
CO4	S	S	M	M	-
<b>COURSE-PL16C03</b>					
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	M	M	M
CO4	S	S	M	M	M
CO5	S	S	S	S	S
<b>COURSE-PL16C04</b>					
CO1	S	S	M	S	M
CO2	S	M	S	M	M
CO3	S	S	M	S	M
CO4	S	S	M	M	M
CO5	S	S	M	S	M
<b>COURSE-PL16CP2</b>					
CO1	S	S	M	M	S
CO2	M	S	S	M	S
CO3	S	S	M	S	M
CO4	M	S	S	M	S
CO5	S	S	M	S	M



<b>COURSE-PL17A01</b>					
CO1	S	M	M	S	S
CO2	S	S	M	M	M
CO3	M	M	S	S	S
<b>COURSE-PL17A02</b>					
CO1	M	S	M	M	M
CO2	S	S	M	S	S
CO3	M	M	M	M	M
CO4	S	S	S	S	M
CO5	S	M	M	M	M
<b>COURSE-PL17AP1</b>					
CO1	M	S	M	M	M
CO2	S	S	M	S	S
CO3	M	M	M	M	M
CO4	S	S	S	S	M
CO5	S	M	M	M	M
<b>COURSE-PL17C05</b>					
CO1	M	S	M	S	M
CO2	S	M	S	S	M
CO3	M	S	M	M	S
CO4	M	S	M	S	S
<b>COURSE-PL17C06</b>					
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	M	M	M
CO4	S	S	M	M	M
CO5	S	S	S	S	S
<b>COURSE-PL17E01</b>					
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	M	M	M
CO4	S	S	M	M	M
CO5	S	S	S	S	S
<b>COURSE-PL16E02</b>					
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	M	M	M
CO4	S	S	M	M	M
CO5	S	S	S	S	S
<b>COURSE-PL16E03</b>					
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	M	M	M
CO4	S	S	M	M	M

CO5	S	S	S	S	S
<b>COURSE-PL17CP3</b>					
CO1	M	S	M	S	S
CO2	S	M	S	S	M
CO3	S	S	M	M	S
CO4	M	S	S	M	S
<b>COURSE-PL16AC1</b>					
CO1	S	S	M	S	S
CO2	S	S	M	M	S
CO3	S	S	M	M	S
CO4	S	S	M	M	S
CO5	S	S	M	M	M
<b>COURSE-PL16AC2</b>					
CO1	S	S	L	M	S
CO2	S	S	L	M	S
CO3	S	S	L	M	S
CO4	S	S	L	M	S
CO5	S	S	L	M	M
<b>COURSE-PL17C07</b>					
CO1	S	S	M	M	M
CO2	S	M	M	S	M
CO3	M	S	S	M	S
CO4	M	S	M	M	S
<b>COURSE-PL17C08</b>					
CO1	S	S	S	M	S
CO2	S	M	S	S	M
CO3	M	M	M	M	S
CO4	S	S	S	M	S
CO5	S	M	S	S	M
<b>COURSE-PL16C09</b>					
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	S	M	S
CO5	S	M	M	S	M
<b>COURSE-PL16E04</b>					
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	S	M	M
CO4	S	S	S	M	S
CO5	S	S	S	S	M
<b>COURSE-PL16E05</b>					
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	M	M	M

CO4	S	S	M	M	M
CO5	S	S	S	S	S
<b>COURSE-PL17E06</b>					
CO1	S	S	S	M	S
CO2	S	M	S	S	M
CO3	M	M	M	M	S
CO4	S	S	S	M	S
<b>COURSE-PL17CP4</b>					
CO1	M	S	S	M	S
CO2	S	M	M	S	S
CO3	M	S	S	S	M
CO4	S	M	S	S	S
<b>COURSE-PL16AC3</b>					
CO1	S	S	S	S	S
CO2	S	S	S	M	S
CO3	S	S	M	M	M
CO4	S	S	M	M	M
CO5	S	S	S	M	M
<b>COURSE-PL16AC4</b>					
CO1	S	S	S	S	S
CO2	S	S	S	M	S
CO3	S	S	M	M	M
CO4	S	S	M	M	M
CO5	S	S	S	M	M

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL17C01	Microbiology & Plant diversity I (Bacteria, Virus, Applied Microbiology, Algae, Fungi, Lichens and Plant Pathology)	CORE	86	4	-	6

### Preamble

To study the characteristics and life cycle of Bacteria, Virus, Algae, Fungi and Lichens.  
To study various plant diseases and their control measures.

### Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1.	Classify the microbes	K1
CO2.	Understand the characteristics of Bacteria, Virus, Algae, Fungi and Lichens	K2
CO3.	Know the life cycle of Bacteria, Virus, Algae, Fungi and Lichens	K2
CO4.	Identify the causes, symptoms and control measures of plant diseases	K2
CO5.	Differentiate the association between microbes and with plants	K3

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4
CO1.	S	S	S	S
CO2.	S	S	S	M
CO3.	M	S	M	S
CO4.	S	M	S	M
CO5.	S	M	M	S

S- Strong; M-Medium

### Syllabus

**Unit-I Bacteria and Virus** **17hrs**

History and scope of microbiology. Classification, Morphology, microbial growth, nutrition and reproduction of bacteria. Viruses – structure, classification and reproduction. A general account on Mycoplasmas.

**Unit-II Applied Microbiology** **17hrs**

Methods of sterilization, Culture media- PDA and Nutrient Agar and Broth media, Pure culture techniques, Staining of bacteria-Gram staining. Conventional bioreactor, typical fermentation process – liquid vs solid state fermentation.

**Unit-II Algae** **18hrs**

General characteristics of algae, Classification (Fritsch, 1935). A detailed study of the structure, reproduction and life cycle of *Chlamydomonas*, Diatoms, *Dictyota*, *Polysiphonia* and *Anabaena*. Economic importance of Algae.

**Unit-IV Fungi and Lichens** **17hrs**

General characteristics of Fungi. Classification (Alexopoulos and Mims, 1972). Detailed study of morphology and reproduction of *Plasmodiophora*, *Albugo*, *Aspergillus*, *Puccinia* and *Fusarium*. Economic importance of Fungi.

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

**Unit-V Plant Pathology** **17hrs**

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 control measures).

**Text Book**

1. Vashishta, B.R., Sinha, A.E and Singh, V.P., 2013. Algae, S Chand and Company Ltd., New Delhi
2. Purohit, S.S. 2008, Microbiology- Fundamentals & Applications, Rastogi Publications, Meerut
3. Pandey, B.P. 2003. College Botany Vol II, S Chand & Company, New Delhi.
4. Vasishta BR & Sinha AK, 2003, Botany for degree students Fungi, S. Chand and Company Ltd., New Delhi

**Reference Books**

1. Alexopoulos, CJ, 1996, Introduction to Mycology, John Wiley & Sons, New York
2. Gangulee, HC. & Kar, AK, 1989, College Botany, Vol-II, Books & Allied Pvt. Ltd. Calcutta.
3. Mehrotra, RS & Aneja, KR, 1999, An introduction to Mycology, 2nd Ed., New Age International Publishers, New Delhi

**Pedagogy**

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

**Course Designers**

1. Dr. B. Chitra Devi
2. Dr. R. Sumathi

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>CATEGORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
<b>PL17C02</b>	<b>Plant Diversity II (Bryophytes, Pteridophytes, Gymnosperms, and Palaeobotany)</b>	<b>CORE</b>	<b>71</b>	<b>4</b>	<b>-</b>	<b>5</b>

### 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

CO Number	CO Statement	Knowledge Level
CO1.	Classify Bryophytes, understand its lifecycle	K2
CO2.	Understand the characteristics of Pteridophytes and their classification	K2
CO3.	Assess the evolutionary features in Pteridophytes	K3
CO4.	Understand the characteristics of Gymnosperms and their classification	K2
CO5.	Interpret the evolutionary sequence with the knowledge of the geological time scale	K3

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4
CO1.	S	S	S	M
CO2.	S	S	S	M
CO3.	S	S	M	M
CO4.	S	S	M	M
CO5.	S	S	S	S

S- Strong; M-Medium

## Syllabus

### Unit I - Bryophytes

14hrs

Classification of Bryophytes (Reimers-1954). General characteristics of the classes and a detailed study of the genera specified: Hepaticopsida (*Marchantia*); Anthocerotopsida (*Anthoceros*); Bryopsida (*Sphagnum*). Economic importance of bryophytes.

### Unit II - Pteridophytes

14hrs

Classification (Sporne, 1975). General characteristics of the major sub-divisions and a detailed study of the genera specified: Psilotopsida (*Psilotum*); Lycopsida (*Lycopodium*). Stellar Evolution.

### Unit III – Pteridophytes (Contd..)

14hrs

General characteristics of the major sub-divisions and a detailed study of the genera specified: Sphenopsida (*Equisetum*); Pteropsida (*Marsilea*). Homospory, heterospory and seed habit. Economic importance of pteridophytes.

### Unit IV- Gymnosperms

14hrs

Classification (Coulter and Chamberlain, 1935). Salient features of the classes and a detailed study of the genera specified: Cycadopsida (*Cycas*); Coniferopsida (*Pinus*) and Gnetopsida (*Gnetum*). Economic importance of Gymnosperms.

### Unit V- Palaeobotany

15hrs

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

## Text Books

1. Pandey, B.P. 2003, College Botany Vol II, S Chand & Company, New Delhi
2. Vasishta PC, Sinha AK & Anilkumar, 2005, Botany for degree students, S Chand And Company Ltd., New Delhi.
3. Vasishta.B.R , Sinha,& Adarsh Kumar, 2012, Botany for Degree students –Bryophyta, S Chand And Company Ltd., New Delhi

## Reference Books

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, Paleobotany 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. B. Chitra Devi
2. Dr. R. Sumathi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL17CP1	Core Practical – I Theory Paper - I (Microbiology & Plant diversity I) & II ( Plant Diversity II)	CORE	-	-	90	3

### 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

To understand the process of fermentation

### Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember and differentiate the different forms of algae, fungi, lichens, Lichens, Bryophytes, Pteridophytes, Gymnosperms and fossilized plants.	K1
CO2	Understand the host – pathogen interactions	K2
CO3	Prepare sterile microbial culture media and demonstrate pure culture techniques	K3
CO4	Interpret the industrial impact of fermentation process	K3

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4
CO1	S	S	M	M
CO2	S	S	M	M
CO3	S	S	M	M
CO4	S	S	M	M

S- Strong; M-Medium

### Syllabus

90 Hrs

**Algae** - *Chlamydomonas*, diatoms, *Dictyota*, *Polysiphonia* and *Anabaena*.

**Fungi** - *Plasmodiophora*, *Albugo*, *Aspergillus*, *Puccinia* and *Fusarium*.



**Lichens** -*Usnea*

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

**Microbial 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 – Lactophenol cotton blue staining,

Microscopic observation of bacteria – Gram staining

Fermentation using yeast

**Study of the following types**

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

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

**Gymnosperms** – *Cycas*, *Pinus* and *Gnetum*

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

**Course Designers:**

1. Dr. M. Kamalam
2. Dr. K. S. Tamil Selvi
3. Dr. B. Chitra Devi
4. Dr. E.Uma

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16C03	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 and mutation

### Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1.	Study the structure and function of basic components of prokaryotic and eukaryotic cells, cell membranes and cell wall	K1
CO2.	Study the structure and function of cell organelles	K1
CO3.	Understand the cellular components underlying mitotic cell division.	K2
CO4.	To study the structure and function of DNA, RNA.	K2
CO5.	To analyse the concept of genetic code with protein synthesis and mutation	K3

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	M	S
CO2.	S	S	S	M	S
CO3.	S	S	M	M	M
CO4.	S	S	M	M	M
CO5.	S	S	S	S	S

S- Strong; M-Medium

### Syllabus

#### Unit -1

14 hrs

Prokaryotic cell and eukaryotic cell –structure, cell wall and plasma membrane –structure and function, cytoplasm, nucleus; cell cycle, cell division- mitosis and meiosis

#### Unit-II

14 hrs

Structure and function - Cell organelles - Mitochondria, Chloroplast, endoplasmic reticulum, golgi body, lysosomes, vacuoles and ribosomes

#### Unit-III

14 hrs

Chromosomes- organisation of chromosomes, lampbrush and polytene chromosomes. DNA structure – Watson and Crick Model, and function, DNA replication- conservative, semi-conservative and dispersive

**Unit-IV****15 hrs**

RNA structure and function – tRNA, mRNA and rRNA, Gene Mutation. chromosomal aberration- variation in number and structure.

Central dogma of life – transcription in prokaryotes and eukaryotes – initiation, elongation and termination

**Unit- V****14 hrs**

Genetic code- concept and properties, wobble hypothesis, exceptions; Translation in prokaryotes and eukaryotes – initiation, elongation and termination. Gene regulation in prokaryotes- operon concept (*lac* operon)

**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 <sup>rd</sup> edition, Books and Allied Pvt Ltd., Kolkatta
4.	Geoffrey M. Cooper and Robert E. Hausman,	2013	The Cell – A Molecular Approach.	6 <sup>th</sup> 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.S. Tamil Selvi****Dr. M. Kanchana**

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16C04	Paper - IV – Plant Anatomy, Wood Technology and Embryology	Core	71	4	-	5

#### Preamble

- To know the anatomical structure of Angiospermic plant
- To identify woods of commercial importance
- Methods of preserving and seasoning of woods.

#### Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1.	To study the structure and function of meristems and simple tissues in plants	K1
CO2.	To understand the complex tissues and anatomical structure of leaves, stem and roots in plants	K2
CO3.	To analyse and differentiate the secondary thickening and anomalous secondary thickening in dicot and monocot root and stem	K3
CO4.	To have a knowledge in preservation of wood	K3
CO5.	To study the structure and development of plant embryo	K1

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	M	S	M
CO2.	S	M	S	M	M
CO3.	S	S	M	S	M
CO4.	S	S	M	M	M
CO5.	S	S	M	S	M

S- Strong; M-Medium

#### Syllabus

##### Unit I

14hrs

**Plant Anatomy:** Meristems – shoot and root apex, theories - apical cell theory, histogen, tunica and corpus. Simple tissues- parenchyma, collenchyma and sclerenchyma.

##### Unit II

14hrs

Complex tissues – primary xylem, primary phloem, secondary xylem and secondary phloem. Anatomical structure of dicot leaf and monocot leaf, Types of stomata. Primary structure of dicot stem and monocot stem and dicot root and monocot root.

##### Unit III

14hrs

Secondary thickening in dicot stem and root. Annual rings and Dendrochronology. Anomalous secondary thickening in the stems of *Nyctanthus*, *Boerhaavia*, and the root of *Betavulgaris*. Anomalous secondary thickening in monocot stem – *Dracaena*.

**Unit IV****14hrs**

**Wood Technology:** Physical, chemical and mechanical properties of wood. Defects in woods. Seasoning of woods, methods of preservation of wood and uses of wood.

**Unit V****15hrs**

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

**Text Books**

S. No	Authors	Year of publication	Title of the book	Publishers
1.	Eames A J	1983	An Introduction to Plant Anatomy	Tata Mc Graw Hill Publishers. New Delhi
2.	Singh, Pande, & Jain.	1998	Anatomy of seed plants.	1 <sup>st</sup> edn (Reprint), Rastogi publ. New Delhi.
3.	Pandey.B.P.	2001	Plant Anatomy	Sixth Revised edition. S.Chand and company.
4.	Katherine Esau	2011	Anatomy of seed plants	John Wiley and Sons. U.S.A.

**Reference Books**

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Chandurkar P J.	1980	Plant Anatomy	Fifth edn., Oxford and IBH Publishing Co. New Delhi.
2.	Foster.A.S.,	2000	Practical Plant Anatomy	East west Ed.D Van Nostrand
3.	Susheela.M.Das,	2003	The Latest Portfolio of Theory & Practice in Plant Anatomy	Dominant Publishers and Distributors, New Delhi
4.	D.F.Cutter, C.E.J Bottla, D.W.Stevenston,	2011	Plant Anatomy, An applied Approach	Blackwell Publishing. Australia.

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

**Course Designers**

Dr. Kanchana. M

Dr. Nithya Meenakshi . S

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16CP2	Core Practical II (Core Paper III & IV)	Core	-	-	60	4

#### Preamble

- To understand the structure of cells in relation to the functional aspects.
- Understand the cellular components underlying cell division.
- 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.

#### Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1.	Understand the cell organelles through electron micrographs.	K3
CO2.	Identify the cellular components underlying cell division.	K3
CO3.	Discuss the structure and functions of the meristematic, primary & complex tissues.	K1
CO4.	Distinguish between normal and anomalous secondary growth.	K2
CO5.	Discuss the development of the endosperm and embryo.	K2

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	M	M	S
CO2.	M	S	S	M	S
CO3.	S	S	M	S	M
CO4.	M	S	S	M	S
CO5.	S	S	M	S	M

S- Strong; M-Medium

#### Syllabus

##### Semester III

##### Paper III - Cell and Molecular Biology

(30hrs)

**Cell Biology:** Study of cell wall and plasma membrane, nucleus, Study of plant cell organelles- Mitochondria, Chloroplast, endoplasmic reticulum, golgi body, lysosomes, vacuoles and ribosomes. Structure of DNA and RNA. Lampbrush and polytene chromosomes. Mitosis – Onion root tip. Meiosis – Flower bud.

##### Semester IV

##### Paper IV - Anatomy, Embryology and Wood technology

(30hrs)

**Sectioning and Identification:**

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*, *Boerhaavia*; root - *Beta vulgaris*. Secondary thickening in the monocot stem *Dracaena*

**Spotters: Through - 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. K.S. Tamilselvi

Dr. E.Uma

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL17A01	Allied Paper – I: Fundamentals of Botany - I	Allied	71	4	-	4

### Preamble

- To gain knowledge of the plant diversity and their internal structure,
- 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

CO Number	CO Statement	Knowledge Level
CO1	To gain knowledge of the plant diversity and their internal structure,	K1
CO2	To gain knowledge of adaptations of plants to different environments	K1
CO3	To learn the horticulture techniques.	K2

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	S	S	M	M	M
CO3	M	M	S	S	S

S- Strong; M-Medium

### Syllabus

#### Unit I

14 hrs

General characteristics and classification of Algae (Fritsch) - A study of distribution, structure, reproduction and life cycle of *Volvox*. Economic importance of algae

General characteristics and classification of Fungi (Alexopoulos and Mims) –A study of distribution, structure, reproduction and life cycle of *Saccharomyces*. Economic importance of Fungi.

General characteristics, classification, reproduction and economic importance of Lichens.

#### Unit II

15hrs

General characteristics and Classification of Bryophyte (Reimer)- Structure, Reproduction and Life cycle of *Riccia*,

General characteristics and Classification of Pteridophytes (Reimer) - Structure, Reproduction and Life cycle of *Lycopodium*,

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



**Unit III****14hrs**

General Characteristics and Classification of Angiosperms (Bentham and Hooker). 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****14hrs**

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

**Unit V****14hrs**

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

**Text Books**

1. Srivastava, H.N. 2004. Algae Pradeep Publications, Delhi
2. Srivastava, H.N. 200. 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**

1. Sharma O.P. 2009. Plant Taxonomy. Tata Mc Graw 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

Dr. E.Uma.

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL17A02	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

CO Number	CO Statement	Knowledge Level
CO1	Appreciate the anatomy of plants	K1
CO2	Appreciate the embryology of plants	K2
CO3	Appreciate the metabolism of plants	K3
CO4	Understand the plant tissue culture techniques	K3
CO5	Understand the microbial techniques	K2

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	M
CO2	S	S	M	S	S
CO3	M	M	M	M	M
CO4	S	S	S	S	M
CO5	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

14hrs

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, 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.

**Text books**

1. Jain.V.K. 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**

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.

**Course Designers**

Dr. R. Sumathi

Dr. E.Uma

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL17AP1	Allied Paper - 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

CO Number	CO Statement	Knowledge Level
CO1.	Differentiate the different forms of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.	K1
CO2.	Preparation of culture media.	K2
CO3.	Illustrate the internal structure of plant tissues.	K3
CO4.	Analyse the various pigments in plants	K3

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	M	S	M	M	M
CO2.	S	S	M	S	S
CO3.	M	M	M	M	M
CO4.	S	S	S	S	M
CO5.	S	M	M	M	M

S- Strong; M-Medium

### Syllabus

#### Specimens

60 hrs

#### Semester- III

#### 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**

**Slides**

Anatomy - Simple Tissues (Parenchyma, Sclerenchyma and Collenchyma),  
Complex Tissues (Xylem and Phloem)

Embryology - T.S. of Mature anther, 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

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
SB16HC01	Skill Based Subject- Horticulture Level-1	SBS	43	2	-	4

### Preamble

- To impart skill oriented knowledge and fundamental aspects of horticulture.
- To learn the soil types and their impact on growth of plants
- To know the methods of plant propagation
- To develop skill in green house

### Syllabus

#### Unit I- 9 hrs

History and importance of horticulture. Soil types- preparation and treatment, Inorganic fertilizers – Nitrogen, phosphorous, potassium, mixed fertilizers, organic fertilizers and bio-fertilizers.

#### Unit II- 9 hrs

Propagation techniques-separation: cutting-root, stem, leaf cutting, Layering- Ground and Air layering, Grafting- Detached scion grafting –splice, wedge cleft grafting, Approach grafting – spliced and cleft approach, Repair grafting-bridge-in arching, budding-T-patch and H-chip budding.

#### Unit III- 9 hrs

Green house- Importance, organization and construction. Green house type based on covering materials-Glass green house and film plastic type. Maintenance- control of light, temperature, humidity and irrigation.

#### Unit IV- 8 hrs

Ornamental garden and its components-climbers and creepers, shrubs, trees. Indoor garden-choice of plants and maintenance-Bottle garden. Hanging basket-Kitchen garden- layout and choice of plants

#### Unit V- 8 hrs

Principles of garden design- English, Italian, French, Mughal and Japanese gardens (Garden wall, fencing, steps, hedge, edging, Lawn, Flower beds, Shrubbery, borders, water garden, some famous gardens in India)

### Text books

1. Kumar.N.2010, Introduction to Horticulture, Oxford &IBH Publishing Co.Pvt.Ltd,New Delhi.
2. Manibhushan Rao.K. 1991. Text Book of Horticulture, Macmillan India Ltd,New Delhi
3. Bansil, P.C. 2008. Horticulture in India. CBS Publishers and Distributors, NewDelhi.
4. Kumaresan, V.2014, Horticulture,Saras Publications, Nagercoil.

### Reference Books

1. Bhattacharjee .S.K. 2006, Amentity Horticulture,Biotechnology and post harvest technology, Pointer publishers, Jaipur.
2. Rajan,S.and B.L.Markose,2007, Propagation of horticultural crops.NewDelhi
3. Christopher, E.P,2001, Introductory Horticulture, Biotech Books, NewDelhi.

### Course Designers

Dr. C. Krishnaveni

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>CATEGORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
<b>SB16HCP1</b>	<b>Skill Based Subject- Horticulture Practical Level-1</b>	<b>SBS</b>	<b>-</b>	<b>-</b>	<b>45</b>	<b>2</b>

### **Practicals**

1. Preparation of soil beds.
2. Fertilizers –inorganic, organic fertilizers, Biofertilizers.
3. Cutting-leaf, root and stem cutting
4. Layering-simple and air layering
5. Grafting-splice and cleft grafting
6. Budding-T-patch and H-chip budding.
7. Plan of glass house
8. Layout of the kitchen garden
9. Visit to nursery and knowledge about the instruments used in horticulture.

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL17C05	Core Paper V – Plant taxonomy and Economic Botany	Core	56	4	-	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:

CO Number	CO Statement	Knowledge Level
CO1.	Understand the technical terms used in morphology of plants	K1
CO2.	Understand the principle and classification of angiosperms	K2
CO3.	Interpret the nomenclature systems and to identify the plants	K3
CO4.	Understand the economic uses of plants	K1

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	M	S	M	S	M
CO2.	S	M	S	S	M
CO3.	M	S	M	M	S
CO4.	M	S	M	S	S

S- Strong; M-Medium

#### Syllabus

##### Unit I

12hrs

Plant Taxonomy: History of plant taxonomy, plant collection 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

11

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.

##### Unit IV

11 hrs

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



**Unit V****11 hrs**

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

**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 <sup>nd</sup> 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 and discussion

**Course Designers**

Dr. C. Krishnaveni  
 Dr. K.S. Tamilselvi  
 Dr. E.Uma

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL17C06	Core Paper - VI Genetics, Plant breeding and Biostatistics	Core	56	4	-	4

#### Preamble

- To study the mendelian genetics.
- To study the inheritance pattern and sex determination
- To judge the breeding methods for specific objective.
- To understand the quality traits for each crop.
- To study the application of statistics in biology.

#### Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Develop their analytical, quantitative and problem-solving skills from genetics.	K1
CO2	Study the different types of inheritance pattern.	K1
CO3	Impart theoretical knowledge about plant breeding objectives, breeding methods for crop improvement	K2
CO4	Understand the quality traits for specific crop improvement	K3
CO5	Apply knowledge on statistical application in biology	K4

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	M	S
CO2.	S	S	S	M	S
CO3.	S	S	M	M	M
CO4.	S	S	M	M	M
CO5.	S	S	S	S	S

S- Strong; M-Medium

#### Syllabus

##### Unit I-Genetics

11hrs

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

##### Unit II- Genetics

11hrs

Non-mendelian 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

11hrs

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 F<sub>1</sub> generation. Heterosis and inbreeding depression (outline only).

### Unit IV- Plant Breeding

12hrs

**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

11hrs

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 <sup>nd</sup> edn,	Oxford – IBH, New Delhi
2.	Singh, B.D	2005	Plant Breeding:Principles and Methods, 7 <sup>th</sup> 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 <sup>th</sup> 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 <sup>rd</sup> Ed.	Macmillan Co. New York.
2.	Gardner, E.J,	2008	Principles of Genetics, 8 <sup>th</sup>	Wiley-India.

	Simmons, M.J, Snustad, D.P		edn.	
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
PL17E01	AOS I - Dietetics, Food Processing and Preservation	Elective	71	4	-	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:

CO Number	CO Statement	Knowledge Level
CO1.	Impart the knowledge on nutritive value of food stuffs and the various sources of food.	K1
CO2.	Recognize diet based on the needs of people.	K2
CO3.	Illustrate food processing methods.	K2
CO4.	Apply the knowledge in preventing food spoilage.	K3
CO5.	Employ good manufacturing practice.	K3

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	M	S
CO2.	S	S	S	M	S
CO3.	S	S	M	M	M
CO4.	S	S	M	M	M
CO5.	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

14 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****14 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	2000	Food Microbiology	McGraw-Hill Publishing Company, New Delhi

	Westoff			
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. Chitra Devi  
 Dr. H. Rehana Banu

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16E02	AOS – II Bioinoculants Paper I	Elective	71	4	-	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 outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Identify the type of bioinoculants	K1
CO2	Recognize and appreciate soil as the medium for the growth of microbes and their diversity	K1
CO3	Working of the different groups of bacterial, fungal and algal bioinoculants.	K2
CO4	Use phosphorus mobilization, ecto and endomycorrhizal activities for improving plant growth	K1
CO5	Analyse the microbial solubilization in silicates and zinc.	K3

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	M	S
CO2.	S	S	S	M	S
CO3.	S	S	M	M	M
CO4.	S	S	M	M	M
CO5.	S	S	S	S	S

S- Strong; M-Medium

### Syllabus

#### Unit -1

**15hrs**

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

**14 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

**14 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 <sup>st</sup> edn	Saras Publication, Nagercoil
2	Dubey, R.C.	2004	A Text book of Biotechnology, 4 <sup>th</sup> edn	S. Chand & Co, New Delhi
3	Satyanarayana, U	2005	Biotechnology. 1 <sup>st</sup> 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 Microbiology	Oxford and IBH Publ. Co., 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
PL16E03	AOS III- Environmental Biotechnology	Elective	71	4	-	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:

CO Number	CO Statement	Knowledge Level
CO1	Study the biodiversity types, conservation methods, endangered plants and Global biodiversity information system.	K1
CO2	Concepts, types, data structure of GIS and output of geographical data.	K1
CO3	Familiarize the sewage and waste water treatments at primary, secondary and tertiary levels.	K2
CO4	Study the strategies for effluent treatment in different industries using microbes.	K2
CO5	Analyse the types of IP, biohazards and biosafety guidelines.	K3

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	M	S
CO2.	S	S	S	M	S
CO3.	S	S	M	M	M
CO4.	S	S	M	M	M
CO5.	S	S	S	S	S

S- Strong; M-Medium

#### Syllabus

##### Unit -1- Biodiversity

14hrs

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

14hrs

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

14hrs

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 Distillery 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 Ranjan. R	2003	Ecology, Environment and Pollution (First Edition)	Agrobios, India,Jodhpur
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 <sup>nd</sup> 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
PL17CP3	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:

CO Number	CO Statement	Knowledge Level
CO1.	Identify the plants using taxonomically and to observe the economic importance	K3
CO2.	Interpret the genetic problems and the hybridization techniques involved in plants	K3
CO3.	Apply common statistical tools to derive inference.	K3
CO4.	Analyze the nutritional quality and adulterants of various food stuffs	K4

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	S	M	S	S	M
CO3	S	S	M	M	S
CO4	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 olitorius* 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  $\text{CO}^{2+}$  and  $\text{Ni}^{2+}$  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),  $\text{CO}_2$ , 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. Tamilselvi  
Dr. B. Chitra 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:

CO Number	CO Statement	Knowledge Level
CO1	Interaction between micro-organisms and food	K2
CO2	Factors affecting the growth of microbes.	K2
CO3	Contamination, preservation and spoilage of different foods	K2
CO4	Realize the microbes underlying food spoilage and food borne illnesses.	K3
CO5	Appreciate the role of government agencies involved in food sanitation and control	K1

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	M	S	S
CO2.	S	S	M	M	S
CO3.	S	S	M	M	S
CO4.	S	S	M	M	S
CO5.	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 <sup>th</sup> edition	Tata McGraw Hill, New Delhi
2	Steinkraur K.H.	1988	Indigenous Food Fermentation, 1 <sup>st</sup> edition	Academic Press, New York
3	William C Frazier, Dennis C Westoff, Vanitha, K.N.	1971	Food Microbiology 5 <sup>th</sup> 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 <sup>nd</sup> edition	New age International (P) Ltd. Publ., New Delhi
2	Benwart, G.J.	1987	Basic Food Microbiology, 1 <sup>st</sup> 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:

CO Number	CO Statement	Knowledge Level
CO1	Vital link between nutrition and health	K2
CO2	Gain knowledge on functions of nutrients	K2
CO3	Metabolism of nutrients	K2
CO4	Importance of deficiency of nutrients	K3
CO5	Role of government agencies involved in combating malnutrition	K1

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	L	M	S
CO2.	S	S	L	M	S
CO3.	S	S	L	M	S
CO4.	S	S	L	M	S
CO5.	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, IV edn	New age International Ltd. Publishers, New Delhi
2	Sheel Sharma	2000	Human nutrition and Meal planning, 1 <sup>st</sup> edn	Jnananda Prakashan, P&D, New Delhi
3	Srilakshmi, B.	2012.	Nutrition Science. Revised 4 <sup>th</sup> 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 <sup>st</sup> 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
PL17C07	Core Paper VII– Biochemistry and Plant Physiology	Core	71	4	-	5

### Preamble

- To understand the structure and functions of biomolecules.
- To obtain knowledge on plant-water relationships
- To study the cycles of metabolism

### Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1.	Understand the structure and functions of biomolecules	K1
CO2.	Understand the plant function and their movements	K2
CO3.	Appreciate the role of photosynthesis and respiration in plant function	K3
CO4.	Gain knowledge on physiological effects of plant growth and movements	K3

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	M	M	M
CO2.	S	M	M	S	M
CO3.	M	S	S	M	S
CO4.	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

14 hrs

Photosynthesis: Pigment systems, Light and biochemical reactions, and C<sub>3</sub>, C<sub>4</sub> and CAM pathways. Respiration-Aerobic and Anaerobic, Glycolysis, Krebs cycle-electron transport system. Nitrogen metabolism– Biological nitrogen fixation, Transamination and reductive amination.

#### Unit V

14 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 <sup>th</sup> 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 <sup>th</sup> 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
PL17C08	Core Paper VIII – Basics of Bioinformatics	Core	71	4	-	5

#### 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:

CO Number	CO Statement	Knowledge Level
CO1.	Understand the basic knowledge of sequencing methods	K1
CO2.	Identify the different types of databases and its application	K2
CO3.	Differentiate the pattern of sequence analysis	K3
CO4.	Understand the genome annotation	K3
CO5.	Reconstruct the evolutionary relationship between species	K4

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	M	S
CO2.	S	M	S	S	M
CO3.	M	M	M	M	S
CO4.	S	S	S	M	S
CO5.	S	M	S	S	M

S- Strong; M-Medium

#### Syllabus

##### Unit I

14 hrs

Bioinformatics:- History, Scope, importance, Challenges and opportunities. DNA sequencing method: -Maxam and Gilbert method, Sanger's Method. Protein sequencing method- X-ray diffraction method.

##### 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, SwissProt, PDB; data retrieval- *Entrez*.

##### Unit III

14 hrs

Sequence analysis: Pair wise alignment types and methods- Global, local and dot plot and its applications, dynamic programming tools –FASTA and BLAST, Amino acid substitution matrices – PAM and BLOSUM. Multiple sequence alignment (MSA)- methods and tools for MSA (Clustal W).

##### Unit IV

15 hrs

Genomics- gene prediction- introduction, methods- outline, gene prediction programs- GRAIL, Glimmer, Genscan, GeneMark. Protein prediction- secondary structure (GOR, Chou-Fasman), 3D - visualization of protein structure – RASMOL, transmembrane (TM Pred)

### Unit V

14 hrs

Phylogeny- introduction, approaches used in phylogenetic analysis, methods, Steps in phylogenetic analysis- tree building methods- phylogenetic analysis database (Phylip).

#### Text Books

S.No	Authors	Year of publication	Title of the book	Publishers
1.	Arthur.M.Lesk	2003	Introduction to Bioinformatics, 1 <sup>st</sup> edn..	Oxford University Press, USA
2.	Mani.K and Vijayaraj.N	2004	Bioinformatics A Practical Approach. 1 <sup>st</sup> edn.	Aparnaa Publication. Tamil Nadu, India
3.	Alam Khan.I	2005	Elementary Bioinformatics. 1 <sup>st</sup> edn	Pharma Book Syndicate, Adithya Art Printers,
4.	Vinay Sharma. Ashok Munjal,Asheesh Shankar	2008	A text book of Bioinformatics. 1 <sup>st</sup> 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 <sup>rd</sup> edn	Viva Books Pvt.Ltd. New Delhi
2.	Mehrotra.P, Kumund Sarin, Swapna.K.Srivastava.	2005	The New hand Book of Bioinformatics, 1 <sup>st</sup> 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 <sup>rd</sup> edn.	PHI learning private ltd, New Delhi.
4.	List of e-books - <a href="http://www.freebookcentre.net/Biology/BioInformatics-Books.html">http://www.freebookcentre.net/Biology/BioInformatics-Books.html</a>			

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

#### Course Designers

Dr. K. Gajalakshmi

Dr. E. Uma

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16C09	Core Paper IX – Plant Ecology and Phytogeography	Core	56	4	-	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 biodiversity conservation.

### Course outcomes

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

CO Number	CO statement	Knowledge level
CO1	Basic principles of ecology	K2
CO2	Interrelationships among the organisms	K1
CO3	Analyze the aspects of ecology like population, community and ecosystem	K4
CO4	Compare and explain the causes and effects of environmental pollution	K3
CO5	Recognize the importance of biodiversity and its conservation	K2

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	S	S
CO2.	S	S	S	S	S
CO3.	S	S	M	S	S
CO4.	S	S	S	M	S
CO5.	S	M	M	S	M

S- Strong; M – Medium

### Syllabus

#### Unit I

11hrs

#### Introduction to Ecology:

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

#### Unit II

11 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

11hrs



**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**

**11 hrs**

**Environmental Pollution:** Definition. Types, Sources, Effects and Control measures of Air pollution, Water pollution, Soil Pollution and Noise pollution. E-waste.

**Solid waste management:** Causes, effects and control measures of urban and industrial.

**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	ManjuYadav.	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, videos, seminar, assignment, quiz and discussion

**Course Designer**

Dr.H. Rehana Banu

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16E04	AOS IV-Plant Biotechnology	Elective	71	4	-	5

#### Preamble

- To study the importance and preparation of tissue culture medium.
- To appreciate the basics of tissue culture techniques.
- To study the biological tools of recombinant DNA technology.
- To understand the gene cloning vectors and its significances.
- 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:

CO Number	CO Statement	Knowledge Level
CO1	Gain knowledge in fundamentals of tissue culture techniques	K1
CO2	Interpret the various techniques of tissue culture	K2
CO3	Functions of restriction enzymes and vectors in rDNA technology.	K2
CO4	Characteristic features of gene cloning vectors and their role in crop improvement	K2
CO5	Interpret the various methods of genetic engineering in plants	K3

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	M	S
CO2.	S	S	S	M	S
CO3.	S	S	S	M	M
CO4.	S	S	S	M	S
CO5.	S	S	S	S	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

14 hrs

**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****14hrs**

Cloning vectors- pBR322 (plasmid), M13 (Bacteriophage vector), lambda gt10 (lambda phage), cosmid pLFR (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****15hrs**

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 <sup>rd</sup> 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

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16E05	AOS V- Bioinoculants Paper II	Elective	71	4	-	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:

CO Number	CO Statement	Knowledge Level
CO1	Symbiotic association of nitrogen fixing bacteria and the plants	K1
CO2	Appreciate the distribution, occurrence, morphological variation and characteristics features of algal and bacterial bioinoculants	K1
CO3	Use Azolla as bioinoculants for crop improvement	K2
CO4	Practice the methods involved in the production of bioinoculants	K1
CO5	Problems associated with the mass production of biofertilizers and its economical condition in the society	K3

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	M	S
CO2.	S	S	S	M	S
CO3.	S	S	M	M	M
CO4.	S	S	M	M	M
CO5.	S	S	S	S	S

S- Strong; M-Medium

#### Syllabus

##### Unit -1

14 hrs

The organisms that fixes 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**

**14 hrs**

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

**Unit-IV**

**14 hrs**

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 <sup>st</sup> ed).	Saras Publication, Nagercoil.
2	Dubey, R.C.	2004	A Text book of Biotechnology (4 <sup>th</sup> edn).	S. Chand & Co, New Delhi
3	Satyanarayana, U.	2005	Biotechnology. (1 <sup>st</sup> 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
PL17E06	AOS VI – Pharmacognosy and Medicinal Botany	Core	71	4	-	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:

CO Number	CO Statement	Knowledge Level
CO1	Traditional systems of Indian medicine	K1
CO2	Identify the crude drugs	K2
CO3	Processing of crude drugs	K1
CO4	Detect the adulteration of the crude drug	K3

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO6.	S	S	S	M	S
CO7.	S	M	S	S	M
CO8.	M	M	M	M	S
CO9.	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

14 hrs

Pharmacological grouping of plant drugs. Secondary pathways 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 (*Adhatoda vasica* Nees), rhizome (*Alpinia galanga* (L.) Willd.), and flower (*Eugenia caryophyllata* L.). Effect of herbal drugs on Central Nervous system- *Datura metal* L., *Withania somnifera* (L.) Dunal and *Papaver somniferum* L.. Cardiovascular system – *Digitalis purpurea* L.

##### Unit V

14 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 <sup>th</sup> 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 <sup>th</sup> 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
PL17CP4	Core Practical IV (Core Paper VII, VIII, IX and AOS IV/V/VI)	Core	-	-	120	4

#### 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:

CO Number	CO Statement	Knowledge Level
CO1.	Determine the movement of plants	K3
CO2.	Examine the morphological, anatomical and chemical constituents of medicinal plants	K3
CO3.	Demonstrate the interactions, adaptations and the distribution of organisms	K3
CO4.	Utilize the knowledge of plant tissue culture for crop improvement	K3

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	M	S	S	M	S
CO2.	S	M	M	S	S
CO3.	M	S	S	S	M
CO4.	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 CO<sub>2</sub> concentration.

Effect of light intensity on O<sub>2</sub> evolution during photosynthesis.

#### Demonstrations 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 O<sub>2</sub> of water samples from polluted and unpolluted sources.
4. Determination of dissolved CO<sub>2</sub> 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 *Adathoda vasica* Nees; bark- *Cinchona officinalis* L., rhizome - *Alpinia galanga* Nees; root- *Withania somnifera* (L.) Dunal; Latex-*Papaver somniferum* L.; Flower bud- *Eugenia caryophyllata* L.

### **Course Designers**

Dr. M. Kamalam

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:

CO Number	CO Statement	Knowledge Level
CO1	Characteristics of bioprocessing	K1
CO2	Processes involved in industrial microbial production	K1
CO3	Microbial production of human growth hormone	K2
CO4	Concept of the waste water treatment and bioremediation	K2
CO5	Get an idea about patenting biotechnology inventions	K1

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	S	S
CO2.	S	S	S	M	S
CO3.	S	S	M	M	M
CO4.	S	S	M	M	M
CO5.	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 <sup>st</sup> 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 <sup>th</sup> edition,	AVI publishing Co. USA.

### Course Designer

Dr. H. Rehana Banu

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16AC4	Mushroom Technology	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:

CO Number	CO Statement	Knowledge Level
CO1	Know about the morphology and classification of common edible mushrooms	K1
CO2	Gain knowledge on the life cycle of mushrooms	K1
CO3	Cultivation processes of mushrooms	K1
CO4	Medicinal properties of mushrooms	K2
CO5	Obtain knowledge on the diseases of mushrooms	K1

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	S	S	S
CO2.	S	S	S	M	S
CO3.	S	S	M	M	M
CO4.	S	S	M	M	M
CO5.	S	S	S	M	M

S- Strong; M-Medium

### Syllabus

#### Unit –I

Morphology and classification of common edible mushrooms. Non edible mushrooms. Key to differentiate Edible from non edible mushroom; Distinctive features and symptoms of mushroom poisoning.

#### 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, isolation, substrates used, 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.

#### 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 <sup>st</sup> 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

<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>CATEGORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
<b>SB16HC02</b>	<b>Skill Based Subject- Horticulture Level II</b>	<b>SBS</b>	<b>43</b>	<b>2</b>	<b>-</b>	<b>4</b>

### **Preamble**

- To impart skill oriented knowledge on lawn making.
- To know the indoor gardening and bonsai.
- To develop skill maintenance of commercial floriculture.
- To develop skill in flower arrangement.
- To learn the techniques of terrace gardens.

### **Syllabus**

**Unit I** **8**

**hrs**

Introduction- History of gardening, designing a garden. Landscape gardening and layout of garden.

**Unit II** **8**

**hrs**

Lawn making- Cultivation of annuals, biennials and herbaceous perennials, Rockery and water garden

**Unit III** **9**

**hrs**

Indoor gardening and Bonsai-Cultivation of important cut flowers- carnation, Aster, Chrysanthemum, Dahlia, Gerbera and Gladiolous.

**Unit IV** **9**

**hrs**

Commercial floriculture- factors affecting flower production, production and packaging of cut flowers. Flower and Bouquet arrangements, Methods of prolong vase life.

**Unit V** **9**

**hrs**

Terrace garden- Growing plants in soil-less culture (hydroponics) sand culture, gravel culture, Nutrient mixture, deficiency, symptoms and precautions.

### **Text Books**

<b>S.No</b>	<b>Authors</b>	<b>Year of publication</b>	<b>Title of the book</b>	<b>Publishers</b>
1	Kumar, N.	1997	Introduction to Horticulture	Rajalakshmi Publications.Nagercoil.
2	Bansil, P.C.	2008	Horticulture in India	CBS Publishers and Distributors, NewDelhi.
3	Kumaresan, V	2014.	Horticulture	Saras Publications, Nagercoil.

### **Reference Books**

<b>S.No</b>	<b>Authors</b>	<b>Year of publication</b>	<b>Title of the book</b>	<b>Publishers</b>
-------------	----------------	----------------------------	--------------------------	-------------------

1	Christopher, E.P.	2001	Introductory Horticulture	Biotech Books, New Delhi.
2	Bhattacharjee, S.K.	2006	Amentity Horticulture, Biotechnology and post harvest Biotechnology	Pointer publishers, Jaipur.
3	Rajan, S and Markose, B.L.	2007	Propagation of horticultural crops	New India Publishing Agency, New Delhi

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

**Course Designer**

Dr. C. Krishnaveni



<b>COURSE NUMBER</b>	<b>COURSE NAME</b>	<b>CATEGORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>CREDIT</b>
<b>SB16HCP2</b>	<b>Skill Based Subject- Horticulture Level II- Practical</b>	<b>SBS</b>	<b>-</b>	<b>-</b>	<b>45</b>	<b>2</b>

1. Methods raising a lawn making
2. Description of cut flowers
3. Cultivation of cut flowers
4. Bonsai techniques
5. Different styles of flower arrangements
6. Bouquet making
7. Terrace garden and water garden
8. To visit to commercial nurseries.

**Course Designer**

Dr. C. Krishnaveni