



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)

2016 - 2019



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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.



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DEPARTMENT OF BOTANY

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

2016 - 2019

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	Tota l		
I	I	TAM1601/HIN1601/FRE1701	Language T/H/F Paper I	6	86	4	3	40	60	100	3	
	II	ENG1601/ ENG16F1	English Paper-I/Functional English Paper -I	6	86	4	3	40	60	100	3	
	III	PL16C01	Core Paper –I Microbiology & Plant diversity I	6	86	4	3	40	60	100	6	
		PL16CP1	Core Practical – I	3	-	-	-	-	-	-	-	
		CE16A01/PS16 A01/ Allied Chemistry Paper-I/ Allied Physics Paper–I/ Allied Paper I	TH16A01	Mathematical Statistics - I	4	56	4	3	40	60	100	4
			CE16AP1 /PS16AP1	Allied Practical Chemistry / Physics	7	101	4	3	40	60	100	5
		NME16B1/ NME16A1/ NME12WS/NM E12AS/NME12 GS	Basic Tamil/Advanced Tamil/ Women Studies/ Ambedhkar Studies/ Gandien Studies	3	-	-	-	-	-	-	-	-
	IV	NME16B1/ NME16A1/ NME12WS/NM E12AS/NME12 GS	Basic Tamil/Advanced Tamil/ Women Studies/ Ambedhkar Studies/ Gandien Studies	2	-	-	3	50/2 5/ 100	50/7 5/-	100	2	
	II	I	TAM1602/HIN1602/FRE1602	Language T/H/F Paper - II	6	86	4	3	40	60	100	3
		II	ENG1602/ ENG16F2	English Paper-II /Functional English Paper -II	6	86	4	3	40	60	100	3
III		PL16C02	Core Paper II – Plant diversity II	5	71	4	3	40	60	100	5	

		PL16CP1	Core Practical I (Core Paper I & II)	3	90	-	3	40	60	100	3
		CE16A02/PS16A02/	Allied Chemistry Paper-II / Physics Paper –II / Allied Paper II -	5	71	4	3	20	55	75	4
		TH16A02	Mathematical Statistics II	8	116	4	3	40	60	100	5
		CE16AP1/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	-	-
III	I	TAM1603/	Language T/H/F – Paper III	6	86	4	3	40	60	100	3
		HIN1603/FRE1603									
	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
	PL16CP2		Core Practical – II (Core Paper III)	2	30	--	--	--	--	--	--
	AS16A01/PS12A03		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/PS08AP1	Allied II- Practical I Zoology/Physics		3	45	-	-	-	-	-	-	
	NM10EVS	FC-II-Environmental Studies	Self-study	-	-	-	-	-	-	-	

	IV	NM14VHR	FC III-Value Education and Human Rights	2	26	4	-	100	-	100	2	
		SB16HC01	Skill Based Subject Horticulture Level- I Theory	3	29	1	-	-	-	-	-	
		SB16HCP1	Skill Based Subject Horticulture Practical Level- I		15	-	-	-	-	-	-	
IV	I	TAM1604/HIN1604/ FRE1604	Language T/H/F Paper IV	5	71	4	3	40	60	100	3	
	II	ENG1604/ENG16F4	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/PS12A04	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
			AS16AP1/PS08AP1	Allied II – Practical – Zoology/ Physics	2	-	-	3	20	30	50	2
			SB16HC01	Skill Based Subject Horticulture Level-I Theory	3	14	1	2	25	75	100	4

V	SB16HCP1	Skill Based Subject Horticulture Practical Level-I		30	-	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	
V	III	PL16C05	Core Paper V – Plant taxonomy and Economic Botany	4	56	4	3	40	60	100	4
		PL16C06	Core Paper VI- Genetics, Plant breeding and Biostatistics	4	56	4	3	40	60	100	4
		PL16E01	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								
PL16CP3	Core Practical III [Core Paper V, VI , AOS I/II/III]	8(3+3+2)	-	-	-	-	-	-	-		

	PL16CP3	Core Practical III [Core Paper V, VI, AOS I/II/III]	--	--	-	3	40	60	100	4
	PL16CP4	Core Practical IV (Core Paper VII, VIII, IX, AOS IV/V/VI)	8 [3+3(VIII & AOS)+2]	--	--	3	40	60	100	4
III	PL16AC3	** Advanced Learners Course Industrial Biotechnology	-	-	-	3	-	-	*100	*5
	PL16AC4	** Advanced Learners Course – Mushroom Technology								
	SB16HC02	Skill Based Subject-Horticulture Level II	2	29	1	3	40	60	100	4
IV	SB16HCP2	Skill Based Subject-Horticulture Practical Level II	1	15	-	3	40	60	100	2
Total									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 coordinator & 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

MODE OF EVALUATION	MARKS	TOTAL
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	- 5 marks

Preparation of rough draft

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	Libra ry Usag e	Attendan ce	Max. Mar ks
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

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

RUBRICS

Assignment/ Seminar

Maximum - 20 Marks (converted to 4 marks)

Criteria	4 Marks	3 Marks	2 Marks	1 Mark
Focus Purpose	Clear	Shows awareness	Shows little awareness	No awareness
Main idea	Clearly presents a main idea.	Main idea supported throughout	Vague sense	No main idea
Organisation: Overall	Well planned	Good overall organization	There is a sense of organization	No sense of organization
Content	Exceptionally well presented	Well presented	Content is sound	Not good
Style: Details and Examples	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
Level of Engagement in Class	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	
Listening Skills	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.	
Behavior	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	
Preparation	Student is almost always prepared for	Student is usually prepared for class	Student is occasionally prepared for	Student is rarely prepared for class	Student is almost never prepared	

	class with required class materials	with required class materials	class with required class materials	with required class materials	for class.	
					Total	

MAPPING OF POs WITH COs

COURSE	PROGRAMME OUTCOMES				
	PO1	PO2	PO3	PO4	PO5
COURSE - PL16C01					
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	-
COURSE - PL16C02					
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	-
COURSE - PL16CP1					
CO1	S	S	M	M	-
CO2	S	S	M	M	-
CO3	S	S	M	M	-
CO4	S	S	M	M	-
COURSE - PL16C03					
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
COURSE - PL16C04					
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
COURSE - PL16CP2					
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
COURSE - PL16A01					
CO1	S	M	M	S	S
CO2	S	S	M	M	M
CO3	M	M	S	S	S
CO4	M	M	M	M	M
CO5	S	M	S	S	S
COURSE - PL16A02					
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
COURSE - PL16AP1					
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
COURSE - PL16C05					
CO1	M	S	M	S	M
CO2	S	M	S	S	M
CO3	M	S	M	M	S
CO4	M	S	M	S	S
COURSE - PL16C06					
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
COURSE - PL16E01					
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
COURSE - PL16E02					
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
COURSE - PL16E03					
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
COURSE - PL16CP3					
CO1	M	S	M	S	S
CO2	S	M	S	S	M
CO3	S	S	M	M	S
CO4	M	S	S	M	S
COURSE-PL16AC1					
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
COURSE-PL16AC2					
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
COURSE-PL16C07					
CO1	S	S	M	M	M
CO2	S	M	M	S	M
CO3	M	S	S	M	S
CO4	M	S	M	M	S

COURSE-PL16C08					
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	S	S	M	S
COURSE-PL16C09					
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
COURSE-PL16E04					
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
COURSE-PL16E05					
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
COURSE-PL16E06					

CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	M	M	M
CO4	S	S	M	M	M
COURSE-PL16CP4					
CO1	M	S	S	M	S
CO2	S	M	M	S	S
CO3	M	S	S	S	M
CO4	S	M	S	S	S
COURSE-PL16AC3					
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-PL16AC4					
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
PL16C01	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-III 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. Vasishtha 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

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16C02	Plant Diversity II (Bryophytes, Pteridophytes, Gymnosperms, and Palaeobotany)	CORE	71	4	-	5

Preamble

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

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

Course Outcomes

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

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 Book

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
PL16CP1	Core Practical – I-Theory Paper - I (Microbiology & Plant Diversity I &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. Mrs. 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 rd edition, Books and Allied Pvt Ltd., Kolkatta
4.	Geoffrey M. Cooper and Robert E. Hausman,	2013	The Cell – A Molecular Approach.	6 th Edition, Sinauer Associates, Inc. Publishers - Sunderland,

				Massachusetts U.S.A.
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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 embryosac (*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 st 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.Stevenson,	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
PL16A01	Allied Paper – I Fundamentals of Plant Biology	Allied	71	4	-	4

Preamble

- To study the characteristics and life cycle of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
- To study different families with their economic uses.

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 internal structure and metabolism of the plant.	K1
CO2	Outline Classification of various life forms	K1
CO3	Illustrate the internal structure of plants	K2
CO4	Description of families	K3
CO5	Demonstration of physiological changes in plants	K4

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
CO4	M	M	M	M	M
CO5	S	M	S	S	S

S- Strong; M-Medium

Syllabus

Unit I**14 hrs**

Outline classification of Algae (Fritsch) - A study of distribution, range of structure, reproduction and life cycle of *Volvox*. Economic importance of algae
Classification of Fungi (Alexopoulos and Mims) –A study of distribution, range of structure, reproduction and life cycle of *Saccharomyces*. Economic importance of Fungi.
Plant Pathology - Symptoms and control measures of *Colletotrichum*.

Unit II**14hrs**

Outline Classification of Bryophyte (Reimer)- Structure, Reproduction and Life cycle of *Riccia*,
Classification of Pteridophytes (Reimer) - Structure, Reproduction and Life cycle of *Lycopodium*,
Classification of Gymnosperms (Sporne) - Structure, Reproduction and Life cycle of *Cycas*.

Unit III**14hrs**

A brief account of meristems. Primary and Secondary structure of dicot stem and root; primary structure of monocot stem and root. 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 IV**14 hrs**

Outline Classification – Bentham and Hooker. Study of the following families with their Economic importance – Annonaceae, Rutaceae, Rubiaceae, Lamiaceae, Amarantaceae and Poaceae.

Unit V**15hrs**

Plant Physiology- osmosis and diffusion. Passive and Active absorption of water, Photosynthesis - Photosynthetic apparatus, light and dark reaction. Growth regulator- Auxin, Cytokinin.

Text Books

1. Singh .V and Jain. 1981. Taxonomy of Angiosperms, Rastogi Publications, New Delhi
2. Pandey, P.B. 2001. Plant Anatomy, S. Chand & Co, New Delhi.
3. Srivastava, H.N. 2004. Algae and Fungi, Pradeep Publications, Delhi.
4. Srivastava, H.N. 2004. Pteridophytes, Pradeep Publications, Delhi.
5. Srivastava, H.N. 2004. Plant Pathology, Pradeep Publications, Delhi.

Reference Books

1. Esau. K. 1953. Anatomy of Seed plant, Wiley Eastern Pvt.Ltd. Newyork.
2. Smith, G.M. 1955. Cryptogamic Botany Vol I and II, Tata Mc Graw Hill Comp, New Delhi
3. Fritsch, F.E. 1965. The structure and Reproduction of Algae – Vol II, Cambridge University, England
4. Pandey, B. P. 1992. Taxonomy of Angiosperms, S. Chand & Co, New Delhi
5. Sharma O.P. 2009. Plant Taxonomy, Tata Mc Graw Hill Comp, 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
PL16A02	Allied Paper II – Fundamentals of Plant Biotechnology	Allied	71	4	-	4

Preamble

- To study the characteristics and life cycle of Bacteria and Virus.
- To know about the plant tissue culture techniques.
- To study the pharmacological uses of plants.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Outline of the microbes	K1
CO2	Understand the production of different products using fermentation technology	K2
CO3	Critically analyze the production of plants in <i>in vitro</i> condition	K3
CO4	Interpret the techniques of resistant plant against pathogens	K3
CO5	Investigate the plant drugs	K4

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

Bacteriology: Classification of bacteria, Morphology, Structure and Reproduction. Virology: Morphology and nature of virus particles, structure, infection and replication of TMV and bacteriophages.

Unit II**14 hrs**

Industrial Microbiology: Fermentation Technology, Industrial manufacture of ethanol, Antibiotic - Penicillin, Vitamin - Riboflavin, Enzymes –Cellulase, Organic acid - Citric acid.

Unit III**14hrs**

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

Unit IV**14hrs**

Transgenic plants – Introduction. Techniques in production of plants resistant to insects and herbicides.

Unit V**15hrs**

Pharmacognosy – Definition and importance. Plant parts used, active principles and uses of *Zingiber officinale*, *Cinchona officinalis*, *Adhatoda vasica*, *Rauwolfia serpentine* and *Myristica fragrans*.

Text Books

1. Jain.V.K. 1999. Fundamentals of plant physiology, Chand & Company, New Delhi.
2. Kumaresan.V. 1999. Biotechnology, Saras Publisher Ltd. Nagerkoil, Kanyakumari.
3. Shah.C.S. and J.S. Qadry. 1994. A Text book of Pharmacognosy. Prakasham Publishers, Ahmedabad.

Reference Books

1. Adrian Gibbs and Bryan Harrison. 1979. Plant Virology. Academic press, Newyork.
2. Kokate . C.K. 1999. Pharmacognosy. Nirali Prakashan, Mumbai.
3. Michael J. Pelczar, E.C.S. Chan and Noel R Krieg. 1988. Microbiology. Mc Graw Hill, New Delhi.
4. Mukherji.S. and A.K. Ghosh. 1996. Plant Physiology. New Central Book Agency, Kolkatta.

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

Course Designers:

Dr. R. Sumathi

Mrs. E.Uma

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16AP1	Allied Practicals	Allied	-	-	60	2

Preamble

- To observe and identify the different types of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
- To identify and differentiate the various plant diseases and causative organisms.
- 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	K4
CO5.	Identify the medicinal plant parts and their uses	K4

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

Plant Pathology- Red rot of Sugarcane- *Colletotrichum*

Bryophytes - Habit of *Riccia*

Pteridophytes - Habit of *Lycopodium cernum*, *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

Slides

Algae - *Volvox*- Daughter colonies, Oogonia and Antheridia.

Fungi - *Saccharomyces*-Single cell structure

Bryophytes - *Riccia*- Reproductive Structures-Antheridium, Archegonium and Sporophyte

Pteridophytes - *Lycopodium*- L.S. of Cone

Gymnosperms - *Cycas*- T.S. of Corolloid root

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

Embryology - T.S. of Mature anther, 8- nucleated Embryosac, Mature Embryo

Sectioning

Bryophytes - *Riccia*- T.S. of Thallus

Pteridophytes - *Lycopodium*- T.S.of Stem

Gymnosperms - *Cycas* - T.S. of Leaflet, T.S. of Rachis

Anatomy - Primary structure of Dicot stems and root
- Primary structures of Monocot stems and root

Demonstration Experiments

Physiology - Determination of osmotic pressure by Plasmolytic method.

Separation of leaf pigment by Paper chromatography.

Microbiology- Preparation of Nutrient Agar Medium and Potato Dextrose Agar Medium

Spotters / Specimens

Pharmacognosy -*Ginger, Cinchona, Adhatoda, Rauwolfia* and *Myristica*

Biotechnology - Bt cotton, Ti Plasmid, Organogenesis and Callus induction.

Course Designers:

Dr. R. Sumathi

Mrs. 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

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

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
PL16C05	Core Paper V – Plant taxonomy and Economic Botany	Core	56	4	-	4

Preamble

- To acquire the fundamental knowledge, basic concepts and principles of plant systematics.
- 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

11hrs

Morphology of root, stem - types and modifications; leaf - types, phyllotaxy and modifications; inflorescence – types; flower – calyx, corolla, androecium, gynoecium, placentation; fruit – types.

Unit II**11 hrs**

Taxonomy: Aims and Scope of plant systematics. Systems of classification: Artificial – Linnaeus; Natural – Bentham and Hooker; Phylogenetic – Engler and Prantl. Herbarium techniques and uses. 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**

Rubiaceae, Sapotaceae, Apocynaceae, Asclepiadaceae, Asteraceae, Verbenaceae, Lamiaceae Amarantaceae, Euphorbiaceae, Liliaceae, Orchidaceae and Poaceae.

Unit V**12 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 nd ed,	Academic Press, Newyork.

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Davis, P.H. and Heywood, V.M	1973	Principles of Angiosperm Taxonomy	Oliver Boyd London

2.	Hutchinson, J.	1973	The families of flowering plants, 3 rd edition	Cambridge, England
3.	Rao. K.N	1984	Angiosperms	S.Viswanathan Pvt Ltd, Chennai
4.	Stace, C.A.	1989	Plant Taxonomy and Biosystematics, 3 rd edition	Edward Arnold, London

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
PL16C06	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- Monohybrid and Dihybrid Cross; Test Cross and Back Cross; Incomplete Dominance; Gene Interaction (Complementary, Supplementary, Duplicate and Inhibitory). Epistasis, Linkage- Definition, types, importance. Crossing over: types, theories, significance.

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.

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 F₁ 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-Vitamin A content of tomato. Sources for quality traits.

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 nd edn,	Oxford – IBH, New Delhi
2.	Singh, B.D	2005	Plant Breeding:Principles and Methods, 7 th edn,	Kalyani Publishers, New Delhi
3.	Shukla, R.S. and Chandel, P.S.	2009	Cytogenetics, evolution, Biostatistics and Plant Breeding	S. Chand & Co, New Delhi
4.	Verma, P.S. and Agarwal, V.K.	2010	Cytology, Genetics and plant breeding	S.Chand & Co, New Delhi
5.	Gupta, P.K.	2014	Genetics, 4 th edn.	Rastogi Publications, Meerut. New Delhi

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Strickberger,	1985	Genetics, 3 rd Ed.	Macmillan Co. New York.

	N.W.			
2.	Gardner, E.J, Simmons, M.J, Snustad, D.P	2008	Principles of Genetics, 8 th edn.	Wiley-India.
3.	Zar, J.H.	2012	Biostatistical Analysis, 4th edition,	Pearson Publication. U.S.A.

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

Course Designer

Dr. K. Gajalakshmi

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16E01	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.	K2
CO2	Recognize diet based on the needs of people.	K1
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	PO	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 **14hrs**

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, expected 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 **14 hrs**

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

Unit V **15 hrs**

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

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Jay, J.M.	1996	Modern Food Microbiology	CBS Publishers & Distributors, New Delhi
2.	Rastogi, S.C.	1998	Biochemistry	Tata Mc Graw Hill, New Delhi
3.	Sivasankar, B.	2002	Food processing and preservation	Prentice Hall of India, New Delhi
4.	Srilakshmi, B.	2006	Nutrition and Dietetics	New age International Ltd. Publishers, New Delhi
5.	Srilakshmi, B.	2011	Dietetics	New Age International Limited, Publishers, New Delhi

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	William C	1971	Food Microbiology	McGraw-Hill Publishing

	Frazier, Dennis C Westoff, and Vanitha, K.N.			Company, New Delhi
2.	Subbulakshmi, B and Udipi, A.S.	2006	Food processing and preservation	New Age International Ltd. Publishers, New Delhi
3.	Winton, A. and Winton, K.B.	2006	Milk and milk products	Agrobios, Jodhpur
4.	Casida, L.E.	2007	Industrial Microbiology	New Age International publishers, New Delhi

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:

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	Understand the working of the different groups of bacterial, fungal and algal bioinoculants.	K2
CO4	Analyse the 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 15 hrs

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

Unit-II 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 14 hrs

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

Unit- V 14 hrs

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

Text Books

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

Reference Books

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

PL16E03	AOS III- Environmental Biotechnology	Category	L	T	P	Credit
		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:

CO Number	CO Statement	Knowledge Level
CO1	Study the biodiversity types, conservation methods, endangered plants and Global biodiversity information system.	K1
CO2	Understand the 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	PO	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

14 hrs

Definition; Geographical causes for diversity; Types of diversity: Genetic diversity, Species diversity and Ecosystem diversity; Quantifying biodiversity; importance of biodiversity; *in-situ* & *ex-situ* conservation; Gene banks; Cryopreservation; Assessing, analyzing and documenting biodiversity; Introduction to biodiversity database: Endangered plants, Endemism and Red data books; Global biodiversity information system.

UnitII-GIS and Environmental Monitoring

14 hrs

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

UnitIII - Effluent treatment systems

14 hrs

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

UnitIV- 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.	Indusekhar Thakur.	2006	Environmental Biotechnology, Basic concepts and application	IK International Publishing House Pvt Ltd, New Delhi
4.	Sateesh.M.K.	2008	Bioethics and Biosafety	IK International Publishing House Pvt Ltd, New Delhi.
5.	Acharya, N.K.	2012	Text book on Intellectual	Jain Book Depot, New Delhi.

			Property Rights	
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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 nd edn.	Dorling Kindersly Pvt Ltd, New Delhi

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

Course Designer

Dr. R.Sumathi

PL16CP3	Core Practical III (Core Paper V, VI & AOS I/II/III)	Category	L	T	P	Credit
		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.

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.

Problem in 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)

1. Preparation of sample menu based on Recommended Dietary Allowance (RDA).
2. Preparation of low calorie diet.
3. Nutritional analysis:
 - i. Estimation of Vitamin C in Fruit juices.
 - ii. Estimation of Iron Content in Iron fortified food by Colorimeter /AAS.
4. Detection of food colours by thin layer chromatography.
5. Food preservation:
 - i. Preparation of pickles
 - ii. Preparation of jams
 - iii. Canning & bottling of vegetable and fruit.
6. Isolation and identification of storage mycoflora from food stuffs/vegetables/fruits.
7. Milk spoilage test.
8. Detection of Adulterants in oils and Fats.
9. Detection of Adulterants in spices and condiments.

Or

AOS-II – Biofertilizers Paper I (30hrs)

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

Environmental Biotechnology (30 hrs)

a. Environmental Parameters

1. Estimation of halides in water samples by potentiometer.
2. Estimation of CO²⁺ and Ni²⁺ 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), CO₂, 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:

CO Number	CO Statement	Knowledge Level
CO1	Understand the interaction between micro-organisms and food	K2
CO2	Analyse the factors affecting the growth of microbes.	K2
CO3	Analyse the 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.	William C Frazier, Dennis C Westoff, Vanitha, K.N.	1971	Food Microbiology, 5 th edition	McGraw-Hill Education, New York.
2.	Steinkraur K.H.	1988	Indigenous Food Fermentation, 1 st edition	Academic Press, New York.
3.	Frazier C., D.C. Westhoff.	2000	Food Microbiology, 4 th edition,	Tata McGraw Hill, New Delhi.

Reference Books

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the vital link between nutrition and health	K2
CO2	Gain knowledge on functions of nutrients	K2
CO3	Analyse the metabolism of nutrients	K2
CO4	Appreciate the importance of deficiency of nutrients	K3
CO5	Appreciate the 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.	Sheel Sharma.	2000	Human nutrition and Meal planning, 1 st edn.	Jnananda Prakashan, P&D, New Delhi.
2.	Mudambi, R. Sumathy and Rajagopal, M.V.	2005	Fundamentals of food and nutrition. IV edn	New age International Ltd. Publishers, New Delhi.
3.	Srilakshmi, B.	2012	Nutrition Science. Revised 4 th edn.	New age International Ltd. Publishers, New Delhi.

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Srilakshmi, B.	1997	Food science. 1 st edn.	New age international ltd. Publishers, New Delhi.
2.	Artibhatia	2000	Nutrition and Dietetics.	Anmol Publications, PVT. LTD., NewDelhi.
3.	Sizer, Francis Sienkiewicz and Whitney Eleanor Whitney	2000	Nutrition – concepts and controversies. VIII edn.	Wadsworth, Australia.
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
PL16C07	Core Paper VII–Plant Physiology and Biochemistry	Core	71	4	-	5

Preamble

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

Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the plant function and their movements	K2
CO2	Appreciate the role of photosynthesis and respiration in plant function	K4
CO3	Gain knowledge on physiological effects of plant growth regulators	K1
CO4	Understand the structure and functions of biomolecules	K2

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

Unit I Plant Physiology

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 II

14 hrs

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

Unit III

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.

Unit IV Biochemistry

14 hrs

Structure of an atom- Plum pudding model, Rutherford model and Bohr model. Chemical bonds- Covalent bond and Hydrogen bonds. Intermolecular force- Vander Waals Interaction. Properties of Acids, Bases, Solutions, colloids, pH and buffer systems.

Unit V

14 hrs

Carbohydrate – Classification, structure, general properties and functions of mono, oligo and polysaccharides; Lipids –Classification, structure, properties and functions of simple, compound and derived lipids; Proteins – Classification, structure, properties and biological functions of proteins.

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Powar. C.B	1983	Cell Biology	Himalaya Publishing House. Kolkata.
2.	Jain. J.L.	2005	Biochemistry	S. Chand & Company. New Delhi
3.	Jain. V.K.	2017	Fundamentals of Plant Physiology, 19 th ed	Chand & Company. New Delhi
4.	Rastogi, S.C.	2011	Biochemistry, Third edition	Tata McGraw Hill Education Private Limited, New Delhi.

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Bernard. S. Meyer & Donald B. Anderson	1963	Plant Physiology	East West Press Private limited, New Delhi.
2.	Devlin. M	1969	Plant Physiology	Van Nostrand Reinhold Company, New York.
3.	Verma, V	1987	Text Book of Plant Physiology	EM Kay Publ. New Delhi.
4.	Plummer, D.	1989	Biochemistry- the chemistry of life	Mc Graw Hill Book Co., London, N.Y. New Delhi, Paris, Singapore, Tokyo.
5.	Salisbury, F.B and Ross, C.W	1992	Plant Physiology	Prentice Hall of India. New Delhi

6.	Day, P.M., and Harborne, J.B.	2000	Plant Biochemistry	Harcourt Asia (P) Ltd., India & Academic Press, Singapore.
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Pedagogy: Power point presentation, Lecture, seminar, quiz and discussion

Course Designers

Dr. C. Krishnaveni

Dr. M. Kanchana

Dr. E. Uma

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16C08	Core Paper VIII – 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:

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

Mapping with Programme Outcomes

COs	PO1	PO	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

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.	Author name	Year of publication	Title of the book	Publishers name
1.	Saharan, Moond, Chouhan and Gupta	2008	Principles of Pharmacognosy	Agrobios, Jodhpur India.
2.	Kokate C.K., Purohit, A.P and Gokhale, S.B.	2014	Pharmacognosy (49 th ed.)	Nirali Publications, Mumbai.

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Tyler, V.E., Bracky, L.R. Bracky and Robert, J.E.	1988	Pharmacognosy, 9 th ed	Lar & Fabiger. Philadelphia.
2.	Warrier, P.K, Nambiar, V.P.K and Ramakutty, (eds).	1993	Indian Medicinal Plants. (1-5)	Orient Longman Ltd, Chennai.
3.	Evans, W.C.	2008	Pharmacognosy (15 th ed.)	Saunders- An imprint of Elsevier, Philadelphia.

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

Course Designer

Dr. M. Kamalam

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
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 rd edn.	I. K. International Pvt. Ltd. New Delhi.
2	Glick and Pasternak	2005	Molecular Biotechnology	ASM Press. Washington
3	Ashwani Kumar and Sudhir K. Sopory.	2008	Recent Advances in plant biotech & its Applications	I.K. International Publishing house, New Delhi.

4	Thieman J. William and Palladino. A Michael	2009	Introduction to Biotechnology.	Dorling Kindersly, PVT. Ltd. Delhi.
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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 fix atmospheric nitrogen- free - living, aerobic, symbiotic bacteria and Frankia. *Rhizobium* classification- cross inoculation groups- characteristics- Infection - root nodule formation- leghaemoglobin- factors affecting nodulation. Nitrogen fixation- Nitrogen assimilation. Associative symbiosis-Biochemistry of Nitrogen fixation- nitrogenase- mechanism of nitrogenase- hydrogenase - Assay of nitrogen fixation.

Unit-II

14 hrs

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

Unit-III

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 st ed).	Saras Publication, Nagercoil.
2	Dubey, R.C.	2004	A Text book of Biotechnology (4 th edn).	S. Chand & Co, New Delhi
3	Satyanarayana, U.	2005	Biotechnology. (1 st ed)	Books and Allied Publishers. Ltd. Kolkatta.

Reference Books

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

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

Course Designer

Dr. K. Sunitha kumara

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
PL16E06	AOS VI – Biological techniques	Core	71	4	-	5

Preamble

- To study the principles and applications of microscopes
- To understand the significance and methods of slide preparation in the field of microscopy
- To enumerate the techniques and uses of chromatography in the branch of plant science.
- To study the principles and various techniques of major laboratory equipments
- To study the methods of isolation, identification and manipulation of molecular components in cells

Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Outline the principles and applications of microscopes	K1
CO2	Describe the significance and methods of slide preparation in the field of microscopy	K2
CO3	Explain the techniques and uses of chromatography	K2
CO4	Assess the principles and various techniques of major laboratory equipments	K3
CO5	Interpret the methods of isolation, identification and manipulation of molecular components of cells	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

Plant sample collection, Temporary, Semi-Permanent, Permanent slide preparation, Microtechniques: Fixation, dehydration, clearing, embedding, serial sectioning, staining and mounting. Maceration techniques.

Unit -II 14 hrs

Principles and Applications of light microscope- Compound and phase contrast, fluorescence microscope, electron microscope – SEM, TEM. Camera lucida.

Unit-III 14 hrs

Principles and uses of pH meter, oxygen electrode and colorimeter. Principles, types and application of centrifuge.

Unit-IV 14 hrs

Principles and applications of chromatography – paper, thin layer and gas chromatography, High Performance Liquid Chromatography (HPLC) ion exchange and affinity chromatography.

Unit- V 15 hrs

Polymerase chain reaction (PCR). Restricted Fragment Length Polymorphism (RFLP), principles and applications of electrophoresis - agarose gel. Blotting - Southern, Northern, and Western blotting, DNA fingerprinting.

Text Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	Prasad & Prasad.	1985	Microtechnique	Emkey Publishing, New Delhi.
2.	Sadhasivam and Manickam.	1996	Biochemical methods (2 nd ed.)	New Age International Publishers, New Delhi
3.	Rana. S.V.S	2008	Biotechniques, Theory and practice.	Rastogi Publications, Meerut.

Reference Books

S.No.	Author name	Year of publication	Title of the book	Publishers name
1.	John.E.Sass.	1964	Botanical Microtechnique	Oxford and IBH publishing Co, Delhi
2.	Patki. L.R	1983	An Introduction to Microtechniques	S. Chand & Company, New Delhi
3.	Grimstone. A.V.	1983	Electron microscope in Biology	The Edward Arnold (publishers) Ltd. Cambridge
4.	Khasim, S.M.	2002	Botanical Microtechniques.	Capital Publishing Company, New Delhi

			Principles and Practice	
5.	Donald A. Johansen.	2009	Plant Microtechnique	McGraw-Hill publications in the botanical sciences, London

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
PL16CP4	Core Practical IV (Core Paper VII,VIII,IX, 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:

- Determination of Osmotic potential by plasmolytic method.
- Separation of leaf pigments by Paper chromatography.

Measurement of rate of photosynthesis under various CO₂ concentration.
Effect of light intensity on O₂ evolution during photosynthesis.

Demonstrations experiments:

Simple respiroscope.
Ganong's potometer
Transpiration pull apparatus.
Determination of water absorption and transpiration ratio.
Estimation of proteins and carbohydrates.

Core Paper VIII -Pharmacognosy and Medicinal Botany (15hrs)

- I. **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.
- II. **Anatomical studies** of leaf of *Adathoda vasica* Nees. and *Mentha arvensis* L.; flower bud of *Eugenia caryophyllata*.
- III. **Qualitative analysis** of Alkaloids and Terpenoids.

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

1. Determination of pH of soil and water samples.
2. Analysis of soil sample for carbonates and nitrates.
3. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method (species to be listed).
4. Study of the morphological and structural adaptation of locally available hydrophytes and xerophytes.
5. Determination of dissolved O₂ of water samples from polluted and unpolluted sources.
6. Determination of dissolved CO₂ of water samples from polluted and unpolluted sources.
7. To locate the hotspots, phytogeographical regions and distribution of endemic plants in the map of India.

Spotters:

1. Study of biotic interactions of: Stem parasite, Root parasite, Epiphytes, Predation – Insectivorous plants (*Nepenthes*).
2. Study of endangered plant species, critically endangered plant species, vulnerable plant species and monotypic endemic genera of India with the help of photographs/herbarium.

AOS IV-Plant Biotechnology (30hrs)

Demonstration:

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

Spotters:

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- Biological techniques

Preparation of semi-permanent and permanent slides – hand sections and microtome sections.
Study of absorption spectrum of chlorophyll pigments by colorimeter.

Demonstration

Centrifugation.
Blotting techniques (Western, Southern and Northern).

Course Designers

Dr. M. Kamalam
Dr. M. Kanchana
Dr. H. RehanaBanu
Dr. E. Uma
Dr. K. Sunithakumari

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, amino acid: L-lysine, antibiotics: streptomycin, Organic acid: Vinegar and lactic acid.

Unit-IV

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

Unit- V

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

Text Books

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

Reference Books

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

Course Designer

Dr. H. Rehana Banu

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
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 st Edition,	Books and Allied Publishers, Ltd. Kolkatta.
2	Dubey, R.C.	2006.	A Textbook of Biotechnology	S.Chand & Co. Ltd, New Delhi.
3	Reeti Singh and U.C. Singh.	2011.	Modern Mushroom Cultivation,	Agrobios (India).

Reference Books

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

Course Designer

Dr. H. Rehana Banu

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

Preamble

- To import 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

S.No	Authors	Year of publication	Title of the book	Publishers
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

S.No	Authors	Year of publication	Title of the book	Publishers
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
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Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designer

Dr. C. Krishnaveni

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

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